# INFLUENCE OF ACCESS TO MARKET INFORMATION ON PRODUCTION OF HIGH-VALUE CROPS AMONG SMALLHOLDER FARMERS IN OL'KALOU SUB COUNTY, KENYA

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## DECLARATION AND RECOMMENDATION

### Declaration

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

Signature  … … Date: ……..29th April, 2022……..

Victor Monda Ombasa

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### Recommendation

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

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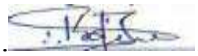
Signature:……..  …..... Date: ……... 3rd April 2022……

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## DEDICATION

This thesis is dedicated to my parents and my immediate family especially my son Emmanuel Monda and daughter Bernice Barongo who are part of my greater inspiration.

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## ABSTRACT

Access to market information is important in the production of high-value crop by smallholder farmers. Inadequate access to market information may lead to decreasing returns to investment in agricultural production and expose farmers to marketing risks and manipulations, thus leading to loss of income hence economic decline. The purpose of this study was to determine the influenceof access to agricultural market information on the production of tree tomatoes as a high-value crop. The study was based on information gap theory. The study employed a mixed-methods research design. Quantitative and qualitative data were generated. The study targeted all smallholder tree tomato farmers, in Ol'kalou Sub-County. The accessible population was all farmers growing tree tomatoes. A sample of 135 tree tomato farmers and five extension officers were studied. The exponential Non-Discriminative Snowball sampling method was used to selectthe sample. Data was collected using questionnaires and an interview guide. The instruments werevalidated by research experts from the Department of Agricultural Education and Extension, Egerton University. A pilot test for the instruments was carried out with 30 respondents in the Gatimu Ward of Ol'joro Orok Sub-County to estimate the reliability. Cronbach alpha coefficient was calculated and found to be 0.79 which was within the acceptable threshold for social science research. Descriptive statistics and multiple regression were used for data analysis respectively, using Statistical Package for Social Sciences (SPSS). The results indicated that radios (75.6%), fellow farmers (74.6%), Extension agents (52.6%) and TV (48.9%) were the commonly used channels of communication. Interpersonal communication channels and radios were most preferred than the use of print and social media. The regression analysis revealed that communication channels influenced tree tomatoes production, at $p = 0.05$ where $F(6,128) = 2.232$, $p = 0.044$ and $R^2 = 0.052$. A few farmers were organized into farmer groups but none of the farmergroups dealt with either marketing or production of tree tomatoes. Extension to farmer interactiondid not significantly influence production, however, face-to-face interactions were described as themost trusted form of extension-farmer interaction preferred by farmers despite its shortcoming. The results of this study indicate that access to market information is important in the production of tree tomatoes. The study recommends that tree tomato market information should be made available to farmers through the channels of communication that are accessible and popular with them.

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| | |
|---|---|
| GAPs | Good Agricultural Practices |
| HVCs | High-Value Crops |
| MLE | Market-Led Extension |
| NACOSTI | National Commission for Science, Technology, and Innovation |
| SDGs | Sustainable Development Goals |
| SPSS | Statistical Package for Social Science |
| SWOT | Strength, Weakness, Opportunity, and Threats |
| UN | United Nations |
| UNCHE | United Nations Conference on Human and Environment |

# CHAPTER ONE
# INTRODUCTION

## 1.1 Background Information

The production of high-value crops, particularly fruits and vegetables is gaining prominence across theworld due to health sensitization and nutritional provisions (Aku et al., 2018a). The demand has also been augmented due to a growing world population and higher urban migration. The world populationstood at 7.7 billion in the year 2019. This is projected to hit 9.15 billion people by 2050. The urban population grows at a rate of 54% across the world (UN DESA, 2018). The market potentials for thesecrops are thus enormous. The high population growth pushes the demand for agricultural products to increase. Additionally, the rapid urban population growth is growing faster than the farming community. The urban population majorly represents a consumer society. Hence the need for increased production, especially for high-value crops.

High-value crops refer to crops with higher market value than conventional crops, and that generally exhibit high market demand. They are mostly non-staple crops (Pandey et al., 2019). In most cases, high-value crops are not grown for subsistence but rather for the market, both local and international markets. They include tea, coffee, pyrethrum, fruits, most vegetables and many others. In Kenya, fruits and vegetables earn a lot of foreign exchange and contribute immensely to the Gross Domestic Products (GDP) (Kenya National Bureau of Statics, 2018). They include most tropical fruits and vegetables such as Avocados, Pineapples, papaya, passion fruits, mangos, oranges, cabbages, Kales, onions, Capsicum, watermelon, Irish potatoes and many others. Recently, there has been a slow shift towards theproduction of non-traditional tropical fruits for both domestic and export markets. These include Pepino Melon, tree tomatoes, grapes, tamarind, and strawberry among others.

These crops have higher market demand than other high-value crops due to their health andnutritional benefits (Siegel et al., 2014). They are rich in nutritional supplements as well as contribute a lot to the national economy and can compete favourably in the liberalized world economy (Mutayoba & Ngaruko, 2015). Such crops are grown in different parts of the country, and varying percentages and have high market demands. The high-value crops in Kenya are mostly in the horticultural sector.

Globally the horticulture sub-sector has been growing faster than any other agricultural sub-sectors. Countries such as USA, China and India produce and export large volume of horticultural products (Van den Broeck & Maertens, 2016). Equally, the horticultural markets have been evolving and becoming more dynamic to the disadvantage of smallholder farmers

(Peter et al., 2018). This is because the marketing of horticultural crops requires immense knowledge of market systems, human capital and technical inputs especially the useof new technologies along the value chain. Therefore, smallholder farmers must strive to correctly understand the market dynamics such as new production techniques, phytosanitary standards, quality and quantity market requirements, and adherence to Good Agricultural Practices (GAP) (Peter et al., 2018). However, the perishability nature of high-value crops, mainly fruits and vegetables, has reduced the expected income from sales. Acquiring timely and adequate knowledge and information about the markets and market requirements is key in minimizing the losses among smallholder farmers.

Therefore, the success of smallholder farmers in the production of High-Value Crops lies intheir ability to have better access to market information, mainly on the price dynamics and other domestic and global guidelines and standards required in marketing of respective products (Al-Hassan et al., 2006). This will improve their market access hence giving them economic incentives to remain in production. Such farmers must be linked to the markets. Effective access to market information leads to high access to the markets. This sustainably increases household income, food security and environmental resilience (Al-Hassan et al., 2006).

Access to market information creates economic value for farmers, reduces inequality and averts farm risks (Ahmed et al., 2016). The study by Ahmed (2016) further shows that access to market information impacts access to output markets. The nature of most high-value crops is that they are highly perishable and hence have a shorter shelf life. The crops also pose a storage dilemma due to their bulkiness. Liberalization of markets both for local and international economies requires that farmers are well versed with market dynamics and specific demand requirements of these markets. Additionally, the need for market information has been augmented by the strict consumer requirements and global guidelines for international markets, for example, Global Gap guidelines (Sonntag et al., 2016). There are frequent changes in price trends and consumer demands hence making the agricultural markettrend shaky (Lemeilleur, 2013).

The information on price changes, market and consumer demands improves fairness in promoting competitive markets and encourages small holder's farmers to participate in all levels of markets. The study by Magesa et al. (2014) shows that smallholder farmers are exploited by traders due to a lack of accurate, adequate and timely market information

(Magesa et al., 2014. The United States of America under a cooperative extension system uses among others; newspapers, farm radios, circulars and news articles on the farm page to disseminate information (Warner & Christenson, 2019). They put more emphasis not only on marketing but also on production. The most notable magazine include successful farming, farm journal magazines, progressive farmer, Agri-News, Capital press and others.

The Government of Kenya had made various efforts to reach farmers with agricultural information. Such efforts included the establishment of the Agricultural Information Resource Centre (AIRC) as a department in the Ministry of Agriculture, Livestock, Fisheries and Cooperatives (Republic of Kenya, 2017a). Among the core functions of the AIRC was to collect, repackage and disseminate Agricultural information through mass media. The Centre was also mandated to train and provide skills to farmers and stakeholders. The Centre was focused on mass media as a way to reach out to farmers and other stakeholders. The channel however did not reach a lot of targeted individuals as it was envisioned. They used print media to reach institutions, universities and other organizations by producing booklets, annual reports leaflets and other documents (Kiptum, 2012). The government also used otherchannels like Agricultural Training Centres (ATCs) (Government of Kenya, 2017).

The Kenyan Government promulgated a new constitution in the year 2010. Agriculture was devolved to the 47 County governments which are autonomous to each other (Republic of Kenya, 2010). The extension system became pluralistic where both public and private sectors had a role. The structures and model of extension delivery used by the national government thus could not fit the different information needs of different counties. Every county was consequently required to establish the commonly used channels of communication that could provide access to market information to farmers especially on high-value crops such as tree tomatoes.

The Nakuru County Government, in Kenya, borrowed the Indian Agricultural Extension Service Model and established a call Centre where farmers could call and get real-time information (Republic of Kenya, 2018b). They reached farmers through SMS, calls, WhatsApp, Facebook and even Twitter. Additionally, they linked farmers to relevant stakeholders for relevant assistance. The Makueni County government, in Kenya, on the other hand, strengthened their mango market, which initially was seasonal. The county government achieved this by establishing a mango processing firm and at the same time, the Makueni county government provided timely market information to farmers which eventuallyimproved production.

Availability and access to market information on tree tomatoes are still low (Karing'u, 2020). This has reduced the expected income from tree tomatoes sales among farmers in regions producing tree tomatoes. Thus undermining the economic value of tree tomatoes. For these reasons, the study seeks to determine the influence of access to market information on the production of high-value crops especially tree tomatoes among smallholder farmers (Republicof Kenya, 2018a). Available market information can be accessed by farmers through various communication channels. Communication channels in most cases determine the accuracy andconsistency with which the smallholder farmers can access market information.

Access to communication channels and the cost associated with the search for information have been attributed to the low participation of smallholder farmers in markets and more soexport markets (Karing'u et al., 2020). The cost of accessing market information can be reduced by channelling market information through the common communication channels used by smallholder farmers. The various communication channels include radios, Televisions, Mobile phones, social media like Facebook, Twitter, WhatsApp, LinkedIn, among others (Duffett, 2017).

Extension services equally play a vital role in disseminating market information to farmers. When farmers come together to form groups, associations and cooperatives, they create a formidable social unit through which the flow of market information can effectively be channelled. ICT use has undoubtedly become a significant tool and platform for communication. The ability of the farmer to use ICT will play a central part in access to market information (Yonazi et al., 2012). The high-value crop to be studied is the tree tomatoes. The crop is relatively new in the region, but they are gaining a lot of attention fromfarmers.

Ol'kalou Sub-County in Nyandarua County is in the central region of Kenya. Ol'Kalou Sub- County receives about 1800 mm of rainfall per annum; however, temperatures are low and can drop as low as 9$^{o}$C (Republic of Kenya, 2017b). A limited number of crops can grow wellthere due to such climatic conditions. The HVCs that grow well in the area include tree tomatoes, Pepino melon, Cabbages, Cowpeas, carrots, Irish potatoes among others. Tree tomato is an emerging high-value crop with the potential to compete with other traditional high-value crops. Its market acceptability and the ease of production increase their demand (Moreno-Miranda et al., 2020). It was, therefore, necessary to understand how access to market information influences the production of tree tomatoes as a high-value crop.

## 1.2 Statement of the Problem

Agricultural production is influenced by several factors, among them: access to information,size of land for farming, seasonality, technology, affordability and availability of inputs. Access to market information is critical in enhancing market access among smallholder farmers. Inadequate access to market information inhibits access to output markets hence discouraging smallholder farmers from participating effectively in the production of high-value crops, including tree tomatoes. Production thus fluctuates from season to season. Tree Tomato farmers with inadequate access to information on when to produce, how much to produce, how to sell, and/or where to sell have difficulty in knowing specifics of the market for the commodity. As a result, it becomes hard for them to fully infiltrate the product market. Additionally, it increases marketing risks and transaction costs, especially when searching for market information. This may discourage farmers from producing tree tomato. A lot of market information is generated through research and market surveillance. However, how the information is packaged and channelled to farmers and especially smallholder farmersis not always appropriate. There is a need for information on the most appropriate channel forthe farmers to access market information on the production and marketing of tree tomatoes.
This is the gap that this study sought to fill.

## 1.3 Purpose of the Study

The purpose of the study was to determine the influence of access to market information through variouscommunication channels on the production of tree tomatoes among smallholder farmers in Ol'kalou Sub-County, Nyandarua County.

## 1.4 Objectives of the Study

The following specific objectives guided the study:

i. To identify the commonly used communication channels for accessing market information on tree tomatoes among smallholder farmers in Ol'kalou Sub-County.
ii. To determine the influence of communication channels for accessing market information on the production of tree tomatoes among smallholder farmers in Ol'kalou Sub-County.
iii. To determine the influence of agricultural extension contact for accessing market information on production of tree tomatoes among smallholder farmers in Ol'kalouSub-County.

iv. To determine how participation in farmer groups influences access to market information on production of tree tomatoes among smallholder in Ol'kalou Sub-County.

## 1.4 Research Questions

The following research questions were used to address objective one and four:

i. Which are the commonly used communication channels for accessing market information on tree tomatoes among smallholder farmers in Ol'kalou Sub-County?

ii. How does participation in farmer groups as a channel for accessing market information influence production of tree tomatoes among smallholder farmers in Ol'kalou Sub-County?

## 1.5 Hypotheses

The following null hypotheses were used to analyse objectives two and three respectively:

**$H0_1$:** There is no statistically significant influence of channels of communication for accessing market information on the production of tree tomatoes as a high-value crop among smallholder farmers in Ol'kalou Sub County.

**$H0_2$:** There is no statistically significant influence of agriculture extension agents for accessing market information on production of tree tomatoes as a high-value crop among smallholder farmers in Ol'kalou Sub County.

## 1.6 Scope of the Study

The study was limited to smallholder farmers growing tree tomatoes and agricultural extension service providers within Ol'kalou Sub-County. Access to market information in the study was limited to agricultural information accessed through communication channels, extension–farmer contacts and farmer group membership. Other channels used to access market information include the use of farmer field schools, agricultural shows and exhibitions, plant clinics, roadshows among others. The high-value crop in the study was represented by studying farmers growing tree tomatoes. Production was measured in terms of kilograms per unit hectare.

## 1.7 Significance of the Study

The findings of the study may provide insights into how access to agricultural market information would help smallholder tree tomato farmers in accessing the output market more efficiently. Access to market information would enable the farmers to earn more income from

sales hence increasing the production of tree tomatoes. Secondly, the study findings may inform extension service providers on areas they need to engage the farmers extensively to support them in accessing timely agricultural market information. Additionally, the research findings may help extension personnel to understand the best way of disseminating market information to smallholder farmers and the support that farmers need to enhance their full participation in the marketing of tree tomatoes as a high-value crop. The study and its recommendations may form a basis for further researches and investigations. Lastly, the findings of the study may assist policymakers at both County and National governments in formulating and implementing policies that can support smallholder farmers in accessing timely agricultural market information for the production of tree tomatoes as a high-value crop.

## 1.8 Assumptions of the Study

The study was based on the following assumptions:

i. All respondents would be able to recall their records on production and that theywould give accurate and truthful information.
ii. All the respondents grew tree tomatoes for commercial purposes. The researcher used referrals from fellow farmers to select respondents.
iii. Most areas would be accessible especially during the rainy season.

## 1.9 Limitation of the Study

The study focused on tree tomatoes as a high-value crop. The crop is relatively new and therefore the result of the study may not be generalized to all high-value crops within thecounty and in the whole country.

## 1.10 Definitions of Terms

**Access to Market:** Ability of an individual or country to sell goods and services in a specific market under certain conditions, tariff and non –tariff measures agreed upon by members for entry of specific products and services into the market (Crawford, 2016). In the study, marketaccess referred to the ability of tree tomato smallholder farmers to sell produce in specific markets locally and to outside markets.

**Access to Market information:** refers to getting information regarding local, regional, and international markets and market requirements (Chamberlin & Jayne, 2013). In the study, it referred to the ability to acquire and utilize useful market information about the marketing oftree tomatoes through the use of appropriate communication channels, agricultural extensionagents and farmer group membership.

**Brokers**: These are intermediaries who act as a link between the farmers and the agricultural market and service providers (Arsyad et al., 2018). In the study, it referred to persons who buy from farmers or assist them in the marketing of their tree tomatoes.

**Communication channels** Are types of media that are used to transfer information from one person or group of people to another (Siapera, 2017). In the study, they referred to various channels used by smallholder farmers to access agricultural market information such as Fellow farmers, Agricultural extension officers, Farmer groups, Mobile phones, Newspapers,Radios, TVs, Internet, workshops/ seminars, Field days and exhibitions.

**Diversification:** This is the production of different products in a field of operation, the practice of cultivation a variety of crops in an area, not just one (Waha et al., 2018). In thestudy, it refers to the production of HVCs alongside other staple crops.

**Extension contact:** is the action of interaction or remaining in communication or meeting someone either physically or otherwise to acquire or of exchanging information or knowledge(Mugwisi et al., 2015). In the study, it meant physical, online, or any other form of interactionbetween extension agents and farmers.

**Extension-Farmer contact:** Refers to direct or indirect personal interaction between an extension agent and an individual farmer (Sanusi & Abdullah, 2018). This study included butwas not limited to the frequency of physical interactions, frequency of telephone calls and SMSs, frequency of informal and social media contacts.

**Farmers' Participation:** Involvement of farmers in farming and marketing activities and involves communication among farmers and extension agents in which farmers take an activerole in situation analysis, planning, implementation and evaluation of agricultural activities

(Hauser et al., 2016). The study referred to the active involvement of individual farmers in activities of the group(s) in the marketing process of High-value crops.

**High-Value Crops:** They refer to non-staple crops such as vegetables, fruits, flowers, ornamentals, condiments and spices. They also have a higher net return per hectare of land than staples or other widely grown crops; that is, they have a financial value more significantthan primary food crops within and across border markets (D. Pandey et al., 2019). In the study, the High-Value Crops referred to are tree tomatoes

**Market information:** the results of marketing research that are used to plan for future marketing or product development activities (Armstrong et al., 2018). In the study, market information referred to facts on market conditions and their requirements for tree tomatoes namely: when to produce, how much to produce, how to produce, where to sell, and who is tobuy.

**Production of Tree tomato:** Refers to the process of cultivating tree tomato crop with high monetary value and with emerging and expanding product market worldwide (Temu & Temu,2005). The aim of growing the crop is commercial rather than local consumption. In this, production of tree tomatoes was measured in quantities harvested in Kilograms per unit hectares acres cultivated for 12 months

**Smallholder farmer**- Is a farmer with a low asset base and operating in less than 2 hectares of cropland (Lowder et al., 2016). In the study, a smallholder was a farmer having 3 hectares(about 7.4 acres) of land and below.

**Tree Tomatoes:** is subtropical perennial tree crop of the family Solanaceae best grown for its edible fruits (Ramirez, 2019). In the study it refers to a high value crop with high monetaryvalue and expanding product market.

# CHAPTER TWO
# LITERATURE REVIEW

## 2.1 Introduction

This chapter provides an overview of previous knowledge and research works. It also provides an overview of the theoretical and conceptual framework, highlighting the research gaps identified. The chapter aimed at orienting the reader on what has been done so far, the inter-linkages between extension communication channels and market information access patterns on high-value crops.

## 2.2 Importance of High-Value Crops in Achieving Global and Local Development Goals

High-Value Crops have the potential of alleviating food insecurity and improving household income (Pratap et al., 2013). This, in turn, helps to deliver on the global and national development goals: Sustainable Development Goals (SDGs) and Kenya's 2030 development Agenda. In hunger alleviation, the sustainable development goals recognize the vulnerability of the poor people and, therefore, there is a need to be empowered economically, protected and exposed to safe, nutritious and sufficient food throughout the year. Most importantly, they should be enabled to come out of poverty (Fukuda-Parr, 2016). Diversification, production and successful marketing of High-Value Crops have the potentialof delivering this (Pratap et al., 2013).

In Africa, the continental goals are also in line with global goals. The New Partnership for Africa Development (NEPAD) through its steering committee established the Compressive Africa Agricultural Development Programme (CAADP), which is a Pan African framework geared towards analysing continental states situations and identifying investment opportunities with optimum returns to investments and greater societal impacts (Benin et al., 2018). The critical areas of the CAADP revolve around African agricultural transformation, wealth creation, food security and nutrition, economic growth and prosperity for all (Benin et al., 2018). The countries reaffirmed their commitments to continental goals through the Maputo declaration 2003, where member states consented to commit 10% of their national budget to agriculture and rural development activities. This was again followed by the Malabo declaration 2014 in which countries renewed their promises to CAADP principles.

The agricultural transformation agenda, especially on food security and wealth creation may easily be realized if more efforts are geared towards supporting and empowering smallholderfarmers towards diversification to and production of High-Value Crops such as tree

tomatoes and actively participating in the marketing of high-value products at all levels (Muhanji et l.,2011).

Kenya, in her quest to meet regional and global goals, developed the blueprint in which it aims to be "a globally competitive and prosperous country with a high quality of life by 2030" (Kenya, 2007). Their focus is to be a newly-industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment. Among the critical sector in the vision is increasing value in agriculture and manufacturing for the regional markets. The horticultural sector, where fruits such as Pepino Melon and tree tomatoes lie, has had a tremendous impact on the economy of Kenya (Kenya National Bureauof Statistics, 2018). The sector contributes immensely towards economic and rural transformation, as envisioned by the 2030 development agenda.

Nyandarua County has developed an ambitious programme to try and align her development agenda to national and global goals as well as meet the development needs of her people. Thecounty goals are aimed at creating a productive, prosperous, newly industrialized and secure county (Republic of Kenya, 2017b). To accomplish this, the county has laid down six pillars, among them agricultural development, infrastructure, financial and trade services and industrialization. In the agricultural sector, the County relies on High-Value Crops especiallythe horticultural sector to deliver on these development goals (Republic of Kenya, 2017b).

More farmers are being encouraged to diversify into the production of High-Value Crops. In agricultural development, the county intends to re-establish agriculture as a dominant component in the economy as well as invest in value addition and agro-industries and enhance access to input and subsidized services, among others (Republic of Kenya, 2017). All these efforts are geared toward reducing poverty and alleviating people's suffering. High- value crops have a tremendous opportunity of driving all these goals from global to local ones(Olofsson, 2021). However, little attention has been given to smallholder farmers in empowering them to access and utilize market information to improve their productivity and also to enable them to access both local and international markets efficiently.

## 2.2 African Government Efforts to Providing Access to Market Information to Smallholder Farmers

Globally each country is working towards a system that can see their farmer's access marketinformation effectively. In India for instance they are implementing a project funded by Billand Melinda Gates foundation aimed at making agricultural marketing information systems

stable and sound globally. The project is targeting India and other countries selected globally (FAO, 2011).

Market liberalization and globalization reduced direct government interferences on the marketing of agricultural products both at local and international markets (Cooksey, 2011). Liberalization brought in competitiveness in the marketing of agricultural products and new dynamics in the market (Shiferaw et al., 2011). However, it also brought fears of pest and disease transmission and other health-related issues (MacLeod et al., 2010). The new dynamics somehow resulted in less transparent marketing for the smallholder farmers hencereducing their marketing power (Jari & Fraser, 2012). This is attributed to the inability of these farmers to access adequate and timely market information.

Access to agricultural market information opens access to agricultural markets hence increasing the competitiveness and the ability of smallholder farmers to participate fully in agricultural markets (Goyal, 2010). Developing countries have their vast population residing in rural areas with agriculture as the predominant economic activity. The farmers mostly lack access to markets due to the inability to access timely and regular market information and other infrastructural challenges (Goyal, 2010). Adequate market information to smallholder farmers will increase their bargaining powers, create a more transparent marketing environment efficient marketing system and market transaction costs (Kiveu & Ofafa, 2013).

To create a more transparent marketing environment, most African countries were funded to support and maintain the market information system (Magesa et al., 2014). They collected information about: marketing prices, quality and quantity of required products in the markets, Market conditions such as Biosafety and Good agricultural practices for the international market, transportation and packaging, value chain and market opportunities available. The information collected was then relayed to farmers. Market information systems established inAfrica after liberalization in the earlier 1990s included: Agricultural Marketing Information Centre (AMIC) in Zambia, Ethiopian Grain Trading Enterprise (EGTE) in Ethiopia, Agricultural Market Information System (SIMA) in Mozambique among others (Magesa et al., 2014). Some private companies also ventured into the provision of market information, especially commodity exchanges such as Kenya Agricultural Commodity Exchange, Malawi Agricultural Commodity Exchange, and Zimbabwe Agricultural Commodity Exchange, among others (Magesa et al., 2014). However most of these effort didn't translate to economic liberty especially to smallholder farmers.

The Kenya Agricultural Commodity Exchange (KACE), for instance, established ICT platforms to collect market information on diverse agricultural commodities at various

marketing places in major towns in Kenya (Rashid et al., 2010). The information was then transmitted to headquarters in Nairobi. The headquarter could then process the information, package it and communicate the same to subscribed farmers through radios, websites, and other channels such as Rural based Market Information Points. Rural information Kiosks were established to collect current commodity prices and offer linkages to farmers, district- level marketing centres and mobile phone through short messaging services to the subscriber (Magesa et al., 2014).

The market information systems later became less effective as donor funds diminished; thus, they were not able to collect reliable and timely market information and support the large distribution of collected information through mainstream media such as televisions, radio and newspapers and modern ICT platforms such as phones and computers (Sitko & Jayne, 2012). The failed market information system worked against rural poor smallholder farmers who wished to diversify and participate in agricultural markets both local and international (Magesa et al., 2014). The farmers needed to understand what to produce, with what technology, at what time to whom and how to produce it to satisfy market conditions and consumer needs. Market information in most developing countries is therefore considered as a public good provided by the government agencies (Doh et al., 2010). Access to market information might be costly to smallholder farmers thus technically edging them from actively participating in the marketing process.

The Kenyan government through the Ministry of Agriculture, Livestock and Fisheries established an information resource Centre known as Kenya Agricultural Information Resource Centre (Republic of Kenya, 2017a). The Centre was supposed to collect, repackage and disseminate Agricultural Information through mass media. Local and national radio programs were the most common. It was supposed to offer training to farmers and stakeholders too and generate finances to support its sustainability. They could also produce documents such as booklets, leaflets, annual reports and other publications. The documents were summarized in an abstract and then stacked on the library shelf (Kathuri, 2013). The information could only be accessed upon request majorly by institutions, organizations and other stakeholders. The smallholder farmers could not access the information easily. After devolution in 2010, agriculture became a county government function and the implementation of its activities are aimed at addressing country-specific needs (Republic of Kenya, 2010). That and other structural and financial difficulties made the centre unable tofully cover all counties in terms of information dissemination.

The rural economies depend so much on smallholder farmers' successful diversification

of high-value agricultural products and efficient marketing of those products (Fan et al., 2013). The farmers, therefore, need to be empowered through proper access to market information to reduce exploitation by brokers and other unscrupulous traders. This will improve the farmer's confidence as to when to produce, invest and how to market. Studies have shown that access to market information improves farm-gate prices and reduces the dispersion of agricultural prices across markets (Magesa et al., 2014). Access to market information in Nyandarua County is not properly established. Less attention has been given to market information channels that can easily reach smallholder farmers.

### 2.3 Factors Influencing Access to Market Information

A study by Xaba and Masuku (2013) on factors affecting the choice of marketing channel by vegetable farmers in Swaziland revealed that social-economic factors such as level of education, age of farmers, economic status of the farmers, distance from the production area to the market and membership to farmer organizations and marketing agreement played a big role in the choice of marketing channels (Xaba & Masuku, 2013). These factors had a great influence on market information. Access to market information influences market participation by smallholder farmers. Marketing incentives such as access to credit and distance to output market too influence access to market information and thus market participation (Hlongwane et al., 2014). Other factors also influencing market access include frequency of extension farmer contact, access to communication channels, farmer groups and other infrastructural factors such as roads and electricity. A single source of information is notsufficient for farmers accessing market information. They need complementary and or substitution information to satisfy the demand (Mittal & Mehar, 2016).

Access to market information is critical in enabling smallholder farmers to access markets for agricultural products. The smallholder farmers in developing countries are characterized by low income, diminishing land size, low technologies and skills and in some cases, low education (Chand et al., 2011). This makes them incur a lot of costs individually, in accessingmarket information or any other information related to agricultural production and marketing due to incomplete and asymmetrical information (Aku et al., 2018b). They become uncompetitive and lose their bargaining power in the product markets hence becoming more vulnerable to brokers and unscrupulous traders. Farmers working in groups increase the ability to overcome the challenges associated with inadequate access to market informationand other information asymmetries. It also enhances farmers' economies of scale thus reducing transaction costs in the marketing system (Fischer & Qaim, 2014)

The study carried in Tanzania by Aku et al. (2018) suggested that smallholder farmers who belonged to a farmer organization accrued more income from the sale of their vegetables thanthose who didn't (Aku et al., 2018a). This was so because those who did not belong to any group incurred a lot of transaction cost in the marketing of their produces. Farmer groups also help to synchronize different pieces of information help by a variety of individuals, organizations, or government departments making it easier for smallholder farmers to access complete information at one point (Sunstein & Hastie, 2015). Farmer groups make it possible to enter into a contractual agreement in marketing specific agricultural commodities because the group enables the farmers to meet the basic market thresholds in terms of quantities, qualities, safety measures and other market conditions. Additionally, groups improve farmer linkages and social capital through enhanced internal and external relations. But, smallholder farmers' groups seldom survive longer thus disadvantaging them when it comes to market participation.

Farmer groups face several challenges while they attempt to remain coherent. Some of them include socio-economic inequalities within members of the group, institutional arrangements,and governance among others. It is, therefore, important to ensure that farmer groups are as homogenous as possible and uphold a high level of integrity and good governance for efficiency and sustainability (Shiferaw et al., 2011). This will influence the active participation of members, which eventually leads to increased collectivity and reciprocities in group activities (Fischer & Qaim, 2014). The groups are, therefore, pivotal in collecting and disseminating market information thus helping to create awareness among smallholder farmers on marketing issues. In addition, framer groups help to monitor and evaluate marketsituations on behalf of the individual farmers (Markelova & Mwangi, 2010). The sustainability and resilience of such groups have to be assured if they are to be used as channels of communication to reach the farmers. It is however not known the influence of such groups in accessing market information for the production of high-value crops.

The market information, knowledge and technologies can be shared through various platforms and communication channels, ranging from individual to mass communication channels (Mugwisi et al., 2015). These include individual farm visits, use of telephone and mobile phones (call and SMSs), Barraza's, farmer field schools, agricultural exhibitions and shows, plant clinics, farmer-farmer extension, mass and print media: use of radios, televisions and social media platforms such as WhatsApp, Facebook, Instagram, Twitter, YouTube, LinkedIn, Google, messenger and many others.

A study on Extension communication channels' usage and preferences by farmers in

Benue state in Nigeria, indicated that interpersonal communication channels were the most preferredat (45.89 percent) followed by extension agents at (38.61 percent). Contact farmers and opinion leaders also played an essential role in extension delivery at 31 percent 22 percent respectively (Okwu & Daudu, 2011). The study, however, showed that low usage of media with radio being the popularly used at 81 percent and television at 9 percent. The frequency of use of print media (newspaper and newsletter) and films was low, with 62 percent unavailable to farmers. Another study by Tandi et al. (2011) demonstrated that farmers' information searching patterns were region-specific; that is, the information was from fellow farmers, neighbours and family members was a major source of information (Tandi et al., 2011). The public extension agents also played an essential role in disseminating information together with radios, press materials and other ICT tools. It is however not clear whether the same holds in Kenya, especially in Ol'kalou County and with increasing use of technology and education level.

## 2.4 The Role of Agricultural Extension in Access to Market Information

The current global approach for the agricultural extension is demand-driven. However, it is difficult for farmers to demand what they don't know or have never seen. It is imperative thento empower the farmers to demand extension services. This can be done through capacity building and effective and timely extension services delivery. There is a need for extension services to focus more on smallholder farmers and empower them through training and extension and more so in accessing specific market information (Ferris et al., 2014). The export and access to the international market have been left to the few, wealthy, and large- scale farmers. The smallholder farmers are in most cases unaware as their contributions are regarded as insignificant. Most export company's deal with these farmers at the cooperative or group level, however, the influence of powerful cartels in those organizations renders smallholder farmers vulnerable to a lot of exploitations and therefore denied access to information either by omission or otherwise (Asfaw et al., 2010).

There is a significant shift from the focus of production-led extension to what is now a market-oriented extension approach (Bhati et al., 2017). The effort is on consumer taste and preferences rather than simply producing ignorant of what the final consumer wants. Market-led extension regards a farmer as an entrepreneur and enables them to emphasize maximizing returns from their produce. The market linkages between the researchers, agricultural extensions, and the farmer are strengthened by concrete and timely market intelligence, and strong market information systems. Market intelligence comprises; likely price trends, demand

position, current prices, market practices, communication network, technology, among others (Gezahegn et al., 2018). Market intelligence, on the other hand, implies different ways in which sources of information can be packaged, in a manner farmer can relyon it as a basis of making production and marketing decisions to improve the quality and volume of their sales.

Market information services are all about gathering information on prices of various products;volumes delivered to the markets and turnovers at local retail outlets, supermarkets, and rural assembly markets (Parker et al., 2016). The information then gathered is disseminated through media outlets for the sole purpose of benefiting the farmers, marketers, policymakers and implementers. This improves transparency in the marketing chains, making the markets purely competitive and avoiding exploitation of the farmers by the many cartels and brokers along the marketing chain (Leslie, 2017).

Market-led extension thus gives farmers information obtained through market research and analysis, establishing linkages in agro-processing and market (Kumar, 2016). It provides critical information across production and marketing processes involving post-harvesting techniques, proper crop and product handling, value addition standardization, grading, and packaging. It also improves direct marketing capacity and skills (Ahmad & Slathia, 2011). This requires a coordinated approach of extension services that disseminate not only production strategies but also holistic market-oriented information for sustainable development (Apata & Shitu, 2013). There is no well-known and documented preferred channels of communication where extension officials can engage effectively with the farmersthus the need to carry out a study to ascertain that.

## 2.5 Benefits of Diversification to High-value Crops by Smallholder Farmers

Production HVCs have gained a lot of prominence among smallholder farmers due to theiradded advantage in income, nutrition and health in general (Jaenicke & Virchow, 2013). This, too, advances both domestic and international consumptions. The world population, mainly in developing nations, is majorly made up of low and middle-income households as well as poor rural populations with large numbers of marginal and smallholder farmers. Some of these farmers are landless or owns small pieces of land (Jayne et al., 2012). Diversification into HVCs such as tree tomatoes could benefit these smallholder farmers and landless labourers by increasing both production and employment (Bakshi et al., 2016). It could also help the rural and urban poor population through growth in the rural and urban non-farm economy and by making food of high nutritional value available for consumption. Such diversification could also empower the poor by increasing their access to the decision-makingprocess by increasing

their capacity for collective action and reducing their vulnerability to shocks through asset accumulation. Diversification into HVCs could thus play a significant role in poverty reduction, sustainable growth, and food security in developing countries, as long as access to market information is made available to smallholder farmers.

Fruit production is on the rise in the world due to increased demand and health benefits. Thisis as a result of their nutritional provision and increased awareness among consumers. Asian production of fruits has risen higher compared to Europe and America (Faostat, 2016). Land under the production of fruits globally is about one percent of total holding with countries in the Mediterranean region contributing more. In Europe and Central Asia, France, Spain, Italy and Turkey are the largest regional producer which accounts for 57 percent of the total regional area (Faostat, 2016). In Kenya, the production of High-Value Crops has been on therise especially fruits and vegetables. Nyandarua produces several fruits and vegetables, mostly for local consumption. Some of the fruits produced include pears, plums, Pepino Melon, tree tomatoes among others. In Nyandarua, Tree tomato and Pepino Melon are emerging high crops that have the potential of demands of consumers.

## 2.6 Tree Tomatoes production and its Benefits (*Solanum betaceum*)

Tree tomatoes is a member of the Solanaceae family, which includes tomatoes, potatoes, andPepino Melon. It is also referred to as Tamarillo (Acosta-Quezada et al., 2015). It produces small, egg-shaped oval fruits with tough skin and varying colours depending on the variety. Tree tomatoes grow at an altitude of between 1500M above sea level to 3000M in a fairlywide range of temperatures and soil conditions (Alves et al., 2017). However, due to its shallow roots, it requires protection from strong winds. Its life can span in 4 years. Tree tomatoes are more abundant in nutritional value and are easier to grow because they do not require heavy agrochemical use (Herraiz et al., 2016). For instance, they provide the bodywith a lot of vitamin A, Vitamin C and Magnesium, besides providing water, iron, proteins and calcium at varying degrees. They are thus helpful in suppressing lifestyle diseases. They have versatile usability; for example, they can be eaten as fresh fruits or processed products like Jam, Juice, or Chilli sauce (Enciso-Rodríguez et al., 2010). They can also withstand adverse climatic conditions hence ideal for growing in Ol'kalou Sub-County. There are fewfarmers growing Tree tomatoes in Ol'kalou. The number of farmers is gradually increasingbut the market poses a great challenge to them. They mostly sell in the local market and to neighbours which is eventually unsustainable (Republic of Kenya, 2017b).

The fruit is native to the Andes of Peru and adjacent regions (Acosta-Quezada et al.,

2011). Itis grown because of its fleshy, edible and juicy taste. Globally the fruit is grown in Jamaica, Australia, Haiti, the southern part of Asia, New Zealand and some parts of South America along the Andes region (Acosta-Quezada et al., 2011). Canada was the leading exporter of tree tomato getting a value of 3.52 billion USD while USA was the leading importer the sameyear by 3.51 USD. In Kenya, tree tomatoes are grown in Embu, Kisii, Kakamega, Murang' a Nyandarua, Nyeri, Kericho, among other areas (Muriithi et al., 2013). In Embu County, the fruit is so prominent and harvested twice a year, with little variation in yields between seasons. The marketing of tree tomatoes has some challenges even though the market price remains stable season after season. Most of the farmers produce for household consumption, with a few doing commercial production. It is an important fruit for diversification especiallyto rural smallholder farmers (Muriithi et al., 2013).

## 2.7 Marketing of High-Value Crops

There is a high potential of HVC to increase farmers' income hence economic security at household levels (Pratap et al., 2015). However, smallholder farmers have a myriadof challenges that can limit their ability to reach high-value markets. The challenges differ from one region to another and among farmers. In the globalized arena of high-value agricultural products, there are highly competitive products both at local, regional, and international markets, making a local subsistence farmer more vulnerable to global market dynamics and price fluctuations (Ngenoh et al., 2018). This is because the poor rural farmer needs to acquire necessary market linkages, technology, and market-specific information, which may be far away from their reach. These farmers will, therefore, need some policy protection and technical assistance for them to penetrate the markets, both local and export markets.

Marketing of high-value crops and products among smallholder farmers may include developing the reasonable partnership in high-value markets, uniting and empowering farmers, promoting good agricultural production practices among small scale farmers, creating marketing policies and strategies that support poor farmers and starting technologies and policies that are suitable in addressing needs of poor rural farmers (Baloyi, 2010). A lot of efforts should be focused on establishing farmer groups and helping them to sustain those associations to help them build on capital base and market linkages. The organizations will help farmers acquire agri-business related mentoring skills, sharing of knowledge and information as well as understanding market structure and governance (Kokate et al., 2016).

Some of the marketing challenges of HVCs consist of issues ranging from storage, perishability, and transporting damages and losses. A study carried out to appraise the tomato

value chain in Nigeria revealed that over 50% of tomatoes produced are lost due to poor storage, transportation systems and lack of processing enterprises (Ugonna et al., 2015).
HVCs such as horticultural products require a sound marketing system basically due to their perishability nature. Without proper market control mechanisms, farmers can be exploited by brokers who end up earning a lot at the expense of individual farmers. Access to the market is, therefore, very critical for these groups of farmers to benefit from local and regional market opportunities. Proper institutions must be in place to help the farmers comply with quality requirements both at local and export markets. Some critical institution arrangements are necessary, such as contract farming, producer organization, and partnerships (Royer et al., 2016).

For successful production and marketing of the high-value crops in Kenya and particularly Nyandarua County, research and extension are critical. Specific farming techniques to the production of high-value crops from selection, planting, crop management, harvesting, and post-harvesting handling and processes must be participatory worked out in the research stations and disseminated to farmers for adoption by agricultural extension agents (Gesare etal., 2017). However, most critical is to continually carry out marketing research on these crops to find new and value-added market opportunities, and help the farmers and grower organizations adapt to ever-varying quality regulations (Wyche & Steinfield, 2016).

Advisory Services have to rise to the occasion and especially public extension service to helpsmallholder farmers to utilize well information generated from market research to increase their production to global standards (Moreddu, 2016). Marketing research can benefit farmers, especially if they work in groups (Wyche & Steinfield, 2016). Farmers should be given the incentives to work and remain in groups or associations, particularly at the start of their production journey. Greater investment in credit facilities is required to meet the initial production and marketing needs of the farmers, and therefore government needs to formulate supportive policies for these farmers and their organizational groups and implement them to the letter (Mitra et al., 2018).

When there is sufficient and timely market information, farmers can use it in the best way possible that gives immense benefits to them and those around them. When farmers have adequate information, they share it with others, thus empowering the community (Nakasone et al., 2014). However, the information is disseminated without properly establishing the most effective way of delivering the information to farmers. The farmer cannot produce, for example, tree tomatoes if he/she does not understand what it is and where he can find the market. Establishing the most appropriate channel of communication influences information

access hence the production of high-value crops.

## 2.8 Farmer Extension Contacts in Accessing Market Information

Access to extension services in crucial in enabling small holder farmer engagement in high value crop production. Extension service delivery approaches differs from country to country. Much efforts should be geared toward bottom up approaches as opposed to bottom down that was so popular years back (Navarro et al., 2016). The current climate situation requires an approach that is climate sensitive for sustained production. The extension delivery can be offered by the government at different levels: National and local (County or district levels) or the service can be offered by private institutions and companies. The main concern is to ensure that the smallholder farmers can access information adequately as well as timely for improved production.

The extension to farmer contacts in Africa is slowly reducing due to cost involved. Farmers are greatly relying other communication channels such use of fellow farmers and farmer groups. (Gido et., 2015). According to Witt's study extension officers rarely visited smallholder farmers especially in the rural setups. The farmers did not feel their presence. This situation in Africa has been undermined by the inefficient government funding thus leading to inadequate facilitative resources as well as human resource. The overall access to information is some worthy hindered translating to poor agricultural production. Sustainable production of high value crops may need specific market information that will guarantee profitable engagement of smallholder farmers in agricultural production (Ferris et al., 2014).

The inadequate access to agricultural market information by smallholder farmers in the production of high value crops has led to a number of them leaning towards the services of middlemen (Magesa et al., 2020). The middlemen do an important role in connecting farmers to the market and have a very good knowledge of the market conditions and requirement. A lot of the market information is never disclosed to farmers leading to poor income from their investment. The middlemen end up amassing much of the benefits at expense the farmers (Paul, 2019). Information is so powerful and therefore if the farmers are made to access a lot of the market information timely and appropriately; it will enable them to circumvent some of the economic obstacles mounted on them by middlemen.

## 2.9 Use of Mobiles in Accessing Market Information for the Production of High Value Crops

Increasing use of mobile phones in the world offer unlimited potential for smallholder farmers accessing agricultural market information. Mobile phones can be employed in a greater way in enabling smallholder farmer's access market information in real time (Kos & Kloppenburg, 2019). The information can be relayed from farmer to farmers or directly using service providers and other mobile service providers. Specific market information such as prices, access to market, market conditions and requirement, specific market quality aspect such as good agricultural practices among others can easily be accessed through mobile phones.

The use of mobile phones requires that most agricultural market information be gathered, stored electronically and be submitted timely to subscribed smallholder farmers (Baumüller, 2018). The information must then be relayed in form that the farmers can easily understand and use for good marketing and thus improved production. Purchasing mobile credits and use of bundles has been some of the impediment in accessing market information through mobiles. Factors affecting access to mobile phone can also affect utilization of phones in accessing market information (Tadesse & Bahiigwa, 2015). Such factors like access to electricity, short lived mobile phone battery and to some extent level of education influence use of mobile phones as a communication channel in accessing market information.

In Ethiopia for instance the penetration of mobile phone is about 23 – 88 percent depending on the location (Tadesse & Bahiigwa, 2015). This indicates that the number of smallholder farmers owning mobile phones is higher however those who are using them to access market information is lower. The low usage cab be attributed to low information available through mobiles as well as network connectivity. Studies have proved that good use of mobiles increases both quantity and quality of agricultural products through enhanced access to agricultural market information (Owusu et al., 2018).

## 2.10 Use of famer groups in accessing market information for the production of high value crops

Smallholder farmers in Kenya as well as Africa are known to be resource poor. This deter a number of them from engaging in high value crop production. Production of high value crops capital intensive and requires organized marketing system (Iyanda et al., 2014). It thus call for smallholder farmers to work together and synergies their efforts with aim of consolidating market as well as marshalling resources for meaning production. Working in groups has benefit of economies of scale, increasing market accessibility and also in increasing

diversification in production. Economic benefits and opportunities available when farmers engage in groups is enormous (Tolno et al., 2015). Studies have indicated that when farmers are organized in groups their ability to exploit the markets increases hence increased agricultural production.

The group dynamics and composition however plays a critical role in the survival and effectiveness of the groups. Trust among members and commitment of individual smallholder farmers is critical in determining the sustainability and effectiveness of the groups. Gender equity enables the farmers to benefit fairly from the social capital of the group. Farmers group with mixed gender and which provides equal rights to leadership and sharing of benefits is more suitable (Annisa et al.,2020)

Sustainability is also determined by level of education of individual smallholder farmers, distance to and from the meeting point as well as farm size (Kiprop et al., 2019). Smallholder farmers living away from the meeting point are less likely to participate in farmer groups compared to smallholder farmers residing near the meeting point. Other factors that may influence smallholder farmer participation in farmer group may include: Age of household head, household size and income participation (Martey et al., 2014).

### 2.11 Participation of smallholder farmers in marketing of high value crops

For the smallholder farmers to benefit fully from international markets and exports they must be well involved in export value chain of high value crops. This will enable them influence exporter to source agricultural products directly from them even without using middlemen (Amare et al., 2019). The smallholder farmers will also appreciate the various firm and export market characteristics, demands for exporting various agricultural products as well as specific production needs that affect safety and quality of the exported products.

Most smallholder farmers lack adequate knowledge on safety standards and other requirement due to non-participation in export market whether directly or indirectly. This affect exporter's judgement on smallholder farmers' ability to produce for export market. Such low judgements lead to unlikelihood of exporters sourcing products from them. However, due to logistic issues it becomes difficult for exporters to source a lot of agricultural products from smallholder farmers for export specifically due to transport cost. Participation of smallholder farmers in export market will help avert risk because always ye exporter will combine with his/her production and ensure his/her supply is steady (Ola & Menapace, 2020)

The participation of smallholder farmers in local high value market is equally important in production of high value crops. The local high value market includes supplies to schools,

hotels, hospitals and supermarkets (Macharia et al., 2016). These markets give better returns to farmers and their market is almost always assured. Furthermore, they provide better market information and thus enhancing the participation of smallholder farmers. Supermarkets for instance provides a better marketing opportunity as opposed to traditional local or open markets.

The supermarkets also ensure that there is food safety and high standards of hygiene hence better demand of their products (Kussaga et al., 2014). This gives better economic returns to farmers. However, there are few smallholder farmers who are able to exploit supermarkets due to a number of reasons. Some of the reason include: small volumes of production, lack of adequate market information and general low capital outlay. Most smallholder farmers therefore fail to meet the procurement conditions set by the supermarkets. Better market information, access to credits and good social capital is required by these farmers to well exploit the opportunities available (Andersson et al., 2015).

Local high value markets such as hospitals, hotels and schools prefer contracting farmers to supply them. Such contractual agreements have so much requirements which may not be within the reach of smallholder farmers as individuals. Similarly, farmers may lack specific market information required for them to participate fully in such markets. These farmers also lacks sufficient capitals, inputs as well a necessary extension information to enable them venture fully into the markets. Smallholder farmers thus need strong linkages into agricultural organizations and other innovation platforms to enable them participate well in these local markets (Kilelu et al., 2017).

## 2.12 Challenges facing small-scale farmers in accessing market information for production of high value crops

Smallholder farmers face a number of constraints that dissuade them from effectively accessing market information. Some of the challenges are structural while others are not (Mutayoba & Ngaruko, 2018). Some of the challenges include financial constraints, access to market information, technology use, and infrastructural challenges among others. Financial constraint has limited the farmers from using improved varieties of crops, adequate use of fertilizers and other necessary inputs resulting to low production. Access to finance is equally significant in enabling smallholder farmers access market information and participate in marketing of high value crop (Osmani & Hossain, 2015) Most financial constraints are associated with access to agricultural credits by smallholder farmers. This can be attributed to high cost of borrowing or risk aversion and financial illiteracy among the farmers. Deliberate

efforts and policy guidelines are therefore needed required to increase credit access and reduce risks (Gaurav & Singh, 2012)

Access to market information is one of the challenges affecting marketing and production of high value crops among smallholder farmers (Matsane & Oyekale, 2014). It leads to dependency of subsistence farming hence negatively affecting the living conditions of the farmers. Poor infrastructure such as roads and electricity supply among rural smallholder farmers can also be attributed to poor access to agricultural market information. Inadequate access affect he farmers' ability to competitively participate in both local and international markets. Mechanisms should thus be put in place to facilitate access and sharing of agricultural market information among smallholder farmers for improved and sustained productivity (Magesa et al., 2014).

### 2.13 Constraints of Smallholder Farmers in Production of High-Value Crops

Smallholder farmers, especially in Africa, are those farmers owning less than 2 hectares of land for subsistence and a few cash crop productions (Rigg et al., 2018). They are about 500 million smallholder farmers in the world feeding about 2 billion people. Their production account for 80% of all the food consumed in Asia and sub-Saharan Africa (Seto & Ramankutty, 2016). They are the resource-poor farmers who have myriad challenges rangingfrom access to resources, knowledge, market and market information and improved livelihood. They work in extraneous conditions and their main worries remain being food security and achieving economic stability.

Smallholder farmers are more vulnerable to climatic waves due to their social-economic status (Tran & Brown, 2018). According to United Nations Conference on Environment and Development *(*UNCED), Earth Summit, the farmers are both agents and victims of environmental degradation (Grubb et al., 2019). Their adoption strategy for climate change is also limited to their social-economic characteristics. However, with proper access to knowledge and information and a specific, actionable plan, they can adapt and sustain practices responsive to climate waves.

Given that smallholder farmers mostly dominate the production of High-value crops in Nyandarua, improved production of the HVC has the potential for reducing poverty through increased food production and income (Republic of Kenya, 2017b). It is, therefore, necessary to recognize how smallholder producers of fruits and vegetables can increase their productivity and face challenges on consumer demands, thus enhancing their market participation. This can be improved by empowering farmers to access market information timely and conveniently

(Van den Broeck & Maertens, 2016). Market information can be accessed using a particular channel(s) of communication thus, such information benefits bothfarmers and policymakers. It helps farmers to make a clear judgment on planting, which aligns well with consumer demands and also makes decisions on storage feasibility within orout of seasons.

## 2.14 Theoretical Framework

The study was being based on the Information Gap Theory by George Lowenstein and Golman (Golman & Loewenstein, 2018). The information gap theory contends that when an individual comes across a new and unexplained fact or phenomenon, which has not be explained by previous knowledge or experience, an information gap is formed. An information gap is a difference between what an individual knows and what they are expectedto know. Each individual has an inherent desire to learn or discover new things. The information gap, therefore, creates a feeling of uncertainty and deprivation which arouses curiosity. This is because there is a difference between what is known currently and what onewants to know, as illustrated in Figure 1.

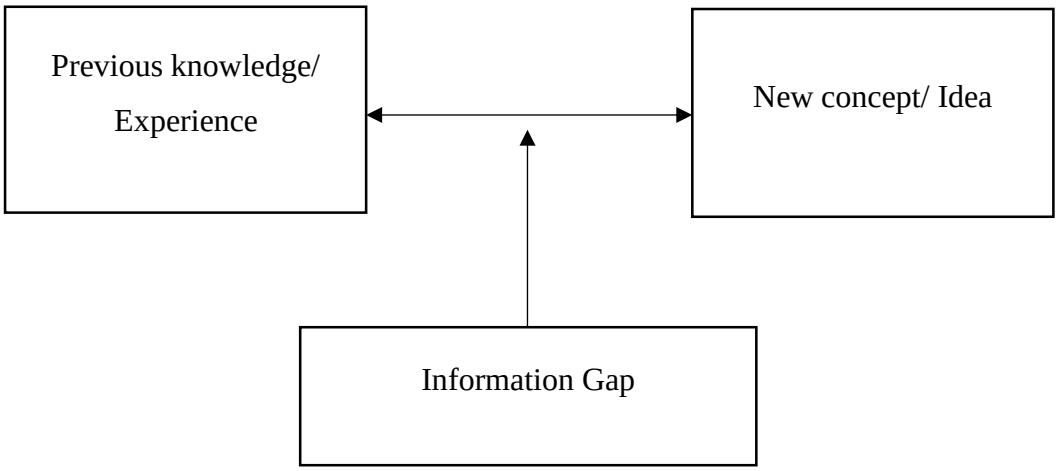


**Figure 1:** Information Gap Model. **Source**: Golman and Loewenstein (2018).

According to the theory, curiosity is "a cognitive induced deprivation that arises from the perception of a gap in knowledge and understanding." The intensity of curiosity is determinedby the information gap and increases when subjects are given part of a greater whole or when they correlate with their understanding of a particular domain. The more a subject knows about a given topic or area of understanding, the more likely they are to focus on their information gap. The theory thus focuses on individual goals, alternative designs/options and focus on the information gap.

When the information gap is wide, it weakens curiosity and creates fear for learning. This isbecause one feels that they might take longer and require more energy to close the information gap. While, when the gap is narrow to medium; it increases the desire to learnand close the gap. The information gap can be narrowed through increased access to information, education and economic empowerment. This eventually arouses their interest and mental strength to learn more about market dynamics which may lead to increased market access.

Therefore, the theory of information gap was to help the extension service providers to understand the best way possible of disseminating market information and also in trying to bridge the information gap. That was to ensure that the smallholder farmer and more so the poor rural farmer had vital access to market information and participate in the production and export of High-value crops

In the study, the theory thus underpinned the importance of access to market information and knowledge in sustaining production. When the farmers' market information is inadequate or itcannot explain a given market phenomenon, for instance, in case of product rejection in the market, it creates fear and discontentment among smallholder farmers. The farmers get discouraged because the economic incentives, that normally keep them in production diminishes. Thus, there was a need to understand how best the farmers can be delivered market information. That becomes even more serious if the information gap is too wide. The theory was used as a guiding blueprint that would enable those who package and transmit information and extension officers to understand how best smallholder farmers can be reached with market information. The primary aim was to reduce the information gap and spur more production especially the high-value crops, hence, more income to farmers.

## 2.15 Conceptual Framework

The independent variable was access to market information. These included the communication channel used by farmers to receive market information, the frequency of extension- farmer contacts made during the production and marketing process and participation in existing marketing groups. The dependent variable of the study was the production of high-value crops. Production was measured in kilograms of tree tomatoes harvested per unit acreage. The Moderator variables included gender and education levels. These variables were likely to influence the dependent variable in one way or the other. The researcher studied them alongside the independent variables to ascertain to what extent theyinfluence the outcome.

**Independent variable**

***Dependent variable***

**Access to Market information**

- Communication channels used: Fellow farmers, Agricultural officers, Newspapers and Magazines, Radio, Televisions, Internet, Agricultural shows and Seminars, Field days and exhibitions
- Agricultural extension contact: Frequency of interactions, the form of interaction, frequency of visit and ease of access to agricultural office
- Participation in farmer group: attendance to group meetings, frequency of attendance to group meetings and type of market information accessed through participation in groups.

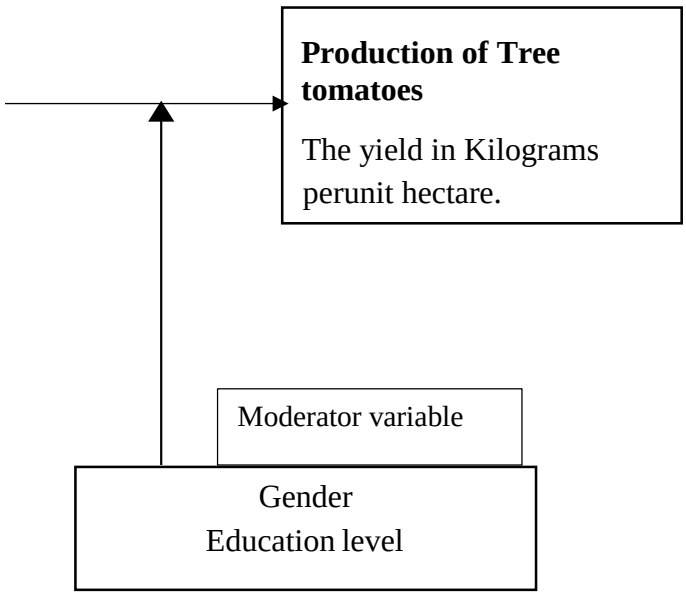


**Figure 2:** Conceptual Framework Showing the Interaction between Independent and Dependent Variables.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter covers the research design, location of the study and sample size, the target population and sampling procedures. The chapter also includes the research instruments, validations of the instrument and reliability estimations, data collection and data analysis procedures.

## 3.2 Research Design

The study adopted a mixed-methods research design. The design involves collecting, analyzing, and interpreting both qualitative and quantitative data in a single research study (Creswell & Clark, 2017). In the study approach, qualitative methods were being embedded in the quantitative (surveys), and then the two sets of data collected simultaneously. The study collected both qualitative and quantitative data; hence, the design helped to integrate the finding and interpretation of both sets of data. The two sets of data were combined during the data analysis and interpretation stage.

The qualitative data provided an understanding of participants' experience in accessing market information on the production of high-value crops. It also brought out different realities held by farmers individually or collectively on access to market information and the levels of interaction with disseminators of market information. The qualitative data, therefore,sought to enhance the understanding of how access to market information correlated with the production of high-value crops (Christ, 2018). Thus, the qualitative data collected were used to triangulate the findings of the quantitative data generated to enable making a concrete conclusion.

## 3.3 Location of the Study

The study was conducted in Ol'kalou Sub-County of Nyandarua County. The location of thestudy was ideal because of its proximity to Nairobi, which is the country's major market andexporting route. The sub-county also boarder major urban areas and municipalities such as Nakuru, nyahururu, Njambini, Gilgil among others. Equally, Nyandarua has several smallholder farmers living in poverty despite their engagement in the marketing of tree tomatoes as a high-value crop and their proximity to major urban centers surrounding it (Ongeri, 2014). The area was also ideal for this study as it portrayed the general characteristics of the whole county of Nyandarua. Equally, Nyandarua County is one ofKenya's agricultural

counties especially known for horticultural production.

The county is in the central part of Kenya. It borders Laikipia, Nakuru, Nairobi and Nyeri Counties. Its capital and largest town is Ol'kalou. The County has a population of 596,269and covers an area of 3,304 square kilometers (Republic of Kenya, 2017b).

Ol'kalou Sub-County is located in the northwest part of the former Central Province and contains Aberdare ranges. The sub-County has a population of about 143,748 persons, of which over 95 percent are involved in agricultural practices. It covers an area of approximately 586.7 square kilometers.The area receives about 1800 mm of rainfall per annum, well distributed throughout the year. The temperatures are as low as $10^{o}$c, exposing the area to frequent frostbite. The area has rugged terrains with spots of swampy soils (Republic of Kenya, 2017b). The soil type ranges from sticky clay to brown loamy soils.Datawere collected from the five wards in the sub-County: Karau, Kanjuiri Ridge, Mirangine, Kaimbaga, and Rurii.

### 3.4 Target Population

The study targeted all smallholder fruit farmers in Ol'kalou Sub-County. The accessible population was all smallholder farmers growing tree tomatoes. From the Ol'kalou Agricultural Sub-County office, it was estimated that about 200 smallholder farmers grewtree tomatoes in Ol'Kalou Sub-County. The study also targeted Agricultural extension officers from the five wards in Ol'kalou Sub-County.

### 3.5 Sampling Procedure and Sample Size

The exponential Non-discriminative snowball sampling technique was used. The snowballingwas used since it was quite difficult to construct the sampling frame from the target population as the accessible population had not been officially documented (Waters, 2015).
Non-discriminative snowball sampling involved recruiting the first subject who gives multiple referrals. Each of the new referrals then provided data for more referrals until the required sample size is achieved (Yadav et al., 2019).To ensure sample diversity, the initial respondents were varied (Kirchherr & Charles, 2018). The initial respondents selected formedthe basis from where snowballing was done non-discriminatively from each ward until the required sample size of 135 respondents was collected. The names of the first farmers from each ward used in the sampling process were obtained from the Sub-County agricultural office. The study also targeted key informants. The key informants were the agricultural extension officers. Each ward had one agricultural extension officer; thus, five agricultural extension officers were purposively selected. The five extension officers were separately interviewed. One focus group

discussion of twenty respondents was carried out for the farmers. The twenty respondents were randomly selected from each ward and from those whoparticipated in the questionnaires.
The sample size for farmers was calculated based on Yamane's formula (Israel, 2013).

$$n = \frac{N}{1 + Ne^2}$$

Where n= Sample size, N = Population size (the tree tomatoes farmers were estimated to be about 200) and e = the error at 5% point

N= 200

$$\text{n} = \frac{200}{1+200(0.05^2)} = 135 \text{ farmers}$$

The total sample size was thus 140. That is; 135 smallholder tree tomatoes farmers and thefive extension officers.

### 3.6 Instrumentation

The study used a survey questionnaire, a focus group guide and a key informant interview guide to collect information on access to market information and the production of high-valuecrops for farmers. The survey questionnaire targeted smallholder tree tomatoes farmers; the focus group guide targeted four selected farmers from each ward while the interview guide targeted extension officers from each ward. The questionnaires were used to collect quantitative data while the interview guide and focus group guide were used to collect qualitative data. The instruments were constructed by the researcher with consultations from research experts. The questionnaire was partitioned into two parts; that is, part I and II. Part I was used to collect information on the independent variable whereas part II was used to collect information on the dependent variable. The questionnaire was researcher-administeredbecause some farmers were not able to read and understand the questionnaire well by themselves. The key informant guide had different sets of questions from the other interview guide. One focus group discussion (FGD) was held. The group consisted of twenty tree tomatoes farmers from the five wards. A central point was established where members convened for the FGD.

#### 3.6.1 Validity

Validity is the extent to which the instruments accurately measure what they intend to measure in a study (Heale & Twycross, 2015). There are various types of validity, including construct, face, internal, external, content, criterion/ predictive, concurrent among others. In this study, face, content and construct validity were determined. The face, construct and content

validity of the research instruments was determined by research experts drawn from the Department of Agricultural Education and Extension of Egerton University.

### 3.6.2 Reliability

Reliability refers to the extent to which a research instrument consistently produces the sameresults if it is used in the same situation on repeated occasions (Heale & Twycross, 2015). The reliability of the research instruments was tested using the Cronbach alpha coefficient. A pilot study was carried out to ensure there are no wide variations in the manner in which the responses were given. A reliability coefficient of 0.785 was obtained. Since that was above the 0.7 reliability threshold for accepting the instruments; the instrument was then used to collect data.

The pilot study was conducted in the neighbouring Ol'joro Orok Sub-County, in Gatimu Ward. The ward is at the far end of Ol'joro Orok Sub-County hence minimizing interaction with the study area. The pilot area had similar demographics and geographical characteristics to the target area and, therefore, was suitable for testing the reliability of the instruments. Accordingto Johanson and Brooks (2010) a pilot study sample should be at least 10 percent of the sample projected for the larger parent study (Johanson & Brooks, 2010). Therefore, the pilot sample size was 25 smallholder farmers who were selected randomly after compiling the list of tree tomatoes farmers. All items in the questionnaire with the rating scale were coded in the SPSS computer software and Cronbach alpha reliability was determined. The results from the pilot study were discussed together with the supervisors and amendments or any other necessary corrections were done.

## 3.7 Data Collection Procedure

A clearance letter was obtained from Egerton University through the Board of Post-Graduate Studies that enabled the researcher to obtain a research permit from the National Commissionfor Science, Technology, and Innovation (NACOSTI). Upon receiving the permit, the researcher then sought permission from the Department of Agriculture within the County government of Nyandarua, that is, from the county and Sub-county agricultural departments and finally permission from the area administration through the office of the chief and the assistant chiefs.

The researcher then sought consent from the farmers who participated in the study. The respondents were met on their respective farms. They were first explained the purpose of the survey to ensure that they understood well intention of the study. This enabled them to make

an informed decision on their participation. Individual methods were used to conduct personal interviews.

### 3.8 Data Analysis

The Statistical Package for Social Science (SPSS) computer software was used to do regression analysis and other statistical analyses. Data analysis was done when all the questionnaires were duly filled and surrendered over (Patten, 2016). Both qualitative dataand quantitative data were generated. Data collected was organized and analysed. Descriptive statistical tools such as means, percentages, tables, graphs and thematic analysiswere employed to organize and analyse qualitative data. Multiple Regression analysis was used to analyse quantitative data. The findings were used to make interpretations and conclusions on each of the hypotheses and research questions. Each research question and hypothesis was analysed separately, and a general conclusion was made. The study recommendations were given based on the findings from the analysed data. Table 1 is a summary of the statistical test that was being used.

**Table 1:** Summary of Data Analysis

| Hypotheses | Independent Variable | Dependent Variable | Statistical Tool |
|---|---|---|---|
| **H01:** There is no statistically significant influence of communication channels for accessing market information on the production of high- value crops among smallholder tree tomatoes farmers in Ol'kalou Sub-County. | Market information communication channels | Average annual production inKilograms | Multiple Regression analysis. Descriptive statistics. Thematic analyses |
| **H02:** There is no statistically significant influence of Extension-Farmer contact for accessing market information on high-value crops among smallholder tree tomatoes farmers in Ol'kalou Sub-County. | Extension-Farmer contacts | Production of High-Value Crops | Multiple Regression analysis Descriptive statistics Thematic analyses |
| **Research Questions** | | | |
| Which are the commonly used communication channels for accessing market information on high-value crops among smallholder tree tomatoes farmers in Ol'kalou Sub-County? | | | Descriptive statistics Thematic analysis |
| How does participation in farmer group influences access to market information on high-value crops among smallholder treetomatoes farmers in Ol'kalou Sub-County? | | | Descriptive statistics Thematic analyses |

# CHAPTER FOUR
# RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter presents the results of the study. It contains results of the analysis of data from the questionnaires and focus group discussions from the farmers, and interviews from the extension officers. It contains both descriptive and inferential statistics. The descriptive entails frequencies, means, mode, pie charts and bar graphs. Multiple regression analysis hasbeen employed to test the hypotheses.

## 4.2 Response Rate

All 135 respondents were reached through snowballing, out of which twenty were selected toparticipate in focus group discussions. Five extension officers from the five wards were interviewed individually. The response rate was, therefore, 100 percent. That was attributed to the fact that the questionnaires were researcher administered.

## 4.3 Information on Access to Information on Tree Tomatoes Production

The study sought to find out how farmers came to know about tree tomatoes. It was importantto understand the primary source of information respondents relied on when they began production of tree tomatoes. A range of sources was provided from which they were supposedto select. They included; fellow farmers, agricultural extension officers, farmer groups, use of mobile phones, newspapers, radios, televisions, internets, agricultural workshops and seminars, agro vets, field days and exhibitions and local market surveys. The results were as shown in Table 2.

**Table 2:** Source of Information on Tree Tomatoes Production (n = 135)

| Source of Information | Percentages |
|---|---|
| Fellow farmers | 68.9 |
| Agricultural extension agents | 11.9 |
| Newspapers | 2.2 |
| Radios | 10.4 |
| Televisions | 3.0 |
| Internet | 1.5 |
| Agricultural Seminars | 0.7 |
| Local markets | 1.5 |

Table 2 indicates that 68.9 percent of the respondents knew about tree tomatoes from fellow farmers. Fellow farmers in this study included; neighbours, village mates, relatives and leadfarmers. That underpinned the significance of farmer-to-farmer extension. Newspapers, the internet and agricultural Seminars were least used to access information on tree tomatoes. It,therefore, implied that the respondents learned more from one another than other channels ofcommunication.

The findings conform to research done by Ronald et al. (2015) among Seaweeds farmers in Unguja, Zanzibar, which found that 93 percent of farmers used neighbours and or friends to access information, 83 percent used family and or parents while 87 percent used mass mediaespecially radios. The study also found that print media (newspaper and brochures) were theleast used channels of communication.

### 4.4 Use of Communication Channels

The variable was intended at establishing the most common communication channels used byfarmers in accessing market information for tree tomatoes crop among smallholder farmers. Itwas important in the study as it was used to Research Question One which states: Which are the commonly used communication channels for accessing market informationon high-value crops among smallholder tree tomatoes farmers in Ol'kalou Sub-County? The farmers were required to state the communication channel used to access marketinformation. Figure 3 shows the results.

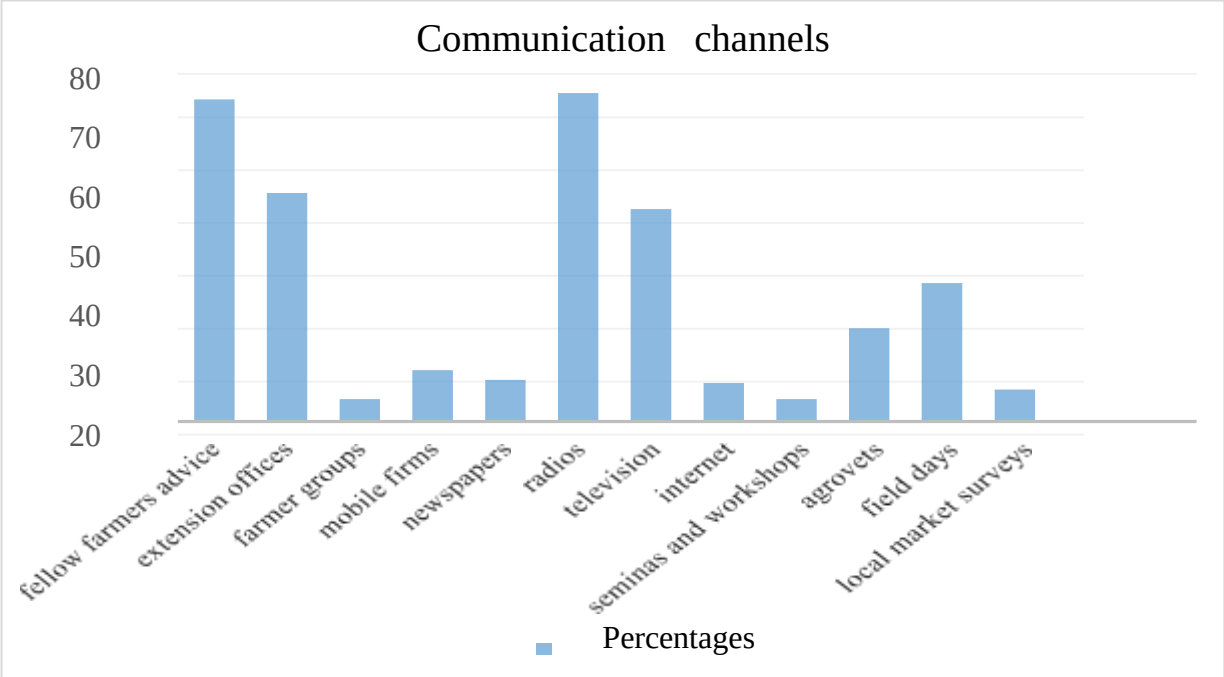


**Figure 3:** Communication Channels

The results from Figure 3 indicate that radios and fellow farmers were the most used channelsof communication at 75.6 percent and 74.1 percent respectively. Those were followed by extension officers at (52.6%), Television at (48.9%) and field days at 31.9 percent. That again reaffirmed the critical role of farmer-to-farmer extension in delivery of extension services. Radios were more easily accessed across the various groups of farmers compared to television. However, from findings of the focus group discussions, farmers acknowledged the use of television in information delivery but due to flexibility (portability) and power connectivity; radio remained the popular medium of accessing information by farmers. The results implied that more market information on the production of tree tomatoes as ahigh-value crop should be made available through the commonly used channels. More content should especially be channelled through radios and fellow farmers. Extension personnel should work closely with farmers in accessing market information.

These findings conform to the findings on extension communication channels usage and preferences by farmers in Benue state; Nigeria by (Okwu & Daudu, 2011). The research foundthat interpersonal channels of communication (fellow farmers, lead/contact farmers, neighbours, relatives and villagers) were more available to farmers at 45.9 percent followed by the use of extension agents at 38.6 percent. In the study, radio was more available among the mass media channels at 81 percent.

### 4.5 Frequency of use of Communication Channels

The respondents were asked to state the frequency of use of various communication channels.In this study, always meant at least once a week; Sometimes meant at least once a month; rarely meant once in a production season while never meant no use at all. This information was necessary for assessing the habit of farmers in accessing market information from the most commonly used channels. The results of the analysis were as shown in Table 3:

Radios, fellow farmers and agricultural extension remained frequently used communicationchannels in accessing market information. The results revealed that 80 percent of the respondent had never used farmer groups, newspapers and the internet as a communicationchannel for accessing market information. The results from interviews of the agricultural extensionists indicated that the officers preferred the use of group approach to reach the farmers. However, the farmer respondents did not prefer the use of groups. The results implied that farmers were not accessing sufficientmarket information since their level of interaction in groups was very minimal.

**Table 3:** Percentage of Communication Channel (n=135)

| | Percentage | | | |
|---|---|---|---|---|
| **Communication channel** | **Always** | **Sometimes** | **Rarely** | **Never** |
| Fellow farmers | 11.9 | 37.8 | 35.6 | 13.3 |
| Agricultural extension | 1.5 | 36.3 | 39.3 | 23 |
| Farmer groups | 0.7 | 9.6 | 9.6 | 80 |
| Phones | 1.5 | 9.6 | 17.8 | 71.1 |
| Radios | 20 | 43.7 | 28.9 | 7.4 |
| Television | 16.3 | 31.9 | 26.7 | 25.2 |
| Newspapers | 3 | 6.7 | 9.6 | 80 |
| Internets | 6.7 | 5.2 | 5.9 | 82.2 |
| Workshops | 1.5 | 6.7 | 19.3 | 72.6 |

The results agreed with the finding by Okwu and Daudu (2011) on extension communication channels' usage and preferences by farmers in Benue state (Okwu & Daudi, 2011). In the study, the frequency of use of interpersonal channels was higher, at 41.1 percent and extension agents at 37 percent. However, in the same findings, only 10.4 percent of the 66.8percent radio users utilized them on regular basis. That was contrary to the finding of this research which showed that over 86 percent of the radio users regularly used the radios (either used it always at 27% or sometimes at 59%).

### 4.6.1 Influence of Communication Channels on Access to Market Information

The study intended to determine the influence of communication channels for accessing market information on the production of tree tomatoes as a high-value crop among smallholder farmers in the Olkalou sub-county. The communication channels determined included: Radio, television, farmer groups, and use of mobile phones, agricultural extension officers, newspapers, internet and agro-vets. This was necessary for testing the following null hypothesis:

***H01:*** **There is no statistically significant influence of channels of communication for accessing market information on the production of tree tomatoes as high-value cropsamong smallholder farmers in Ol'kalou Sub County.**

Tables 4, 5 and 6 show the summary of the results.

**Table 4:** Analysis of variance showing influence of communication channels

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 703503784.285 | 6 | 117250630.714 | 2.232 | .044[b] |
| | Residual | 6723324304.707 | 128 | 52525971.131 | | |
| | Total | 7426828088.993 | 134 | | | |

a. Dependent Variable: Average production per year

b. Predictors: (Constant), agricultural-related website/internet, radio, agricultural extension officers, farmer group, mobile phone(SMS), television

The ANOVA Table 4 indicates F (6, 128) = 2.232, P = 0.044. The model was significant at *p* = 0.044. The factors (communication channels) thus successfully predicated the outcome variable (production of tree tomatoes).

**Table 5:** Model Summary of Influence of Communication Channels

| | | | | | Change Statistics | | |
|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df1 |
| 1 | .308[a] | .095 | .052 | 7247.480 | .095 | 2.232 | 6 |

From Table 5, communication channels explained a small proportion of variance in the production of tree tomatoes. Adjusted $R^2$ =0.052, F (6,128) = 2.232. Hence only 5.2% of the total production could be explained by the use of communication channels. That meant that 94.8% of total production was determined by other factors apart from communication channels.

**Table 6:** Coefficients

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | -2464.24 | 2451.18 | | -1.005 | .317 |
| | Radio | 1246.63 | 685.28 | .185 | 1.819 | .071 |
| | Television | 450.52 | 603.62 | .077 | 0.746 | .457 |
| | Farmer group | 1938.86 | 1051.69 | .164 | 1.844 | .068 |
| | Mobile phone (SMS) | 1027.19 | 1167.72 | -.086 | -.880 | .381 |
| | Agricultural extension officers | -250.39 | 569.36 | -.039 | -.440 | .661 |
| | Agricultural related website/internet | 109.85 | 675.18 | .015 | .163 | .871 |

The unstandardized coefficients showed that radio, televisions, farmer groups and the internethad positive contributions on the production of tree tomatoes at 1246.637, 450.522, 1938.866and 109.851, respectively. However, agricultural extension officers and the use of mobile phones had a negative contribution of -250.39 and – 1027.192 respectively. That could be so because the use of agricultural extension officers and mobile phones in the marketing of tree tomatoes was not common among the farmers. Extension officers were only limited to other crops and their field presence and farmer interactions in specifically marketing tree tomatoes were minimal. The regression model below explains the interaction of factors:

$$Y = \beta_O + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6$$

Where

$\boldsymbol{Y}$ = production of tree tomatoes in Kilograms; $\boldsymbol{X_1}$= Radio; $\boldsymbol{X_2}$ = TV; $\boldsymbol{X_3}$= Farmer groups; $\boldsymbol{X_4}$ = Mobile phone; $\boldsymbol{X_5}$ = Agricultural extension Officers; $\boldsymbol{X_6}$= Internet. Thus

$$Y = 1246.637\boldsymbol{X_1} + 450.522\boldsymbol{X_2} + 1938.866\boldsymbol{X_3} - 1027.192\boldsymbol{X_4} - 250.399\boldsymbol{X_5} + 109.851\boldsymbol{X_6} - 2464.244$$

The negative coefficient in the use of agricultural extension officers could be ascribed to lowfarmer-extension interaction and when that interaction happened, the subject was more of other crops other than tree tomatoes or livestock production and thus farmers ended up mixing information meant for other crops to production and marketing tree tomatoes. The interviews by extension officers moreover showed that they had little information on the

marketing of tree tomatoes. On the other hand, the negative coefficient on a mobile phone could be attributed to the fact that different people gave conflicting information on marketingof tree tomatoes. That was so because little information on marketing of tree tomatoes was made available either in print or audio-visual for the farmers. The farmers during the focus group discussion also acknowledged that they received little assistance from extension officers especially in accessing market information.

The standardized beta coefficients showed that radio was most influential followed by farmer groups at 0.185 and 0.164 standard deviations respectively. The farmer group was positively influenced even though few farmers belonged to tree tomatoes marketing groups. From the focus group discussions, farmers had registered some reservations to belonging to a farmer group. Their negative connotation of farmer group formation portrayed some underlying issues which could be subjected to further research. The constant indicated how the factors doinfluence production. Without the factors, production was estimated to reduce by over 2,464 kg which translates to over Ksh.123, 200 loss of income. This is substantial for a smallholder farmer. However, none of the factors (communication channels) was significant at $p = 0.05$. The nullhypothesis was accepted, at $p = 0.05$. The result implied that more other factors influenced the production of tree tomatoes as a high-value crop other than communication channels.

A study by Mulbah et al. (2020) on "Do transaction costs influence smallholder rubber farmers' choice of selling outlets?" found out that other factors such as transactional cost and socio-economic factors (including access to credit, income, climate and others) do play a vital role in marketing and subsequently the production of high-value crops. By accepting the null hypothesis; it implied that other factors significantly influenced the marketing of treetomatoes other than access to market information.

## 4.7 Participation in Farmer Groups

The farmers were asked whether they belonged to a farmer group(s). It was important inaddressing Objective Four of the study. Their responses were as shown in Figure 4.

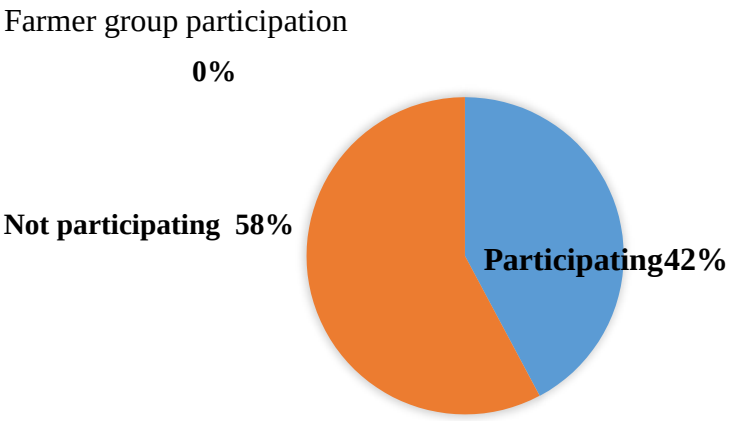


**Figure 4:** Farmer Group Participation

Figure 4 indicated that 58% of the respondent did not participate in any farmer group, whereas 42% did participate. When asked if the purpose of the group; they gave a variety of responses as follows: Input (e.g. fertilizer), dairy farming, One-acre fund (maize and horticultural production),Table banking/ loans Potatoes, Cowpeas farming and Cabbages. Farmer groups were mostly formed around a running project, such as One Acre Fund. The frequently mentioned purposes were: potatoes production, dairy farming, inputs acquisitionand table banking. Farmers were then asked whether they belonged specifically to a group that dealt with themarketing of tree tomatoes. The results are shown in Table 7:

**Table 7:** Farmer Group Dealing with Marketing of Tree Tomatoes

| | **Frequency** | **Percent** |
|---|---|---|
| Yes | 3 | 2.2 |
| No | 132 | 97.8 |
| Total | 135 | 100.0 |

Table 7 shows that 97.8 percent of the farmers did not belong to a group dealing with marketing of tree tomatoes. Although they acquired much of the information through fellow farmers, they found it difficult to organize themselves along specific tree tomatoes groups. They even expressed reservations about working in groups freely. They pointed out that existing groups were only sustained by projects. The few respondents (2.2 %) who belonged to the tree tomatoes marketing group were working online. Hence; there was no physical marketing tree tomato farmer group. That implied farmers lacked trust in one another, to enable them to work harmoniously in groups. A research by Ochieng (2018) on effect of market access provided by farmer organizations on smallholder vegetable farmer's income in Tanzania shows that belonging to market organizations by smallholder farmers increases their income through

increased access to market information. According to Jebesa (2019) researchtrust influence smallholder choices such as market outlet choices among others. The study also sought to determine whether farmer groups influenced farmers' opinion in accessing market information on quality aspects required in the production of tree tomatoes.The results were as indicated in Table 8.

**Table 8:** The extent to which Farmer Groups Influenced Farmers to produce quality Tree Tomato

| Extent of Influence | Frequency | Percent |
|---|---|---|
| Not at all | 121 | 89.6 |
| Small extent | 8 | 5.9 |
| Moderate extent | 5 | 3.7 |
| Large extent | 1 | .7 |
| Total | 135 | 100.0 |

Results in Table 8, indicate clearly that 89.6 percent of farmers were not influenced at all by farmer groups in accessing market information on quality aspects required in the production of tree tomatoes. Only 10.4 percent of farmers were either influenced to a small extent or a very large extent. That could be attributed to the fact that 97.8 percent of farmers did not belong to farmer group(s) dealing with marketing of tree tomatoes.

The implication was that low participation of farmers in farmer groups possibly limited their ability to produce tree tomatoes with qualities desired in the market, and also limited their effective participation in marketing activities. A research done by Abdul-Rahaman and Abdulai (2018) on the impact of farmer groups on farm yields and efficiency of smallholder farmers showed that participation of farmers in farmer groups increased their yields and technical efficiency. Social capital increases farmers' bargaining power and effective participation in the market. Fischer and Qaim (2014) in their publication, attribute low participation in farmer groups to structural and institutional factors and recommend the focus of groups be broadened to cater to the diversified interests of smallholder farmers (Fischer & Qaim, 2014). That implied that farmers did not benefit from the group approach which was mostly employed by extension officers. At the same time, they didn't harness social benefits associated with the group approach as highlighted above.

## 4.8 Agricultural Extension- Farmers Interaction

The extension–farmer interactions were analyzed by looking at both descriptive and inferential statistics through the use of linear regression. The extension-farmer interactions meant any form of communication ranging from physical to the use of media. Media forms included: Internet, Facebook, Twitter, WhatsApp and the use of phones. It was important in the study to underscore the significant role extension personnel play in providing information on production and marketing of high-value crops especially, tree tomatoes. The farmers were first asked whether they had ever interacted with extension personnel in whatever form. The results were as shown in figure 5.

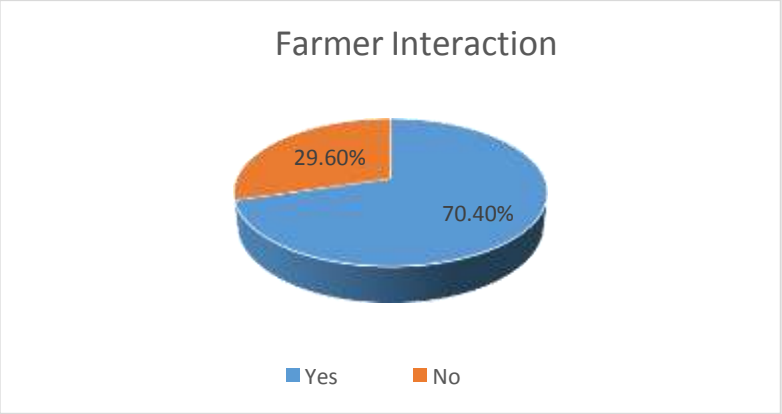


**Figure 5:** Farmer Interaction

The results show that the majority of farmers (70.4%) had some form of contact with extension personnel. When they were asked what kind of interaction they had, the resultswere as shown in Table 9:

**Table 9:** Percentage and Forms of Extension Interactions

| Interaction | Percent |
|---|---|
| Physically | 74.8 |
| Through phone calls | 8.9 |
| Through SMS | 1.5 |
| WhatsApp/Facebook | .7 |
| TV | 2.2 |
| Never | 5.2 |

The results indicated that majority of the farmers used face-to-face forms of interaction with less usage of social media platforms. That agreed with Ganpat et al. (2014) assertion that

physical visits were considered by farmers as effective in arousing satisfaction although their frequencies remained low (Ganpat et al., 2014). But when asked how frequently they used physical forms of interaction, their responses were as shown in Figure 5 (where always meant at least once a week, sometimes meant once a month, and rarely meant once in a production cycle):

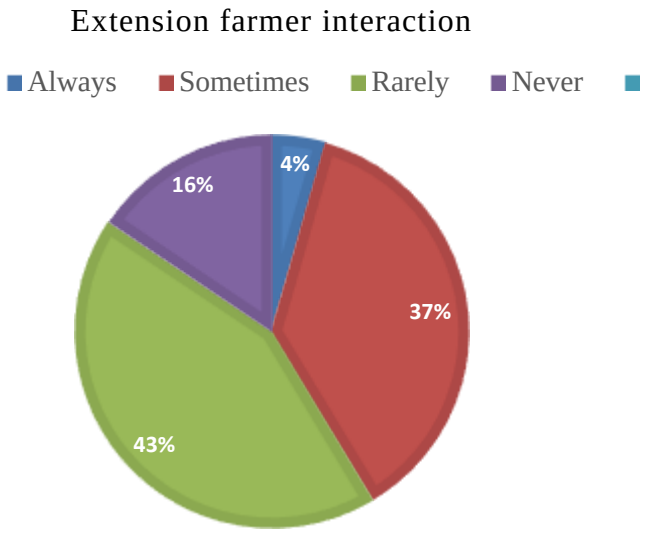


**Figure 6:** Extension Farmer Interaction.

The results in Figure 6 indicate that the extension to farmer interactions through face-to-face channels were done rarely (43%). It, therefore, meant that although they preferred physical interaction, the interaction was occasional. The farmers were then asked whether they ever visited the agricultural office. In their responses; 64.4 percent said yes they did while 35.6 percent said they had never visited the extension office. Therefore, 64.4 percent had visited agricultural offices at least once a year. Out of that, over 40 percent had gone either to seek information on subsidized fertilizer or apply for input provision. About three percent went to inquire about pests and diseases of major crops or dairy. However, none of the farmers went to inquire about market information on tree tomatoes marketing. Information flow between the farmers and extension personnel had little to do with access to market information on tree tomatoes. That was evident because tree tomatoes had not been incorporated in the County Strategic Plan hence no documentation was available in the office about tree tomato farmers. It, therefore, meant that agricultural extension, in general, had no influence in access to market information in the production of tree tomatoes as a high-value crop.

The results imply that the production and marketing of tree tomatoes were not on the prioritylist of extension training. The farmers had expressed a lot of interest in tree tomatoes even from the focus group discussion results. However, the extension office did not put it as a

priority crop implying that the interest of the farmers at one point had a mismatch with those of the extension office and the county government at large.

The results conform to research done by Ganpat et al. (2014), on farmers' satisfaction with extension services in the Organization of Eastern Caribbean States. The results showed that farmers preferred physical interactions with extension agents and that face-to-face interactionhad a significant effect on farmers' satisfaction with extension services provided (Ganpat et al., 2014).

### 4.9 Extension- Farmer interactions and Access to Market Information

The study sought to determine the influence of extension-farmer interaction in accessing market information for the production of tree tomatoes as a high-value crop among smallholder farmers. It was also necessary for addressing the third objective of the study. The third objective of the study was to determine the influence of extension farmer interactions in accessing market information on the production of tree tomatoes as a high- value crop among smallholder farmers in Olkalou Sub County. The following null hypothesiswas tested:

***H02:*** **There is no statistically significant influence of extension-farmer interactions in accessing market information on the production of tree tomatoes as a high-value cropamong smallholder farmers in Ol'kalou Sub County**

The forms of interactions analysed were: physical (face to face), use of the phone (calls and messages) and social media (WhatsApp and Twitter). The factors were analyzed along a rating scale of 1-5. The results were as shown in Table 10:

**Table 10**: Analysis of variance Showing Influence of Extension-Farmer Contact

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 128917741.649 | 5 | 25783548.330 | .456 | .808[b] |
| | Residual | 7297910347.344 | 129 | 56572948.429 | | |
| | Total | 7426828088.993 | 134 | | | |

a. Dependent Variable: Average production per year

b. Predictors: (Constant), Twitter contact, physical contact, phone call contact, WhatsApp contact, SMS contact

**Table 11:** Model Summary

| | | | | | Change Statistics | | |
|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted RSquare | Std. Error ofthe Estimate | R Square Change | F Change | df1 |
| 1 | .132[a] | .017 | .021 | 7521.499 | .017 | .456 | 5 |

The extension-farmer interactions were established by five items on a five-point rating scale:physical (face to face) contacts and media (phone call, SMS, WhatsApp and twitter). The regression model below shows how the factors interacted:

$$Y = \beta_O + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$$

Where; **Y**= production of tree tomatoes in kilograms $\boldsymbol{\beta_O}$= constant, $\boldsymbol{X_1}$= physical contacts, $\boldsymbol{X_2}$ = phone calls, $\boldsymbol{X_3}$ = SMS, $\boldsymbol{X_4}$ = WhatsApp, $\boldsymbol{X_5}$ = Twitter.

From Table 11, F (5,129) = 0.456, P = 0.808. The adjusted $R^2$ = 0.021. The p-Value for the model (0.808) was thus not significant. The null hypothesis was thus accepted at p = 0.05.

Therefore, extension-farmer interactions did not successfully predict the outcome (productionof tree tomatoes as a high-value crop). That could imply that extension-farmer interactions were very minimal and majorly concentrated on major crops, dairy and county flagship crop projects of which tree tomatoes was not one of them.

### 4.10 Education level and Access to Market Information

The education level was one of the moderator variables and thus was necessary to determinehow it affected access to market information and production of high-value crops especially production and marketing of tree tomatoes among smallholder farmers. The result of the study was as shown in Table 12:

**Table 12:** Level of Education

| Education Level | Frequency | Percentage |
|---|---|---|
| Post graduate | 2 | 1.5 |
| Bachelor | 7 | 5.1 |
| Diploma | 13 | 9.6 |
| Secondary | 54 | 40 |
| Primary | 53 | 39.3 |
| Certificate | 3 | 2.2 |
| Did not go to school | 3 | 2.2 |
| Total | 135 | 100 |

Table 12 showed that 39 percent of the farmers had primary level education while 40 percent had secondary level education. That implied that the majority of the respondents were literate.To determine whether education level influenced choice of communication channel used in accessing market information; Table 12 shows the results of the analyses.

From Table 13 level of education had no much influence on the choice and use of a particularcommunication channel. The pattern of choice and use was almost similar except for the use of farmer groups where those with higher education levels (above secondary) slightly preferred the use of farmer group. The internet use also tended to follow the same pattern with those with post-primary level tending to slightly employ it more than the other groups. Generally; the use of print media and social media was low across the levels of education compared to the use of interpersonal and mass media platforms.

**Table 13:** Cross-tabulation of Education Levels and Communication Channels

| Communication channel | Levels of education (%) | | | | | |
|---|---|---|---|---|---|---|
| | Postgraduate | Bachelor | Diploma | Secondary | Primary | No formal school |
| Fellow farmers | 100 | 42.9 | 53.8 | 81.5 | 75.5 | 66.7 |
| Extension | 50 | 57.1 | 84.6 | 40.7 | 54.7 | 66.7 |
| Farmer groups | 50 | 14.3 | 0 | 7.4 | 1.9 | 0 |
| Mobile phones | 0 | 28.6 | 7.7 | 13 | 11.3 | 0 |
| Newspapers | 0 | 28.6 | 23.1 | 11.1 | 3.8 | 0 |
| Radios | 50 | 100 | 84.6 | 70.4 | 75.5 | 100 |
| Televisions | 50 | 57.1 | 38.5 | 42.6 | 56.6 | 66.7 |
| Internets | 0 | 57.1 | 30.8 | 7.4 | 0 | 0 |
| Vorkshop/seminar | 0 | 14.3 | 7.7 | 5.6 | 5.7 | 0 |
| Agrovets | 0 | 28.6 | 7.7 | 18.5 | 26.4 | 33.3 |
| Exhibition | 0 | 42.9 | 53.8 | 35.2 | 26.4 | 0 |
| Local markets | 0 | 14.3 | 7.7 | 9.3 | 5.7 | 0 |

Access to market information through market channels was equally not influenced by the level of education as the majority preferred use of the local market as indicated in Table 15. The study also sought to determine whether there existed a relationship between education level and farmer group association and interaction with extension personnel. The results were as indicated in Table 14:

**Table 14:** Education Levels, Farmer Groups and Interactions with Extension Officers

| General | Levels of education (%) | | | | | |
|---|---|---|---|---|---|---|
| **Farmer group** | **Postgraduate** | **Bachelor** | **Diploma** | **Secondary** | **Primary** | **No formalschool** |
| Belonged | 50 | 42.9 | 46.2 | 44.4 | 39.6 | 33.3 |
| Not belonged | 50 | 57.1 | 53.8 | 55.61 | 60.4 | 66.7 |
| **Tree tomatoes group** | | | | | | |
| Belong | 0 | 14.3 | 7.7 | 1.9 | 0 | 0 |
| Not belong | 100 | 85.7 | 92.3 | 98.1 | 100 | 100 |
| **Interaction with Extension Officers** | | | | | | |
| Not at all | 0 | 42.9 | 0 | 0 | 15.1 | 0 |
| Some form ofinteraction | 100 | 57.1 | 100 | 100 | 84.9 | 100 |

Education level had a negligible effect on the participation and interaction of farmers. Farmers who had education levels below primary education tended to participate minimallyin general farmer groups. That was more evident as none of the farmers with either primary level education or with no formal education participated in groups dealing with the marketingof tree tomatoes as indicated in Table 14.

### 4.11 Gender and Access to Market Information

Gender was the other moderator variable in the study and so it was essential to also determinehow it affected access to market information on the production of tree tomatoes as a high- value crop. Figure 6 shows gender distribution among tree tomatoes farmers in Ol'kalou sub-County.

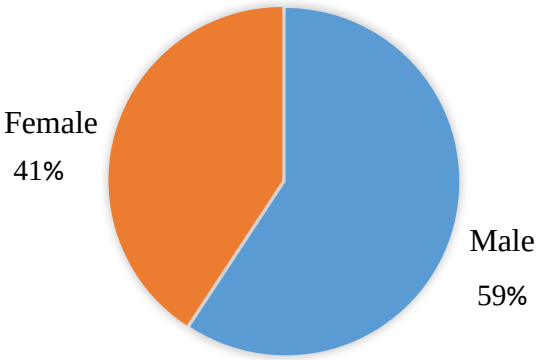


**Figure 7:***Gender of Respondents*

Figure 7 indicates that male farmers participated in the marketing of tree tomatoes at 59 percent. That was attributed to cultural issues where decision-making on the marketing of farm produce in most African families was bestowed to males (Pandey et al., 2011). This conforms to research done on extension communication channels' usage and preferences by farmers in Benue State, Nigeria (Okwu & Daudu, 2011). In the study, 97.6 percent of respondents were male compared to 2.2 percent female. However, this might also imply that females do participate in the production process but are less involved in marketing decisions.

The study also sought to determine how gender impacted access to market informationthrough various market outlets. The results of the study were as shown in Table 15:

**Table 15:**

*Gender and where Farmer Sell Their Produce*

| | **Male** | | **Female** | |
|---|---|---|---|---|
| **Market Type** | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Local market | 51 | 63.8 | 42 | 76.4 |
| Brokers | 15 | 18.8 | 3 | 5.5 |
| Export market | 5 | 6.3 | 0 | 0 |
| Neighbours | 9 | 11.3 | 10 | 18.2 |

Table 15 showed that 63.8 percent of male farmers and 76.4 percent of female farmers sold their produces at local markets. Accessing market information through the local market waspreferred irrespective of gender. However, males relied more on brokers than women. No female accessed market information through participation in the export market. The respondents expressed during focus group discussions that they feared the use of brokers due to their exploitative nature and hence female farmers tend to be more cautious in their

engagements with them.

The study also sought to find out how gender influences the participation of farmers in farmer groups. Table 16 indicates the association of farmers in farmer groups.

**Table 16**

*Gender and Farmer Groups Association*

| | **Male** | | **Female** | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| General Farmer group | | | | |
| Belongs | 25 | 31.3 | 32 | 58.2 |
| Do not belong | 55 | 68.8 | 23 | 41.8 |
| **Tree tomatoes Farmer group** | | | | |
| Yes | 2 | 2.5 | 1 | 1.8 |
| No | 78 | 97.5 | 54 | 98.2 |

Table 16 indicates that, generally, more females participated in farmer groups than male farmers at 58.2 percent as compared to 31.5 percent. Female farmers were used to working ingroups and thus it was easier for them in participating comfortably in groups. Gender did nothave any effect on farmers participating in tree tomato groups.

The study also sought to find out whether gender had any influence on access to market information through the various communication channels. Table 17 shows comparison between gender and the use of communication channels in accessing market information

**Table 17**

*Gender and Channels of Communication*

| Access to Market Information | Male | | Female | |
|---|---|---|---|---|
| **Channel of communication** | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Fellow farmers | 59 | 73.8 | 41 | 74.5 |
| Extension officers | 47 | 58.8 | 24 | 43.6 |
| Farmer groups | 3 | 3.8 | 4 | 7.3 |
| Mobile phone | 10 | 12.5 | 6 | 10.9 |
| Newspapers | 8 | 10 | 5 | 9.1 |
| Radios | 60 | 75 | 42 | 76.4 |
| Televisions | 36 | 45 | 30 | 54.5 |
| Internets | 7 | 8.8 | 5 | 9.1 |
| Seminars/workshops | 3 | 3.8 | 4 | 7.3 |
| Agro vets | 18 | 22.5 | 11 | 20 |
| Field days/ exhibitions | 28 | 35 | 15 | 27.3 |
| Local market surveys | 7 | 8.8 | 3 | 5.5 |

Table 17 shows that gender did not influence the choice of communication channels used in accessing market information. It was, however, worth noting that, more male accessed information through extension agents at 58.8 percent as opposed to 43.6 percent. At the same time, 45 percent of the male farmers accessed market information through television compared to 54.5 percent of female farmers. More female farmers used television probably because they were likely to be at home when such programmes are aired**.** The study also sought to determine whether gender affected farmer-extension interactions. Table 18 shows the relationship between gender and farmer-extension interactions**.**

**Table 18**

*Gender and Farmer Extension Interaction*

| Interaction with the extensionofficer | Male | | Female | |
|---|---|---|---|---|
| | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Yes | 61 | 76.3 | 34 | 61.8 |
| No | 19 | 23.8 | 21 | 38.2 |
| **Visit agriculture office** | | | | |
| Visited | 55 | 68.8 | 32 | 58.2 |
| Not visited | 25 | 31.3 | 23 | 41.8 |

Table 18 showed that gender generally did not affect the overall farmer-extension interactions in accessing market information for the production of tree tomatoes. However, the results also indicated that ten percent more male farmers visited the agricultural office for consultation than their female counterparts. That could be because female farmers spend a lot of time in domestic works over and above their farming hours. According to Hill and Vigneri (2014) female farmers on average work 1.5 times more a week than male farmers and most of their time is spent in domestic work (Hill & Vigneri, 2014).

### 4.12 Challenges Faced by Respondents in Accessing Market Information

The findings on challenges faced by respondents in accessing market information are shown in Table 19.

**Table 19**: Frequency of Respondents reporting Challenges faced in Accessing Market Information(n=135)

| Challenges | Percentage |
|---|---|
| Infrastructural challenges | 72 |
| Difficult in accessing market information | 47 |
| Brokers giving inadequate or unreliable information | 22 |
| Lack of organized marketing system for tree tomatoes | 42 |

Table 19 shows that the main challenges were infrastructural, difficult in accessing market information and lack of organized system for tree tomato. This conforms to a research done by Misaki (2018) on challenges Sub-Saharan smallholder farmers. Through the focus group discussions, the respondents cited some challenges they faced while trying to access

market information on Tree Tomatoes. First, the information was scanty, scattered and not well organized hence difficult to acquire an adequate, reliable and consistentflow of information. The major source of their information was fellow farmers and since the information was not well documented; their main confidence was on experiences from progressive farmers. The little information they got was not timely, reliably verifiable and from a source, they could trust. The respondents reported that the brokers also hid critical information or gave scanty information to retain them in business. In that way, they were ableto manipulate and exploit farmers who somehow had little knowledge about the market.

A study by Miller indicates that brokers could not wish the farmers to be aware of market prices so that they may continue to be in business (Miller, 2014). In a different study, the researchers found out that inadequate access to market information poses a serious challengein the adaption of technologies in agriculture (Shiferaw et al., 2015). A research carried out by Maheshwar and Chankwa (2006), also pointed out that over 40 million tons of fruits and vegetables were wasted annually in India due to poor infrastructure, insufficient storage capacity, poor transportation and unavailability of cold storage facilities close to the farms (Maheshwar & Chanakwa, 2006).

The respondents also reported that Tree tomato farmers did not have access to inputs just likein other crops. Inputs were only available for major crops like maize, potatoes and dairy farming. Additionally, extension personnel were few. They were hardly available and when available were majorly concerned with potatoes, maize, dairy and County flagship project crops like avocado, macadamia and bamboo. Similarly, the flow of information from extension personnel was erratic. It was equally difficult to acquire quality, certified and clean planting materials. The farmers locally prepared their planting seedlings from ripe fruits. However, they lacked adequate information on how to achieve quality and certification.

Inadequate infrastructural facilities like electricity, roads, cooling and storage among others were cited as challenges facing farmers. Electricity connectivity hindered internet and other network connectivity thus access to information. Inaccessible feeder roads too hampered theflow of produce to the market. Lastly, the lack of an organized marketing system that was heavily dependent on brokers did pose a challenge to farmers. That coupled with constant price fluctuations and inaccessible major markets made it cumbersome for them to market tree tomatoes.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## 5.0 Introduction

This chapter provides a summary of study, and also gives the conclusions and recommendations of the study. The chapter ends with suggestions for further research.

## 5.1 Summary of the Study

The study was carried out along four objectives, that is, to identify the commonly used communication channels for accessing market information on the production of tree tomatoes among smallholder farmers in Ol'kalou Sub-County; to determine the influence of communication channels for accessing market information on the production of tree tomatoes among smallholder farmers in Ol'kalou Sub-County; to determine the influence of extension-farmer interactions for accessing market information on the production of tree tomatoes among smallholder farmers in Ol'kalou Sub-County and lastly to determine how participation in farmer groups influenced access to market information on the production of tree tomatoes as a high-value crop among smallholder farmers in Ol'kalou Sub-County. The commonly used communication channels included: Radios at 75.6 percent, fellow farmers at 74.1 percent, agricultural extension at 52.6 percent, and television at 48.9 percent. Radio played a key role in informing farmers about the marketing of tree tomatoes. Most of the radio stations in question broadcasted in vernacular and therefore it was easier for farmersof all levels to connect well with it. At the same time, the time when these radio programs were being aired was convenient to most farmers.

The results of the regression analysis was $F(6,128) = 2.23$, $p = 0.044$. That result indicated that access to communication channels only influenced 5.2 percent of the production of tree tomatoes. A bigger variance (94.8%) of the outcome variable would therefore be explained byother factors other than access to communication channels. The influence of all the communication channels was not significant at $p = 0.05$ and thus the null hypothesis was retained.

Extension- farmer interaction was positive at 70.4 percent, with physical/face-to-face interaction being popular at 74.8 percent. The frequency of face-to-face interaction was rare at 43% or sometimes at 37 percent. That showed that the interaction was not as frequent as it would be. The interactions, were, however, not about the production or marketing of tree tomatoes but other factors like an inquiry into input subsidies such as fertilizer and seeds. The result of the regression analysis indicated that $F(5,129) = 0.465$; $P = 0.808$ and $R^2 = 0.021$.The

model was not significant and therefore the null hypothesis retained at p = 0.05.

## 5.2 Conclusions

The following were the conclusions of the study:

i. Radios and fellow farmers are the most commonly used channels for accessingmarket information on tree tomato production among smallholder farmers in Olkalou sub-county.

ii. Communication channels for accessing market information do not influence the production of tree tomatoes among smallholders in Olkalou Sub-county.

iii. Extension- farmer interactions do not influence the production of tree tomato among smallholder farmers in Olkalou sub-county.

iv. Participation in farmer groups has a positive effect on the production and marketingof tree tomatoes crop among smallholder farmers in Olkalou Sub County. The farmer groups have a positive effect on the marketing of tree tomatoes although it was unpopular among smallholder farmers in the sub-county.

## 5.3 Recommendations

Based on the research findings and conclusions, the following recommendations are made:

5.3.1 The County Government of Nyandarua should work closely with vernacular radio stations in developing appropriate tree tomatoes marketing information content and disseminating it to farmers. The radio stations are popular and mostly used by farmers.

5.3.2 Farmers should be encouraged to work in groups and assist them to dispel any fears founded on historical accounts especially mistrust that originated from the collapse of cooperatives. Farmers groups had a positive impact on the marketing of tree tomatoes. In the groups, farmer to farmer extension can easily be enhanced since thefarmers also preferred fellow farmers as a channel of accessing market information.

5.3.3 The extension personnel should encourage the use of other forms of interactions such as media or establish a call Centre since face-to-face interactions may not be tenable. They should also engage farmers in marketing tree tomatoes as an emerging high- value crop.

## 5.4 Suggestions for Further Research

Based on the findings of the study, it is recommended that further research be carried out todetermine:

a. The Socio-Economic and institutional factors that influence the production of tree tomatoes

b. Factors affecting group marketing of high value crops.

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## APPENDICES

### APPENDIX A: Questionnaire for Smallholder Farmers

**Introduction**

My Name is **Victor Monda Ombasa**. I am a student taking MSC agricultural extension from **Egerton University**. I am carrying out a study on the influence of access to market information on the production of high-value crops, particularly for the production of Pepino melon and tree Tomatoes. I would like to request your time to provide me with the following information. The questions will take approximately 30 minutes of your time; your response tothem will help in evaluating the topic of study.

You are instructed to answer questions concerning access to market information, production of high-value crops within the Sub County, agricultural practices, sex and education, employment, culture, and agricultural extension activities. Your input will assist in addressing the issues that are affecting the majority of the community members. Confidentiality is guaranteed, and no penalty for both participating and not participating.

**Questionnaire number: …….**

**SECTION A: PERSONAL DATA**

1. Age in years (……)
2. Sex: Male (……) Female (……)
3. Main source of Income: Farming (……), business (……), employment (……), other (……) (specify)
4. Education: Postgraduate (……) Bachelor/Diploma (……) Secondary (……) Primary(……) Did not go to school (……) Others (……) (specify) ((……) )

**SECTION B: Production of Tree Tomatoes**

1. How did you come to know about the Tree tomatoes?

   Fellow farmers' advice (……). Agricultural extension officers (……) Farmer groups(……) Mobile phones (……..) Newspapers (……) Radio (……) Televisions (……) Internet (……) Agricultural workshop/ seminars (……) Field days and exhibitions (……) others (specify) what is your average acreage underproduction ofPepino Melon/Tree Tomatoes?

2. What is the size of your farming land and how much is under tree tomatoes production?

a. Size of farm land

b. Size under tree tomatoes

3. How many times do you harvest tree tomatoes in a year? (……)
4. What is your average production of Tree tomatoes in every harvesting season inKilograms? (……)
5. What is your average income from the sale of Tree tomatoes per harvesting season? (……)
6. Where do you sell your produce?

   Local markets (……) Brokers (……). Private companies (……) Export markets (……). Neighbours (……) others, specify (……)
7. What challenges do you face in accessing market information?

**SECTION C: Participation in Farmer Group**

1. Do you belong to any of the farmer groups? Yes (……) No (……)
2. If yes the purpose
3. Do you belong to any farmer group dealing with the marketing of tree tomatoes? Yes(……) No (……)
4. If yes, how often do you attend meetings of the group?Rarely (……) Sometimes (……) Regularly (……)

   *N/B: regularly means attendance in all meetings, sometimes means over half of themeetings while rarely means less than half of meetings held.*
5. What kind of activities that the group are you involved in?

   ……

   ……

   ……
6. What type of market information have you ever received as a result of yourinvolvement in the farming group(s)?

   Transportation (……) Selling and pricing of the produces (……) Available market opportunities (……) Specific market demands, quality and preferences (……) Others,specify (……)
7. On a rating scale of 1-5, do what extent has involvement in farmer groups influencedyour production of Tree tomatoes. Scale 1=Not at all, 2= to small extent, 3= to Moderate extent 4=to

a large extent, 5= to a very large extent

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| | | | | |

**SECTION D**: **Use of Communication Channels**

How do you get information on production and marketing of tree tomatoes?

Fellow farmers' advice (……). Agricultural extension officers (……) Farmer groups(……) Mobile phones (……..) Newspapers and Magazines (……) Radio (……) Televisions (……) Internet (……) Agricultural workshop/ seminars (……) Field days and exhibitions (……) Others (specify)

……

5. Which of the sources mentioned above has been more useful in informing you onproduction and marketing of tree tomatoes?

……

6. How often do you get information from the following channels of communication?

*N/B: Always means at least once a week; Sometimes means at least once a month; rarelymeans once in a production season while never means none the whole production cycle and year.*

| **Channel of communication** | **Always** | **Sometimes** | **Rarely** | **Never** |
|---|---|---|---|---|
| Fellow farmers' advice | | | | |
| Agricultural extension officers | | | | |
| Farmer groups | | | | |
| Mobile phones | | | | |
| Newspapers and Magazines | | | | |
| Radio | | | | |
| Televisions | | | | |
| Internet | | | | |
| | | | | |
| Agricultural workshop/ seminars | | | | |
| Field days and exhibitions | | | | |
| Others (specify) | | | | |

7. What challenges do you face in accessing agricultural market information/ advice?

   ……

   ……

   ……..

8. On a rating scale of 1-5, to what extent have the following communication channels influenced your production of Tree tomato? Scale 1=Not at all, 2= to small extent, 3= toModerate extent 4=to a large extent, 5= to a very large extent.

| **Communication channel** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| Radio | | | | | |
| Television | | | | | |
| Farmer group | | | | | |
| Mobile phone( SMS) | | | | | |
| Agricultural extension officers | | | | | |
| Agricultural related website/internet | | | | | |
| Newspapers/ Magazines | | | | | |
| Internet | | | | | |

**SECTION E: Information on Extension Contact**

1. Who do you go to for agricultural information?
2. Have you ever interacted with agricultural extension officers during your productionof tree tomatoes? Yes (……) No (……)
3. How often do you interact with extension officials?
   Always (……) Sometimes (……) Rarely (……) Never (……)
   *N/B: Always means at least once a week; Sometimes means at least once a month;rarely means once in a production season while never means none the whole production cycle and year.*
4. How did you interact with the extension officers?
   Physically (……). Through phone call (……) Through SMS (……) WhatsApp (……) Facebook (……) others (specify) (……)
5. How many times have you interacted with agricultural officer using the form ofinteraction identified above?

| Form of interaction | Always | Sometimes | Rarely | Never |
|---|---|---|---|---|
| Face to face | | | | |
| Phone calls | | | | |
| Messages( SMS) | | | | |
| Internet | | | | |
| Radio | | | | |
| Television | | | | |
| Others( Specify) | | | | |

6. Have you ever visited the agricultural office(s) for agricultural advice on access tomarket information for the production of tree tomatoes or any other form of agricultural advice? Yes (……) No (……)
7. If yes, how often: Always (……) Sometimes (……) rarely (……)
8. How easy is it to access services from extension personnel?
   Very difficult (……) Difficult (……) Somehow difficult (……) Not difficult at all(……)
9. How many times, in average, in a year do you interact with extension personnel(s)

   ……
10. On a rating scale of 1-5, do what extent has the following extension-farmer contact influenced your production of tree tomatoes. Scale 1=Not at all, 2= to small extent, 3=to Moderate extent 4=to a large extent, 5= to a very large extent.

| **Extension-Farmer contact** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| Physical | | | | | |
| Phone call | | | | | |
| SMS | | | | | |
| WhatsApp | | | | | |
| Twitter | | | | | |
| Other forms of contact | | | | | |

## APPENDIX B: Interview Guide for Focus Group Discussions

**Questions for the farmers**

1. Do what extent do you participate in the production of the crop in terms of totalhectares?

……

……

2. How do you market and where do you sell your produce?

……

3. What do you think about marketing of tree tomatoes?

……

4. How often do you interact with agricultural officers during your production process in a three months cycle?

……

5. What kind of information do you share during the interactions?

……

6. What do you think about extension services you receive?

……

……

7. How do you access agricultural information?

……

8. What challenges do you encounter in accessing market information?

……

……

9. How do farmers participate in farming groups in your area?

……

10. What are some of the challenges you are faced in accessing market information?

……

## APPENDIX C: Interview Guide for the Agricultural Extension Officers.

1. How many farmers in your area do produce Tree tomatoes?
2. What can you say about tree tomatoes in your area?
3. What is the average number of farmers are you able to advice regarding theproduction of tree tomatoes in a year?
4. How often do you go out to meet farmers?
5. Are you making follow ups to farmers you visit? If yes how often?
6. How do you interact with farmers? Which are the possible means ofcommunication is convenient to you for use?
7. Tell me something about farmer groups in your area and how they are promoting production and marketing of tree tomatoes?
8. What unique experience have you had with farmers and you wish to share?

**Thanks for your time**

**APPENDIX D: Map of the Study Area**

## APPENDIX E: Regression Analysis Result

**Model Summary**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 703503784.285 | 6 | 117250630.714 | 2.232 | .044[b] |
| | Residual | 6723324304.707 | 128 | 52525971.131 | | |
| | Total | 7426828088.993 | 134 | | | |

a. Dependent Variable: Average production per year

b. Predictors: (Constant), agricultural-related website/internet, radio, agricultural extension officers, farmer group, mobile phone(SMS), television

**Model Summary of Influence of Communication Channels**

| | | | | | Change Statistics | | |
|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df1 |
| 1 | .308[a] | .095 | .052 | 7247.480 | .095 | 2.232 | 6 |

**Coefficients**

| | | **Unstandardized Coefficients** | | **Standardized Coefficients** | | |
|---|---|---|---|---|---|---|
| Model | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | - 2464.244 | 2451.180 | | -1.005 | .317 |
| | Radio | 1246.637 | 685.284 | .185 | 1.819 | .071 |
| | Television | 450.522 | 603.625 | .077 | .746 | .457 |
| | Farmer group | 1938.866 | 1051.694 | .164 | 1.844 | .068 |
| | Mobile phone (SMS) | - 1027.192 | 1167.727 | -.086 | -.880 | .381 |
| | Agricultural extension officers | -250.399 | 569.366 | -.039 | -.440 | .661 |
| | Agricultural related website/internet | 109.851 | 675.187 | .015 | .163 | .871 |

**APPENDIX F: ANOVA Showing Influence of Extension-Farmer Contact**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 128917741.649 | 5 | 25783548.330 | .456 | .808[b] |
| | Residual | 7297910347.344 | 129 | 56572948.429 | | |
| | Total | 7426828088.993 | 134 | | | |

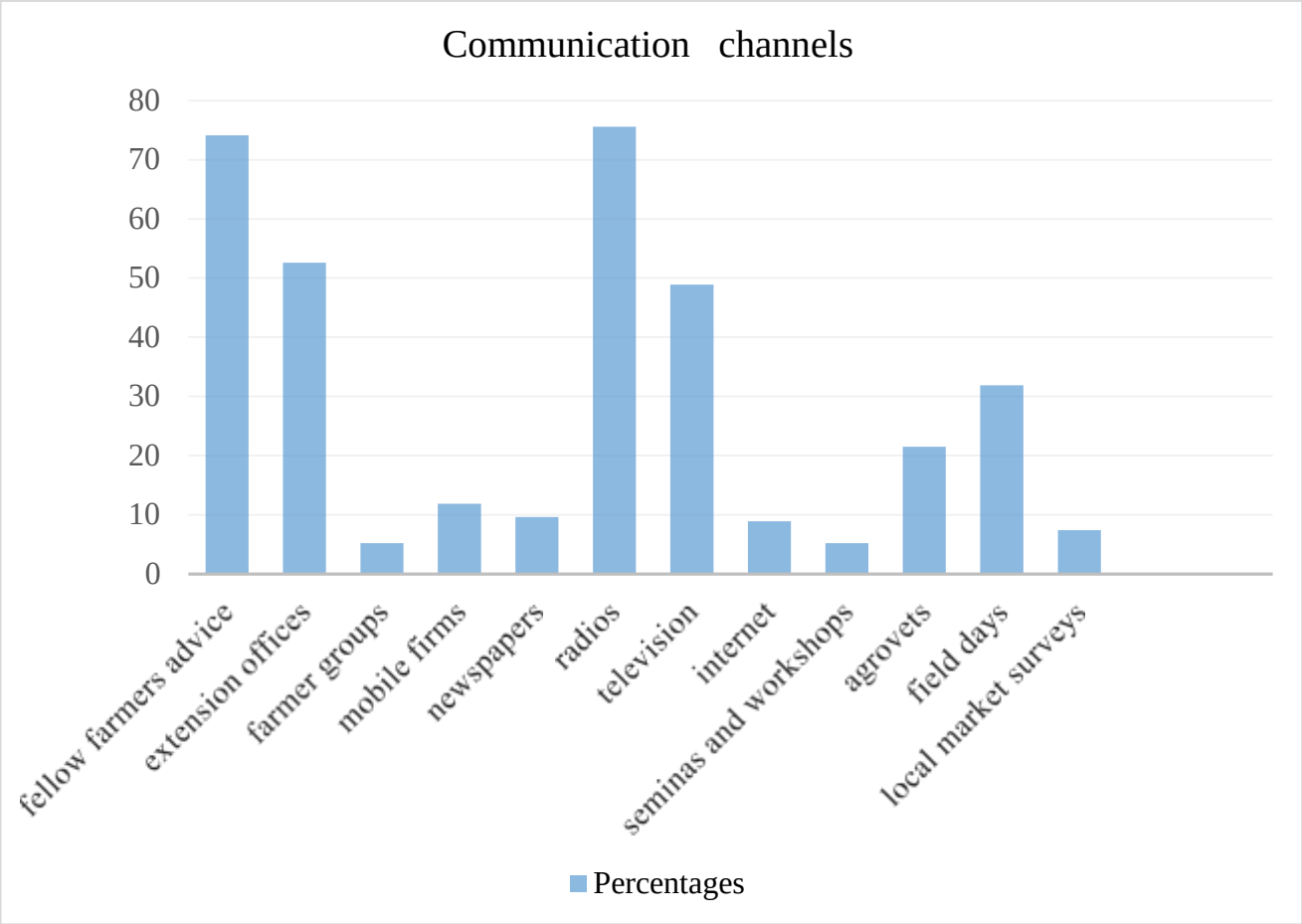
a. Dependent Variable: Average production per year

b. Predictors: (Constant), Twitter contact, physical contact, phone call contact, WhatsApp contact, SMS contact

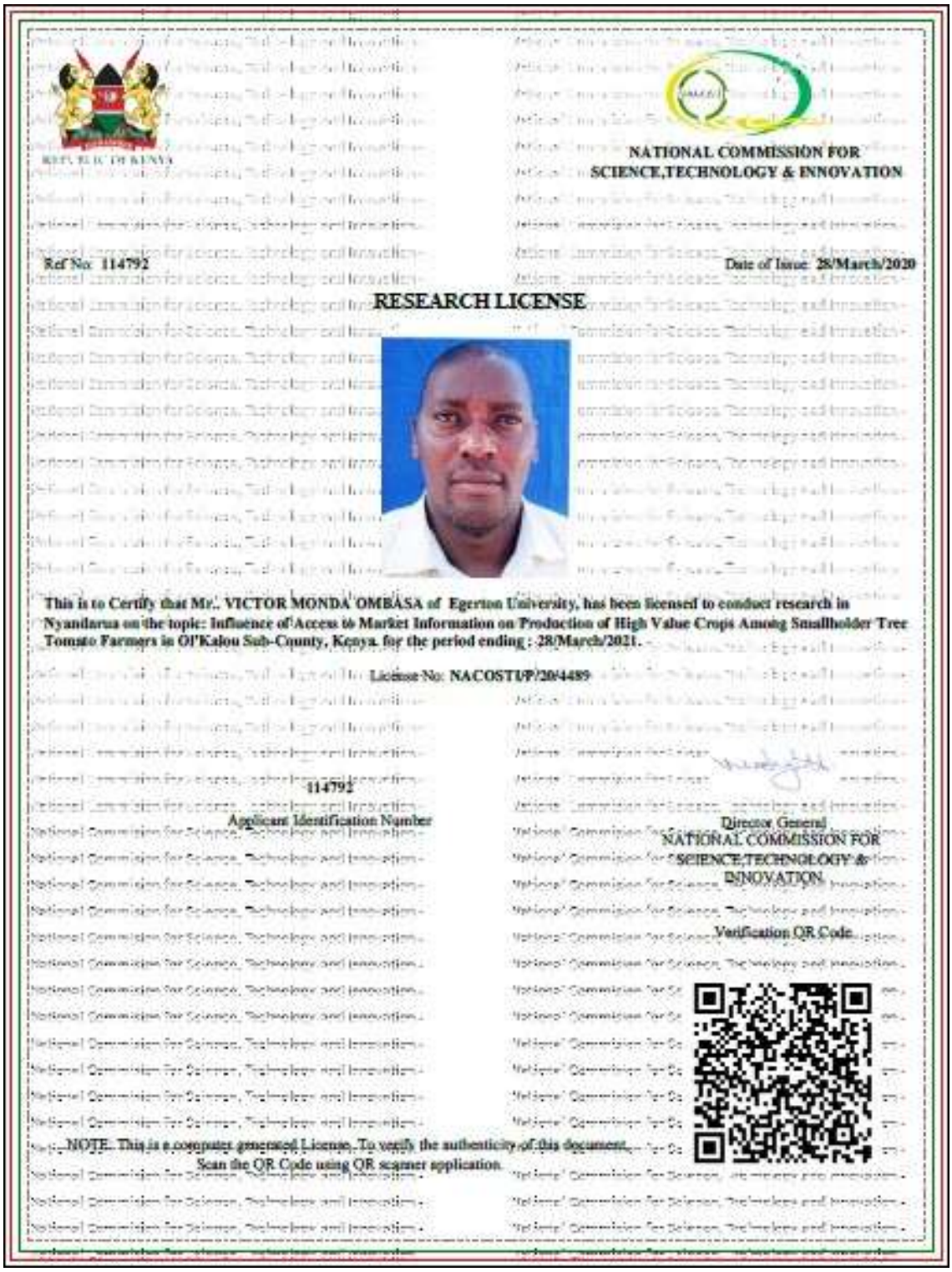
Model summary

| Change Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df1 |
| 1 | .132[a] | .017 | .021 | 7521.499 | .017 | .456 | 5 |

**APPENDIX G: Commonly used Communication Channels**



## APPENDIX H: Research Permit



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# INFLUENCE OF MARKET INFORMATION COMMUNICATION CHANNELS ON THE PRODUCTION OF HIGH-VALUE CROPS AMONG SMALLHOLDER TREE TOMATO FARMERS IN OL'KALOU SUB-COUNTY

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## Abstract

*Access to market information is crucial in accessing market for agricultural production. Farmers should be facilitated to access market information for sustainable production. This study was done to understand the most preferred channels of communication through which information reaches farmers. The study was conducted in June 2020 in Olkalou Sub- County of Nyandarua County, Kenya. It targeted 200 tree tomato farmers. Exponential Non-Discriminative Snowball sampling method was used to select a sample of 135 Tree tomato farmers based on Yamane's formula. A survey questionnaire and interview guide were used to collect data. The instruments were validated by research experts from the Department of Agricultural Education and Extension, Egerton University. A pilot test was carried out in Gatimu ward in the neighboring Ol'joro Orok Sub-County. Cronbach alpha coefficient of 0.785 was obtained for reliability. Descriptive statistics and multiple regression were used for data analysis respectively, using Statistical Package for Social Sciences (SPSS). The results indicated that radios (75.6%), fellow farmers (74.6%), Extension agent (52.6%) and television (48.9%) were the commonly used channels. The regression analysis, at α level of 0.05 were; $F(6,128) = 2.232$, $p = 0.044$ and $R2 = 0.052$; hence communication channels influenced production by 5.2%.*

*Keywords: High value crops, Smallholder farmer, communication channel, access to market information, Extension contact*