

**THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)  
IN MARKET INFORMATION ACCESS AMONG SMALLHOLDER POTATO  
FARMERS IN BUURI SUB COUNTY, MERU COUNTY. A CASE STUDY OF  
VIAZISOKO DIGITAL PLATFORM.**

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## **Dedication**

I dedicate this work to Almighty God, my wellspring of inspiration, knowledge, wisdom, and insight. Throughout this program He has been my source of strength and hope.

I also dedicate this work to my mom and siblings who have supported and encouraged me. To my nephews and nieces this to encourage you to follow your dreams and never give up.

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## **List of Abbreviations**

GDP	Gross Domestic Product
ICT	Information Communication Technology
ICT4D	Information Communication Technology for Development
DAPs	Dital Agricultural Platforms
IoT	Internet of Things
USSD	Unstructured Supplementary Service Data
SSA	South Saharan Africa
NPCK	National Potato Council of Kenya
KIIs	Key informant Interviews
AU	African Union
KNBS	Kenya National Bureau of Statistics
SMS	Short Messaging Service

## Abstract

Agriculture plays a very significant role in social economic development of most African countries. The sector is a key contributor to economic growth, employment creation, and foreign exchange earnings. Despite the critical role it plays, one of the biggest obstacles to realizing its full potential is lack of market information. This includes paucity knowledge and expertise in contemporary agronomy techniques, faulty information conveyance, particularly regarding best farm practices, and a scarcity of linkages linking extension workers, researchers, farmers, markets, and processors. Specifically, due to inadequate market information potato smallholder farmers in Meru County are facing diverse production and marketing constraints which limit their productivity. Therefore, the study sought to understand the role of Information and Communication Technology (ICT) in market information access among smallholder potato farmers in Buuri Sub County, Meru County. The study intended to understand how ICT is aiding smallholder potato farmers address inadequate market information through enhanced communication, transmission of relevant and timely information and services. Descriptive design was appropriate for the study, necessitating detailed description of a phenomenon. The study adopted purposive sampling where 60 viazisoko digital platform members were selected from the three farmers' groups in Buuri sub-county. Both qualitative and quantitative approaches were used in data collection including questionnaires and KIIs as the approaches complemented each other. The key findings of the study were: All 60 potato farmers agreed agricultural market information is crucial throughout the potato value chain. However, due to declining extension services, this has created an opportunity for digital agricultural platforms like Viazisoko to bridge this information gap by empowering farmers to adeptly respond to opportunities. Consequently, the ICT tools are becoming an effective channel that can serve all farmers surpassing age and gender divide. The majority of farmers perceive information derived from the app as reliable, useful, and accurate. The major positive effects garnered by potato farmers via utilization of the platform were increased production and improved quality of produce. However, increased risks and uncertainty linked to climate change and high cost of production have persisted notwithstanding utilization of the app. Farmers' access to the agricultural digital platforms is hampered by lack of infrastructure, low literacy levels, and power outages especially in rural areas. Therefore, agriculture is an information-intensive sector that demands farmers to be knowledgeable about modern farming technologies along the value chain in order to thrive

## CHAPTER ONE

### Introduction

In most African nations, agriculture is crucial to the social and economic development of the nation and is the main driver of economic growth. In addition to boosting the GDP and creating jobs, it also generates foreign exchange earnings. The sector serves as the catalyst for economic expansion, better living conditions by helping reduce poverty and ensuring food security. Notwithstanding its vital functions in major African economies, it is confronted with serious problems that have impeded realization of its capability. Thus, the sector has been experiencing decline over the last forty years (Munyua, 2007); (MOALF, 2018).

Okediran et al., (2018) notes that agriculture sector in Africa is disadvantaged due to deprived access to agricultural information, inadequate enabling infrastructures, heightened transactional expenses, inadequate accessibility to inputs, low literacy levels, and digital gaps. Furthermore, most farmers in the continent are predominantly smallholders who are facing multidimensional challenges including: paucity knowledge and expertise in contemporary agronomy techniques, faulty information conveyance, particularly regarding best farm practices, and a scarcity of linkages linking extension workers, researchers, farmers, markets, and processors, scarce storage facilities plus limited experience in marketing their produce. Therefore, agriculture is a knowledge and information demanding sector that necessitates farmers be knowledgeable on the latest farming technologies along the value chain to thrive.

In Kenya, the sector is the backbone of the economy, directly accounting for 26% of GDP annually and 25% of GDP indirectly due to its connections to other industries. More than 70% of rural informal employment is supported by this sector, which accounts for 65 percent of the nation's overall exports. Therefore, agriculture is not only the key contributor of Kenya's economy but also the means of livelihood for bulk of Kenyans (Alila & Atieno, 2006); (GOK, 2010) (Awuor & Rambim, 2022). According to (World Bank, 2018), agricultural sector growth in Kenya, afforded for the biggest segment of poverty decline between 2005 and 2015. The sector supports livelihoods and has a high employment multiplier effect; approximately nine million Kenyans, that is, 56 percent of total employment, were in agriculture in 2017 (KNBS, 2018). The sector certainly holds the key to Kenya's socio-economic development, poverty

mitigation and food security. Small-scale farmers make up the bulk of Kenyan farmers, accounting for 80 percent of those who grow food for consumption and trade. These farmers are confronted with numerous obstacles including limited access to agricultural market information and insufficient market entrée thus hindering maximum agricultural productivity (Munyua & Stilwell, 2013).

According to strategic plan 2018-2022 (MOALF, 2018), one of the key constraints that affect agriculture development at national level is scarcity of market access and marketing information structure as a result of defectively managed agricultural marketing information systems. In developing countries, the concern of agricultural market access has been significantly viewed as a plan for empowering farmers' social-economic aspect. Therefore, there has been a shift from constantly focusing on boosting farmers' production abilities to enhancing their market entree (Magesa et al., 2014b). The shift is firmly based on the principle that for farmers to enhance their earnings and improve rural businesses this has to be hinged on their capability to engage effectively in marketplaces (Shepherd, 2011).

Due to low accessibility to information regarding cultivation conditions and markets, smallholder farmers are also marginalized, which reduces their potential to take calculated risks and realize profits. (Fraser, 2009). Being at the bottom level of the production value chain, farmers are the ultimate casualty of inadequate quality information. Therefore, those with accessibility to precise information at the opportune time stand chances of diminishing poverty trap while those who lack access are disadvantaged (Ameru et al., 2018). As such, Information and Communication Technology (ICT) is offering a channel for farmers and experts to interact and share agricultural information more swiftly. Smallholder farmers now have a great chance to use ICT to increase yields, provide insightful information, and become empowered due to the proliferation of inexpensive technology. Thus, agricultural productivity, profitability, and sustainability in developing nations is contingent upon the rural populace's capacity to embrace technological advancements and modifications (Qiang et al., 2012). Further, in order to improve agricultural productivity and provide pertinent information that is essential for agricultural research, planning, extension, production, marketing, and trade, modern information and communication devices and technologies, such as computers, cellphones, satellites, information systems, and digital platforms, ought to be embraced (Okediran et al., 2018).

## **1.1 Background to the study**

ICT for Development (ICT4D) entails the utilization of ICT as tools to boost development especially in developing countries. In Africa, using ICT as a platform for service delivery in industries including banking, healthcare, education, and agriculture has become commonplace. For instance, Mobile for development (M4D,) that is delivery of cell technology resolutions in service provision emanated from (ICT4D). ICT advances in agriculture entail offering services connected to agriculture on gadgets like computers, tablets, mobile phones, and other hand-held computing devices. Throughout the continent, agriculture is deprived mainly due to inadequate infrastructure, challenges with availability of inputs and deficit in agricultural information (Okediran et al., 2018). According to Nyende et al., (2011), agricultural markets in East Africa region are branded by myriad of constrains; very extensive chains of transaction among farmers and consumers, poor access to reliable and timely market information and poorly organized and inefficient markets resulting to wastage of produce and low income among smallholder farmers. More so, there has been distrust and dishonesty among market actors due to lack of timely and pertinent market information.

The inconsistency in market information confuses farmers and policy makers who depend on such information for decision making, hence poor production and marketing decisions. In addition, bad roads and telecommunication networks, heightened transaction costs, and risks have limited participation of smallholder farmers to profitable and viable markets (Poulton et al., 2006). Paucity market access is the key impediment facing smallholder farmers and improved market access can result to enhanced returns, food security, rural employment and sustained agricultural growth (Dorward et al., 2003; Poulton et al., 1998; and Stiglitz, 2002). Farmers typically relied on word-of-mouth exchanges to transmit traditional knowledge about agricultural methods and timing, but this had a limited reach. Subsequently, extension methods have evolved throughout time to address a range of agricultural demands, such as best market pricing, weather forecasts, crop types, animal breeds, planting seasons, high-quality seeds, disease and pest control methods, and advantageous financing providers (El Bilali & Allahyari, 2018). But in recent years, due to resource limitations, governance issues, and the need for improved efficiency and technical developments, significant penetration of non-contact and mass media modes of extension has emerged (Omulo & Kumeh, 2020).

Knowledge and information are the primary forces behind development, and smart information communication technology (ICT) solutions have the potential to significantly improve agricultural productivity levels in Kenya. Additionally, the adoption of social media, mobile technology, and the internet across a variety of industries has transformed how information is used and shared (Boniface et al., 2019). Therefore, because of the solid connection between ICT and agriculture, ICT tools have become preferred platforms which aid farmers to actively participate in key farming decisions (GOK, 2010). Langat et al., (2016), points out that developing countries need valid information and knowledge on agricultural matters which should be accessible and well communicated. Consequently, ICTs have come in handy as a suitable market information channel.

Additionally, farmers should be provided with timely information delivered in a style and manner that best suits their demands and comprehension potentials. Despite the unfavorable circumstances in rural areas, such as exclusion and limitations on access to markets, public services, and information as a result of inadequate linkages to transportation and communication infrastructure, agricultural technology investment is presumed to have the potential to unlock untapped human and natural capital hence, reducing poverty through enhanced agricultural productivity (Gatzweiler & von Braun, 2016).

ICTs incorporate tools and media that gather, archive, and share data and knowledge. These include devices like radio, television, teletext, voice information systems, tablets, fax machines, and computer-enabled platforms (Warren, 2002). The term "digital agriculture" refers to the digitalization of many facets of the agricultural value chain. Further, it refers to the provision of focused information services that allow farmers to utilize modern technology to improve productivity and profitability. The production and transmission of well-timed, focused information services to farmers on crop planting time, seed variety, accurate meteorological data, and anticipated market prices is made easier by digital agriculture (Olaniyi et al., 2018).

Digital Agriculture Platforms, or DAPs, are becoming popular platforms for tech entrepreneurs in the agricultural ecosystem, with the potential to improve impact, financial sustainability, and outreach to other market segments and value chains. Therefore, digital platforms can be broadly characterized as networks and interfaces that constitute businesses, customers, and marketplaces. Platforms in the agriculture sector link together a wide range of players that are necessary to promote sustainable productivity and smallholder inclusion (Dalberg et al., 2021).



Various agronomic services can be presented using information and communication tools such as mobile software, voice or collaborative voice feedback, Short Message Service (SMS), capture photos and videos, Global Positioning System, and internet. Major innovations are compatible with standard mobile phones, smart phones, and internet of things (IoT) and are dependent on users' availability to ICT infrastructure and service network (Okediran et al., 2018).

Kenya is a leader in digital communication and various mobile services (M services) are running in the agriculture sector. Communication Authority of Kenya projects mobile penetration at 88.1 percent of the population (CAK, 2020). According to Ogutu, *et al.* (2012) ICT and market information systems are platforms dispensing market details for instance, Mfarm, is a web-based market information system that farmers can use to access retail produce prices, connect with other farmers and manufacturers of farm inputs, and find produce markets via text messaging. Kenya Agricultural Commodity Exchange (KACE) is another platform offering a platform for smallholder farmers to access typical markets for agricultural commodities. (Langat et al., 2016) mentions *Shamba Shape up* a television program which guides smallholder farmers in pest management, irrigation, price information among other interactive and informative practices.

The study sought to understand the role of Information and Communication Technology (ICT) in market information access among smallholder potato farmers in Buuri Sub County, Meru County. Therefore, the researcher adopted a case study of viazisoko digital platform, where active members in Buuri Sub County were studied. Viazisoko digital platform is a web-based portal, mobile application and USSD (Unstructured Supplementary Service Data) platform developed by the National Potato Council of Kenya (NPCK) and other partners. The platform is centered on marketing of potato related products and services, and information dissemination. With the aim of addressing diverse challenges faced by potato farmers and other stakeholders (International Potato Center, 2021).

The study focuses on Buuri Sub County in Meru County, since it is predominately an intensive potato farming region in Kenya. Consequently, the potato subsector plays a major role in food security and contributes to poverty alleviation via income and employment generation (Kaguongo et al., 2008). Nevertheless, farmers generally lack awareness of both input and output markets resulting in exploitation by brokers and traders. In addition, there is frequently

fluctuating of farm gate and market potato prices often with the minimum and maximum prices contrasting by more than 70 percent (Kaguongo et al., 2008) & (Sophie, 2018).

Studies have also shown that potato smallholder farmers are grappling with agricultural food production losses estimated at 46 percent. These losses are at different levels of the supply chain from planting, crop management, harvesting, post-harvest handling, processing and distribution in retail, wholesale or at consumption stage. The losses are a big disincentive to farmers in the county ultimately resulting in losses in household incomes, further perpetuating poverty in rural areas (Lemaga, n.d.). Therefore, the study sought to understand how ICT is aiding smallholder potato farmers address inadequate market information through enhanced communication, transmission of relevant and timely information and services. Further the study has shed light on the role of ICT in offering timely information, enhancing choices, diminishing transaction cost, facilitating improved efficiency in decision making among smallholder farmers.

## 1.2 Problem statement

One of the major challenges confronting smallholder farmers in rural areas is inaccessibility to market information (Barrett, 2008). The paucity of market information signifies a crucial barrier to market access for smallholder farmers in rural areas (Shepherd, 2011).

Dalberg et al., (2021) further notes systemic challenges that smallholder farmers face includes limited resources, poor land utilization, weak assets, market inaccessibility, and inadequate infrastructure. Ineffective connections to off-takers, unstable prices brought on by seasonality and middlemen, and limited availability to high-quality inputs like seeds and fertilizer can all further stifle agricultural markets and lower farmer incomes and productivity. Moreover, dependence on dated productivity practices coupled with inadequate information sharing results in skills and knowledge gaps. Farmers require various forms of information ranging from farm preparation to post harvest and marketing so as to make informed decisions. Hence, well-timed information is vital to farmers' enhanced productivity which is a key challenge facing the agricultural sector in developing countries (Njelekela & Sanga, 2015).

The Oxford Meru County report (Oxford, 2014), notes that agriculture is the backbone of Meru County economy generating approximately 80 percent of the county's income. The agricultural

landscape consists mainly of smallholder farms, approximately 98.6 percent of farms. The County is depicted by high agricultural productivity owing to favorable climatic conditions, fertile lands and rain-fed agriculture which is supplemented by irrigation. Therefore, agriculture is core source of livelihood in the County, accounting for about 80 percent of the average household income. Despite the high yields, farmers in Meru County are faced with poor market organization resulting to exploitation by middlemen who dominate the marketing of agricultural produce leading to disincentive among farmers thus affecting returns (MoALF, 2016).

The Meru County Integrated Development Plan 2018-2022 asserts presence of the following challenges facing farmers in the county; low levels of agricultural skills among farmers and other stakeholders, low adoption of new agricultural technologies, inadequate training and poor facilities, inadequate storage facilities, insufficient extension services to farmers due to inadequate workforce and low productivity due high cost of production. Therefore, the county strategic plan is to enhance farmers capacity through creation of awareness in agricultural market information via trainings (CGOM, 2018).

Studies conducted in Meru County by Kaguongo et al., (2008); Lemaga, (n.d.) & Muthoni et al., (2013), showed that potatoes farmers in the county are faced with diverse production and marketing constraints. In terms of production, farmers have low awareness of the importance of high-quality seeds in obtaining high yields thus improved incomes. Scarcity of clean planting inputs compels farmers to informal supplies such as farm saved and leftovers (self - supply), local markets or neighbors. The use of uncertified seeds, poor crop and post-harvest management has impeded farmers' efforts of managing crop diseases resulting in high cost of production, low yields, poor quality produce and spread of diseases.

Regarding marketing constraints, farmers are grappling with poorly managed marketing systems. The potato infrastructure is mostly informal, lacking coordination, cooperation, and transparency in market information flow. Therefore, markets outlets are largely dominated by brokers and traders resulting in fluctuation of farm gate prices as farmers lack the ability to influence selling prices. Low awareness of packaging standards compels farmers to sell their produce in extended bags instead of weights. Generally, there is inadequate farmers' support systems along the value chain, low extension services, poor road infrastructure, limited market information services, high cost of inputs, lack of storage and distribution structured systems, and limited access to financial services.

Such challenges are prevalent in Meru County and have been linked to limited market information. Thus, low market participation; market monopolies by few individuals resulting in distortion of input and output prices, and limited marketing opportunities. Furthermore, compromised quality and quantity of produce, access to markets, fluctuating market prices and low prices issues have persisted (Dilley et al., 2021). Owing to the fact that studies and documentations reveal smallholder farmers in Meru County are grappling with inadequate market information resulting to low productivity. The study, therefore, aims to explore the role of Information and Communication Technology (ICT) in market information access among smallholder potato farmers.

### **1.3 Research Questions**

- i. What are the various types of information potato farmers are sourcing for from viazisoko digital platform?
- ii. What benefits have farmers achieved via the ICT platform?
- iii. What is the effect of market information access among smallholder potato farmers in Buuri Sub County, Meru County?

### **1.4 Main Purpose of the study**

The purpose of the study is to explore the role of Information and Communication Technology (ICT) in market information access among smallholder potato farmers in Buuri Sub County, Meru County. The study seeks to provide an understanding on how ICT contributes to accessibility of market information among smallholder farmers.

#### **1.4.1 Specific Objectives of the study**

1. Establish the various types of information potato farmers are sourcing for from viazisoko digital platform.
2. Determine benefits farmers have achieved through their utilization of ICT platform.
3. Establish the effects of market information access among smallholder farmers in Buuri Sub County, Meru County.

## **1.5 Justification of the study**

The motivation for this study was driven by the inadequacy of market information among smallholder farmers which results in low productivity and opportunistic behaviors. As a result, the majority of smallholder farmers are still trapped in cycles of poverty. The study sought to understand the role of ICT in aiding market information access among farmers. Therefore, the study findings add to knowledge on the role of ICT in market information access among smallholder farmers in Meru County especially in potato subsector.

As earlier indicated the bulk of Meru County population is reliant on agriculture as the prime source of livelihood. Therefore, the study is important as it enlightens smallholder farmers on the role of agricultural ICT platforms in supplying vital agricultural market information that can improve productivity, markets, incomes, and consequently enhance their welfare. The study can provide policy makers with additional information on how to create ICT interventions that solve the issue of smallholder farmers' current difficulty in obtaining market information. Private sector and tech innovators can utilize the findings to better understand farmers' motivations in seeking market information, this will impact on technology uptake. Donors can also benefit from the study as the findings provide opportunities to fund high impact interventions. The key objectives of various market information mediums are to advance public policies via heightened awareness of market trends plus improve market transparency through fairer and more effective provision of resources (Galtier et al. (2013).

## **1.6 Scope and Limitations of the study.**

The study concentrated on the role of ICT in market information access among smallholder farmers in Meru County. In this case, the study intended to study the role of Viazisoko digital platform amongst potato smallholder farmers. Therefore, the study concentrated on active members who are utilizing the platform. The study was restricted to Buuri Sub County, Meru County as it is one of the largest potatoes growing areas and from the studies, a significant number of famers are adopting Viazisoko digital platform at various stages along the value chain. The main challenge posed was the targeted population spread out across the Sub County since ICT uptake and adoption among smallholder farmers is low. The covid 19 situation in

the country also posed a challenge in terms of movement and interaction, therefore the study in some instances resulted in various virtual platforms to minimize physical interactions.

## **CHAPTER TWO**

### **Literature Review**

#### **2.0 Introduction**

Literature review is an inquiry of relevant literature in the field of study, with an aim of identifying significant authors, documents, theories, and findings in a specific discipline. It delves further into the current knowledge in the field of inquiry and this aids in identifying knowledge gaps. Similarly, the review may offer some prospective solutions to pertinent questions, as well as indicate theories that have previously been applied to a similar study quest. Mugenda and Mugenda (1999) characterizes literature review as coherent classification of articles covering relevant information regarding the subject of interest under study in the study problem. Literature review aids the researcher with detailed understanding of the study.

This chapter begins by reviewing empirical literature focusing on the following thematic areas: state of agriculture in Africa, benefits of ICT tools in agriculture and the role of agricultural market information. The key theoretical literature reviewed include agriculture sector in Kenya, digitization in agriculture, the role of ICT tools in agriculture, and significance of agricultural market information. Theoretical framework based on empowerment theory has also been assessed. The conceptual framework of the study has further been incorporated in this chapter.

#### **2.1 Empirical Literature Review**

##### **2.1.1 State of Agricultural Sector in Africa**

Agriculture is largely the mainstay of major Sub-Saharan countries 'economies and fundamentally contributes vastly to their Gross Domestic Product (GDP) (Awuor & Rambim, 2022).

Munyua, (2007), in a study on ICTs and small-scale agriculture in Africa, using a combination of methods, including desk research, field observations, individual and group interviews, found that about 2/3 of developing countries depend on agriculture for their livelihoods, and that 75% of these farmers are small-scale farmers. About 3/4 of the population of Africa lives in rural areas, while 60–90% of all workers are employed in the agricultural industry. As a result,

agriculture is seen as being essential to ensuring food security, poverty reduction, and driving the rural economy in Africa. The capability of agriculture to eradicate poverty and spur economic development differs between and within nations, the author argues. The study further indicates agriculture sector in Africa is marred by low investment in the rural areas, inadequate access to markets and uncompetitive market conditions, insufficient information on prices and markets, inadequate access to advanced technologies, poor infrastructure, and high production and transaction costs. Therefore, in SSA, per capita food production has gradually declined, and the author recommends tackling smallholder difficulties in a holistic manner and offering a package or 'basket' solutions.

According to Chavula, (2014) in a study conducted in 34 African countries revealed that African economies are largely agricultural with the sector contributing to 15 percent of the continent's GDP, employing 90 percent of rural workforce and 60 percent of total labor force both urban and rural, accounting for 40 percent of export earnings and providing over 50 percent of household needs and income. However, despite the critical role the sector plays various national governments have shown minimal support particularly in the areas believed to be crucial for its development resulting in the sector's poor performance. The current poor situation in the agricultural sector across Africa has been exacerbated by inadequate rural infrastructure, insufficient access to advanced technologies, limited access to affordable financing and markets, incapacitating market conditions, high production and transport costs, and low skills in the sector. In this regard, the share of agriculture in many African countries is often less than 30 percent revealing the low productivity levels in the sector and constantly their agricultural production and yields have been low compared to those in developed countries. The study findings revealed that indeed ICT platforms play a significant role in improving agricultural production. ICTs enable technological adoption to convey information regarding inputs, new markets, and market prices. In addition, the study also revealed some socio-economic features such as level of education are basics for actual improvements in agricultural production.

Diao et al., (2007), on the empirical findings from many countries' case studies done in Africa also shows that the pro-growth and pro-poor accomplishment in agriculture is widely dependent on participation of smallholder farmers in value chain. In addition, (World Bank, 2006) highlights the key driving factors to Africa's agricultural sector is improved productivity



and sustainability through linking the poor to markets, improved human development, service delivery to deprived populations and sustainable utilization of natural resources.

Research carried out in Tanzania to explore market access through farmers organization the authors assert, most smallholders in Africa rely on information from traders despite prospect of such information being inaccurate. As a result, they receive asymmetrical and incomplete market information because relevant information is dispersed across various agencies, both state and private sectors which impedes feasibility of smallholder farmers accessing it. Therefore, in order to get market access and generate more demands and earnings, smallholder farmers must have improved access to market information on prices, quality, quantities, where to sell, and appropriate production methods. Further, the study supports the urgent need to enhance market access via provision of market information to smallholder producers. Hence, vegetable farmers who have access to better market information are likely to access the markets. Further, access to market information is perceived to aid in planning marketing process as well (Aku et al., 2018).

In Kenya, farmers are earning minimal farm revenues from various food crops which are mainly depended on as supply of nutrition and livelihood, resulting to high poverty levels in the country. This is primarily due to scarcity of precise market information to empower farmers to take appropriate actions to improve their farming venture (Kibet et al., 2011). A major hindrance to farmers accessing markets is inadequate information regarding produce, input, and credit markets. As a result, farmers are dependent on peers, kin, and agents for market information and opportunistic behavior of traders and other market actors emerge (Njelekela & Sanga, 2015).

However, Amer et al., (2018), notes that the major hinderance in accessing market information amongst smallholder farmers in rural Kenya is poor coordination among the major information sources at the national research institutions and extension workers. Thus, information disseminated is often un-harmonized and conflicting. Ideally, knowledge is intended to flow from research institutions via extension officers. However, a breakdown emerged when the ministry of agriculture under which extension is, devolved while national agricultural research institutes remained centralized. Coordination of functions between the two state departments is vital to promote efficient capture, analysis, organization, packaging, storage, and dissemination of adequate, relevant, and current information to support farming and marketing

activities in the country. The trajectory out of poverty for many SSA countries depends on the expansion and improvement of the agriculture sector, since there is a strong correlation between decreasing poverty and increasing agricultural output. Therefore, a more inclusive agriculture is required to realize some of Sustainable Development Goals (SDGs) for instance, eliminating acute poverty, hunger, and investment in rural areas for inclusive and sustainable rural transformation (Mekonnen, 2017).

### **2.1.2 Benefits of ICT Tools in Agriculture**

The Rural Knowledge Network (RKN) pilot project conducted in East Africa by Nyende et al., (2011), demonstrated that consistent access to information and communication technology (ICT) services such as email, SMS, cellphones, and the internet have significantly improved the efficacy and cost-efficiency of information exchange and, as a result, helped minimize pervasive mistrust along the marketing value chains. Increased effectiveness as well as openness along the value chain is attested by farmers' increased earnings, due to enhanced output prices, and increased entry to conducive markets.

Equally, research conducted by USAID (O'Donnell, 2013), to determine how ICT solutions empower smallholders in Sub Saharan Africa, where agricultural value chain stakeholders were interviewed revealed smallholder farmers are inadequate in their marketing capabilities. Habitually, they are dependent on a single trader, have minimal details regards to cost and demands with modest negotiating leverage. Findings show ICT solutions varying from voice call, SMS, and other information conveyance channels when integrated with market-enabled systems, can improve productivity and competitive dynamics in agriculture, leading to higher incomes and food security.

Further, ICT solutions can enhance smallholder marketing through finding new buyers, basic calls have empowered smallholders by growing their direct communication networks thus, wider circle of potential buyers. Having multiple buyers may present various opportunities, willing to pay higher price, buy bigger volumes, offer favorable terms for instance, better timing, or demands that may be aligned to production. Utilization of ICT solutions can enhance management and quality control such as better traceability, compliance with safety and standards. ICT devices including phones, smartphones, tablets and ICT applications and

software can be used to inform and communicate best practices in transport, packaging, processing, and logistics thus diminishing losses that smallholder may incur due to non-compliance. According to Braimok, (2017), in a study assessing benefits and drawbacks of ICT for Kenyan women farmers, majority of women have increased their agency and ability to manage finances owing to mobile phones. In addition, utilization of mobile phones increased their autonomy, access to opportunities, resources, and power to assert control over their life. More so, they were able to make deliberate life choices that mirrored their preferences and improved their ability to effect change compared to previously when this choice or opportunity was denied to them. Socially, adoption of mobile phones was beneficial in their mobility and flexibility as they offered women capabilities to keep contact and reach out to others regardless of the distance thus broadening their social networks.

Jensen, (2007), established that access to cellphones reduced price variation and waste by enabling transmission of information to fishermen in Kerala India. Thus, ensuing favorable markets and improved welfare. Mobile phones aided farmers to access appropriate price information and available opportunities so they could choose the best locations to trade their everyday catch. Similarly, (Abraham, 2007), the extensive utilization of mobile phones enhanced markets efficiency by reducing risks and uncertainty. Both findings disclose use of mobile phones has close correlation to reduced wastage, transaction cost, and search cost. Fishermen can swiftly respond to market demand thus avert wastage which was initially witnessed before adoption of mobile phones. Therefore, mobile phones have helped to organize supply and demand, ensuring traders and transporters profit from the expansive stream of price information via supplying demand in scarce markets. According to Jensen, (2010) in a related study, adopting mobile technology allows farmers to farm more expansively, sell more produce, invest in productive assets, utilize emerging agricultural inventions, shift land from non-agricultural use, diversify crops, and participate in spatial arbitrage. However, this potential efficiency was pegged on easy access to capital.

Bhatnagar, (2008), clarifies the cost of information search for farmers in developing countries accounts for 11 percent of the overall expenses farmers spend during the farming cycle. Agricultural ICTs have reduced transaction costs (de Silva & Ratnadiwakara, 2008), in a study among smallholder vegetable farmers in Sri Lanka found farmers can diminish search and general operation costs as adoption of mobile phones enhanced their decision-making skill.

Utilization of mobile phones among farmers can also diminish information search costs thus reducing transaction costs as well enhancing greater farmer participation in commercial agriculture. In Ghana, adoption of mobile phones among farmers and agricultural traders has aided reduction of transportation and transaction costs. According to the study, members who utilized trade networks provided by prevailing telecommunication channels were able to enhance and coordinate their operations in a profitable manner. Thus, adoption of modern telecommunications aided in diminishing information asymmetry (Overå, 2006).

Aker & Mbiti, (2010), further demonstrated using of cellphones to search for information has minimized search expense for farmers by close to 50 percent in Niger. Farmers who use mobile phones are no longer passive consumers of information from mediums like newspapers, television, or radio, instead they are active participants who have ease of access to various information avenues. Furthermore, the study reveals mobile phones have enhanced coordination among agents, and improved market efficiency due to enhanced communication and improved supply chain management.

A study conducted in Tanzania to explore the influence of ICTs in enhancing access to market information amongst smallholder farmers (Njelekela & Sanga, 2015), confirms farmers who have utilized various ICT tools have enhanced access to market information. Hence, ICT plays a crucial role in enabling smallholder farmers to access sustainable and reliable market information minimizing exploitation by middlemen. These platforms eliminate middlemen who often benefit the most by withholding the crucial market information. Further, utilization of ICT has also improved farmers' livelihoods due to enhanced bargain power due to market access capability through access to market information.

Utilization of mobile phones has also been linked to farmers' behavior change. A survey conducted in Morocco among smallholder farmers, established utilization of mobile phones ensued 21 percent income increase. More so, the use of technology is also attributed to behavior change via farmers gradually contacting wholesalers directly. A major change realized was that farmers used their newly acquired knowledge to strategically plan their production, by relinquishing low value crops thus diversifying into high value enterprises. Further, the knowledge acquired via utilization of mobile phones diminished perceived levels of risk and aided farmers target their production to specific, identified market opportunities (Ilahiane, 2007).

Mittal, (2012), in a study carried out in India adopting both desk research and case studies elaborated, adoption of advanced ICT for agronomic expansion has enhanced risk management among smallholder farmers. Farmers are particularly exposed to risk due to erratic climate conditions and market uncertainties. This risk is further increased by the lack of knowledge about the weather, inputs, farming techniques, and market prices, which leads to low productivity. Because of the erratic nature of the weather and the unpredictability around rainfall, farmers face output risks. Therefore, it is essential to have access to information about predicted weather patterns, general knowledge about which crops to plant, the best seed varieties to utilize, and optimum cultivation procedures in order to reduce production risks and guarantee production.

Farmers are also faced with market risks which are occasioned by either overproduction resulting to discrepancy between supply and demand. Inadequate market information regarding demand signals, prices, and logistical information may result in high production, transportation and search costs which can significantly affect wages. Findings reveal farmers who have access to quality, current information, and their ability to utilize this information have an edge in overcoming effects of risks. However, there are worries that despite having access to information, some smallholder farmers have unsuccessfully in tackling barriers stemming from insufficient access to cash, inputs, ineffective infrastructure, and markets.

### **2.1.3 The Role of Agricultural Market Information**

Market information encompasses specifications regarding prospective market channels including payment conditions, packaging, quality, and all the requirements a producer needs to make a successful sale (Amer et al., 2018). Farmers often negotiate pricing based on information from traders, customers, and intermediaries due to a lack of sufficient knowledge about the agricultural market, including the quantity and quality of produce needed at the market, the price of output, conducive marketplaces, and the availability and quality of inputs. Consequently, farmers' negotiating strength is diminished, leading to uncompetitive markets. According to (Okediran et al., 2018), in a study where a total of ninety smallholder farmers were interviewed, results show that agricultural information plays a crucial role in improving

the productivity of smallholder farmers and linking their increased output to profitable markets, which improves livelihoods, food security, and national economies. Fundamentally, farmers can attain higher levels of productivity in agriculture if they have access to vital information.

Svensson & Yanagizawa, (2009) in a study conducted in Uganda, it is a clear indication that increasing farmers' access to market information through the provision of accurate, timely, and suitable information regarding farmers' decisions regarding what to produce, how much to sell, where to sell, and prices for output is essential in raising farmers' living standards. Consequently, the performance of output markets and distribution networks is essential for improving household earnings. However, in major developing states, markets are dispersed, and infrastructure is deprived hence, smallholder farmers lack information on market prices resulting to ineffectiveness in allocation of goods among markets. Often, this is occasioned by the presence of asymmetric information among sellers who are mainly smallholder farmers and buyers. More so, market information asymmetries amongst traders and farmers have resulted in worsening of farmer's bargaining position to negotiate prices. The study established a link that access to market information ensued greater farm gate returns. In the study, information was broadcasted via local FM radio in the daily bulletin and farmers with access to radio realized 15 percent higher farm-gate price. Therefore, the ICT tool facilitated poorly functioning markets operate optimally resulting to enhanced farmers' bargaining position vis-à-vis wholesalers and middlemen eventually resulting to increased incomes.

A study conducted in Tharaka Nithi County by Amer et al., (2018), also ascertained farmers who had access to pertinent information about effective agricultural practices and output marketing fetched greater prices for their farm produce. Improved profitability among farmers may act as an incentive therefore, shifting their production, investment, and marketing decision. Access to markets and market data gives farmers the flexibility to negotiate better prices, take advantage of market possibilities by modifying their production schedules and allocating production factors more effectively, including making more informed marketing decisions (Njelekela & Sanga, 2015).

## **2.2 Theoretical Literature Review**

### **2.2.1 Agriculture Sector in Kenya**

Agriculture is defined as a type of land usage that denotes alterations in the topography emanating from a blend of cultivation, rearing and domestication of plants and animals. Cultivation mainly entails human actions aimed at preparing the soil and germinating, tending and harvesting produce while domestication involves inherent and structural transformations that have ensued plants adaptation to cultivation (Harris & Fuller, 2014). Agriculture is fundamental to social, economic growth and poverty reduction in many African economies.

Hirst et al. (1988) examined there is no collective description of small-scale farming in developing countries. Nevertheless, literature classifies any farm less than five hectares as small. Smallholder farmers generate their livelihood from holdings that are between two and five hectares in size and between ten and twenty heads of livestock, though many have fewer than two or none. A common practice among smallholder farmers is a combination of commercial and subsistence farming, wherein the farm serves as the primary source of income and the family provides the majority of the labor.

A Helpdesk report on agricultural productivity in Kenya (Birch, 2018), noted that the agriculture sector accounts for 51 percent of Kenya's GDP, that is; 26 percent directly and 25 percent indirectly and it accounts for 60 percent of export. Smallholder farming on farms between 0.2 and 3 hectares dominates the sector and accounts for 70 percent of all agricultural production. Furthermore, productivity is crucial for reducing poverty because majority of the impoverished work in agriculture. There are concerns that productivity is diminishing and some main barriers to agricultural productivity include: Land and population strains, the typical farm size is waning resulting to low production; the portion of farmers accessing extension services is falling and government investment in agricultural research is declining; inadequate market access instigated by institutional barriers, transaction costs linked to market information and marketing processes; climate change, mainly variability of rainfall and temperatures have impacted on agricultural production; soil fertility and land degradation due to poor implementation of sustainable land management practice is on the rise; public expenditure, the

government of Kenya is investing low in the sector approximately less than two percent of total expenditure. According to Kenya's Vision 2030, agriculture is a key industry that can help the country achieve its goal of a 10% annual economic growth rate. However, the sector has to transform from mostly rain-dependent, poorly mechanized activities with low productivity and minimal value addition to an inventive, commercially focused, modern, and competitive agricultural sector (MoALF&I, 2019)

### **2.2.2 Digitization in Agriculture**

FAO, (2006) describes E-agriculture as an evolving field at the convergence of agriculture information science, agricultural advancement, and enterprise, pertaining to agricultural services, technology diffusion and information delivery and enhancement via internet and other related technologies. One of the objectives during the World Summit on Information Society plan of action regarding e-agriculture is ensuring systematic dissemination of information using ICT tools to generate readily, accessible, and comprehensive current knowledge and information particularly to rural areas.

According to World Bank report on ICT in Agriculture (World Bank Group, 2017), market information services, especially those that operate on smartphones and tablets, can help farmers better access markets, and meet consumer demands by enhancing the flow of information between producers and traders, lowering transaction costs, and making it easier for farmers to buy essential inputs. As an alternative to tardy market information due to taxed extension agents, farmers and agriprenuers can access input and output market prices directly on their phones. The internet enabled solutions can empower farmers to enhance their performance resulting to effectiveness and efficiency, growth in scale of operations and earn gains of international and regional markets from which they have previously been barred (Dalberg, 2013).

In Kenya, Communications Authority of Kenya reports ranks Kenya's current mobile penetration at 95 percent which is the highest rate in Africa after Nigeria and South Africa (CAK, 2020). Additionally, Kenya's budding ICT environment is spotlighting the country as a conducive space for local entrepreneurs to create and utilize M-services (Baumüller, 2016). Growth of ICT in Kenya can be attributed to the sea cable connection that came online in July



2009 linking Kenya internationally. The initiative enabled provision of faster and cheaper alternative satellite connections. ICT adoption in the country has been on the rise due to the increasing pool of human resources and the ever-raising youth bulge.

Kenya is also leading in digital communication and various mobile services (M services) have been incorporated in the agriculture sector. These M services are classified into information and knowledge, monetary skills, access to farming inputs and output markets. The case study (Baumüller, 2016) on M-farm platform revealed farmers in Kenya are utilizing information from the application to schedule for production processes such as, what to grow, when to harvest and whom to sell to. Information regarding demand is also relevant for decision making. For instance, price information has motivated farmers to diversify their farming patterns by intensifying specific crops. However, agricultural ICT platforms should not be perceived as panacea to challenges facing farmers in Kenya and for these platforms to be sustainable, they should be incorporated in complimentary support projects and infrastructure developments focusing on production and marketing challenges. Partnership in provision of complimentary services between various actors in agriculture value chain such as private sector, non-governmental organizations, and government institutions is recommended.

### **2.2.3 The Role of ICT Tools in Agriculture**

The book, “Innovation applying knowledge in development,” (Juma et al., 2005), asserts there are two basic ways that technology affects human development. First, innovation has the possibility to significantly enhance the scope of already-existing science, technology, and innovation initiatives to combat poverty and advance human potential. The technological advancements in public health, agriculture, energy consumption, and ICT are mainly indicative of this. Second, technology has the potential to improve productivity while boosting incomes and economic growth. The production of workers can be increased, agricultural yields can be intensified, and service efficiency can be increased; increased productivity can lead to higher revenues, which can help individuals satisfy their fundamental needs. ICT is a potent enabler of development goals because it significantly improves communication and the sharing of information, strengthening and generating new social and economic opportunities.

ICT is widespread and can be utilized for a wide range of human activities, including personal, enterprise, and governmental functions. The ability of ICT tools to store, retrieve, sort, filter, distribute, and share information has led to notable improvements in production, distribution, and market efficiency. Furthermore, ICT is universal hence transcending cultural and linguistic barriers as it challenges policy, legal and regulatory structures within and between countries. More specifically, ICT is functional in agriculture as it can enhance market access, efficiency, and competitiveness for instance, these platforms improve interactivity and ensures social inclusion of the disadvantaged as they are more feasible facilitating social connections.

According (World Bank Group, 2017) report on ICT in agriculture, farmers use ICT tools involving cellphones, special applications, and internet for market intelligence. Technology is solving various challenges experienced by the traditional market information services that have been marred by inefficiency in terms of information inaccuracy and delays. Farmers create networks of contacts which enhance their experience and expertise to gain relevant information more swiftly. ICTs have enabled farmers directly transact with wholesalers or large-scale intermediaries therefore minimizing middlemen dominance. The utilization of ICT in agriculture has had an effect on price and location since farmers' capacity to compare prices improves their capability to negotiate with traders. Hence, empowering farmers who are at liberty to shift time and place of marketing to capture better prices. Farmers who acquire market knowledge have an edge as they can detect and diversify into unconventional and profitable yields. The report specifies the main goal of improving access to market information through various ICT tools is to motivate farmers to seize control of marketing their produce and positioning their yield to specific or identified market opportunities.

Deichmann et al., (2016), emphasizes the three major trajectories that ICT advances development goals are through increasing market participation (inclusion), ensuring that current factors are more productive (efficiency), and enabling massive economies of scale by supporting innovative business models. For example, technological advancements have made it easier for the disabled to communicate through text, audio, and video, enabled people to work from home, and allowed those who were previously unable to use conventional banking systems to obtain credit using a mobile phone. Utilization of mobile phone and internet have potential to support productivity and rural development owing to the fact; they ease information challenges, facilitate access to market and diminish persistent information asymmetries occasioned by market intermediaries. Digital technologies have therefore resulted in enabling

market transparency occasioned by high search costs that have minimized competition and created inefficient distribution of goods across markets. However, technology enabled interventions must be backed by complimentary investment or investing in facilitating conditions in physical infrastructure, electricity, and literacy to ensure inclusive development.

Stienen, (2007), via an article how can ICT make a difference in agricultural livelihood contents, utilization of ICTs among smallholders can enhance capacity and empowerment through interaction with other stakeholders hence opening of new business opportunities, increasing efficiency and transparency in the whole agricultural value chain thus waning social exclusion. However, for information and knowledge to be capably utilized or sustainable for rural communities there ought to be conducive and enabling environment. Consequently, governments should link ICT and agriculture and integrate ICT in agricultural sector policies and programmes.

(AU, 2015) and Hårsmar et al., (2007), recommends improved agricultural productivity ought to be derived from application of new knowledge and innovations. More so, these innovations should be complemented with institutional reforms, where respective stakeholders are involved, including farmers. Furthermore, Institutions African Union, NEPAD, and regional and subregional organizations should also provide frameworks so that all parties can work together to improve farmers' quality of life.

#### **2.2.4 Significance of Agricultural Market Information**

Magesa et al., (2014), discusses market information to include market news on prices, quantities, market conditions and business contacts: market analytical reports encompassing analysis on factors that cause market fluctuations and their effect on stakeholders: business reports that avail information that aid stakeholders in identifying reliable trade partners. Market information is also categorized as information on prices, quantities of commonly traded agricultural products collected on a regular basis from rural assembly markets, wholesale, and retail markets which is disseminated on timely and regular basis through various mediums to farmers, traders, government officials, policymakers, and consumers among others (Shepherd, 1997). The fundamental hypothesis is that information and communication are essential resources that improve performance of markets for instance, price notification is crucial

information that impacts on various participants in the economy who rely on it to make effective decisions.

Shepherd, (1997), in a FAO Agricultural Service Bulletin on market information and services states, efficient market information has positive benefits for various stakeholders in agricultural value chain including farmers, traders, and policymakers. Current market information empowers farmers to consult with traders from a position of better strength, allowing farmers to efficiently allocate productive resources so they may make well-informed production decisions that are in line with market demands, and allows farmers to schedule their harvests when most profitable. Further, according to this bulletin, information reduces transaction costs, that is the cost of selling the produce, by reducing risks. The rationale is because farmers have access to fast and accurate information, they can choose whether to send their produce to market at all or to sell it in a place that will yield the highest profits. Effective market information is essential for agricultural policymakers and researchers in policy formulation to enhance the functioning of markets. Also, production and trade are hampered by insufficient of information; nonetheless, farmers who have access to information generate higher-quality goods and farmers with little information find it challenging to engage in trading thus lowering market competitiveness.

Smallholders' productivity is also limited due to inadequate agricultural market information resulting in poor market access and constrained incomes. Frequently, these farmers have little power to negotiate as they are dependent on a few buyers and have limited access to price details. Rural areas are also characterized by limited sources of information regarding market prices and other production allied information. As a result, information is disseminated poorly, scarcely, and ineffectively communicated hence smallholder farmers have been offered low prices by dealers and middlemen. Consequently, due to inadequate selling alternatives, farmers are compelled to create long-term trading relationships with a few traders leading to '*clientelisation*' (Geertz, 1978).

Developing countries, especially those in rural areas, have a slow flow of market information, which leads to farmers producing the incorrect crop mix and occasionally using inefficient technologies which further exacerbates low productivity. The primary objective of a farmer is to maximize income from farming and in order attain this farmer will need price information so as to decide how to diversify the crops they produce based on relative prices. Further, even

if the farmer may only be able to grow one crop due to conditions, the crop's price informs him on how much to produce thus prices factors enable farmers to produce more effectively. Additionally, he can acquire quality inputs when and where they are cheapest. Usually, though rates vary across areas the farmer is normally aware of the local price. Consequently, price information also cushions farmers from exploitation by middlemen (Eggleston et al., 2002). Ultimately, strategic information gives farmers the ability to schedule harvests at the most profitable times, decide which market to send their produce to, and negotiate more fairly with traders, shift produce profitability from surplus to deficit markets, and help with decisions about the viability of storage. Therefore, farmers are empowered on how to deal with agricultural risks and uncertainties (Magesa et al., 2014b).

### **2.3 Theoretical Framework**

In this section, the purpose of the study is to elucidate the theoretical connections that underlie the observed events. A theory is systematic explanation of the underlying phenomenon or behavior (Bhattacharjee, 2012). The theory adopted for this study is empowerment theory. Empowerment has various meaning in different sociocultural and political contexts, basically it entails use of words such as self-efficacy, control, self-power, self-reliance, independence, making one's own decisions and being free to define it (Narayan, 2002).

Kabeer, (n.d.), describes empowerment as “the expansion in people's ability to make strategic life choices in a context where this ability was previously denied to them”. It is a transition of change from a state of disempowerment, which is applied to people who had been deprived of the capacity to make tactical decisions in their lives. The three interrelated components of the author's conceptualization of the empowering process are achievements, agency, and resources. Resources (conditions) or preconditions that aid people the power to formulate and enact prudent life choices which mainly entail material, economic, human to social resources. Agency (process) is regarded as the “power within” denoting proficiency to act upon one's stipulated goals entailing decision making, bargaining, negotiation. Achievements (outcomes) of the choices that empower people to reach their goals. Essentially empowerment is strongly associated with the ability to choose, thus it is fundamental to the concept of power.

Zimmerman, (1995), defined psychological empowerment (PE) as empowerment at the individual level, and the theory includes notions of personal control, a proactive outlook on life, and a critical awareness of the sociopolitical context. PE, he continues, involves having the conviction that one's goals can be realized, being aware of the resources and other elements that can help or hinder one's endeavors to attain those goals, and making an effort to achieve those goals.

Bebbington et al., (2007), on the other hand characterizes empowerment as a procedure that allows the excluded to take a more active role in choices about how to grow, how to develop, and how to distribute their product. Consequently, enhancing the dignity of those in the present conditions who are unable to escape from the trap of poverty and under-development thus creating and enabling self-reliance society.

Mardikanto and Soebiato, (2013) links empowerment to ability and productivity thus, empowerment of farmers is regarded as the process of enhancing optimization ability or productivity, individual, organization or system where farmers operate. Further, empowerment is translated as competitive advantage or bargaining position of the farm community.

As earlier indicated, studies reveal smallholder farmers in rural Kenya have limited access to market information to make informed decisions about their livelihoods thus are disenfranchised. ICT platforms have been found to advance benefits and have positively impacted many developing countries. ICT tools can be perceived to empower farmers by allowing them to make proper choices on production, market obligations, and enhancing their knowledge on best farm practices (Langat et al., 2016).

Various ICT platforms are empowering farmers as they enable them to gain access to and control more or better resources on favorable terms which can enhance production thus better remuneration. Farmers are also relying on various ICT tools to inform them and offer them access to new or better technologies that can ensure available resources are more productive and also provide better knowledge and skills for using these technologies. ICT facilitates linkages among farmers with various organizations both formal and informal that give them access on favorable terms to resources and technologies, and enhanced market access for their products thus ensuring farmers' organizations function more effectively (Uphoff, 2012).

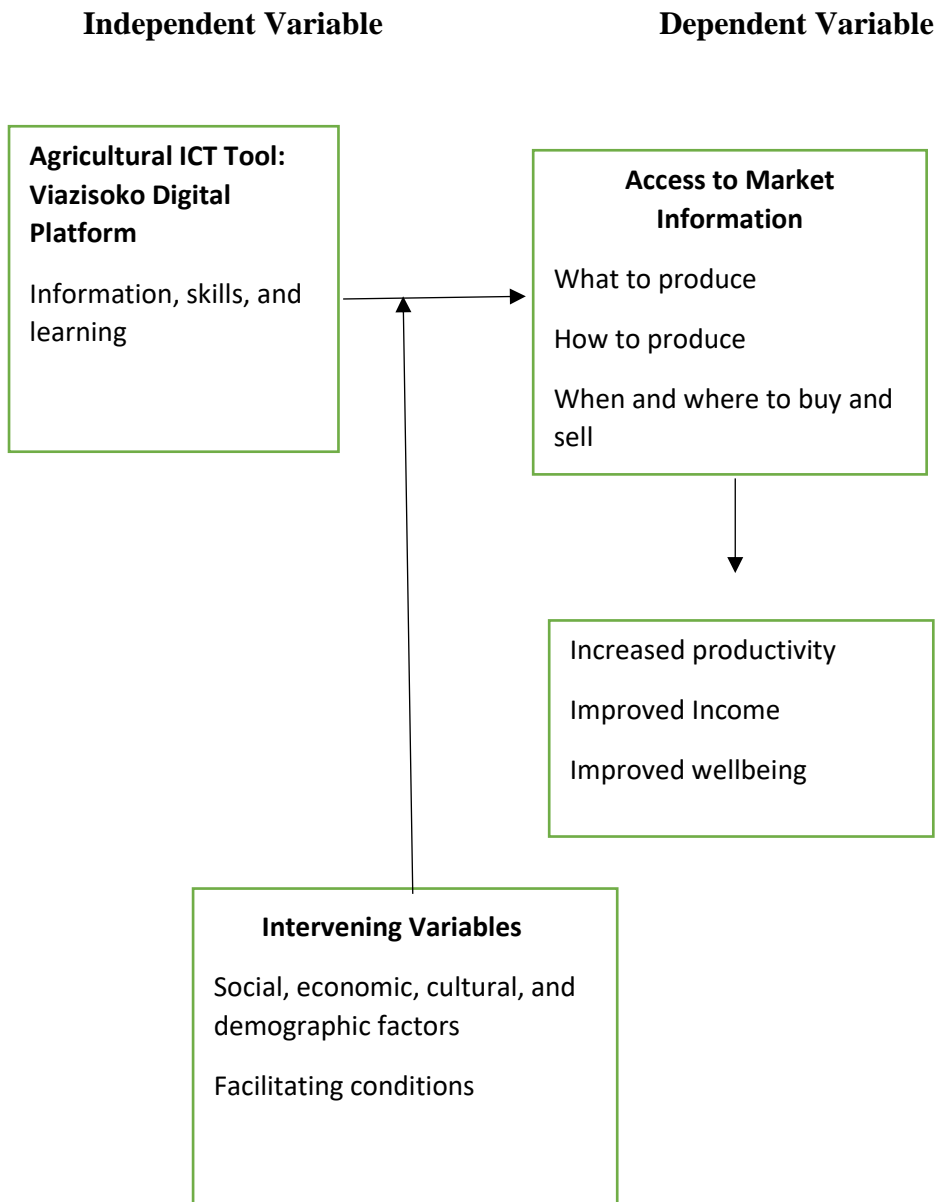
ICT can enhance farmers' livelihoods through provision of information on rapidly changing dynamic situations for instance fluctuations in market prices, prevailing supply, and demand conditions for their output also more reliable information on seeds, pests, and weather patterns,

among others. Therefore, various agricultural technology tools are supposed to empower farmers through access to information that they need to make decisions, become independent, proactive, and enhance their livelihood. The empowerment process should result in the following outcomes: sense of control, increased self-efficacy beliefs, enhanced knowledge, and competence (Ginige & Richards, 2012).

## 2.4 Conceptual Framework

A conceptual framework describes the relationships between research variables and how the goals of the study fit together to provide conclusions that make sense (figure1). The independent variable for the study is agricultural ICT tool - Viazisoko digital platform and the dependent variable is access to market information.

Figure 1: Conceptual framework



Source: Reseacher (2022)

The agricultural digital platform tools enhance access to market information. This empowers farmers by allowing them to make informed decisions on what to produce, where to buy and



sell, how much to sell, and enhances awareness of their produce. Farmers' adoption of ICT tools and utilization of timely market information availed via such mediums is expected to result in increased productivity, income, and improved wellbeing.

According to (Dalberg et al., 2021), merging digital innovations empower smallholders and aid in tackling challenges serving as single interface between farmers and other stakeholders in various agricultural ecosystems. For instance, farmers' market access inventions include market information explanations on prices, stock quantities and market entry routes. Digital marketplaces connect smallholders to liable customers with online markets that can adopt actual time digitalized stock control systems. Other innovations entail land related innovations such as climate smart technologies that improve farmers' resilience to impacts of climate change. Innovations in skills development include provision e-learning platforms via text messaging, chat rooms, and social media to instruct farmers on best agronomic techniques to increase efficiency. In addition, advisory platforms enable entrepreneurial and land business administration. Some innovations have women- targeted content with an aim of engaging women and to narrow the gender gap.

### **Intervening variables**

Bryman, (2012), elaborates intervening variable is affected by another variable and has a causal impact on another variable. Thus, it is important to take intervening variables into account as it aids understanding of the relationship between two variables. Major intervening variables in this study include social-economic and cultural aspects such as farmers' perception of technology, level of education, age, gender, income and facilitating conditions.

According to (FAO, 2019), for digital transformation in agriculture to materialize, various requirements such as basic and enabling conditions must be in place. Basic requirements are the conditions needed in order to use technology which include infrastructure and connectivity as mobile subscriptions, network coverage, internet access, and electricity availability. Other requirements are affordability, education attainment both ICT and literacy, and institutional support. Likewise, enabling requirements are factors that enhance adoption of technologies.

For instance, in rural Kenya, several smallholder farmers cannot access mobile phones due to financial constraints. Ayim et al., (2022), in rural area the state of infrastructure is characterized by poor road network, no access to electricity and poor network connectivity. Therefore, the absence of these facilitating infrastructures poses a challenge to ICT in these areas. Farmers'

literacy level also influences their capacity to effectively interpret information and efficiently utilize ICT tools. With regards to gender, women may be disadvantaged in accessing agricultural market information due to inequality in accessing ICT tools as a result of discrepancies in income and education. (ISF & RAF, 2021), women tend to face challenges in accessing and utilizing digital platforms as they have a lower access to mobile phones and heightened rates of digital illiteracy. In SSA the gender digital gap is prevalent amongst women where they are less likely to use mobile internet services than their male counterparts. Moreover, due to caregiving responsibilities and social norms, women's access to ICT tools is hindered. According to (Nzozzo & Mogambi, 2016), there are other limiting factors that may inhibit adoption and effective utilization of ICT tools among smallholder farmers such as inadequate ICT proficiency, lack of benefit awareness, user challenges, absence of technological infrastructure, technology cost, inadequate training on ICT tools.

## CHAPTER THREE

### Methodology

#### 3.0 Introduction

This section outlines the study area description, research design, target population and sampling techniques. It further explains data collection procedure and methods, and data analysis methods to be employed. Ethical concerns are also elaborated.

#### 3.1 Study Area Description

The study was conducted in Buuri Sub County, Meru County. Buuri Sub County is deemed viable for the study because agriculture is the social economic engine in the area generating approximately 80 percent of the county's income. Meru county has approximately 98.6 percent smallholder farmers who are dependent on the sector as a source of livelihood, food security and means to alleviate poverty. Reports also reveal the agriculture sector in the county has not been fully harnessed and this has often resulted in massive crop failure thus diminished livelihoods, food insecurity and disillusionment among the smallholders. According to data from National Potato Council of Kenya, Buuri sub county has the majority number of smallholder farmers in Meru County utilizing the Viazisoko digital platform.

#### 3.2 Research Design

Research design is the framework of methodologies and procedures a researcher uses to conduct a study. The design aids researchers to modify their study techniques to suit the topic, which also helps to build up successful research. Research design is also perceived as a strategy and arrangement of analysis, or a plan used to generate answers to research questions.

Bryman, (2012), explains research design as a structure that guides the implementation of a research method and the analysis of ensuing data. Similarly, Mugenda & Mugenda (1999), adds that descriptive design is appropriate for studies necessitating detailed description of a phenomenon.

The study utilized descriptive research design to provide information on the role of ICT among smallholder farmers. The researcher intended to generate insight and gain a deeper understanding of the relationship that exists between viazisoko digital platform and access to market information among smallholder potatoes in the study area. The researcher also used the

descriptive design because it is cost effective and fast, also, it utilizes both qualitative and quantitative data for more complete understanding of research topics.

### 3.3 Study Population

A study population is individuals or objects (units of analysis) that share the qualities being studied. The unit of the analysis could be a person, a team, or anything else about which you want to make scientific inferences.

Mugenda & Mugenda (2008) characterizes the research population as the totality of people, things, or events that share observable traits. The target population in this study were smallholder potato farmers groups in Buuri Sub County, Meru County.

**Table 1: Target Population**

<b>Group</b>	<b>No. of Members</b>
Kirimara Potato Growers	50
Timuko SHG	40
Meru Tamu Potato Farmer Cooperative	100
Total	200

Source: National Potato Council, (2022).

### 3.4 Sampling and Sample Size

The study adopted purposive sampling; it is a non-probability sampling that entails intentional election of specific units of the population for forming a sample. The goal is to sample participants in a strategic way to ensure those sampled are relevant to research questions that are being posed (Kothari, 2004; Bryman, 2012). Therefore, the researcher purposely sampled 60 active members of the three farmers' groups in Buuri sub-county, Meru County. Purposive sampling was preferred as it aided the researcher to collect detailed information from the best-fit respondents thus making the findings relevant to study objectives. Also, considering the general low ICT adoption by farmers, the study targeted only the active members of viazisoko platform; this means only a limited number in the population can serve as primary data. For key informant interviews, the researcher identified respondents with relevant information pertaining to the purpose of the study.

**Table 2: Sample Size**

<b>Group</b>	<b>Active Members</b>
Kirimara Potato Growers	25
Timuko SHG	17
Meru Tamu Potato Farmer Cooperative	18
<b>Total</b>	<b>60</b>

Source: National Potato Council, (2022).

### **3.5 Data Sources and Data Collection**

The study incorporated both qualitative and quantitative approaches in data collection. The two approaches complemented each other. Questionnaires were utilized as the main primary data collection tool. Key informant interviews were conducted to obtain greater insight. Further, both primary and secondary data sources were used. The primary data was collected from the 60 active members via questionnaires with both closed and open-ended questions. Physical and virtual key informants' interviews were conducted among sub-county agricultural officers, National Potato Council officials, Agri scientist, chairpersons of farmers' groups, agronomists and agrovets attendants. Journal articles, websites, reports, and various credible documents which relate to study objectives were reviewed for secondary data. The study adhered to COVID-19 health guidelines as stipulated by the Ministry of Health.

### **3.6 Data Analysis**

The data collected was qualitatively and quantitatively analyzed. Information collected was coded, using Statistical Package for Social Sciences (SPSS) package. Qualitative data derived from key informant interviews was categorized into themes. This method was used because the researcher sought to identify and analyze recurrent themes in the data in order to gain insight into the role ICT plays in market information access, and the benefits of such information access among small holder farmers. Emerging themes were analyzed in accordance with the study objectives consequently generating the overall study findings. Descriptive analysis incorporated frequencies and percentages.

### 3.7 Reliability and validity of instruments

Reliability is the degree to which results are reliable or consistent over time, also referred to as the precise interpretation of the population being studied. Therefore, the degree to which the study findings may be replicated using an equivalent approach is considered reliable (Kirk & Miller, 1986). Validity establishes how accurate the research is and whether it actually measured what it was designed to measure. Content validity test via pre-test was conducted to measure the extent to which the research tools were viable. Modifications were done accordingly to minimize misinterpretations and errors thus increasing validity.

### 3.8 Ethical Considerations

According to Diener & Crandall (1978), ethical principles in social science research delves into the following four areas.

1. No harm to the participant,
2. Acquiring information consent,
3. No invasion of privacy
4. No deceit involved.

As such, the researcher observed total adherence to ethical principles by acquiring relevant licenses and consents, notifying the respondents that their participation is voluntary, and information gathered is confidential.

**Table 3: Data Needs**

Research Questions	Data Needs	Source	Instrument
1. What are the various types of information potato farmers are sourcing for from viazisoko digital platform?	<p><b>Information</b></p> <p><b>Learning</b></p> <p><b>Skills development</b></p>	<p>Farmers</p> <p>Key informants</p>	<p>Questionnaires</p> <p>Key Informants</p> <p>Interviews</p>

<p>2. What benefits have farmers achieved via the ICT platform?</p>	<p><b>Benefits</b></p> <p><b>Increased</b> production, sales, Income, negotiation, customers, markets</p> <p><b>Reduced</b> production, search, and transaction costs: minimal interference by middlemen:</p>	<p>Farmers</p>	<p>Questionnaires</p>
<p>3. What is the effect of market information access among smallholder farmers in Meru County?</p>	<p><b>Input</b> – quality, quantity, and prices.</p> <p><b>Land and production management</b> – weather, soils, pests, and diseases.</p> <p><b>Markets</b> – location, quality, quantity, and prices.</p> <p>Risk and uncertainties management</p>	<p>Farmers Key informants</p>	<p>Questionnaires Key Informants Interviews</p>

Source: Researcher (2022).

## CHAPTER FOUR

### FINDINGS AND DISCUSSION

#### 4.0 Introduction

This chapter of the research intends to provide the findings and discussions regarding the role of Information and Communication Technology (ICT) in market information access among smallholder farmers in Buuri Sub County, Meru County. The ICT tool in focus is the Viazisoko Digital Platform. The study's main objective was to understand how ICT contributes to the accessibility of market information among small-scale potato farmers. The focus areas in the research instrument were the participants' demographics, farmer information needs, benefits of the Viazisoko platform, and the effect of market information access among potato smallholder farmers. Therefore, the key findings discussed in this section include the various types of information potato farmers are sourcing from the Viazisoko digital platform, benefits farmers have achieved through the ICT platform and the effect of market information access among smallholder farmers in Meru County.

#### 4.1. Demographics of Potato Farmers

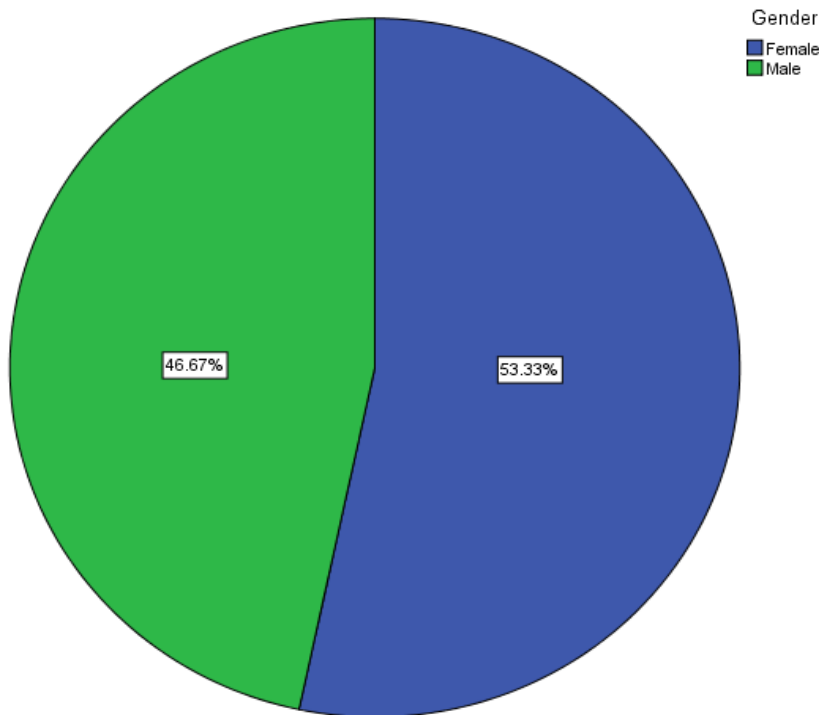
This section focuses on the demographics of the farmers that were part of the study sample. The demographics examined in the study are age, gender, education level, and their principal source of livelihood. Understanding the participants' demographics is important because information gathered determines whether the sample represents the target group for generalization purposes. Further, demographics are considered as intervening variables used to explain causal link between ICT tools and access to information. Kaguongo et al., (2008) also considers farmers' characteristics very crucial as they affect their farm management choices, which are vital in understanding the adoption of improved technologies.

##### 4.1.1. Gender of Potato Farmers

In order to reveal gender allocation and parity in the study area, respondents' gender was considered. This is presented in figure 2. Findings show majority of respondents in the study were female, there were 32 women at 53%. Male respondents were 28 at 47%.



**Figure 2: Distribution of Gender**



Source: Field Data (2022).

The study shows majority of potato farmers in Buuri sub county adopting the ICT tool are women. Such findings can be linked to various studies that show in Kenya women make up half or more of the agricultural labor force, significantly contributing to the nation's agricultural sector and food production (Ingutia and Sumelius, 2022). However, women tend to face challenges in accessing and utilizing digital platforms as they have a lower access to mobile phones and heightened rates of digital illiteracy. In SSA the gender digital gap is prevalent amongst women where they are less likely to use mobile internet services than their male counterparts. Moreover, due to caregiving responsibilities and social norms women's access to ICT tools is hindered (ISF & RAF, 2021). The current study findings bring into focus the double role and plight of women in agriculture. For instance, they supply most of farm labor and are still the household primary caregivers leaving them with limited time for utilization of ICT tools. Therefore, agricultural ICT tools inventors should adopt a gender lens in their design, content, and adoption strategies. For instance, targeted customer engagements where service delivery is adapted to fit their needs also involving women's groups in adoption, training and utilization strategies will reduce the gender digital divide among female farmers.

#### 4.1.2. Age Distribution of Potato Farmers

The study utilized farmers' age bracket in order to determine perspective diversity on ICT adoption and utilization among various age brackets also, for representation and reliability purposes. Majority of respondents were over the age of 40 years. Only 30% of potato farmers were youths. The Kenyan government defines a youth as a person of an age between 18- 35 years and these age group form the majority of Kenyan population.

**Table 4: Age Distribution of Potato Farmers**

Age Values	Frequency	Percent
21-40	18	30%
41 and above	42	70%
<b>Totals</b>	60	100%

Source: Field Data (2022).

Table 4 shows though potato farming is dominated by persons not considered young, the 70% of 41 years and above are the lead group utilizing the ICT tool to access information in order to improve potato farming. The researcher had anticipated majority of respondents utilizing the digital platform would be comprised of young farmers, as various studies reveal youths have a higher affinity for ICT uptake. Since farmers utilizing the platform are not youths, this implies technology is surpassing age barriers and is becoming an effective channel that can serve farmers of all ages. That being the case, application innovators should consider various age cohorts involved in farming as they design and create content. Findings also reveal two implications, that the youths are the majority in Kenya and are the minority in agriculture which employs the majority of rural poor in SSA. Therefore, agriculture has potential to deliver jobs that are necessary to tackle the ever-rising youth unemployment. Stakeholders in the sector can take advantage of the youth bulge and transform the sector into more productive and profitable through modernization and a cultivated shift of the sector to an enterprise.

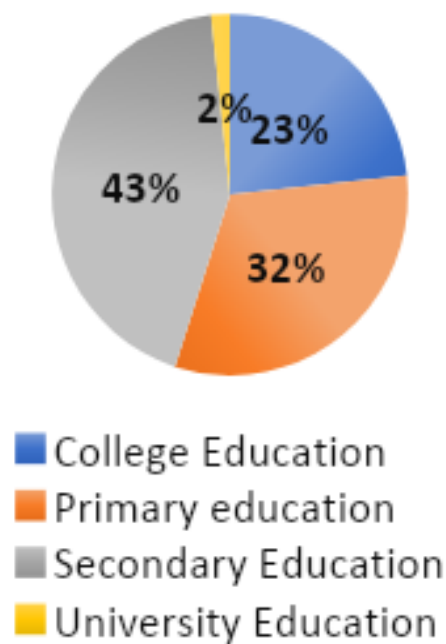
#### 4.1.3. Education Level of Potato Farmers

Respondents' education level was incorporated in the study to reveal farmers' educational background and to reveal the mutual relationship between technology use and education level. Due to the fact that illiteracy levels not only include inability to read and write, but also one's

inability to interpret agricultural market information, thus, impacting farmers' capacity to access significant information. Therefore, education is presumed to have a positive effect on efficiency. As indicated in figure 3 below, findings reveal the majority of farmers; 43% had completed secondary education, 23% completed college and 2% university.

**Figure 3: Education Level of Potato Farmers.**

### Education Level



Source: Field Data (2022).

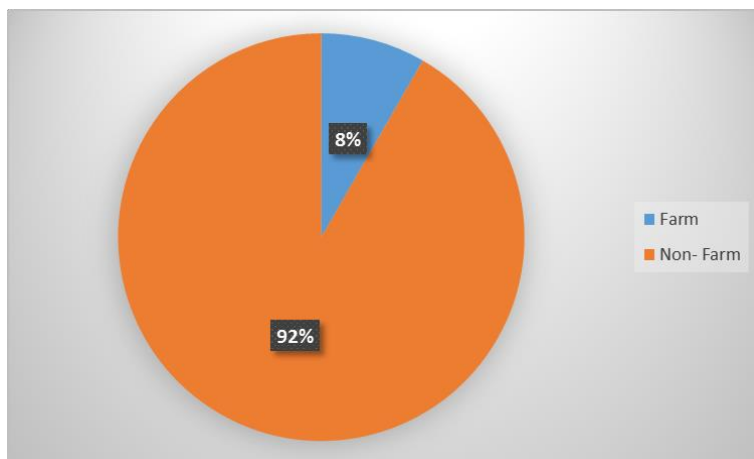
Viazisoko users are deemed literate because about 68% have at least secondary school level of education, with 32% having completed primary education. Such findings show that a substantial number of the respondents (a third) can have challenges in utilization of the ICT tool. Wawire et al, (2017) found that literacy is among the factors affecting farmers' adoption of technology. Other studies have identified that literacy levels correlate with farmers' adoption of technology. For instance, Okello et al. (2014) indicates an increase in ICT literacy level increases the ICT-based market information services used by a farmer thus, literacy levels can influence awareness and utilization of ICT tools in agriculture. Therefore, even though the current study demonstrates in figure 2 that a significant number of about 68% has either at least secondary education, there is also the remaining 32% that can struggle with the adoption of ICT tools such as Viazisoko app because of low literacy levels. Further, illiterate farmers may

struggle to effectively communicate with traders and other market actors thus limiting themselves to their local traditional markets, traders, and intermediaries. Hence, literacy and customized digital content should be promoted in Kenya and Africa at large in order to promote adoption and utilization of technology for agricultural productivity.

#### 4.1.4. Sources of Livelihood for Potato Farmers

Understanding the sources of income is important for the study because it shows farmer's level of commitment to agriculture as source of livelihood. The researcher anticipated households with farming as the sole source of income would be utilizing various technologies in order to improve productivity. Findings from the study, as indicated in figure 4, majority of the participants (92%) identified farming as the main source of income compared to 8% whom farming is not their principal source of income.

**Figure 4: Main Source of Livelihood for Potato Farmers**



Source: Field Data (2022).

The findings demonstrate that farming is solely practiced as the main source of income and farmers exclusively rely on it to support their livelihood. 92% of farmers dependent on agriculture as the primary source income are utilizing the ICT tool with expectation of improved productivity.

*KI.1 The main objective of every farmer is to increase yields which will translate into higher income and for this to be realized information plays a very pivotal role.*

It is evident from the findings that farming is the mainstay of the study area, this is akin to (Alila & Atieno, 2006), that agriculture maintains livelihoods of over two thirds of labor force

and over 80% of Kenyan population reside in rural in areas and obtain their livelihoods, directly or indirectly from agriculture.

The study shows majority of respondents utilizing Viazisoko application are fulltime potato farmers who utilize the ICT tool to seek information in order to improve their potato farming practices. The findings are similar (Awuor & Rambim, 2022), ICT solution platforms can aid farmers access emerging farming techniques that can enhance their productivity. Further, (Akuku et al., 2019) also concurs growth and development in agriculture can be realized via effective utilization of ICT in that, it is a vital contributor to growth and social economic development. Therefore, in order to support farmers' main avenue for livelihood, agriculture needs to be robust to improve productivity.

#### 4.2 Period of Viazisoko Platform Utilization

The period of app utilization considers how long the respondents have used the platform. It is an important aspect for the study because it determines farmers' commitment to utilizing the platform. Additionally, it also aids in determining benefits achieved as a result of utilization of the app. The perceived benefits can be monitored since farming is a seasonal practice that is contingent to a specific harvest period. In table 5, the data shows majority of respondents 58% have used the app for two years and above. 17% of farmers have used the application for one year and 25% for less than one year.

**Table 5: Distribution of period farmers have used Viazisoko App**

<b>Membership Period</b>	<b>Frequency</b>	<b>Percent</b>
Above two years	27	45.0
Less than one year	15	25.0
One year	10	16.7
Two years	8	13.3
Total	60	100.0

Source: Field Data (2022).

Findings reveal most of the respondents, 75%, have utilized the application for more than a year. This shows farmers' commitment to utilize Viazisoko and that the app is useful when

seeking potato farming information. Similarly, Muriithi et al, (2009), in their study that examines experiences of Kenyan farmers regarding ICT for agriculture and rural development, reveal the longer farmers utilize farming technologies relates to their willingness and usefulness in exploring agricultural information and techniques.

The 45% of respondents who have used the app for two years and above signifies superior level of reliability exists in using the application. The substantial number of these respondents can be attributed to beneficial effects they have experienced while utilizing the platform. As a result, farmers are relying on the app to get appropriate market information on potato farming practices throughout the value chain. Okello et al. (2012) also identifies farmer's experience as a factor shaping use of ICT solutions.

#### **4.3. Type of agricultural information potato farmers are seeking.**

Information plays a very fundamental role in addressing the needs of various human endeavors. In agriculture, smallholder farmers require agricultural information more than ever due to the emergence of various farming challenges and needs. Therefore, smallholder farmers are perceived as distinct and complex with varying agricultural information needs. One of the study objectives was to investigate various agricultural information needs farmers are generally seeking. In order to comprehensively understand the key prevalent agricultural information needs amongst potato farmers, the researcher focused on the following keys areas; respondents were asked if they require agricultural information, to rate availability of extension services, to stipulate their greatest agricultural information need, to quantify the frequency of seeking for certain information on viasisoko platform and to indicate the extent to which their information need is addressed.

#### **4.3. Farmer's Agricultural Information Needs**

The main objective of the study is to understand how ICT contributes to the accessibility of market information among smallholder farmers. Therefore, respondents were asked if they require market information, and this aided in identifying the significance of agricultural information among respondents in the study area. It was acknowledged by all 60 potato farmers that they needed agricultural information. Further, when asked if lack of information hinders potato farming productivity. One key informant stated (KI:2)

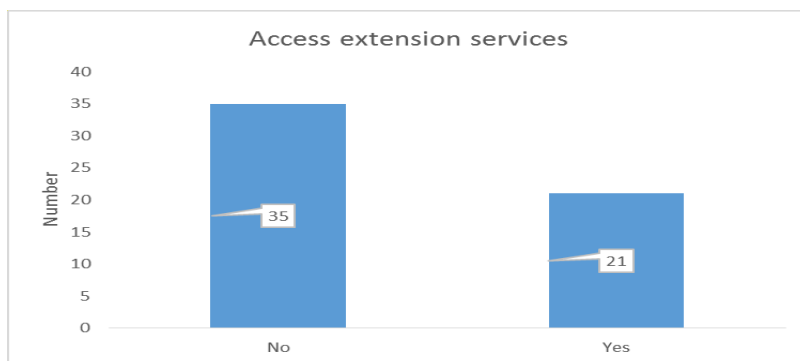
*lack of information is the major contributor to low productivity. Insufficiency of information means farmers use poor / low quality seed variety which results to low production and low quality thus low incomes among farmers and basically “the potato sector is about to die”. Further, resulting to low/ poor living standards among potato farmers.*

Similar to the study findings, (Nzozzo & Mogambi, 2016), elaborates information is becoming a key input in agriculture as knowledge and information play a fundamental role in improving farmers’ response to opportunities that could boost their agricultural productivity. The study parallels, Rop, (2018) that farmers require information regarding how and where to access regular support services associated with unusual challenges that are not easy to diagnose during normal plant health, or information on how to access inputs that include pesticides, fertilizers, and the quality of seeds. Further, (Mbagwu et al., 2018) emphasizes it is necessary to understand farmer’s information need as it aids in determining the best method and form of information system to adopt and use. For instance, whether information is to be personalized or nonspecific.

#### **4.3.1. Availability of Extension Services**

The majority of the respondents, 62.5%, stated extension services are not available and 37.5% agreed of the presence of extension services. This indicates there is a major demand for agricultural market information amongst small-holder potato farmers yet on the other hand most of them lack extension services. This creates an opportunity for digital agricultural platforms like Viazisoko to bridge this information gap with a variety of services. Notably, the insufficient public extension services, which is essential for increasing agricultural productivity, cannot be solved by ICT tools alone.

**Figure 5: Access to Extension Services**



Source: Field Data (2022).

From the findings presented in Figure 5, the common extension services received by about 37% of respondents are information, advice and training on certified seeds, fertilizers and agrochemicals, pesticide application, chemical application, crop management and technical advice in general on farm maintenance.

The 63% of farmers without access to extension services would like to receive knowledge, training and information on inputs, climate change, soil analysis, current potato farming techniques, access to markets, certified and quality seeds variety, subsidized inputs, transport, correct use of fertilizers and pesticides application, weather information, and farm management. When it comes to markets, potato farmers are particularly interested in market access, marketing expertise, and how to deal with a variety of market problems and information asymmetries.

According to the findings, extension services have been steadily declining. As a result, private sector extension services have taken the place of traditional government-led services. However, there is a caveat that these services are profit-driven and have invested interests.

KI.3 shared the challenges linked to private and public extension services as follows:

*The main problem is the available extension officers are overstretched, for instance here in Timau one extension officer is required to serve 36,000 farmers. The government has really neglected farmers, and this has given way to private supported services with vested interests as they are driven by profits as opposed to free government services.*

Similar premise is emphasized in the strategy plan for the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives, until the late 1980s, the extension service was dominated by the public sector, well-staffed up to the sub-location level and sufficiently facilitated to implement its duties. However, for the last 15 years the staffing and facilitation of these services by the government has declined due to sector freeze on public employment and diminished funding (GOK, 2012).

As a result of inadequate extension services farmers have adopted various ICT tools in order to access information that will enhance their potato farming productivity. In similarly vain, (Gakuru et al., 2009) asserts most farmers access information from extension offices, websites, and libraries, but the number of officers has declined while that of farmers has increased hence the need to integrate ICT tools to address the gap.



The results of the current study show that there is room for improvement in the existing in-person agricultural extension programs given the widespread adoption of basic mobile phone technology and access to ICT tools. As a result, the government can improve its extension service by using digital platforms for agriculture. Additionally, they can collaborate with the private sector to offer extension services to farmers, particularly the most vulnerable ones, as a social protection measure. The government should also continue to regulate extension services which are currently dominated by the private sector to curtail exploitation of farmers.

#### 4.3.2. Most Important Agricultural Information Need

Information needs vary from one farmer to another. This section offers findings on the most valuable information needed as cited by potato farmers in the study. The majority of respondents (72%) cited access to markets as the major information need, followed by access to inputs at 70%. Other information highly sought after is risk mitigation measures and advisory, information, and learning at 52% and 47% respectively.

One of the key informants (KI.4) stated: *Farmers are seeking markets for their potatoes. Not only markets but also alternatives for higher selling prices to increase incomes.*

**Table 6: Most Important Agricultural Information Need**

<b>Factor</b>	<b>Number</b>	<b>Percentage of Respondent</b>
Access to Markets	43	72%
Access to inputs	42	70%
Risk Mitigation Measures	31	52%
Advisory, information, and learning	28	47%

Source: Field Data (2022).

From the findings, potato farmers are consistently seeking information throughout potato value chain from pre-planting to post-harvest. However, it is evident that search for alternative and conducive markets is a priority, this is as a result of dominance by middlemen resulting to low farm gate prices.

Key informant (KI.5) stated that the ICT tool allows *access to alternative markets, thus reduction of intermediaries.*

The findings echo (Akuku et al., 2019) that farmers utilize ICT tools to access market prices and market outputs, weather and other information that can aid in dealing with confronting

issues. Previously farmers were vulnerable to exploitation by traders, however, they now hold a better position.

The current study also established that intermediaries in potato value chain can be a valuable asset as they possess information on alternative markets, compliance, and logistical insight which an ordinary farmer is usually unaware of. Therefore, potato sub sector stakeholders can seek mutual relationship.

### 4.3.3. Frequency of Seeking Specific Information from Viazisoko Platform

This section also focuses on the information that smallholder farmers are looking for on Viazisoko platform, but it looks at how regularly they look for that information. On the Viazisoko platform, a range of information is offered, including mechanized services, spray services, soil testing, approved agrochemicals, fertilizer specifically for potatoes, certified seeds, and market outlet linkages (IPC, 2021).

The frequency of respondents' searches for each sort of information was thus inquired for, on the scale of 1-5, where: 1= Not at All, 2= Once in a While, 3= Sometimes, 4=Fairy Often, and 5= Frequently. Table 7 shows market outlets is the most frequently sought-after information as ranked by farmers, with a mean of 4.12, followed by advisory, information, and learning (m=3.97), Potato specific fertilizer and agrochemicals (3.70)

**Table 7: Summary Statistics of Ranks on Possible Information Sought by Potato Farmers**

<b>Factor</b>	<b>Mean</b>	<b>Std. Deviation</b>
Certified Seeds	3.60	1.21
Potato specific fertilizer and agrochemicals	3.70	1.33
Soil testing	2.18	0.87
Market outlets	4.12	1.21
Weather forecast	3.00	1.12
Advisory, information, and learning	3.97	1.04
Query and feedback	2.17	1.36

Source: Field Data (2022).

The study shows potato farmers in the study area are regularly using the platform to search for market outlets for their produce. Farmers are constantly searching for market outlets in order to overcome prevailing marketing challenges since the market ecosystem is marred by various problems. These findings correspond to (Kaguongo et al., 2008), revealing farmers in Kenya produce potato for commercial purpose specifically, Meru County has the highest proportion of marketed potato with 80% of farmers selling their produce. Further, markets in the region are marred by various constrains for instance, markets are dominated by intermediaries, low prices and farmers are unaware of packaging standards. Due to such constrains information regarding market outlets has become paramount among potato farmers in Meru County.

Table 7 also shows that the least frequently sought information is soil testing at 2.18. Therefore, the low frequency of soil testing is attributed to the fact that the process is not continuous and is performed before planting, and once potato seeds have been planted, there is no need for the tests until the next planting season. Mallory et al., (2022), explains soil testing has been identified as an important process in addressing the challenge of poor soil fertility and limited fertilizer application across Sub-Saharan Africa (SSA). Further, Hochmuth et al. (2012) expounds that soil testing is done before planting to know the nutrients needed and predict the fertilizer needs.

#### **4.3.4. Extent Information Needs are Addressed.**

The study sought to examine the extent to which information needs are met via Viazisoko app to understand its efficiency and usefulness. Table 8 below shows, the app has had at least moderate extent in addressing majority of farmers information needs to over 92% users. Only 8 percent of farmers feel that the extent to which the app addresses farmers' information needs is small.

**Table 8: Distribution of the extent to which Viazisoko app addresses farmers' information needs**

<b>Extent</b>	<b>Frequency</b>	<b>Percent</b>
Great extent	16	26.7
Moderate extent	24	40.0
Small extent	5	8.3
Very great extent	15	25.0
Total	60	100.0

Source: Field Data (2022).

Therefore, the majority of respondents can assert Viazisoko app has aided in provision of their agricultural information needs. Hence, the findings show that the ICT tool effectively meets potato farmers' needs in the study area. The findings are in line with the claim by Mbagwu, et al (2017), that use of ICT tools for providing farmer information needs is seen as an excellent solution that has enormous potential to improve agriculture in developing countries.

#### **4.4. Benefits of the Viazisoko Platform**

Another key objective of the current study was to determine gains of utilizing viazisoko platform to access agricultural information as compared to conventional sources of information. This section sought to identify benefits farmers have experienced through their utilization of the ICT platform. Therefore, the study focused on these subsequent areas: Frequency use of the app, it examined how often respondents utilize the platform. Reason for using the application, why respondents prefer to use viazisoko platform. Quality of information, examining how farmers regard the quality of information accessed via the platform. Changes observed, respondents described areas along the potato value chain they have witnessed remarkable changes as a result of utilizing the platform. Some of the expected changes include increase, decrease or no change in production output, cost of production, access to inputs, access to markets, information, knowledge, skills and learning, and income.

##### **4.4.1. Frequency of App Use**

Respondents were asked to show how often they utilized viazisoko platform to access agricultural information. Assessing the frequency of use is crucial in depicting some degree of

adoption of the ICT tool as an avenue for agricultural information. Table 9 below shows the respondents occasionally use the app at 45%, with regular use constituting 35%, and 20% for those that utilize the platform rarely. Therefore, more respondents reported using the application compared to the ones that rarely use it.

**Table 9: Frequency of using the app.**

Frequency	number	Percent
Occasionally	27	45.0
Rarely	12	20.0
Regularly	21	35.0
Total	60	100.0

Source: Field Data (2022).

Based on the findings in table 9, it is evident that most farmers are using the application, which indicates there are benefits associated with utilization of Viazisoko app. However, the 20% rarely utilizing the app can be attributed to KI.6:

*At times, farmers rarely seek information as they really don't understand the importance of agricultural information. The infrastructure also limits seeking behaviors e.g., connectivity to internet, network, and electricity. Low ICT literacy levels also hamper their seeking behavior.*

Also, Mbagwu et al., (2017), asserts farmers will rarely use ICT tools due to low level of interest in utilizing agricultural information thus affecting the extent of use. Various studies also claim there is a relationship between the level of interest in something and the degree of use. Hence, some farmers prefer to use traditional ways of gathering information about farming instead of internet-based tools. The respondents who infrequently use the app might favor conventional methods of accessing information about potato cultivation over utilizing the Viazisoko app. Stakeholders in the sub sector can initiate programs and campaigns to boost farmers' awareness of the benefits of utilizing information provided via various agricultural digital platforms.

#### **4.4.2. Reason for App Use**

For benefits of using Viazisoko to be known, it is important to identify motives that inspire respondents to use the application in the first place. From previous sections, the main objective

for adopting the ICT tool is access to information. Findings show the main reason respondents use the app is, it is readily accessible (70%), followed by cost-effectiveness (50%), then easy to use (35%) and timeliness at (25%).

**Table 10: Reasons for preferring Viazisoko app**

Reasons for preference	Number	Percent
Timely	15	25
Easy to use	21	35
Cheap	30	50
Readily accessible	42	70

Source: Field Data (2022).

One key informant (KI.7) shared: *farmers depend on ICT tools in absence of extension services because farmers can readily access information they are desperately looking for.*

Therefore, the elevated level of accessibility is considered beneficial as the app attempts to fill the vacuum created by inaccessible and limited extension services. As Cox & Sseguya (2015), observed the high percentage of accessibility of ICT tools provides, the potential for full exploitation of ICTs in the improvement of agricultural information provision and knowledge pathways.

Therefore, the participants in the current study have demonstrated that the Viazisoko app is accessible and can utilize the app to access information that is valuable in advancing their potato farming. According to Mbagwu et al., (2017), development of ICT tools has enabled the spread of information and knowledge and has revolutionized the use of technology in agricultural provision and production of market information to optimize agricultural returns.

However, timely delivery of information, convenience of use, and cost effectiveness are other additional factors mentioned by respondents that are unrelated to information acquisition.

According to one of the key informants, the capacity of ICTs to transcend location and time can be connected to the 50% who indicated they would use the app due to its cost efficiency.

*KI.8: They are dependable, cost effective and save time unlike the traditional ways of seeking information which are time consuming, expensive, and unreliable. Also, the Apps can reach many farmers unlike conventional ways of communication which is confined to space and time.*

Thus, findings indicate farmers are saving money and time spent searching for information,

markets, and inputs through the use of Viazisoko app. Equally, de Silva. & Ratnadiwakara, (2008), also elaborates the cost-effectiveness of using ICT tools is associated with the reduction of transaction costs that include transportation costs which is a per-unit cost of accessing markets.

#### 4.4.3. Quality of Information

This section carefully examines the caliber of the information obtained from Viazisoko. The quality of the information is crucial because it ensures that farmers receive information they can put to good use. As shown in Table 11, the majority of users, 55%, find the quality of information on the platform to be user friendly and can easily extract what they want. About 40% find the information on the platform to be accurate. But only 13% find the information to be sufficiently detailed.

**Table 11: Quality of Information**

Quality of Information	Number	Percent
User Friendly can extract what you want	33	55%
Sufficiently Detailed	8	13%
Accurate	24	40%
Up to Date	21	35%

Source: Field Data (2022).

Findings from the current study reveal 24% of the respondents find Viazisoko app accurate, which increases the reliability of information shared. One of the key informants shared he considers information obtained from the app accurate as it is championed by NPCK which is a trusted body.

*KI.9: Farmers are relying on viazisoko because it is a product of a registered body thus, they trust information provided and perceive it as reliable, which is probed and can identify with NPCK.*

User friendly is another key feature that respondents rated highly. Viazisoko app is identified as being easy to use and understand thus increasing its usability by most respondents. The user-

friendliness of ICT tools has been identified as an important feature by Oyinbo et al., (2020) in their study on designing digital agricultural extension tools. The researchers identified that user-friendliness is associated with interface ease-of-use, which is the ease of navigating through tool modules.

However, about 8% of respondents considered the app sufficiently detailed, agriculture being an information driven activity farmers need to be supplied with appropriate, comprehensive information consistently. Therefore, various ICT platform developers can scale-up content provided.

#### 4.4.4. Changes Observed in Potato Farming

In order to ascertain the benefits of using the Viazisoko platform, it is crucial to look at how respondents' use of the app affects potato farming. Table 12 shows that majority of the respondents constituting 97% experienced enhanced Information, knowledge, skills, and learning, 82%, an increase in production output, 78% claimed an increase in access to markets, 70% an increase in access to inputs, 77% observed an increase in income. Only 42% of the farmers stated reduced cost of production.

**Table 12: Changes Observed in Potato Farming**

<b>Factor</b>	<b>Increase</b>	<b>No change</b>	<b>Decrease</b>
Production output	82%	13%	5%
Cost of Production	37%	22%	42%
Access to inputs	70%	27%	3%
Access to Markets	78%	22%	0%
Information, knowledge, skills and learning	97%	3%	0%
Income	77%	22%	2%

Source: Field Data (2022).

The biggest changes were observed in information, knowledge, skills, and learning increase, this reveals farmers are hungry for information in order to improve their productivity. KI.10: *Our farmers are actively seeking information more than ever.*



*KI1: Availability of information throughout potato value chain will aid farmers achieve optimal returns and breakeven.*

Report by (Tsan et al., 2021), also expounds digital solutions supply farmers with tailor made information and insights that enable them to optimize their production, improve access to proper products and services and explore new linkages with markets.

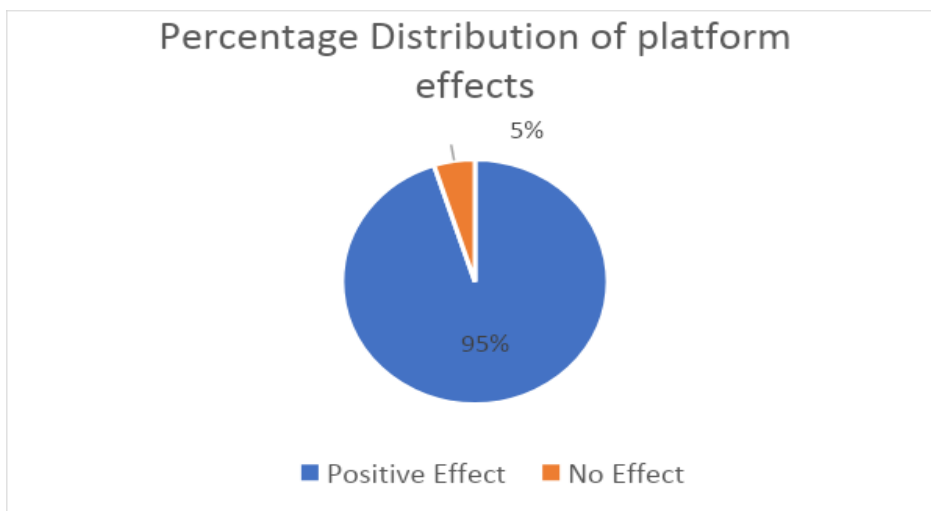
As seen in table 12 above, the change in the cost of production is minor. Despite farmers having greater access to supplies, most input costs have remained high, leading to little change and, in some cases, rising production costs. According to (KNA, 2019), Kenya's cost of production and taxes remains fairly high compared to their neighbors Tanzania and Uganda, this has disadvantaged farmers. For instance, the cost of farm inputs has enormously hit high the biggest concern being cost of fertilizer where a 50 Kg of Di-ammonium Phosphate (DAP) planting fertilizer is retailing at 6,000 upwards from 2,500 and 3,000 in the previous planting season (Tanui, 2022).

Therefore, Kenya government ought to consider investing in local manufacture of key agricultural inputs so as to ease high cost of production occasioned by high input prices. In addition, proper and stringent mechanisms should be put in place to ensure subsidized inputs reach the intended recipients.

#### **4.5. The Effect of Market Information Access among Potato Smallholder Farmers**

This section will focus on effects farmers have realized in their utilization of the platform, both negative and positive effects will be discussed. As various studies have revealed the intended objective for adoption of any agricultural digital platform is to enhance access to agricultural market information in order to improve productivity, however, negative effects can persist despite adoption.

**Figure 6: Effects of Utilizing Agricultural market Information from the App**



Source: Field Data (2022).

Only 5% of respondents acknowledged no effect, while 95% of farmers claimed to have benefited from using the information from the app. similar to (Chuluunbaatar et al., 2021), ICT tools have enhanced provision of various services such as agricultural advisory, market linkages, financial access, supply chain management, agricultural intelligence among others. These digital solutions have enhanced accessibility, delivery, transparency, scope and effects of information and services to small-scale farmers, as well as to the rural youth, women, and other vulnerable factions.

#### **4.5.1. Positive Outcome from Utilizing Information from the App**

Viazisoko platform has been associated with positive effect amongst potato farmers via provision of agricultural information resulting to increased production and improved quality produce. This is presented on Table 13. Findings reveal the major positive effects garnered include increased production 73%, higher quality produce 60%, increased access to inputs 48%, higher selling price and risk mitigation at 45% and 35% respectively. According to key informant (KI.12):

*The main objective of every farmer is to increase yields which will translate into higher income, and for this to be realized, information plays a very pivotal role.*

**Table 13: Positive outcome of utilizing information from Viazisoko application.**

<b>Factor</b>	<b>Number</b>	<b>Percentage</b>
Increased amount of production	44	73%
Lower cost of production	10	17%
Higher selling price	27	45%
Risk mitigation (wastage, supply, and demand)	21	35%
Higher quality produce	36	60%
Access to markets	14	23%
Increased access to inputs	29	48%

Source: Field Data (2022).

From the study, the anticipated benefit by potato farmers is to incorporate information obtained from the app to improve potato productivity. Therefore, more bags of potatoes were harvested, and better prices were earned during the times the app was in use, indicating increased productivity and higher-quality produce. Consequently, farmers have become empowered to utilize best farm practices, access quality inputs leading to improved quality and quantity, better post-harvest handling, more access to markets leading to higher incomes as well as improved wellbeing. Thus, effecting strong multiplier effect through forward and backward linkages.

Interview with key informant KI.13 indicate: *Utilization of information has resulted to high production resulting to development where farmers have demanded for post-harvest facilities such as cold storages, sourced for contract farming and eventually infrastructure development. Due to higher incomes this will result in improved livelihood translating to better education, health, housing etc.* These findings are similar Amer et al., (2018); farmers who access agricultural information related to improved farming methods and markets, enjoyed better prices for their maize and beans. Consequently, farmers may be able to enhance their standard of living with higher incomes.

Increase in production can be linked to farmers' empowerment, the ICT tool has enhanced access to agricultural information and farmers have become knowledgeable on best farm practices. As KI.14 stated: *Due to access to information farmers have become knowledgeable on best practices thus increasing their yields and improved quality. Farmers are also aware of where they can get quality, certified seeds, and other inputs even at a subsidized rate.*

According to (Oladele, 2011), providing information on best farm practices, timely access to market information enables farmers to make better decisions concerning what crop to cultivate, where to source for input and where to sell produce. Therefore, information is vital for enhancing agricultural production and improving marketing as well as distribution strategies. Another informant KI.15 states that: *The platforms are further linking farmers with markets so as to minimize the dominance of middlemen.*

#### 4.5.2. Negative effects that have persisted despite utilization of the App.

Despite the positive effects associated with using the Viazisoko app, as observed in previous sections, there has been persistent drawbacks experienced by farmers. Table 14 below shows that 55% of the respondents highlighted increased risks and uncertainty have persisted notwithstanding utilization of the app. High cost of production came in second at 37%, with market unavailability and crop failure at 27% and 13% respectively.

**Table 14: Negative effects that have persisted despite utilization of the App.**

<b>Factor</b>	<b>Number</b>	<b>Percentage</b>
Production failure	8	13%
High cost of production	22	37%
Increased risks and uncertainty	33	55%
Low quality produce	1	2%
Low output prices	4	7%
Unavailability of markets	16	27%

Source: Field Data (2022).

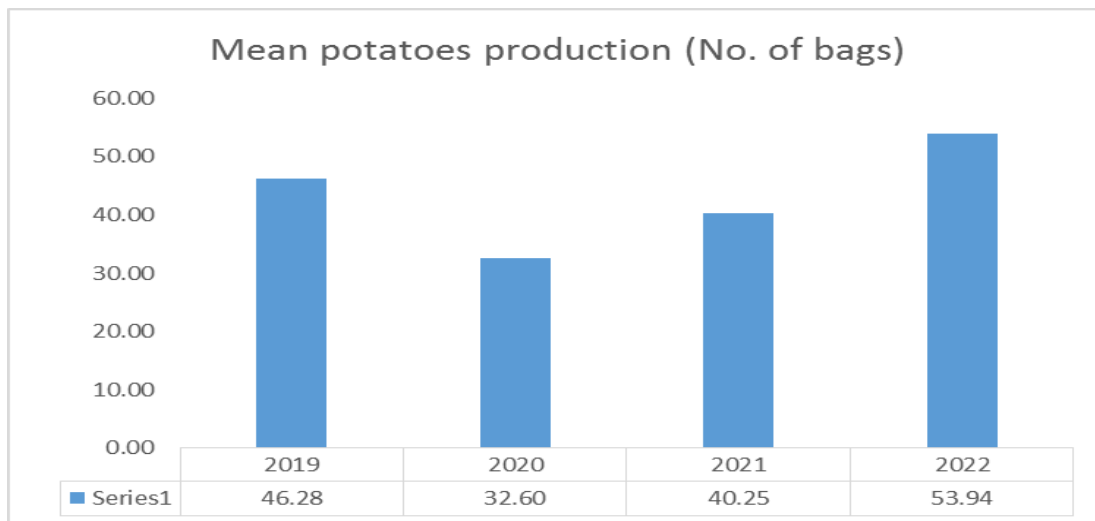
The intensified risks and uncertainties have been linked to climate change. Respondents revealed, for the past 2-3 years, the study area has not had consistent rainfall required for potato farming resulting to some farmers experiencing crop failure. The findings align (Akuku et al., 2019) that climate change exacerbates agricultural risks resulting in dire implications for agriculture, food security and wider community. Tsan et al., (2021), also elaborates agriculture is increasingly experiencing climate volatility and damaging effects of drought, floods, emergence of new pests and diseases due to climate change.

To tackle the issue of climate change, ICT tools developers can provide farmers with information on mitigation measures to minimize effects of climate change. Further, these platforms can link farmers with irrigation experts who can provide advice on best techniques to adopt and reduce overdependence on rainfed agriculture. The government and other stakeholders can avail irrigation equipment and services to farmers at an affordable rate to ensure inclusivity.

### 4.5.3. Bags of Potato Harvested

This section aims to quantify production changes observed during the app utilization period amongst potato farmers in the study area. Therefore, the main metric used in the quantifying process is the 50kg potato bag and weight. Based on the findings in figure 7, the mean bag of potato keeps fluctuating, but it is on an increasing trend from 2020 through 2022. The highest mean of bags harvested was 54 bags in 2022. However, it should be noted that not all participants provided the number of bags harvested in 2022 since not all had harvested their produce at the time of the study.

**Figure 7: Bags of Potato Harvested**



Source: Field Data (2022).

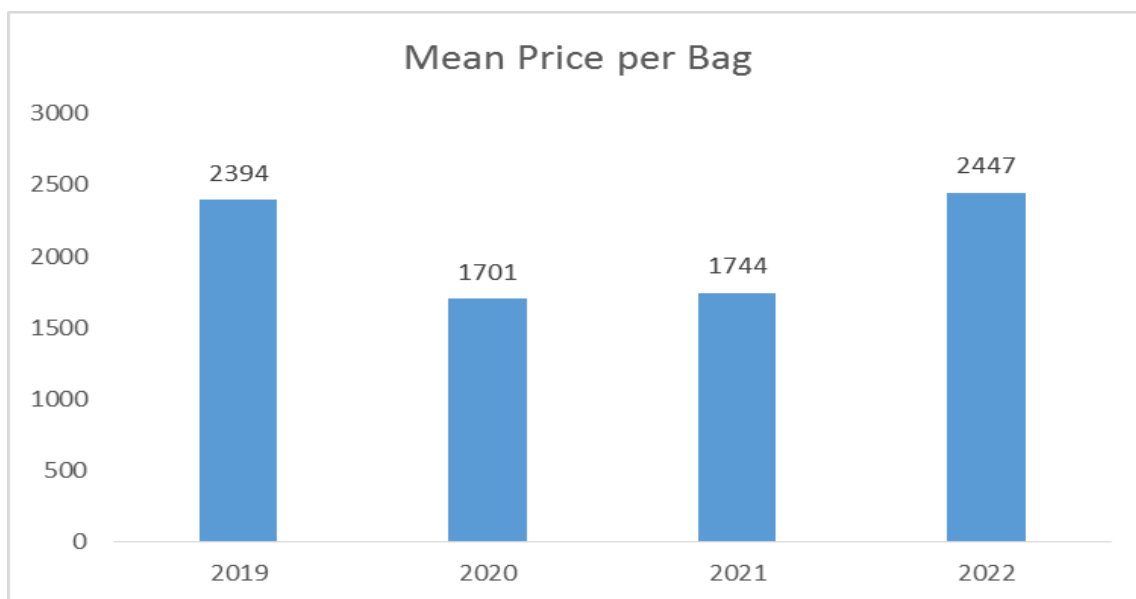
In 2020, potato production was also disrupted by the COVID-19 pandemic. According to NPCK (2022), there were significant disruptions in potato farming in areas commonly known for consumption and potato cultivation due to the pandemic. Mitigation measures affected extension services, quality of farm inputs, and declined markets. However, the study findings

point to an increase in potato production from 2019 to 2021. Similar results have been cited by (Chepkoech 2022), where in 2019, potato production was 2 million tons. Xinhua (2021) further shows in 2021 production of potatoes reached 2.5 million tons indicating an increase from the previous year.

#### 4.5.4. Average Price Annually of Potato Harvested

Price is an important factor that needs to be considered in the study because it determines the average income potato farmers get from selling their produce. The Viazisoko app plays an important role in accessing market outlets so that farmers can fetch the best price for their produce. In figure 8 below, the mean price of potato keeps fluctuating, but it is an increasing trend from 2020 through 2022. The highest average price based on the feedback from the respondents was observed in 2022 at Ksh 2,447 followed by 2019 at Ksh 2,394 the lowest were 2021 and 2020 at Ksh 1,744 and 1,701 respectively. As observed in figure 8, in 2020, the pandemic also significantly impacted on potato prices due to disruptions in production and market access for produce (NPCK, 2022). It is crucial to note at the time of data collection not very participants provided 2022 prices since some respondents had not harvested their produce. Others did not plant due rainfall failure linked to climate change.

**Figure 8: Average potato price over the years (price per bags)**



Source: Field Data (2022).

The increase in prices can also be linked to contract farming within the study area especially for farmers in Timau area where farmers have been selling directly to industrial processors through contract farming, thus attracting better prices, and selling terms for instance, selling in weight as opposed to extended bags as is commonly the case.

*K16: Farmers are seeking for alternative markets especially contract farming e.g., farmers in Timau are selling their produce to serene fries, Holland Chips, Molly Flower,*

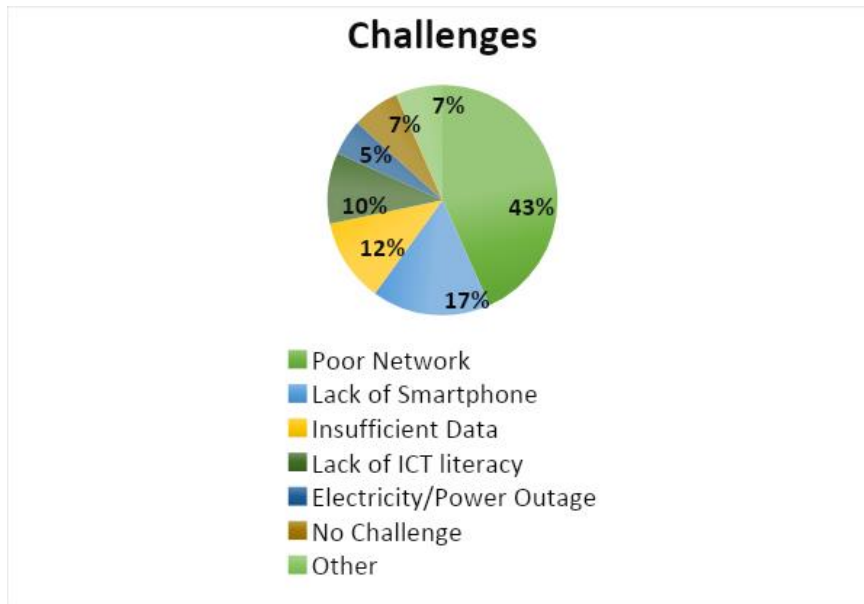
Similar to the current study findings (Kaguongo et al., 2014), positive market signals may emanate from contract farming which aids farmers minimize the vicious cycle of volatile markets and exploitations. As a result, stakeholders in potato sub sector can search for more favorable, alternative, conducive markets at the national, regional, and international levels. This results in more markets, better income, value addition, employment opportunities and overall improved community welling and development.

#### **4.6.1. Challenges Encountered when Accessing Information via the App**

Challenges exist when adopting ICT tools such as Viazisoko that can negatively affect how and when farmers use ICT tools. Key challenges, (43%) of the respondents identified poor network, lack of smartphones (17%) and insufficient data (12%).

Braimok (2017) states that even though some advantages and benefits exist in using ICT, difficulties may exist that may impede effective utilization of these tools. It is crucial to draw attention to any issues or obstacles that potato farmers encounter when using the platform so that creators of such solutions and policymakers can take appropriate action to improve adoption and effectiveness.

**Figure 9: Challenges Encountered when Accessing Information Via the App**



Source: Field Data (2022).

Poor network can be attributed to poor infrastructure as one of the key informants noted (KI.17): *The infrastructure also limits seeking behaviors, e.g., connectivity to the internet, network, and electricity.*

The study by Mbagwu et al., (2017) also identifies that among the key challenges farmers experience when adopting ICT tools is the lack of infrastructure, especially in rural areas. The researchers identify that absence of ICT infrastructure hinders rural farmers' information needs via an internet-based information system. One of the key reasons identified for the poor network in Meru County, where the study was conducted, is the high cost of the internet that hampers internet penetration in the region (Ndeke, 2013).

Another challenge identified is the lack of a smartphone, which can be attributed to the cost of buying a smartphone, which might be costly for the farmers. According to Guguyu (2020), increase in taxes means smartphone prices will increase by 35% because of the 10% excise taxes and the 25% import duty. The journalist argues that previously the taxes were scrapped, leading to the rapid expansion of Kenya's information sector that has led to the rise of accessories and computer parts. The current rise of taxes leads to challenges that will impede farmers' access to smartphones.

However, the problem of not having smartphones can also be attributed to farmers not having received adequate training on how to use the platform. Because Viazisoko platform can be



accessed through the USSD service that does not need a smartphone, even though mobile-based apps and web-based portals require smartphones, computers, or laptops. Farmers' lack of awareness about the possibilities available for accessing such platforms is a barrier that might be noted as arising from this assertion.

In figure 9, lack of ICT literacy was identified by 10% of the respondents. A key informant (KI.18): *Low ICT literacy levels also hamper their seeking behavior.*

The study was conducted in the Buuri sub-county, which can be described as a rural area in Meru County. The ICT literacy challenge can be linked to 32% of the respondents who attained primary level education, and the 13.3% of respondents above 61 years. Mbagwu, et al (2017) also reveals, ICT literacy among rural farmers, particularly in developing nations, is significantly low. As a result, there is a substantial limitation when it comes to meeting the needs of rural farmers.

Therefore, digital agricultural platforms developers should invest more in creating awareness and training on various ICT tools available to farmers so that they can adequately utilize them and reap optimum benefits. The government should also focus on improving the infrastructure in rural areas in order to ensure rural folks are not excluded from the revolutionary ICT progress. Further, more emphasis should be put on advancing general literacy levels in rural areas to ensure higher ICT adoption.

#### **4.7.1. Information Farmers Want More of To Improve Potato Productivity**

Understanding the information needed to maximize potato productivity is essential because it allows farmers to determine which aspects of potato production are most significant. Table 15 shows key information farmers want more of in order to improve their potato productivity. 77% and 75% of respondents preferred market price and soil improvement respectively.

**Table 15: Information Farmers Want More of To Improve Potato Productivity**

Information to be Acquired	Number	Percentage
Pest management	40	67%
Soil improvement	45	75%
Weather forecast	37	62%
Use of fertilizer and pesticides	38	63%
Market price	46	77%
Financial management	25	42%
Risk mitigation measures	37	62%

Source: Field Data (2022).

Issues surrounding markets and prices have proved pertinent in this study as key informant (KI.19) identified:

*Even if the farmer has access to this important information, the farmer still faces financial difficulties. As a result, they are unable to put the advice into practice due to a lack of resources. Changes to payment arrangements should be made so that farmers receive an advance at the start of the season rather than at the conclusion where they wind up spending so much money and are forced to sell to anyone who comes to the farm gate.*

Developers of agricultural ICT tools and other stakeholders in the potato sector should therefore think about starting initiatives that help protect farmers from precarious and exploitative circumstances. Therefore, give attractive terms of payment by expanding the number of alternative markets, make sure that all farmers can afford inputs by lowering the cost of key inputs, offer favorable credit to farmers, and provide financial management training to farmers.

62% of the respondents would want more information on risk mitigation measures, more specifically on how to combat climate change as it is proving a serious threat to potato farming in the study area. Many expressed their eagerness in learning new techniques and technologies that can alleviate effects climate change. The issue of climate change is mutually linked to the emergence of pests in potato farming. According to Waaswa et al. (2022), temperature increases encourage the growth of pests and other problems including weed invasion and diseases. Future potato output will be substantially impacted by such occurrences. ICT solutions like Viazisoko must therefore integrate practices that can address the inevitable

problems with pests and diseases, as well as risk and uncertainties exacerbated by climate change.

Additional information needs majorly mentioned though not in the list include information on post-harvest handlings, value addition, and agribusiness in order to transform agriculture into profitable venture. Also, information on conducive markets, contract farming to reduce brokers, ready markets for all potato varieties, crop insurance to mitigate crop failure, and subsidized inputs. Farmers also emphasized the need for practicals where they are trained on how best carry out various farm practices.

Key information KI.20: emphasized, *provision of information through the platform is great however, farmers require someone on ground to show them how to implement various techniques.*

The issue of farmer's safety also featured. The agronomists interviewed expressed their worry that many farmers neglect their health during input application. Therefore, the ICT tools developers can integrate safety measures information in these platforms. The private sector involved in extension services can offer training on safety measures as well as make provision for PPEs to farmers.

## CHAPTER FIVE

### Summary Conclusions and Recommendations

#### 5.1 Introduction

Based on research objectives and questions, this chapter provides an overview, discussion, and conclusion of the study. The study conceptual framework identified independent variable as the ICT tool Viazisoko Digital platform and the dependent variable was access to market information. The intervening variables were incorporated to explain elements that could affect the causal relationship between the ICT tool and information access. Therefore, the key intervening variables considered in the study were the social, economic, and demographic factors, and facilitating conditions. Empowerment theory was adopted to explain and predict how agricultural ICT tools can affect farmer's empowerment. ICT tools have been found to be empowering to smallholder farmers through provision of information, knowledge and skills resulting to improved access and control over resources on favorable terms thus improved productivity. Key findings from the study are summarized below.

#### 5.2 Summary of the Key Findings

The main objective of the study was to examine the role of information and communication technology in accessing market information among smallholder farmers in Buuri Sub-County in Meru County; a case of Viazisoko app. The research sought to understand the role digital agricultural platforms play and how they facilitate access to agricultural market information among smallholder potato farmers. The study utilized descriptive type of data analysis.

The study's first goal was to identify the respondent's demographics, including age, gender, education level, and source of livelihood. The study sample comprised of 32 female participants who were the majority at 53% and male participants were 28 at 47%. Thus, the total number of respondents for the study was 60. It is evident that majority of potato farmers utilizing the application are women. In terms of age, majority of respondents were over 40 years. The 41 to 51 years group was the largest age cohort in the study for both male and females. Only 30% of the respondents were youths despite them being the majority in the country. Findings revealed utilization of ICT tools was prevalent among the age group not considered young alluding ICT solutions are transcending age barriers. Respondents' level of education was considered, 68% of the respondents have at least secondary level of education. Respondents' source of livelihood was also assessed and 92% of the participants considered

farming as their main source of income compared to the 8% whom farming is not their principal source of income. The study shows majority of respondents utilizing Viazisoko application are fulltime potato farmers who utilize the ICT tool to seek information in order to improve their potato farming.

Section two focused on study objective one, which was to investigate various agricultural information needs farmers are usually seeking. All 60 potato farmers agreed agricultural market information is crucial. In regard to the availability of extension services, the majority of respondents, 63% stated extension services were not available and 37% agreed to presence of extension services. This means that there is a big demand for agricultural market information but on the other hand most of them lack extension services. Findings show that extension services have been steadily declining. As a result, the traditional government-led services have been replaced with private extension services, but with a caveat as they are interest and profit driven. As a result of inadequate extension services farmers have turned to agricultural digital platforms in order to access information thus enhance their potato farming productivity. Respondents were asked to identify the most important agricultural information needed. Majority of respondents cited access to markets and inputs as the major information need. The study further examined farmer's information seeking behavior via assessing their frequency in seeking specific information from the app. Market outlets is the most frequently sought-after information, with a mean of 4.12, followed by advisory, information, and learning ( $m=3.97$ ). The least frequently sought information is soil testing at 2.18, this is because the process is not continuous, only done in pre-planting phase. The extent information needs are met via Viazisoko app was also reviewed in order to understand its efficiency and usefulness. The app has had at least moderate extent in addressing majority of the respondent's information needs over 92%. Only 8% of farmers feel that the extent to which the app addresses farmers' information needs is small.

The second objective of the study was to determine benefits farmers had experienced as a result of utilizing ICT platforms. The main areas respondents have experienced enhanced changes are heightened skills and learning, production output, access to markets, and income. However, the cost of production remained fairly high, and this has been linked to the high cost of inputs. Findings reveal 70% of respondents utilize the platform because it's precise, readily accessible, cost-effective, easy to use, and timely.

The third and last objective was to assess the effect of market information access among potato smallholder farmers. Therefore, both negative and positive effects were considered. The major positive effects garnered were increased production, higher quality produce, increased access to inputs and higher selling price. Increased production and quality were linked to farmers' empowerment whereby they have become more knowledgeable on best farm practices. Despite the positive effects associated with using the ICT tool there have been persistent drawbacks experienced by farmers. Mainly, increased risks and uncertainty linked to climate change have persisted notwithstanding utilization of the app and more often ensuing crop failure. Further findings reveal both number of bags harvested, and potato prices have been fluctuating on an upward trend 2019-2022. However, in 2020, potato production, quality, access to market outlets and provision of extension services were hampered due COVID 19 pandemics. Lastly, in order for ICT tools to enhance potato productivity and to adequately meet the respondents needs, farmers demanded more information on, alternative market and prices, mitigation measures to combat climate change, post-harvest handlings, value addition, subsidized inputs, and agribusiness.

### **5.3 Conclusion**

Based on research findings the following conclusions have been made on the role of Information and Communication Technology (ICT) in market information access among smallholder farmers. From the findings it can be deduced, information is becoming a key input in agriculture. Information is highly demanded by the majority of potato farmers in the study area, and it plays a fundamental role in empowering farmers through enhancing their response to opportunities. Therefore, farmers are actively seeking information more than ever in order to fulfill various agricultural information needs.

The study has established potato farmers are seeking various agricultural information throughout the value chain from pre planting to post harvest handling. However, the findings reveal there is a big demand for agricultural market information because government extension services have been on a decline for the past 20 years. This has created an opportunity for digital agricultural platforms like Viazisoko to bridge this information gap. These platforms have been embraced by farmers across the age and gender spectrum. Consequently, the ICT tools are becoming an effective channel that can serve all farmers surpassing age and gender divide. More specifically, ICT tools can help women minimize transaction cost, search cost, and

increase their incomes. Therefore, improving women's household decision making power and confidence while diminishing the gender digital divide. However, these platforms are not panacea in resolving shortage of public extension services hence, government should invest more in extension service since it plays a key role in boosting agricultural productivity. Findings further deduce agricultural digital platforms such as viazisoko are beneficial to potato farmers because they have become crucial information avenues. Therefore, farmers have utilized the platform as it serves farmers across age spectrum and all genders. Further, the majority of farmers perceive information derived from the app as reliable, useful, and accurate. Access to markets and inputs, risk mitigation measures, and advisory and learning are the most sought-after agricultural information. Therefore, the search for alternative and conducive markets is a top priority for a majority of potato farmers in the study area. Findings also establish brokers and other market intermediaries can play a significant role in enhancing the potato market ecosystem as they possess information on alternative markets, compliance, and logistical insight which an ordinary farmer is usually unaware of.

Findings have further established utilization of Viazisoko has implications on potato farming in the study area. Increased production and improved quality of produce are the major positive effects garnered by potato farmers. These significant changes have been linked to farmers' empowerment due enhanced access to agricultural information. However, increased risks and uncertainty linked to climate change, and high cost of production have persisted notwithstanding utilization of the app. Throughout the study the issue of climate change has become a reoccurrence phenomenon demanding special attention from various stakeholders. Lastly, farmers' access to the agricultural digital platforms is hampered by lack of infrastructure, low literacy levels, and power outages especially in rural areas.

In conclusion, digital agricultural platforms have the potential to generate economic gains through increased agricultural productivity, cost effectiveness, and market opportunities, as well as social and cultural gains via improved communication and inclusivity, as well as environmental gains through resource optimization. More specifically, agricultural market information including information on inputs, markets and prices, weather, best farming practices is very crucial throughout the potato value chain and development at both micro and macro levels. For instance, at the macro level the information is needed to make policy decisions for both private and public institutions, to track changes in the economy and to assess food security situation in the county. Non-governmental institutions further need the

information to guide farmers on profitable and sustainable farming ventures through invention of profitable solutions and technologies. From the study, ICT tools like Viazisoko platform have enhanced access to timely and accurate agricultural information thus improving knowledge on potato farming. Ensuing planned production targeted at market demand, increased production and quality of produce, improved links that boost productivity, alternative and conducive markets at regional, national, and international level thus better incomes. Consequently, enhancing food security, economic growth, reducing hunger and poverty in rural areas. Overall, agricultural digital transformation will enhance potato farming productivity converting the subsector to a more inclusive and profitable venture. Hence this inclusive agricultural improvement in the sector will support steady and effective social-economic shift resulting in greater multiplier and growth linkage effects that will advance human development amongst smallholder potato farmers.

#### **5.4 Recommendations**

The study has demonstrated ICT tools specifically agricultural digital platforms can be effective agents in enhancing agriculture productivity in the country. Therefore, the challenge of inadequate essential digital infrastructure such as access to electricity, access to digital services, and reliable network coverage and connection ought to be addressed. Therefore, the study recommends key legislators in Meru County, national government, and private entities should devote resources and invest in improving these basic and enabling conditions. This will ensure more smallholder farmers adopt and utilize digital solutions thus enhancing digital transformation in agriculture.

Low ICT literacy levels can be addressed via investment in basic, secondary, and post-secondary education as well as vocational and technical training by the government and other stakeholders. This will ensure smallholder farmers are well equipped to take advantage of emerging digital opportunities. Moreover, ICT tool developers should also intensify ICT literacy training in rural areas to diminish challenges linked to farmers' inability to operate the ICT tools. There is also a need to integrate more local languages in the agricultural digital solutions to make them more accessible to rural folks. For instance, integrating of mother tongues to accommodate the older persons and those with difficulties comprehending English. Access to mobile phones is also another issue that the farmers pointed out. The prices of mobile



phones need to be lowered so that more farmers can access them and use digital platforms to improve their farming practices.

Due to empowerment stemming from increased information access via the ICT tool, positive effects such as increased potato quantity and quality have been realized. The produce surge presents an opportunity for farmers and other stakeholders to venture into processing and value addition of products such as frozen chips, crisps, flour, cubes, and potato flakes. Consequently, curbing agricultural foods production losses as well as enhancing productivity through linkages with other sectors. Furthermore, through strategic investment and collaboration with various stakeholders, value addition can enhance opportunities for employment generation in the off-farm sector. Hence the sector has the potential to deliver a number of jobs including agricultural self-employment, agricultural wage employment and in off-farm sectors of the agri-food system. Such opportunities are valuable in addressing the overriding issue of unemployment.

Increased potato quantity and quality presents an opportunity for Potato sub sector stakeholders to look for alternative and more conducive markets opportunities local, regional, and international including contract farming. Therefore, advancing inclusive agri-business ventures amongst smallholder farmers, promoting their bargaining voice and prowess, and ensuring fair reward due to sound risk sharing approach. The government can also partner with other stakeholders to provide post-harvest facilities and improve infrastructure in rural areas. This will ensure produce reaches the desired markets at the right time and in good quality to fetch better prices. Also, as a result of higher incomes, farmers should be offered financial literacy skills so that they transform their farming into profitable agribusiness venture.

Additionally, there is a need for practical training to be complemented with ICT solutions. There is a need to heighten extension and farmer training for instance, use of group approaches like forming online farmers' discussion forums along with farmer-led extension which involves farmer field schools such as demonstration plots or farm trials. These on-ground trainings can be beneficial to farmers as they provide farmers with opportunities to learn from experts on how various farm techniques are executed. For instance, county government can partner with the private sector that has more resources and presence in the region.

From the findings, the issue of climate change scored highly among areas where potato farmers needed more information in order to improve their potato farming. Therefore, agricultural

innovation developers can use these platforms to inform farmers more on issues of climate change such as mitigation, adaptation, compatibility, and resilience. If not addressed, the continual decline in potato productivity will persist and the country will experience loss of livelihood and a major mass transfer of those employed in agriculture to other sectors. For instance, potato stakeholders can use the ICT tools to inform and train farmers on irrigation techniques in order to ensure consistent food production throughout the year and lessen effects linked to over-reliance on rainfed farming.

### **5.5 Areas for Further Research**

Future research should examine how ICT tools can be used to mitigate risk and uncertainty associated with climate change.

Comparative study of active members, inactive members, and those not using any ICT tool. This will aid in determining the real benefits and effects of utilizing ICT tools.

In order to assess the sustainability of digital agricultural platforms future studies can focus on farmers who have utilized ICT tools for at least five years.

## References

- Abraham, R. (2007). Mobile Phones and Economic Development: Evidence From the Fishing Industry in India. *Information Technologies and International Development*, 4(1), 13. The MIT Press 2008
- Aker, J. C., & Mbiti, I. M. (2010). Mobile Phones and Economic Development in Africa. *Journal of Economic Perspectives*, 24(3), 207–232. <https://doi.org/10.1257/jep.24.3.207>
- Alila, P., & Atieno, R. (2006). *Agricultural Policy in Kenya: Issues and Processes*. A paper for the Future Agricultures Consortium workshop, Institute of Development Studies, 20-22 March 2006
- Amer, J. N., Odero, D., & Kwake, A. (2018). *Towards Improving Agricultural Marketing Information Systems for Smallholder Farmers: A Tharaka Nithi Case*. 11, 30. *Journal of Agriculture and Sustainability*, 11.
- Ameru, J. N., Odero, D., & Kwake, A. (2018). *Implications for access and non-access of agricultural market information in Tharaka Nithi county.pdf*. JOURNAL OF AGRICULTURE AND SUSTAINABILITY. <http://erepository.mkuit.ac.rw/bitstream/handle/123456789/6671/Implications%20for%20access%20and%20non-access%20of%20agricultural%20market%20information%20in%20Tharaka%20Nithi%20county.pdf?sequence=1&isAllowed=y>
- Awuor, F. M., & Rambim, D. A. (2022). Adoption of ICT-in-Agriculture Innovations by Smallholder Farmers in Kenya. *Technology and Investment*, 13(03), 92–103. <https://doi.org/10.4236/ti.2022.133007>
- Ayim, C., Kassahun, A., Addison, C., & Tekinerdogan, B. (2022). Adoption of ICT innovations in the agriculture sector in Africa: A review of the literature. *Agriculture & Food Security*, 11(1), 22. <https://doi.org/10.1186/s40066-022-00364-7>
- Baumüller, H. (2016). Agricultural Service Delivery Through Mobile Phones: Local Innovation and Technological Opportunities in Kenya. In F. W. Gatzweiler & J. von Braun (Eds.), *Technological and Institutional Innovations for Marginalized*

*Smallholders in Agricultural Development* (pp. 143–162). Springer International Publishing. [https://doi.org/10.1007/978-3-319-25718-1\\_9](https://doi.org/10.1007/978-3-319-25718-1_9)

- Barrett, C. B. (2008). Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy*, 2007 Elsevier Ltd 2008 33(4), 299–317. <https://doi.org/10.1016/j.foodpol.2007.10.005>
- Bebbington, A., Lewis, D., Batterbury, S., Olson, E., & Siddiqi, M. S. (2007). Of texts and practices: Empowerment and organisational cultures in world bank-funded rural development programmes. *The Journal of Development Studies*, 43(4), 597–621. <https://doi.org/10.1080/00220380701259665>
- Bhattacharjee, A. (2012). *Social Science Research: Principles, Methods, and Practices*. CreateSpace Independent Publishing Platform. University of South Florida. [http://VH7QX3XE2P.search.serialssolutions.com/?V=1.0&L=VH7QX3XE2P&S=A\\_C\\_T\\_B&C=Social%20science%20research%20:%20principles%2C%20methods%2C%20and%20practices&T=marc&tab=BOOKS](http://VH7QX3XE2P.search.serialssolutions.com/?V=1.0&L=VH7QX3XE2P&S=A_C_T_B&C=Social%20science%20research%20:%20principles%2C%20methods%2C%20and%20practices&T=marc&tab=BOOKS)
- Birch, I. (2018). *Agricultural productivity in Kenya: Barriers and opportunities*. 19. Helpdesk Report. Knowledge, evidence & learning for development.
- Braimok, T. (2017). *Exploring the Opportunities and Challenges of ICTs for Women Farmers in Kenya*. Swedish University of Agricultural Sciences, Department of Urban and Rural Development. [https://stud.epsilon.slu.se/12789/1/braimok\\_t\\_171024.pdf](https://stud.epsilon.slu.se/12789/1/braimok_t_171024.pdf)
- Boniface, A., Haaksma, G., & Derksen, H. (2019). *Digital Farming in Kenya*. 67. Netherlands Enterprise Agency
- Bryman, A. (2012). *Social Research Methods* (4th ed.). Oxford University Press Inc., New York. [https://drive.google.com/file/d/1FjMEcD4fNkwupZDVslG3Kwmwto0ZAp-Y/view?usp=drive\\_open&usp=embed\\_facebook](https://drive.google.com/file/d/1FjMEcD4fNkwupZDVslG3Kwmwto0ZAp-Y/view?usp=drive_open&usp=embed_facebook)
- Communications Authority of Kenya. (2020). *FOURTH QUARTER SECTOR STATISTICS REPORT FOR THE FINANCIAL YEAR 2019/20*. Communications Authority of Kenya <https://ca.go.ke/wp-content/uploads/2020/10/Sector-Statistics-Report-Q4-2019-2020.pdf>
- County Government of Meru. (2018). *Meru County Integrated Development Plan, 2018-2022*. 337. County Government of Meru
- Chavula, K. H. (2014). The role of ICTs in agricultural production in Africa. *Journal of Development and Agricultural Economics*, 6(7), 279–289. <https://doi.org/10.5897/JDAE2013.0517>

- Dalberg, AgriFin, & GIZ. (2021). *Digital Agriculture Platform Blueprints*. Dalberg, Mercy Corps-AgriFin and German Agency for International Cooperation (GIZ) [https://www.mercycorpsagrifin.org/wpcontent/uploads/2021/01/GIZ\\_AgriFin\\_WhitePaper2.pdf](https://www.mercycorpsagrifin.org/wpcontent/uploads/2021/01/GIZ_AgriFin_WhitePaper2.pdf)
- de Silva, H. & Ratnadiwakara. (2008). *Using ICT to reduce transaction costs in agriculture through better communication: A case-study from Sri Lanka*. International Development Research Centre, Ottawa, Canada. <https://irneasia.net/wp-content/uploads/2008/11/transactioncosts.pdf>
- Deichmann, U., Goyal, A., & Mishra, D. (2016). *Will Digital Technologies Transform Agriculture in Developing Countries? Policy Research Working Paper: World Bank: 2016 World Development Report Team & Development Research Group Environment and Energy Team May 2016*
- Diao, X., Hazell, P., Resnick, D., & Thurlow, J. (2007). *The Role of Agriculture in Development: Implications for Sub-Saharan Africa*. International Food Policy Research Institute. <https://doi.org/10.2499/9780896291614RR153>
- Dilley, L., Mausch, K., Crossland, M., & Harris, D. (2021). What's the Story on Agriculture? Using Narratives to Understand Farming Households' Aspirations in Meru, Kenya. *The European Journal of Development Research*. <https://doi.org/10.1057/s41287-021-00361-9>
- El Bilali, H., & Allahyari, M. S. (2018). Transition towards sustainability in agriculture and food systems: Role of information and communication technologies. *Information Processing in Agriculture*, 5. <https://doi.org/10.1016/j.inpa.2018.06.006>
- Fraser, A. (2009). *Harnessing Agriculture for Development* (p. 75). Oxfam International Research Report.
- Food and Agriculture Organization of the United Nations. (2019). *Digital technologies in agriculture and rural areas—Briefing paper*. Food and Agriculture Organization of the United Nations Rome, 2019
- Gatzweiler, F. W., & von Braun, J. (Eds.). (2016). *Technological and Institutional Innovations for Marginalized Smallholders in Agricultural Development* (1st ed. 2016). Springer International Publishing : Imprint: Springer. <https://doi.org/10.1007/978-3-319-25718-1>
- Geertz, C. (1978). The Bazaar Economy: Information and Search in Peasant Marketing. *The American Economic Review*. American Economic Association, vol. 68(2),

- Ginige, T., & Richards, D. (2012). *A Model for Enhancing Empowerment in Farmers using Mobile Based Information System*. 10. Deakin University Press Australia
- Government of Kenya. (2010). *AGRICULTURAL SECTOR DEVELOPMENT STRATEGY 2010–2020*. <http://www.kenyagov.go.ke/sites/default/files/agricultural-sector-ds-2020.pdf>
- Hårsmar, M., Sverige, Utrikesdepartementet, & EGDI (Eds.). (2007). *Agricultural development in Sub-Saharan Africa: 8-9 March 2006, Frösundavik, Sweden : workshop proceedings*. Expert Group on Development Issues, Ministry of Foreign Affairs.
- Harris, D. R., & Fuller, D. Q. (2014). Agriculture: Definition and Overview. In C. Smith (Ed.), *Encyclopedia of Global Archaeology* (pp. 104–113). Springer New York.  
[https://doi.org/10.1007/978-1-4419-0465-2\\_64](https://doi.org/10.1007/978-1-4419-0465-2_64)
- International Potato Center. (2021). *Enhancing the Digital Platform Viazi Soko to Support Seed and Potato Marketing in Kenya*. International Potato Center.  
<https://doi.org/10.4160/9789290605713>
- International Solidarity Foundation, & Rural Agriculture Finance. (2021). *AGRICULTURAL “PLATFORMS” IN A DIGITAL ERA: : ISF Advisors and RAF Learning Lab analysis*  
[https://isfadvisors.org/wp-content/uploads/2021/03/ISF\\_RAFL\\_Agricultural\\_Platforms\\_Report.pdf](https://isfadvisors.org/wp-content/uploads/2021/03/ISF_RAFL_Agricultural_Platforms_Report.pdf)
- Jensen, R. (2007). The Digital Divide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector. *The Quarterly Journal of Economics*, 122(3), 879–924. <https://doi.org/10.1162/qjec.122.3.879>
- Jensen, R. T. (2010). Information, efficiency, and welfare in agricultural markets. *Agricultural Economics*, 41(s1), 203–216. <https://doi.org/10.1111/j.1574-0862.2010.00501.x>
- Juma, C., Yee-Cheong, L., & UN Millennium Project. Task Force on Science, T. (2005). *Innovation: Applying knowledge in development*. Earthscan 8–12 Camden High Street London, NW1 0JH, UK,. <https://digitallibrary.un.org/record/570015>
- Kabeer. (n.d.). *Resources, Agency, Achievements: Reflections on the Measurement of Women’s Empowerment*. United Nations Research Institute for Social Development (UNRISD) Geneva 10 Switzerland. Retrieved July 15, 2021, from <https://cdn.sida.se/publications/files/sida984en-discussing-womens-empowerment---theory-and-practice.pdf>
- Kaguongo, W., Gildemacher, P., Demo, P., Wagoire, W., Kinyae, P., Andrade, J., Forbes, G., Fuglie, K., & Thiele, G. (2008). Farmer Practices and Adoption of Improved Potato

- Varieties in Kenya and Uganda. Social Sciences Working Paper 2008-5. International Potato Centre (CIP), Lima, Peru
- Kibet, L. K., Mutai, B. K., Ouma, D. E., Ouma, S. A., & Owuor, G. (2011). *Determinants of household saving: Case study of smallholder farmers, entrepreneurs and teachers in rural areas of Kenya*. *Journal of Development and Agricultural Economics*, 1, 137-143.
- Kothari, C. R. (2004). *Research Methodology Methods and Techniques.pdf* (2nd ed.). New Age International Publishers. [https://drive.google.com/file/d/1tWl\\_GzAKXd-4vmyNaG68cE6EbB3RQwDk/view?usp=drive\\_open&usp=embed\\_facebook](https://drive.google.com/file/d/1tWl_GzAKXd-4vmyNaG68cE6EbB3RQwDk/view?usp=drive_open&usp=embed_facebook)
- Langat, R. J., Litondo, K. O., & Ntale, J. F. (2016). *INFORMATION COMMUNICATION TECHNOLOGIES AND MARKETING DECISIONS AMONG SMALL SCALE FARMERS IN KENYA: REVIEW OF EVIDENCE*. University of Nairobi
- Lemaga, B. (n.d.). *Kisima Farms: A large farm supporting local communities*. Retrieved August 23, 2021, from <https://potatocongress.org/wp-content/uploads/2018/05/potato-value-chain-EXAMPLE-1.pdf>
- Lewis, R. A. (2002). *CRC dictionary of agricultural sciences*. CRC Press.
- Magesa, M., Michael, K., & Ko, J. (2014a). *Agricultural Market Information Services in Developing Countries: A Review*. *Advances in Computer Science: An International Journal, (ACSIJ)Vol. 3, Issue 3*
- Magesa, M., Michael, K., & Ko, J. (2014b). *Access to Agricultural Market Information by Rural Farmers in Tanzania: Measuring informational capabilities*. *The Electronic Journal of Information Systems in Developing Countries*, 86(6), 12134. <https://doi.org/10.1002/isd2.12134>
- Mbagwu, F. C., Benson, O. V., & Onuoha, C. O. (2018). *Challenges of meeting information needs of rural farmers through internet-based services: Experiences from developing countries in Africa*. Paper presented to IFLA WLIC 2018 Kuala Lumpur. <https://library.ifla.org/2195/1/166-mbagwu-en.pdf>
- Mekonnen, T. (2017). Impact of agricultural technology adoption on market participation in the rural social network system. In *MERIT Working Papers* (No. 2017-008; MERIT Working Papers). United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT). <https://ideas.repec.org/p/unm/unumer/2017008.html>

- Mittal, S. (2012). *Modern ICT for agricultural development and risk management in smallholder agriculture in India*. The International Maize and Wheat Improvement Center (CIMMYT).
- Ministry of Agriculture Livestock Fisheries. (2016). *Climate Risk Profile for Meru County. Kenya County Climate Risk Profile Series* [Report]. <https://cgspace.cgiar.org/handle/10568/80454>
- Ministry of Agriculture Livestock Fisheries. (2018). *STRATEGIC PLAN MOALF 2018 – 2022*. Ministry of Agriculture Livestock Fisheries <https://kilimo.go.ke/wp-content/uploads/2021/02/Strategic-Plan-for-MOALF-for-2018-2022.pdf>
- Ministry of Agriculture Livestock Fisheries & Irrigation. (2019). *AGRICULTURAL SECTOR TRANSFORMATION and GROWTH STRATEGY*. Ministry of Agriculture Livestock Fisheries & Irrigation [Abridged Version]. <https://www.kilimo.go.ke/wp-content/uploads/2019/01/ASTGS-Full-Version-1.pdf>
- Munyua, H. (2007). *ICTs and small-scale agriculture in Africa: A scoping study*. International Development Research Centre (IDRC) <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/50998/IDL-50998.pdf?sequence=1>
- Munyua, H. M., & Stilwell, C. (2013). Three ways of knowing: Agricultural knowledge systems of small-scale farmers in Africa with reference to Kenya. *Library & Information Science Research*, Elsevier Inc 35(4), 326–337. <https://doi.org/10.1016/j.lisr.2013.04.005>
- Muthoni, J., Shimelis, H., & Melis, R. (2013). Potato Production in Kenya: Farming Systems and Production Constraints. *Journal of Agricultural Science*, Canadian Center of Science and Education 5(5) <https://doi.org/10.5539/jas.v5n5p182>
- Narayan, P. D. (Ed.). (2002). *Empowerment and poverty reduction: A sourcebook*. World Bank. © Washington, DC: World Bank. <http://hdl.handle.net/10986/15239> License: CC BY 3.0 IGO.”
- Njelekela, C., & Sanga, C. (2015). *Contribution of information and communication technology in improving access to market information among smallholder farmers: The case study of Kilosa District*. The International Journal of Management Science and Information Technology (IJMSIT), ISSN 1923-0273, NAISIT Publishers, Toronto, Iss. 17, pp. 56-71 <http://Hdl.Handle.Net/10419/178806>. [https://www.econstor.eu/bitstream/10419/178806/1/IJMSIT\\_y2015\\_i17\\_p056-071.pdf](https://www.econstor.eu/bitstream/10419/178806/1/IJMSIT_y2015_i17_p056-071.pdf)



- Nyende, P., Food and Agriculture Organization of the United Nations, Food and Agriculture Organization of the United Nations, Office of Knowledge Exchange, R. and E., Research and Extension Branch, & Rural Knowledge Network. (2011). *Building networks for market access: Lessons learned from the Rural Knowledge Network (RKN) Pilot Project for East Africa (Uganda, Kenya and Tanzania)*. Food and Agriculture Organization of the United Nations.
- Nzonzo, D., & Mogambi, H. (2016). *An Analysis of Communication and Information Communication Technologies Adoption in Irrigated Rice Production in Kenya*. 4(12). International Journal of Education and Research Vol. 4 No. 12 December 2016
- O'Donnell, M. (2013). *Using ICT to Enhance Marketing for Small Agricultural Producers*. 6. Briefing Paper USAID
- Okediran, O., Ganiyu, R. A., & Badmus, T. A. (2018). *AN mAGRICULTURE FRAMEWORK FOR AGRICULTURE INFORMATION SERVICES DELIVERY*. Lautech Journal of Engineering and Technology. <https://library.net/document/zgro9x7q-magriculture-framework-agriculture-information-services-delivery.html>
- Olaniyi, E., Оланиї, Е., & Оланин, Э. (2018). DIGITAL AGRICULTURE: MOBILE PHONES, INTERNET & AGRICULTURAL DEVELOPMENT IN AFRICA. *ACTUAL PROBLEMS OF ECONOMICS*, 16. MPRA Paper 90359, University Library of Munich, Germany. <https://ideas.repec.org/s/pramprapa.html>
- Omulo, G., & Kumeh, E. M. (2020). Farmer-to-farmer digital network as a strategy to strengthen agricultural performance in Kenya: A research note on 'Wefarm' platform. *Technological Forecasting and Social Change*, Elsevier, vol. 158(C). 158, 120120. <https://doi.org/10.1016/j.techfore.2020.120120>
- Oxford. (2014). *The Report Meru County 2014*. <http://meru.go.ke/image/Oxford%20report.pdf>
- Poulton, C., Kydd, J., & Dorward, A. (2006). Overcoming Market Constraints on Pro-Poor Agricultural Growth in Sub-Saharan Africa. *Development Policy Review*, 24, 243–277. <https://doi.org/10.1111/j.1467-7679.2006.00324.x>
- Qiang, C. Z., Kuek, S. C., Dymond, A., & Esselaar, S. (2012). *Mobile Applications for Agriculture and Rural Development*, © World Bank, Washington, DC. <http://hdl.handle.net/10986/21892> (p. 414).
- Shepherd, A. W. (1997). *Market information services: Theory and practice*. 66. Agricultural Services Bulletin No. 125, FAO- The UN, Rome (1997)

- Shepherd, A. W. (2011). *Understanding and using MARKET INFORMATION*. Market Linkages and Value Chains Group Rural Infrastructure and Agro-Industries Division. <http://www.fao.org/3/x8826e/x8826e.pdf>
- Stienen, J. (2007). *How ICT can make a difference in agricultural livelihoods*. 3. International Institute for Communication and Development (IICD)
- Svensson, J., & Yanagizawa, D. (2009). *GETTING PRICES RIGHT: THE IMPACT OF THE MARKET INFORMATION SERVICE IN UGANDA*. 12. Journal of European Economic Association, Oxford University Press
- Uphoff, N. (2012). *Empowerment of Farmers through ICT*. 19. Draft paper for ECOSOC Expert Group Meeting on Promoting Empowerment of People in Advancing Poverty Eradication, Social Integration, and Decent Work for All, UN HQ, NYC, September 10-12, 2012
- Warren, M. F. (2002). *Adoption of ICT in agricultural management in the United Kingdom: The intra-rural digital divide*. Agricultural Economics, Czech Academy of Agricultural Sciences, vol. 48(1)
- World Bank Group. (2017). *ICT in Agriculture (Updated Edition): Connecting Smallholders to Knowledge, Networks, and Institutions*. © 2017 International Bank for Reconstruction and Development / The World Bank 1818 H Street NW, Washington, DC 20433 <https://openknowledge.worldbank.org/handle/10986/27526>
- Zimmerman, M. A. (1995). Psychological empowerment: Issues and illustrations. *American Journal of Community Psychology*, 23(5), 581–599. <https://doi.org/10.1007/BF02506983>

## Appendices

### UNIVERSITY OF NAIROBI INSTITUTE FOR DEVELOPMENT STUDIES

#### STUDY TITLE: THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN MARKET INFORMATION ACCESS AMONG SMALLHOLDER POTATO FARMERS IN MERU COUNTY

#### QUESTIONNAIRE FOR POTATO FARMERS

##### Consent.

My name is Ann Karwitha Mbaya, a postgraduate student at the Institute for Development Studies (IDS), University of Nairobi. I am carrying out a study on the role of Information and Communication Technology (ICT) in market information access. A case study of Viazisoko digital platform among smallholder potato farmers in Buuri Sub County, Meru County. The study is for academic purpose and the objectives include:

1. Establish the various types of information potato farmers are sourcing for from viazisoko digital platform.
2. Determine benefits farmers have achieved through their utilization of ICT platforms.
3. Establish the effect of market information access among smallholder farmers in Meru County.

Your participation in this research is appreciated and completely voluntarily. The information you give will be confidential and only used for academic purposes. For further privacy and security, your name will not appear anywhere, in any of the published materials without your consent.

Kindly confirm whether I can go on with the interview Yes [  ] No [  ]

##### Section One

##### Demographics

1. What is your age

- Below 20 years old ( )    21 – 30 years old ( )    31 – 40 years old ( )  
41 – 50 years old ( )    51 – 60 years old ( )    Over 61 years old ( )

2. Gender

Male ( ) Female ( )

3. What is the highest level of education?

Primary education ( ) Secondary education ( )

College education ( ) University education ( )

Others (Please specify) .....

4. How long have you been a member of Viazisoko App?

Less than one year ( ) One year ( )

Two years ( ) Above two years ( )

**SECTION B: Farmer information needs**

1. What is your source of livelihood?

Farming is the principal source of income ( )

Farming is not the principal source of income ( )

2. Do you require agricultural market information?

Yes ( ) No ( )

3. Are extension services readily available to you?

Yes ( )

No ( )

If yes kindly mention the common services available for potato farmers.....  
.....

If no, kindly mention services you like provided for potato farmers.....

.....

4. As a farmer, what is your most important agricultural information need?

- Access to inputs ( )
- Access to Markets ( )
- Risk Mitigation Measures ( )
- Advisory, information, and learning ( )

Other (please specify) .....

.....

5. Below is a range of possible information sought by potato farmers on Viazisoko platform. Kindly indicate the frequency of utilization with which each type of information need applies to you on the scale of 1-5, where:

**1= Not at All,      2= Once in a While,      3= Sometimes,**  
**4=Fairy Often,      5= Frequently**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Certified Seeds					
Potato specific fertilizer and agrochemicals					
Soil testing					
Market outlets					
Weather forecast					
Advisory, information, and learning					
Query and feedback					

6. To what extent are your information needs addressed?

- Very great extent ( )      Great extent ( )
- Moderate extent ( )      Small extent ( )

No extent ( )

**SECTION C: Benefits of viazisoko platform**

1. How often do you use the App to access agricultural information?

Regularly ( ) Occasionally ( ) Rarely ( )

2. Why do you prefer to use the Viazisoko platform?

Readily accessible ( ) Cheap ( )

Easy to use ( ) Timely ( )

3. What is the quality of information ?

Accurate ( ) Sufficiently detailed ( )

Uptodate ( ) User friendly can extract what you want ( )

4. In your opinion do you think the information provided by the App helps in improving your potato farming?

Yes ( ) No ( )

If yes, please explain how it has helped your potato farming.....

.....

5. Kindly indicate changes you have witnessed in your potato farming since you started applying viazisoko information?

	<b>Increase</b>	<b>No change</b>	<b>Decrease</b>
Production output			
Cost of Production			
Access to inputs			
Access to Markets			
Information, knowledge, skills and learning			

Income			
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**SECTION D: The effect of market information access among potato smallholder farmers**

1. What kind of effect have you realized in your utilization of information from the App?

Positive effect ( )    No effect ( )    Negative effect ( )

1b. Which positive outcome have resulted from utilizing information you have received from the App?

Increased amount of production ( )    Higher quality produce ( )

Lower cost of production ( )    Increased access to inputs ( )

Higher selling price ( )    Access to markets ( )

Risk mitigation (wastage, supply, and demand)( )

Other, kindly specify .....

2. Which negative effects have persisted despite utilization of the App?

Production failure ( )    Low quality produce ( )

High cost of production ( )    Low output prices ( )

Increased risks and uncertainty ( )    Unavailability of markets ( )

Other, kindly specify.....

.....

3. How many bags of potato did you harvest in the following years?

2019..... 2020.....

2021..... 2022.....

**4. What price did you sell a bag of potato in the following years?**

2019..... 2020.....

2021..... 2022.....

**5. What challenges do you encounter in accessing information via the App**

.....  
.....  
.....

**6. What kind of information would you like to acquire more in order to improve your potato productivity?**

Pest management ( )      Use of fertilizer and pesticides ( )

Soil improvement ( )      Market price ( )

Farm management ( )      Financial management ( )

Farm mechanization ( )      Risk mitigation measures ( )

Weather forecast ( )

Others, kindly specify .....  
.....



**Thank you for your time.**

**UNIVERSITY OF NAIROBI**  
**INSTITUTE FOR DEVELOPMENT STUDIES**

**STUDY TITLE: THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN MARKET INFORMATION ACCESS AMONG SMALLHOLDER POTATO FARMERS IN MERU COUNTY**

**Key Informant Interview Guide**

My name is Ann Karwitha Mbaya, a postgraduate student at the Institute for Development Studies (IDS), University of Nairobi. I am carrying out a study on the role of Information and Communication Technology (ICT) in market information access. A case study of Viazisoko digital platform among smallholder potato farmers in Buuri Sub County, Meru County.

Your participation in this research is appreciated and completely voluntarily. The information you give will be confidential and only used for academic purposes.

Name (Optional) :

Organization :

Position :

Contact.....

1. Do farmers require agricultural information?
2. Do potato smallholder farmers actively seek information?
3. What type of information do these farmers look for?
4. Are extension services readily available to potato smallholder farmers in Meru County?
5. Does lack of information hinder potato farming productivity?
6. Do you think agricultural digital platforms play an alternative role in providing agricultural information?
7. In your opinion why are farmers relying on agricultural Apps in absence of extension services?
8. What kind of information are farmers generally seeking from social media?

9. What is your opinion on the use agricultural digital platforms as a source of information?
10. What are some of the benefits potato smallholder farmers have realized through their utilization of information obtained from Viazisoko App?
11. What are the anticipated long-term effects on smallholder farmers and potato farming productivity due to the utilization of the App?
12. What challenges do smallholders encounter when obtaining information from the App?

**Thank you for your time.**