EVALUATION OF THE ROLE OF MOBILE PHONE COMMUNICATION IN ACCESSING MARKET INFORMATION BY HORTICULTURAL FARMERS IN KIRINYAGA COUNTY, KENYA

BY:

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Declaration

I hereby declare that this dissertation is my original work and that other scholars work referred to herein have been acknowledged. I also declare that this dissertation has not been submitted anywhere for any academic award.

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Dedication

I dedicate this work to my beloved parents: Antony Mugwimi and Alice Wambui for their sacrifice beyond imagination to educate me, my sisters Teresiah and Florence and my brother Douglas. You were there for me when I needed you most. I love you all.

Acknowledgement

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Acronyms

CD	Compact Disk
DVD	Digital Video Disk
EPZA	Export Processing Zones Authority
FM	Frequency Modulation
GDP	Gross Domestic Product
GoK	Government of Kenya
HCDA	Horticultural Crops Development Authority
ICT	Information and Communication Technology
KACE	Kenya Agricultural Commodity Exchange
Kg	Kilograms
Kshs	Kenya shillings
MoA	Ministry of Agriculture
SMS	Short Message Service
SPSS	Statistical Package for Social Sciences

Abstract

This study sought to evaluate the role of mobile phone communication in accessing market information by horticultural farmers in Mwea Sub County, Kirinyaga County. In this area, horticultural farming is a major livelihood for the farmers. However, the farmers are faced by challenges of accessibility of markets and market information hence end up fetching poor prices for their produce resulting in low income. The objectives of the study were to establish the extent to which mobile phone communication is used in accessing market information; to analyze the factors that influence adoption of mobile phone communication in accessing market information and to establish various challenges that horticultural farmers in the area face in accessing market information. Purposive sampling was used to select the population of the study which consisted of 500 farmers from Kangai horticultural farmers group in Mwea Sub County. A sample size of 97 respondents was obtained using Mugenda and Mugenda (2003) approach. Systematic random sampling was used to select the households. Data was collected using a semi-structured questionnaire and an interview guide. The response rate was 84 respondents. Descriptive statistics were used to analyze the extent to which mobile phones were used by the farmers in accessing market information; the factors that influenced adoption of mobile phone communication in accessing market information as well as the challenges that farmers faced in accessing market information. The results showed that only 20.2% of the farmers used mobile phones to access market information. Most farmers used mobile phones mostly to communicate with friends and relatives. Among other communication channels used, middlemen were used to a very great extent (median=5), followed by fellow farmers to a moderate extent (median= 3). Extension officers were rare channels used to access market information because they were mostly contacted to access information on farm inputs and disease control. The radio and television were also used to a very low extent. The two were mostly for entertainment but not to access market information. Computer internet and newspapers were also used to a very low extent mostly due to low literacy level and high cost. Lack of training on technology use, technology cost, difficulty in usage and lack of awareness of the technology were the major factors that influenced adoption of mobile phone communication in market information access as reported by 84.5%, 82.1%, 67.9% and 65.5% respectively. The least considered factor was distrust (7.1%). Based on the above findings, the study recommends that to improve markets and market information access, there is need for awareness and training programmes on use of mobile phone communication to access market information. This can be done by the government of Kenya through the Ministry of Agriculture, Livestock and Fisheries, the Ministry of Information Communications and Technology as well as the private sector agricultural information providers. With time, as farmers accumulate more knowledge, they will fetch better prices for their produce, increase their income hence improve their livelihoods.

CHAPTER ONE
INTRODUCTION

1.1 Introduction

This chapter covers the introduction to the study. This includes: background to the study, statement of the problem, purpose and objectives of the study, research questions, justification of the study, significance of the study, limitations of the study and definition of terms.

1.2 Background to the study

Agriculture is the mainstay of the Kenyan economy, directly contributing 26 percent of the Gross Domestic Product (GDP) annually and another 25 percent indirectly. The sector accounts for 65 percent of Kenyaôs total exports and provides more than 18 percent of formal employment and more than 70 percent of informal employment in the rural areas (GoK, 2010).

Horticulture is the largest sub sector and contributes 33 percent of agricultural GDP and 38 percent of export earnings (GoK, 2010). The ideal tropical and temperate climatic condition in Kenya makes it favorable for production since it can support a wide range of horticultural products including cut flowers, vegetables, fruits, nuts, herbs and spices. Kenya is the second largest horticultural exporter in Sub-Saharan Africa after South Africa, the second largest developing country exporter of flowers in the world after Colombia and the second largest developing country supplier of vegetables to the European Union after Morocco. Most horticultural farmers in Kenya however, practice farming on a small scale basis. The production accounts for 75 percent of the total agricultural output and 70 percent of marketed agricultural produce and it is mostly done on 0.2 to 3 acres piece of land (GoK, 2010).

Horticultural Crops Development Authority (HCDA) is the main regulatory body of the horticultural sub-sector in Kenya is charged with the responsibility of promoting the development of horticultural crops, licensing exporters, and disseminating information on horticultural marketing. HCDA was originally given authority to fix prices, regulate trade, and operate processing facilities and market horticultural goods. This has however changed after the body withdrew its buying and selling functions from the market way back in 1986. Therefore, marketing of horticultural products in Kenya has generally been free of direct

government interventions with the government confined to regulatory and facilitative functions. The local market for horticultural produce is mainly open hence the prices are controlled by demand and supply factors (EPZA, 2005). In Kenya, changes in demand at the markets are a problem especially where the farmers marketing education is not well developed (HCDA, 2009).

Information, if used in the right way, is a powerful tool in addressing Kenyaôs agricultural needs and can definitely change the economy of the country positively, in terms of farmers making better decisions, increased production and higher income (Kizilaslan, 2006). Marketing of agricultural produce and products is critical to increasing agricultural productivity and commercialization of enterprises so that farming is perceived as a business. In Kenya, this is conducted by the private sector either as formal marketing companies or as brokers (GoK, 2010). National and regional markets have great potential of expansion with better marketing infrastructure and quality assurance.

Lack of market information has been given as one of the major reasons for the low productivity and low income in Kenyan agriculture (Asenso-Okyere and Mekonnen, 2012; Nzioki, 2013). Availability of markets and market information gives farmers the potential to bargain and improve their incomes, to seize market opportunities through the adjustment of production plans and better allocation of production factors, and also to use the information to make choices about marketing (Asenso-Okyere and Mekonnen, 2012). Information and Communication Technologies (ICTs) can be applied in increasing the effectiveness of accessing information examples of these ICTs include; mobile phone, radio, television, Compact Disk (CD) & Digital Video Disk (DVD), computer network and geographical information systems. All these play important roles in access, transfer and use of agricultural information in Kenya.

Farmers adopt different Information and Communication Technologies (ICTs) depending on their situations as well as their socioeconomic characteristics. Research has come up with an innovation which uses mobile phone communication in accessing information on various needs such as availability, accessibility and prices of various farm inputs, information on weather forecasts and availability of market and prices of products in the market (Maritz, 2011). Assessment of mobile phone communication by small scale horticultural farmers to access market information will provide the necessary framework to identify its current

strengths and weaknesses which will lead to recommendations that will increase its effectiveness.

1.3 Statement of the problem

One of the challenges traditionally experienced by smallholder farmers in Kenya and the rest of Africa has been lack of transparency of market information for their agricultural produce (Maritz, 2011; Nzioki, 2013). Mobile phones are major ICT tools that most of the rural populations use in communication. Research has been carried out to enable use of the same technology in the agricultural sector to empower farmers with agricultural information (Osadebamwen and Ele, 2015). According to Maritz (2011), there are a number of mobile applications addressing this problem by giving farmers access to market information, enabling them to make better decisions of what to produce, when to produce, where and when to sell and at how much. These mobile applications include voice call, phone internet and Short Message Service (SMS), where farmers can call, browse or send an SMS to a specific number which then gives them wholesale and retail prices of crops.

Horticultural farming is a major farming system and a source of livelihood for many farmers in Mwea Sub County, Kirinyaga County who practice it on small scale basis. The farmers in the area still face a major challenge in accessing markets and market information. Adoption of mobile phone communication can help them have access to the right market information which will increase their market sales, increase their income and thereby improve their livelihoods. It will also enable them access more personalized information considering that farmersô information needs are heterogeneous (Maritz, 2011).

Despite the recognition of the potential impact mobile phone technology can make in accessing market information, the adoption and use of the same has not been fully explored and therefore not well known. Therefore this study was set to address the problem by evaluating the adoption of mobile phone communication in accessing market information among horticultural farmers in Mwea Sub County, Kirinyaga County.

1.4 Purpose and objectives of the study

1.4.1 Purpose of the study

The purpose of this study was to evaluate the role of mobile phone communication in accessing market information by horticultural farmers in Mwea Sub County, Kirinyaga County of Kenya.

1.4.2 Specific objectives

i. To establish the extent to which mobile phone communication is used to access market information by horticultural farmers in Mwea Sub County
ii. To analyze the factors that influence adoption of mobile phone communication in accessing market information by horticultural farmers in Mwea Sub County
iii. To establish challenges faced in accessing market information by horticultural farmers in Mwea Sub County

1.5 Research questions

i. What is the extent to which mobile phone communication is used to access market information by horticultural farmers in Mwea Sub County?
ii. What are the factors that influence adoption of mobile phone communication in accessing market information by horticultural farmers in Mwea Sub County?
iii. What are the challenges faced in accessing market information by horticultural farmers in Mwea Sub County

1.6 Justification of the study

The importance of mobile phone communication has been suggested in improving agricultural productivity. This is attributed to the benefits it offers such as facilitating communication between parties, a short response time to farmers and other clients and farmers get personalized information (Mittal and Triphathi, 2009; Gelb et al, 2009).

In accessing agricultural market information, mobile phone communication has been identified as a practice that can lead to increased market sales, increased incomes and improved livelihoods for farmers based on the benefits it offers (Maritz, 2011). The above mentioned studies only gave an insight into the benefits of mobile technology in accessing agricultural information but did not evaluate its adoption in accessing market information

among farmers. This study therefore attempted to contribute towards filling in the knowledge gap.

The focus of Mwea Sub County was justifiable owing to the fact that a great proportion of farmers in these area relied on horticultural farming as a source of livelihood. Despite the horticultural production characteristics and associated returns from the enterprise, most farmers still faced challenges in accessing market information.

1.7 Significance of the study

The agricultural information providers benefited from this study as it advanced their understanding and knowledge on information dissemination via mobile phone communication. The study was also relevant to the government/policy makers as it will assist them on coming up with better policies, legal and regulatory reforms on use of ICTs in accessing agricultural information. To the scholars and academicians, the study contributed to the understanding and focus of future studies. It also added to the body of knowledge for future references on market information access via mobile phone communication by rural farmers.

1.8 Limitations of the study

The study was limited to small scale horticultural farmers in Mwea Sub-County, Kirinyaga County. The results of the study might have been different in other regions in the country. The researcher employed purposive sampling and systematic random sampling in selecting the study area and households. The results might have been different if different sampling techniques were used.

1.9 Definition of terms

Information and Communication Technology (ICT): tools, programs and applications used for generating, processing, storing and disseminating information (Asenso-Okyere and Mekonnen, 2012).

Market information: This includes price information systems e.g. market prices of different inputs and agricultural commodities in different trading locations (Bertolini, 2012).

Communication: communication is defined as a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior. It is also defined as the imparting or exchanging of information by speaking, writing or using some

other medium. It is aimed at influencing the behavior or action of the receiver and is complete when feedback is received by the sender (Asenso-Okyere and Mekonnen, 2012).

Mobile phone communication: this is sending and receiving information via a cell/mobile phone. In this study, mobile phone communication will include sending or receiving agricultural information via short messaging service (SMS), voice calls and internet based applications Mittal and Mehar, 2012).

Relative advantage: is the degree to which an innovation or a new idea is perceived as better or advantageous than the idea it supersedes or the idea that was been used before (Rogers, 1995).

Compatibility: is the degree to which a new idea is perceived as being consistent with the existing values, past experiences, and needs of potential adopters (Rogers, 1995).

Complexity: is the degree to which an innovation is perceived as difficult to understand and use (Rogers, 1995).

Trialability: is the degree to which a new idea may be experimented with on a limited basis before it is implemented fully (Rogers, 1995).

Observability: is the degree to which the results of a new idea are visible to others hence they can discuss further about it (Rogers, 1995).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers the review of relevant literature to the topic of study. It consists of mobile phone applications in accessing information, communication channels used in accessing market information, empirical review, theoretical framework, conceptual framework and summary of the literature review.

2.2 Mobile phone applications in accessing information

ICT in Kenya is growing at a high rate. The penetration of mobile service in Kenya reached 64.2 percent by 2012 (Asenso-Okyere and Mekonnen, 2012). Kenyaôs high mobile penetration rate and subscription number indicates that mobile technology is a promising business opportunity, and an indispensible tool for empowering the countryôs citizens, especially its rural poor. The services widely used include use of *MPesa* which is a mobile money transfer service owned by safaricom and launched in 2007. It allows users to use their mobile phones to send, receive and transfer money; *MFarm*, an agribusiness software solution which was started in 2010 and offers information to farmers on farming and market information to improve their productivity through sending an SMS (short messaging service) to 20225; *iCOW* which is an SMS and voice-based mobile application launched in 2013 and used by dairy farmers to access information on the cowsô gestation period, veterinary information and record keeping; *Airtel Kilimo* is a unique and innovative service aimed at providing phone-based agricultural information, advice and support to smallholder farmers over Airtelôs mobile network, launched in 2011. This service is utilizing Africaôs mobile network and technologies to bridge the knowledge gap in rural areas. The service can be subscribed on *760# for free, SMS subscription where a customer is charged KSh3 per SMS and on Interactive Voice Response (IVR) for KSh3 per minute (Maritz, 2011).

Another ICT program is the Kenya Agricultural Commodity Exchange (KACE), established in 1997, which has offers and bids. These services are prominently displayed on blackboard and are disseminated via SMS and Internet. KACE collects, updates, analyses and provides reliable and timely market information and intelligence on a wide range of crop and livestock commodities, targeting actors in commodity value chains, with particular attention to

smallholder farmers and small scale agribusinesses (KACE, 2011). The components of the KACE links are: market resource centres, mobile phone short messaging service (SMS), interactive voice response service, internet database system, radio and the KACE headquarters central hub in Nairobi. All these application helps in accessing information on daily wholesale buying prices for about 20 commodities as well as offers to sell and bids to buy (KACE, 2011).

Mobile phones are also being used to distribute agricultural insurance products to farmers, most of whom cannot afford conventional insurance. A product called *Kilimo Salama*, Swahili for ósafe agricultureô, enables smallholder farmers in Kenya to insure their agricultural inputs against adverse weather conditions, such as drought or too much rain. Developed by UAP Insurance, the Syngenta Foundation for Sustainable Agriculture and Safaricom, *Kilimo Salama* allows smallholder farmers to insure their inputs and produce. To be covered under the scheme, farmers only need to pay an extra 5% for a bag of seed, fertilizer or other inputs.

Mobile technology plays a central role in the scheme as it is used both for registration of new policies as well as for payouts (Asenso-Okyere and Mekonnen, 2012). *Kilimo Salama* is distributed mostly through agro dealers that have been equipped with a camera phone that scans a special bar code at the time of purchase, which immediately registers the policy with UAP Insurance over Safaricom mobile data network. This innovative application then sends a SMS message confirming the insurance policy to the farmerôs handset. Payouts are determined by automated weather stations that monitor the rainfall. Based on the stationsô measurements and a predefined formula of crop rainfall needs, payouts are automatically made to farmers using Safaricom mobile money transfer service, *M-Pesa*. Farmers do not have to fill out any claim forms. Since its official launch in 2010, the scheme has already made payouts to numerous farmers (Asenso-Okyere and Mekonnen, 2012). It is expected that products like *Kilimo Salama* will increase productivity since only about half of Kenyan farmers invest in improved seeds and soil inputs (Asenso-Okyere and Mekonnen, 2012). A key reason for the low demand is the fear among farmers that poor conditions, such as drought, will render their investment worthless, robbing them of both their crops and their savings.

2.3 Other communication channels used in accessing market information

According to a study done by Asenso-Okyero and Mekonnen (2012), awareness of up-to-date market information on prices for commodities, inputs and consumer trends can improve farmersô livelihoods substantially and have a dramatic impact on their negotiating position. In Africa, such information is instrumental for the farmers in making decisions about future crops and commodities and about the best time and place to sell and buy goods. Typically, price information is collected at the main regional markets and stored in a central database. The information is published on a website, accessible to farmers via information centres. To reach a wider audience, information is broadcast via rural radio, television or mobile phone, thereby creating a ólevel playing fieldô between producers and traders in a region. Kenya is fertile ground for ICT-enabled information services. Radio, television, mobile telephones and the Internet are all popular among farmers in rural areas, although their accessibility differs. Integrating new ICT tools such as mobile phone SMS with old ICTs such as radio or television can extend the reach to the farmers (Asenso-Okyero and Mekonnen, 2012). Combining new and unfamiliar ICTs with older, more trusted ICTs may increase the adoption and use of newer ICT tools and may ultimately build trust and buy-in for new services. Furthermore, using ICTs to complement face-to-face extension services has the potential to overcome the human and financial constraints on the public extension system.

2.4 Empirical review

Mittal and Triphathi (2009) studied the role of mobile technology in improving small farm productivity in India by looking at the potential solution mobile phones could have in information asymmetry in agricultural sector. The study used focus group discussions and in-depth interviews with farmers to find answers to the use and impact of mobile phones and mobile-enabled services on agricultural productivity. The results showed that although mobile phones can act as catalyst to improving farm productivity and rural incomes, the quality of information, timeliness of information and trustworthiness of information are the three important aspects that have to be delivered to the farmers to meet their needs and expectations. This implies that the major factors for adoption of the technology were timeliness, quality of information and trust. The current study is similar to that of Mittal and Triphathi (2009) in that it looks at use of mobile phone technology by smallholder farmers in accessing agricultural information. However, it is different from it in that it used both quantitative and qualitative approaches while that of Mittal and Triphathi (2009) used

qualitative approach. The current study also focuses on improving access to market information while that of Mittal and Triphathi (2009) looked at improving agricultural productivity.

Nyaga (2012) did a study in Kiambu, Kenya on adoption of ICTs in enhancing marketing of agricultural produce. Random sampling was used for the study. Results showed that public extension services remain significant to small scale farmers but results point towards a need to strengthen this institution to provide up-to-date market information. The study showed that there is a need to use information and communication technology in identifying new markets and in dissemination of information to agricultural producers. The study is similar to the current study in that both are looking at importance of technology adoption in enhancing market information. However, the two differ in research methodology in that Nyaga (2012) used random sampling while the current study used purposive in selecting the study area and systematic sampling in selecting households. The current study also looked at specifically horticultural small holder farmers while that of Nyaga (2012) focused on all small holder farmers.

Mittal and Mehar (2012) carried out a study on how mobile phones contribute to growth of small holder farmers in India. The authors argue that rapid growth of mobile telephony and the introduction of mobile-enabled information services provide ways to improve information dissemination to the knowledge intensive agriculture sector and also help to overcome information asymmetry existing among the group of farmers. It also helps, at least partially, to bridge the gap between the availability and delivery of agricultural inputs and agriculture infrastructure. Data was collected from focus group discussions. Results showed that mobile phone communication provided a better connectivity to markets and price realization and reduced transaction costs. The similarity with the current study is that both studies look at use of mobile phone communication in accessing agricultural information. However Mittal and Mehar (2012) used only focus group discussions to collect data whereas the current study employed questionnaires and interviews in addition to focus group discussions.

Martin and Abbot (2009) examined the diffusion and perceived impact of mobile phone use among small-to-medium-size limited-resource farm holders in Kamuli District, Uganda. Sampling was done in both group farmers and non- group farmers. Results showed more than half of the farmers were using their mobile phones for access to agricultural inputs, getting

market information, monitoring financial transactions and agriculture emergency situations. This study by Martin and Abbot (2009) differs from the current study in that it used samples from both group farmers and non-group farmers whereas the current study sampled from a particular farmersô group. The current study also looked at small scale farmers only whereas that of Martin and Abbot (2009) looked at both small scale and medium scale farmers.

Lwoga et al, (2011) did a study on assessing access to and use of agricultural knowledge and information in the rural areas of Tanzania. Mixed quantitative, qualitative and participatory methods were deployed. The findings demonstrated that the knowledge and information needs, and information seeking patterns of farmers were location specific. The major sources of information for farmers were predominantly local (neighbors, friends and family) and public extension services. Apart from radio and cell phones, advanced technologies (i.e. internet and email) and printed materials were used at a low rate despite their existence in the communities. The study differs with the current study in that it looked at all channels that farmers use in accessing all agricultural information whereas the current study is particular on mobile phone communication channel and market information access. However, both studies are similar in that they both look at access and use of agricultural information and use same research methodology which is mixed methods.

Duncombe (2012) did a literature review of the potential and the limitations of mobile phones in the delivery of rural services for agricultural and rural development in developing countries. The results showed variation in levels of awareness and usage of services that could potentially be accessed via mobile phones. Most commonly, this was due to poor technological skills and experience and in many cases that the information provided lacked relevance to their needs. This was because traders preferred a system that allowed interaction with the broad range of participants in any given produce value chain including agents, brokers, assemblers, wholesalers and final purchasers and voice best facilitates this. This review study differs with the current study in that data collected was secondary as compared to the current study which relied on primary data. However, there is similarity in that both looked in mobile phones usage in accessing agricultural information among farmers.

2.5 Theoretical framework

Diffusion of innovation theory was chosen as the theoretical framework of this study. This theory was central to adoption of mobile technology in accessing market information,

particularly by smallholder farmers (Osadebamwen and Ele, 2015). One reason why there is so much interest in the diffusion of innovations is because getting a new idea adopted, even when it has obvious advantages, is often very difficult. There is a wide gap in many fields, between what is known and what is actually put into use. Many innovations require a lengthy period, often of some years, from the time when they become available to the time when they are widely adopted (Rogers, 1995).

The theory application indicates its strength in description of the four key elements of the theory which are innovation, adoption, diffusion and communication. Innovation refers to a new idea or practice; adoption is a decision to make full use of an innovation as the best course of action available; diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system while communication a process in which participants create and share information with one another in order to reach a mutual understanding (Rogers, 1995). Rogersôs theory was found to encompass all the components. Thus the theoryôs application to information technology and agriculture made it the most appropriate theoretical framework in this study. The characteristics of innovations that influenced adoption of mobile technology in this study included: relative advantage of mobile phone communication compared to other forms of communication; compatibility with other existing values and past experience; complexity in its usage or how easy is it to use?; triability in terms of being able to be tried or experimented on a limited basis and observability of the results, for example increased sales and income (Rogers, 1995).

The innovation decision process is characterized by five stages namely; knowledge, persuasion, decision, implementation and confirmation. In the knowledge stage the individual or household is exposed to the innovationôs existence and gains understanding of how it functions. However, even after acquiring information on an innovation, individuals may need to be persuaded to use it because they do not regard it as relevant to their situation. Decision implies that the individuals chose to adopt the innovation while the implementation stage is when an individual puts an innovation into use. The final stage is confirmation during which the individual seeks reinforcement for the decision made. In this study, the process stages are seen in training farmers to have knowledge of the mobile technology and how it works, persuading them to adopt the mobile technology, using the mobile technology in accessing market information while realizing its benefits (Mburu, 2013; Rogers, 1995).

2.6 Conceptual framework

The figure below shows interaction between dependent and independent variables. The independent variables are the extent of use of mobile phones in accessing market information, the factors influencing adoption of mobile phone communication in accessing market information and challenges faced in accessing market information. The dependent variable is the adoption of mobile phone communication which leads to increased access to market information, better prices hence increased incomes.

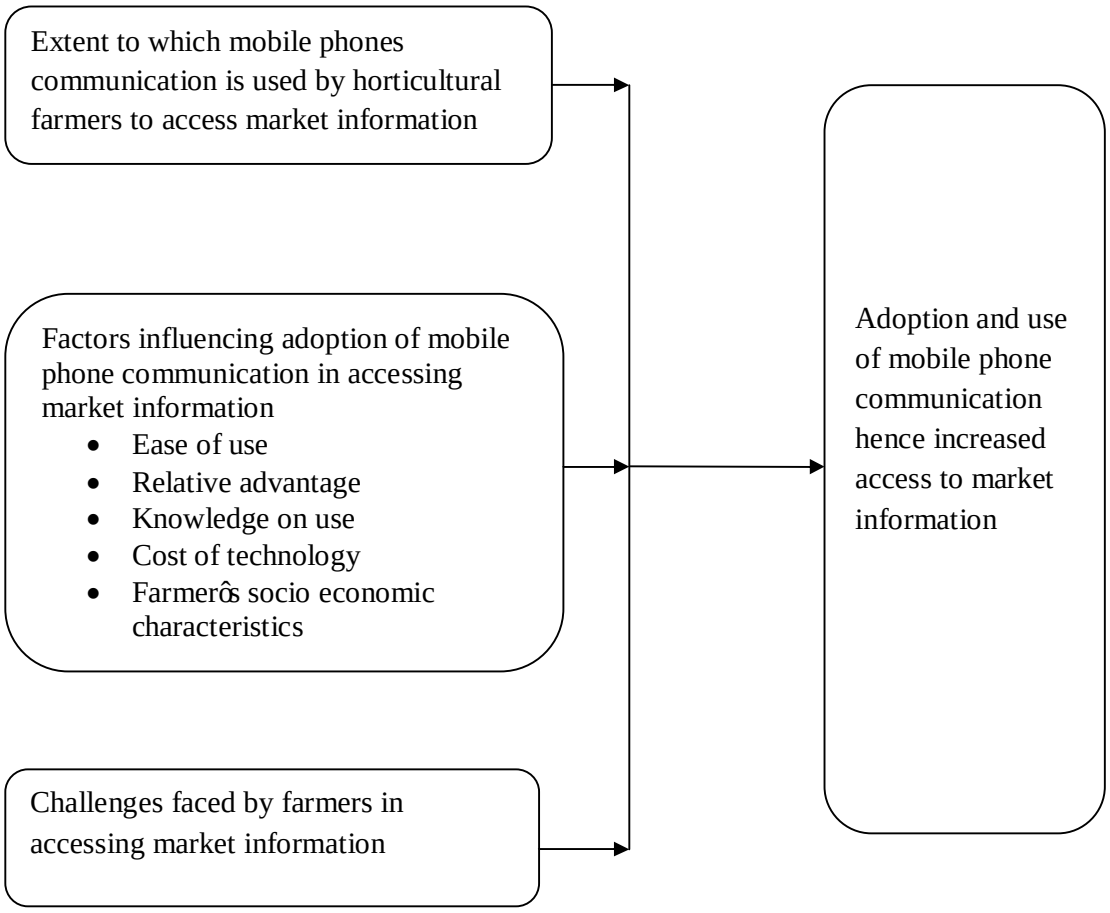


Figure 1: Conceptual framework showing relationship between independent variables and dependent variable

Source: Author (2015)

2.9 Summary of literature

Despite the high rate of growth of ICT in Kenya and almost every adult Kenyan possessing a mobile phone, reviewed literature still show a major challenge in accessing market information by farmers (Mitaal and Triphathi, 2009; Mittal and Mehar, 2012). According to Rogers (1995), individuals will more likely adopt an innovation when they test and see positive results of the innovation. Mobile phone communication has the advantage of that it is easy to use, convenient, saves time hence faster adoption (Maritz, 2011). Most rural households are still relying on traditional ICTs like radio and television as well as the extension officers to access market information for their produce (Mittal and Mehar, 2012). However, these tools might not be relied upon fully since farmersô needs are heterogeneous in nature.

There is evidence that rural incomes have been increasing with the use of ICTs to access information (Bertolini, 2012). However, there are challenges in making ICT platforms available to a large number of the rural population who are engaged in agriculture and these have to be tackled through public policy in the context of rural development and incentives for investments in rural areas (Asenso-Okyere and Mekonnen, 2012). There is no solely accepted model which is the most effective in access of agricultural information. Fortunately Africa is witnessing a phenomenal increase in mobile phone acquisitions and when they are combined with other ICT platforms like radio the impact on agriculture can be very high (Asenso-Okyere and Mekonnen, 2012).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was used to carry out this study. It consists of study area, research design, target population, sample size and sampling procedure, data collection and data analysis. The research methodology aimed at enabling the researcher to obtain data and process it.

3.2 Study area

The study was carried out in Mwea Sub County, Kirinyaga County. Kirinyaga County is 112km from Nairobi, Kenyaôs capital city, and covers 1479.09 square kilometers. It has a population of 528,054 according to the Government of Kenya 2009 population and housing census report (GoK, 2009). It borders Embu to the east, Machakos to the south, Murangôa to the south west and Nyeri to the west. Most of the farmers in this area practice horticultural farming on small scale basis. The study sought to collect data on farmersô and farm characteristics, how farmers access market information and the factors that influence adoption of mobile phone communication in accessing market information.

3.3 Research design

This study adopted a descriptive research design which sought to obtain information on individualsô perceptions, attitude, behavior and values. It determines and reports the way things are and attempts to describe characteristics associated with target population, estimates of proportions of a population that have these characteristics and discovery of associations among different variables. Descriptive research portrays an accurate profile of persons, events, or situations in their current state (Robinson, 2002).

3.4 Target population

The target population of this study was the Kangai Horticultural Marketing and Exporters Cooperative Society Limited in Mwea Sub County. The farmer group has 500 registered members. This group was selected as it had the highest number of registered members as compared to the other farmer groups and was the most active.

3.5 Sample size and sampling procedure

The study location was purposively selected due to its intensive horticultural farming and also based on the researcherôs accessibility to the area. The sample size for the research was calculated using the following formula as referred to by Mugenda and Mugenda (2003):

$$n = \frac{Z^2 pq}{d^2}$$

Where; **n** = the desired sample size for N>10,000,

Z = constant associated with the required confidence level which in this study was 95%, z value= 1.96,

p = the proportion of the population that possessed the target characteristics. Since this was not known, it was estimated to be 50%= 0.5,

q = 1-p= 0.5 and

d = the level of precision estimated to be 10%= 0.1

$$n = [1.96^2 * 0.5 * 0.5] / 0.1^2 = 96.04$$

The sample size arrived at was 96 households (rounded to the nearest whole number). However, the target population was 500 horticultural farmers which is less than 10,000 (N<10,000) and hence the sample size was adjusted using the following (Mugenda and Mugenda, 2003):

$$nf = \frac{n}{1 + (n/N)}$$

Where; **nf** = the adjusted sample size (N<10,000),

n = sample size when N>10,000 and

N = the population size.

Nf= 96/ [1+ (96/500)] = 80.5

The resulting sample size (80.5) was marked up by 20 percent to take care of non-response among other data collection irregularities. This gave a sample size estimate of 96.6 households which was rounded off to the nearest whole number (≈ 97).

Systematic random sampling technique was applied to select the households. The 500 horticultural farmers formed the sampling frame for the study. The sampling interval (k) was determined using the formula $k = N/n$, where **N** is the population size and **n** is the sample size. The sampling interval, k was therefore **500/97= 5**. The first member to be included in

the study was randomly selected which in this case was the first person on the list of registered members of the farmers group. By use of the formula, □ = □ + □, where **K** is the next household to be included in the sample, **n** is the previous member included and **k** is the sampling interval (Mugenda and Mugenda, 2003). The K^{th} household was determined and the process was repeated until a sample size of 97 was achieved. In this study the second household was **1+5=6**; the third was **6+5=13**, and so on until the sample size was achieved.

3.6 Data collection

The research relied on primary data. A semi-structured questionnaire containing both open and close ended questions was used to collect data. Each question in the questionnaire was developed to address a specific objective of the study (Orodho, 2010). The researcher also conducted interviews to collect data from key informants who were leaders of the farmersô group and an agricultural extension officer in the location. Mugenda and Mugenda (2003) asserted that, the accuracy of data to be collected largely depend on the data collection instruments in terms of validity and reliability. Validity was ensured by including the research questions in the questionnaire while reliability was ensured by pre-testing the questionnaire where the researcher issued a questionnaire to ten respondents and then evaluated the data to ensure all the questions were answered properly.

3.7 Data analysis

The completed questionnaires were edited for completeness and consistency. Data was analyzed using Microsoft excel and Statistical Package for Social Sciences (SPSS version 20). The data was analyzed by use of descriptive statistics and presented using mean, median, standard deviation, frequencies and percentages. The scale used to analyze mean and median was a likert scale of 1 to 5 where 5 = ótó a very great extentô, 4 = ótó a great extentô, 3 = ótó a moderate extentô, 2 = ótó a low extentô and 1 = ótó a very low extentô. The information was displayed by use of tables and figures. The results were used to make conclusions and inferences.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discusses them in the context of the broad objective of evaluating adoption of mobile technology in accessing market information. The results from the questionnaires are presented and discussed. Further, the information from the interviews are also incorporated in order to validate the questionnaire information. The response rate was 87 percent with data from 84 households being analyzed.

4.2. Household characteristics

4.2.1 Gender

Horticultural farming in Mwea Sub County was mostly male-dominated (76.2%) with only 23.8% of the farmers being female as shown in figure 2. This is because men were mostly the head of households and also the land owners while women mostly participated in provision of labor which involves harvesting, grading and packaging as confirmed by findings by Ongeri (2014).

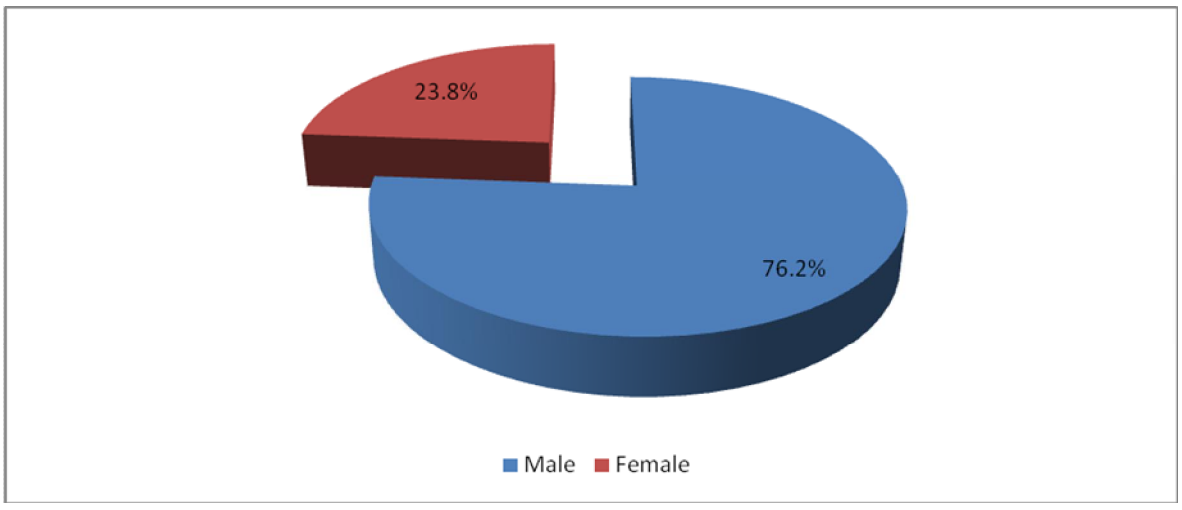


Figure 2: Gender of respondents

Source: Field data (2015)

4.2.2 Age

Most farmers were aged between 18-35 years (50%) with 33.3% and 16.7% of them aging 36-55 years and over 55 years respectively as shown in figure 3 below. This shows that horticultural farming in Mwea was mostly done by the youth as they formed the majority. This confirms the Government of Kenya (2009) census report that the youth constitute the majority of the population. The findings also confirm those by Njenga et al (2012) who reported that there are more youths taking up farming due to the high rate of unemployment coupled with efforts by the government to educate the youth to see the potential in agriculture.

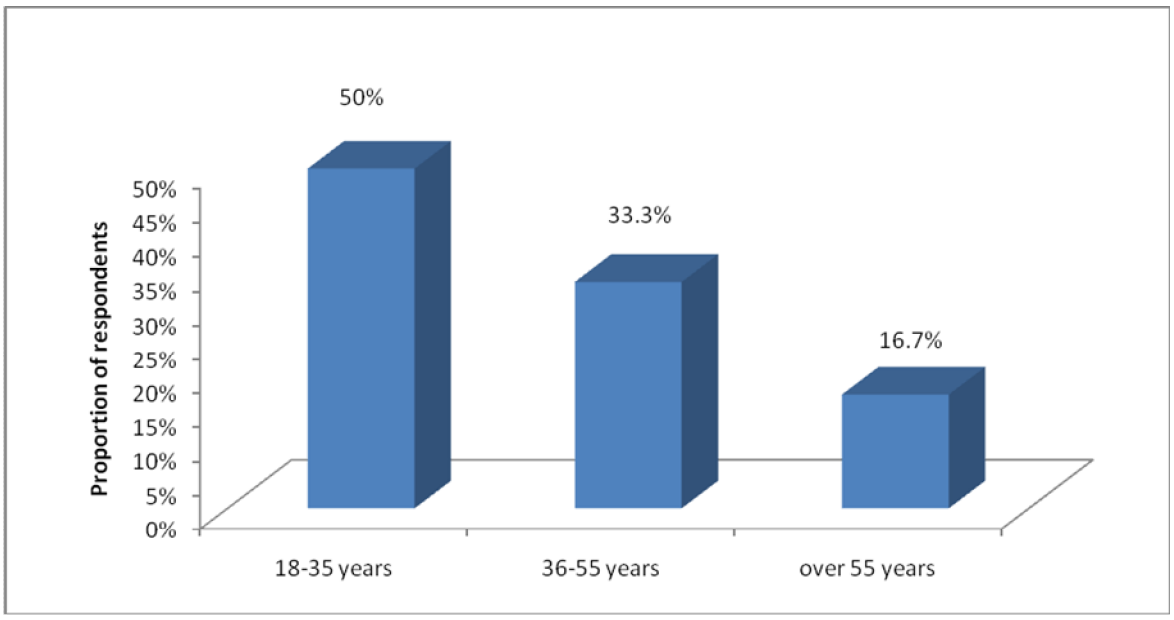


Figure 3: Age of respondents

Source: Field data (2015)

4.2.3 Education

The maximum number of years spent in formal education was 16 years while the least learned farmer had no formal education. Most farmers spent 5-8 years in school (N= 35, 41.7%) as shown in Table 1 below. Farmers who had spent 9-12 years were 33.3% while 15.5% and 9.5% had spent 0-4 and 13-16 years in school respectively. This shows that most farmers in the area had only gone up to the primary level of education.

Table 1: Years spent in formal education

Source: Field data (2015)

Years spent in school	N	Percent (%)
0-4	13	15.5
5-8	35	41.7
9-12	28	33.3
13-16	8	9.5
Total	84	100

4.3 Farm characteristics

4.3.1 Land

High population density has led to high land fragmentation in Mwea. The minimum land ownership was reported to be 0.25 acres with only three farmers having 10 acres of land. Majority of the farmers had less than 3 acres of land (N=73, 86.9%), 9.5 % had between 3-6 acres of land while only 3.6% of the farmers had more than 6 acres of land as shown in table 2. This supports the findings by the Government of Kenya report (2010) that small scale farming system is carried out on 0.2-3 acres of land.

Table 2: Land size

Source: Field data (2015)

Land size (acres)	N	Percent (%)
<3	73	86.9
3-6	8	9.5
>6	3	3.6
Total	84	100

4.3.2 Farming experience

The most experienced farmer has carried out horticultural farming for 20 years while the least experienced farmer has done the practice for 1 year. Most farmers had less than 5 years of experience (N=33, 39.8%), 36.9% had between 5 and 10 years, 11.9% of the farmers had

practiced horticultural farming for 10-15 years and same proportion had practiced it for more than 15 years as shown in table 3 below. This shows that most farmers did not have much experience on horticultural farming as most of them were the youth.

Table 3: Farming experience

Source: Field data (2015)

Farming experience (years)	N	Percent (%)
<5	33	39.3
5-10	31	36.9
10-15	10	11.9
>15	10	11.9
Total	84	100

4.3.3 Horticultural crops grown

French bean is the major crop grown by farmers in Mwea (73.8%). Other major ones were bananas (66.7%) and tomatoes (52.4%). Capsicum, passion fruits, and soya beans had the least growers with only 14.3%, 11.9% and 6% of the farmers respectively as shown in figure 4 below.

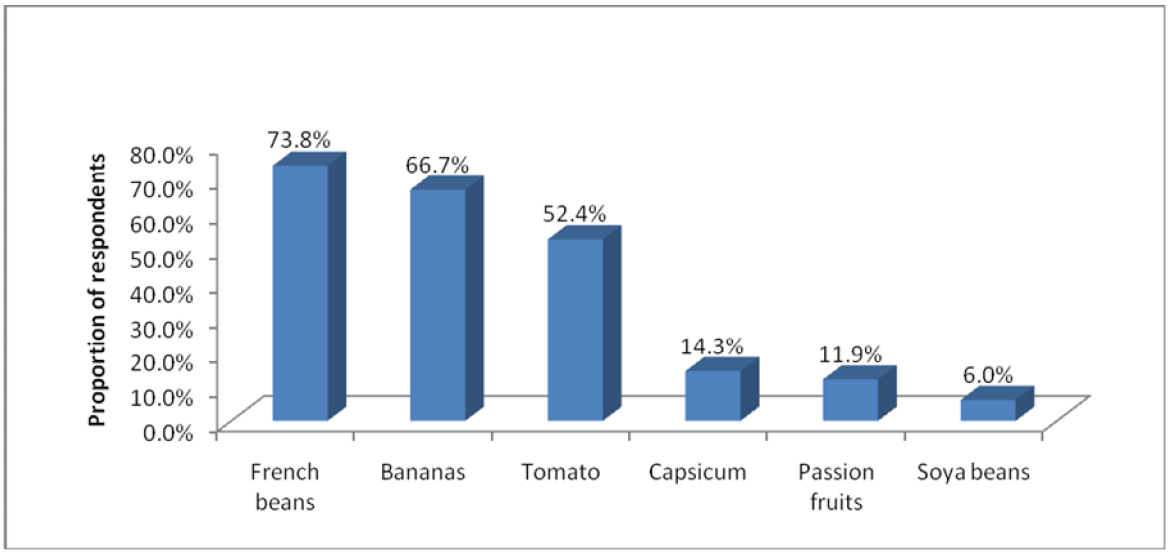


Figure 4: Horticultural crops grown

Source: Field data (2015)

Farmers also reported that they grew other crops besides horticultural crops. These included rice, maize, beans and sorghum. Small holder farmers in Mwea take horticultural farming as a business with 100 percent of the respondents reporting to practice horticultural farming for commercial purpose as opposed to subsistence farming. There is due to increased growth rate of the subsector coupled with favorable climatic conditions as confirmed by GoK (2010) report findings.

4.3.4 Marketing

Horticultural farmers in Mwea sold their crops in various places. Overall, majority of the farmers sold to middlemen (85.7%), 65.5% to farmersô cooperative, 35.7% to open air markets, 8.3% to supermarkets and 7.1% sold in major towns. Results show that middlemen formed the largest market for horticultural farmers in Mwea. This shows that the sector is mainly controlled by the private players with minimal government involvement. The government only plays the role of regulatory body as confirmed by the findings from EPZA (2005) report. These results are also supported the findings by HCDA (2009) that the horticultural sector is mainly controlled by private sector. The results are shown in figure 5 below.

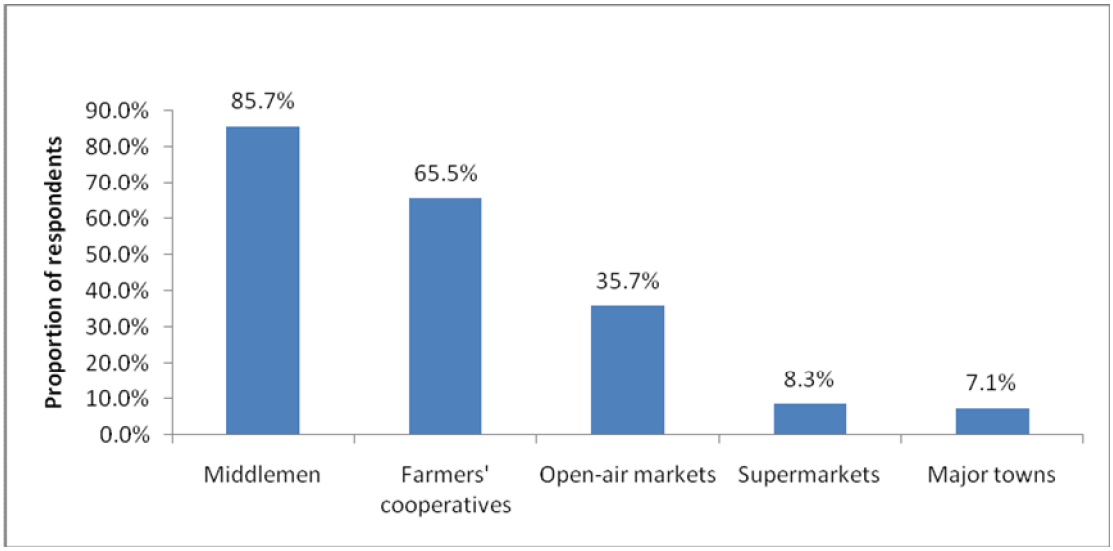


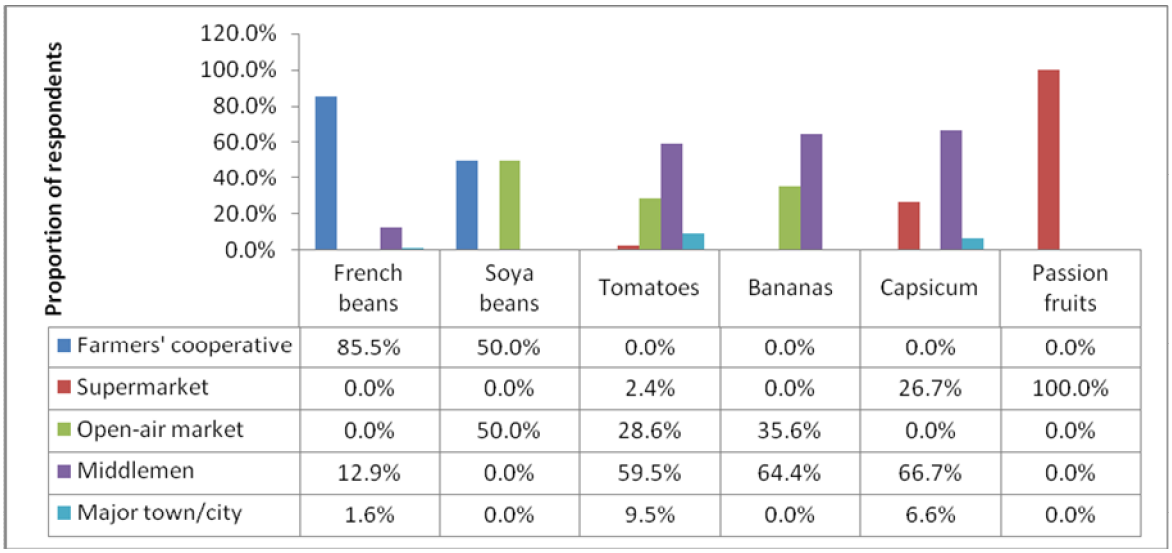
Figure 5: Market places

Source: Field data (2015)

Farmersô cooperative was the major market for French beans. Out of the 73.4% (N=62) of farmers who grew French beans for market, 85.5% of the respondents reported to sell the

produce to the farmersô cooperative. This is because this crop formed the basis for formation of farmersô cooperative in the area to help them market the produce as a group. The farmersô cooperative had also signed contracted farming with the buyer for the same produce. Only 4 farmers grew soya beans as the farmers reported to lack a well-structured market for the crop. Out of the 4, half of these sold the crop to farmersô cooperative while the rest sold to the open air market (Figure 6). Out of the total respondents, half of them (N=42) grew and marketed tomatoes. Most of the tomato farmers sold their crop to middlemen (59.5%) while 28.6%, 9.5% and 2.4% of the respondents sold in open air market, major town and supermarkets respectively. The open air market was Kagio trading centre while Nairobi was reported as the major town/city where tomatoes were sold as shown in figure 6 below.

Most of the farmers grew bananas mainly for subsistence and therefore did not market them (N=39). Out of 45 respondents who grew bananas for market, middlemen formed the major market for bananas (64.4%) with open air market being the alternative market and forming 35.6% of the response. Capsicum was only grown by 17.9% (N=15) of the farmers. Most of the capsicum was marketed through middlemen (66.7%) with 26.7% of the farmers taking their crop to supermarkets and 6.6% to the major town/city. Only two farmers grew and marketed passion fruits with all produce being sold to supermarkets. The results are shown in figure 6 below.



	French beans	Soya beans	Tomatoes	Bananas	Capsicum	Passion fruits
Farmers' cooperative	85.5%	50.0%	0.0%	0.0%	0.0%	0.0%
Supermarket	0.0%	0.0%	2.4%	0.0%	26.7%	100.0%
Open-air market	0.0%	50.0%	28.6%	35.6%	0.0%	0.0%
Middlemen	12.9%	0.0%	59.5%	64.4%	66.7%	0.0%
Major town/city	1.6%	0.0%	9.5%	0.0%	6.6%	0.0%

Figure 6: Market size for horticultural crops

Source: Field data (2015)

The average quantity of tomatoes sold was 2213 Kg per annum while that of French beans was approximately 898 Kg per annum. The average quantity of soya beans sold was 425 Kg, 1270 Kg for bananas, 232 Kg for capsicum and 750 Kg for passion fruits (the average quantity was reported to the nearest whole number). The results are shown on table 4 below. A standard deviation of 668.608 Kg for French beans implies that 68 percent of the farmers produced between 230 and 1566 Kg per year.

French beans received the highest price on average which was approximately 46 Kshs per Kg while the second highest was tomato with 40 Kshs. These two crops received highest price since they were the most common crops grown in the area, they also take shorter growing season and rely on irrigation. The least was passion fruits with an average price of 10 Kshs per Kg. The highest price that farmers received for each Kg of French beans was 50 Kshs, soya beans at 40 Kshs tomato 58 Kshs, bananas 45 Kshs, capsicum 80 Kshs while passion was sold at a maximum price of 10 Kshs. Standard deviation showed dispersion from the mean. A standard deviation of 7.53 Kshs for French beans implies that 68 percent of the farmers sold the crop between 39 and 53 Kshs per Kg.

Table 4: Quantities sold and the prices of different crops

Source: Field data (2015)

Crop	N	Quantities sold per year (Kg)				Price (Kshs per Kg)			
		Mean	Minimum	Maximum	Std deviation	Mean	Minimum	Maximum	Std deviation
French beans	50	898	300	3000	668.608	46	30	50	7.53
Soya beans	4	425	300	600	150	40	40	40	0
Tomatoes	44	2213	240	12000	2131.34	31	17	58	62.613
Bananas	45	1270	150	4000	879.82	40	35	45	2.634
Capsicum	14	232	100	500	104.894	56	40	80	12.157
Passion fruits	2	750	500	1000	353.553	10	10	10	0

4.3.5 Income

Farmers in the area reported different sources of income which included horticultural farming, other crops sales, salaried employment, business operations, livestock farming and remittances. Most farmersô total annual income ranged from Kshs 100,000 to 250,000 (N=41,

48.8%). Those earning between 250,000 and 500,000 Kshs per annum were 27.4% while those earning less than Kshs 100,000 comprised 15.5% of the total respondents. Only 8.3% earned more than 500,000 Kshs per annum.

The average income from horticultural farming was Kshs 87,897 per annum. The highest income from sale of horticultural crops was Kshs 263,700 while the lowest was Kshs 6,000 per annum. Horticultural farming being the major source of income for farmers in Mwea Sub County, 100% of respondents obtained their income from it. This was due to favorable climate for the farming system hence the most common farming system by majority of the farmers. Those who obtained income from business operations were 41.7% while sales from other crops such as rice, maize and beans was 39.3%. Salaried employment, sale of labor, livestock sales and remittance were reported as sources of income by 25%, 21.4%, 20.2% and 13.1% of the respondents respectively. The results are shown in figure 7 below.

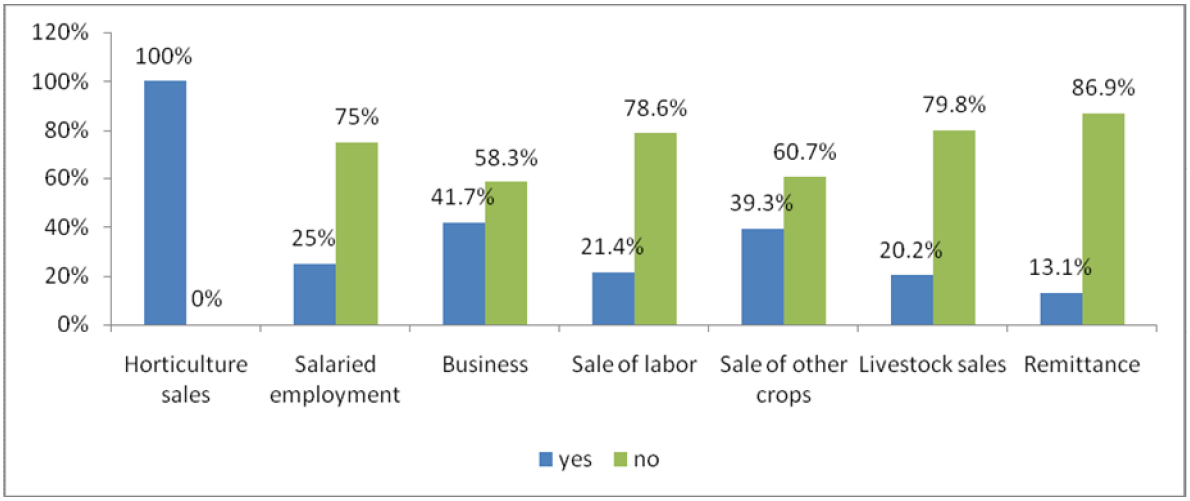


Figure 7: Sources of income

Source: Field data (2015)

4.4 Access to market information

Farmers were asked to what extent they had the following market information. The responses were analyzed using the median which ranked the responses on a scale of 1 to 5 with 5 being ‘to a very great extent’, 4 being ‘to a great extent’, 3 being ‘to a moderate extent’, 2 being ‘to a low extent’ and 1 being ‘to a very low extent’. Price information was accessed to a low extent (median= 1.5), while access to market places, buyers and peak and off peak seasons information were accessed at a moderate extent (median=3) as shown in table 6 below. The

results tally with the findings by Maritz (2011) which found out that lack of transparency in markets and market information is the most common challenge faced by farmers.

Table 5: Market information access

Source: Field data (2015)

Variable	Median
Prices of horticultural crops	1.50
Places where there is ready market for horticultural crops	3.00
Buyers of horticultural crops	3.00
Peak and off peak seasons for horticultural crops	3.00

4.4.1 Extent of use of mobile phones to access market information

Majority of farmers in the study area had access to mobile phones (98.8%) with only 1.2% of the respondents reporting not to have access to a mobile phone. The results confirm the findings by Asenso-Okyere and Mekonnen (2012) who found that there is a high adoption on use of mobile phone communication in Kenya and that the penetration of mobile service which had reached 64.2 percent by 2012. However, majority of the horticultural farmers in Mwea did not use mobile phones in accessing market information (79.8%) with only 20.2% of the respondents reporting to use mobile phones to access market information as shown in figure 8 below. The study results contrast with those of Martin and Abbot (2009) which showed more than half of the farmers in Kamuli District, Uganda were using their mobile phones for coordination, access to agricultural inputs, getting market information, monitoring financial transactions and agriculture emergency situations.

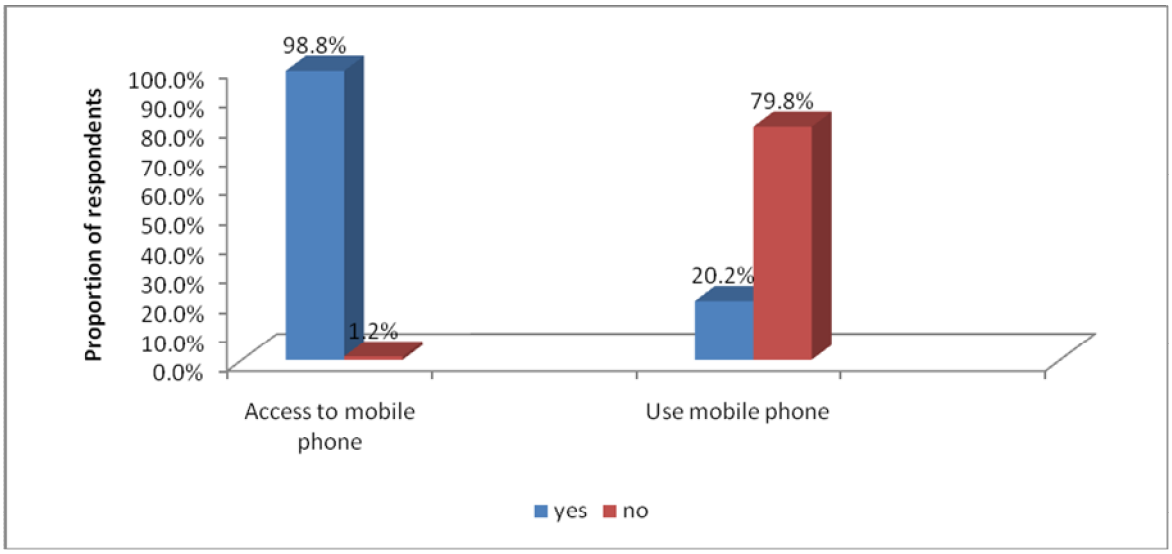


Figure 8: Access to mobile phones

Source: Field data (2015)

4.4.1.1 Reasons of not using mobile phones in accessing market information

Majority of farmers in the study area (N=76, 79.8%) reported not to use mobile phones in accessing market information for their horticultural produce. They gave various reasons as to why they didnôt use the technology. Most farmers gave lack of training on use of mobile technology in accessing market information as the reason of not using mobile phones (39.8%). Lack of awareness was given as a reason by 30.3% while 15.4% gave high cost of technology in terms of buying mobile phones with access to internet and buying airtime. These results tally with the findings by Chukwunonso (2012) study in Nigeria which confirmed that lack of knowledge was the major reason why farmers did not adopt ICT in agriculture. Only 3% gave farmersô socioeconomic characteristics (age, income and literacy level), lack of interest, small scale production and distrust as reasons for not using mobile phones in accessing market information for their produce. Other farmers reported that having an already local market was the reason for not using mobile phone communication in accessing market information (2.5%) as shown in figure 10 below.

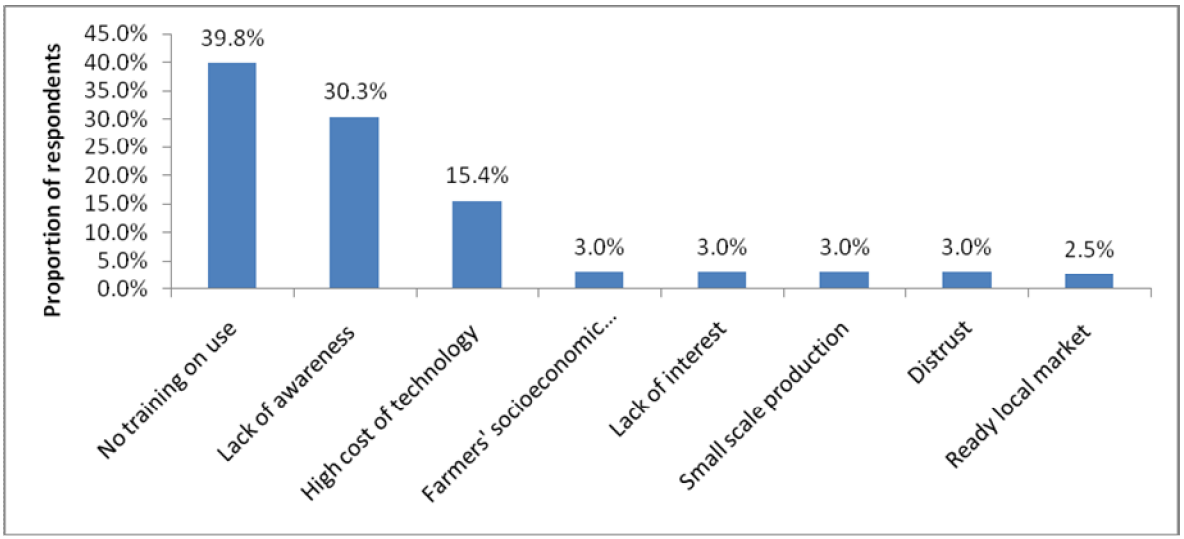


Figure 9: Reasons for not using mobile phones in accessing market information

Source: Field data (2015)

4.4.1.2 Mobile phone applications used and the source of information

Horticultural farmers in Mwea used Short Messaging Service (SMS), voice call and phone internet applications to access market information. Out of the total respondents, only 17 used mobile phone communication to access market information while 67 of them did not use. SMS application was used by 5 out of the 17 mobile phone communication users. This represents 29.4% usage of all applications. Out of the 5, 40% (N=2) sourced the information from middlemen, 40% (N=2) from Airtel Kilimo and 20% (N=1) sourced information from the Ministry of Agriculture.

Most of the users used voice call (82.4%; N=14) as compared to SMS and phone internet applications. Market information mostly came from middlemen (92.9%; N=13) with only 7.1% getting the information from Ministry of Agriculture. Phone internet was the least used application (5.9%) with only one farmer accessing market information via it. The source of information was the Ministry of Agriculture. The results are shown in the table below.

The study findings showed that voice call is the most preferred mobile phone application compared to SMS and internet. This is in line with findings by Crandall (2012) that most farmers, regardless of age, sex, or location, tend to prefer making calls to using SMS. This is because calls consume less money to get a final response compared to SMS which has much

back and forth. Low internet usage is as a result of high cost of purchasing mobile phones that have internet application and also lack of knowledge on internet use among the farmers.

Table 6: Mobile applications used and source of information

Source: Field data (2015)

Mobile application		**Usage**	**MoA**	**Mfarm**	**KACE**	**Middle men**	**Airtel Kilimo**	**Local radio program**	**Total**
SMS	**yes**	-	1 (20%)	0 (0%)	0 (0%)	2 (40%)	2 (40%)	0 (0%)	**5 (100%)**
	no	12 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**12 (100%)**
Voice call	**yes**	-	1 (7.1%)	0 (0%)	0 (0%)	13 (92.9%)	0 (0%)	0 (0%)	**14 (100%)**
	no	3 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**3 (100%)**
Phone internet	**yes**	-	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
	no	16 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**16 (100%)**

4.4.1.3 Other communication channels used in accessing market information

Farmers were asked the communication channels and tools they used to access market information. The responses were analyzed using the median. The responses were ranked on a scale of 1 to 5 where 5 represented ‘to very great extent’, 4 ‘to a great extent’, 3 ‘to a moderate extent’, 2 ‘to a low extent’ and 1 ‘to a very low’. Middlemen were the most common communication channel (median= 5) as the sector is mostly controlled by the private sector where there is little government involvement. This is confirmed by findings from the EPZA (2005) report. Fellow farmers was used to a moderate extent (median=2). The rest of the channels were used to a very low extent.

Farmersô cooperative was used only in marketing French beans and soya beans which were the basis for formation of the cooperative. Low level of literacy led to low usage of computer internet and newspapers since most of the farmers did not have knowledge on use of internet and also high cost of accessing them. This confirms the findings by Lwoga et al, (2011) that advanced technologies such as computer internet and printed media were used at a low rate despite their existence in the communities. Radio and television were mainly used for entertainment purposes as opposed to market information access while extension agents and farmer field schools were mainly used to access information on inputs but not accessing market information.

Table 7: Other communication channels and tools used in accessing market information Source: Field data (2015)

Communication tool/ channel	Median
Farmers cooperative	1
Middlemen (brokers)	5
Radio (Inooro fm, Kameme fm)	1
Television (Citizen television, Nation television)	1
Newspaper	1
Computer internet	1
Farmer field schools	1
Extension agents	1
Fellow farmers	3

4.4.2 Factors influencing adoption of mobile phone communication in accessing market information

Horticultural farmers in Mwea Sub County in Kirinyaga County gave different factors that influence adoption of mobile technology in accessing market information for their produce. Farmer reported that, having not been trained on use of the technology, high cost of the technology, difficulty in its usage and lack of awareness on use of mobile technology were major factors that influenced adoption of the technology in accessing market information (84.5%, 82.1%, 67.9% and 65.5% response respectively). Availability of ready local market

and distrust were the least considered factors that influenced adoption of mobile technology in market information access (9.5% and 7.1% response respectively) as shown in table 7 below. These results further confirm the findings by Chukwunonso (2012) study in Nigeria which confirmed that lack of knowledge was the major reason why farmers did not adopt ICT in agriculture.

Table 8: Factors influencing adoption of mobile phone communication technology in accessing market information

Source: Field data (2015)

Factors	Frequency	Percentage
I am not aware of such technology	55	65.5%
It is difficult to use	57	67.9%
It is costly	69	82.1%
I have not been trained on how to use it	71	84.5%
I prefer other communication methods compared to mobile	10	11.9%
I do not trust the information	6	7.1%
Technology is biased towards large quantities yet I produce small quantities	10	11.9%
There is ready local market	8	9.5%
Farmersô socio economic characteristics	13	15.5%

4.4.3 Challenges facing farmers in marketing and suggested solutions in enhancing access to markets

4.4.3.1 Challenges

Farmers in Mwea, Kirinyaga County gave various challenges that they faced in marketing their produce. Market being controlled by middlemen was given by majority of the respondents (52.4%) while poor and price instability was reported as a challenge by 11.9% of the respondents. This confirms the findings by Nzioki (2013) and Muthoka and Ogutu (2014) that, middlemen is one of the major challenges facing horticultural farmers since they get

larger profit share at the expense of the farmers who apparently have low level of education and limited information on the prevailing market situation. Nzioki (2013) further reported that low level of education and lack of market information by farmers result in poor prices.

Grading was also a challenge as reported by 8.3% of the farmers. This led to huge losses especially for the case of French beans and tomatoes. Delayed payments by buyers and poor infrastructure were also reported by 8.3% of the respondents. This further confirms the report by the Government of Kenya, 2010 that poor infrastructure which increases transport costs is a constraint in marketing of produce. Seasonality was given by 6% while and 2.4% of the farmers gave poor communication between buyer and seller and perishability as a challenge faced in marketing their horticultural produce as shown in figure 12 below.

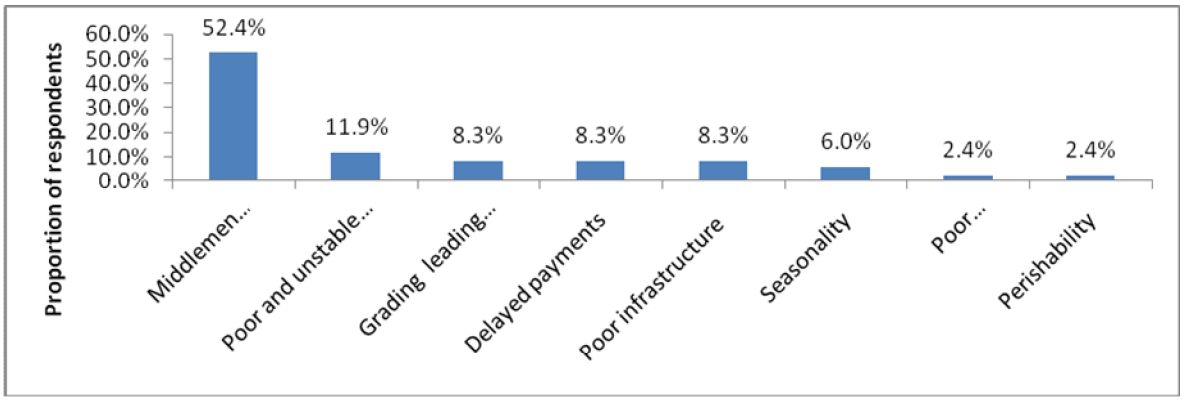


Figure 10: Challenges faced by farmers in marketing their produce
Source: Field data (2015)

4.4.3.2 Suggested solutions

Farmers in the study area suggested various ways in which marketing of horticultural produce can be improved. Most of the respondents (45.2%) suggested educating farmers on how to use modern technology. Contract farming and forming farmersô cooperative societies and horticultural export companies had each 11.9% response rate. Creating an information and technology platform at the county level to assist farmers get easy access to information and government forming and implementing policies on registration of buying companies & individuals had equal response of 10.7%. Value addition such as storage and processing facilities for perishable products, reducing technology cost to enable easy access and

improving road infrastructure to reduce transport costs had 4.6%, 4% and 1% response rate respectively. The results are shown in figure 13 below.

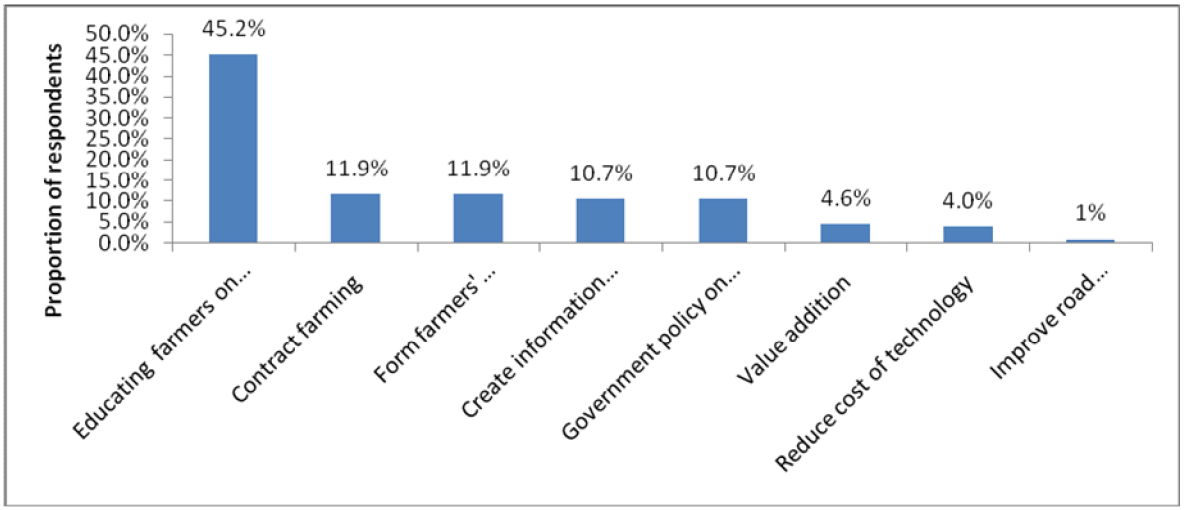


Figure 11: Suggested solutions on enhancing access to market information

Source: Field data (2015)

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study has found out that horticultural farming is still the major economic activity in Mwea, Kirinyaga County. Farmers are still fetching low prices for their produce majorly contributed by poor access to markets and market information. While more support and investment is required from the public sector for the horticultural sub-sector to grow, much of the work, such as production, processing, marketing, value addition and financing, is done by the private sector (GoK, 2010).

During the study, it was found that farmers mostly relied on middlemen, open air market located at Kagio trading centre and farmersô cooperative mostly for French beans. This crop was the basis for formation of the cooperative society and adoption of contracted farming to access markets and market information.

In addition, adoption of mobile phone communication in accessing market information is still low despite majority of the farmers owning or having access to mobile phones. Farmers use the mobile phones only to do other kinds of communicating besides market information access. Lack of training on use of the technology, high cost of the technology, difficulty in its usage and lack of awareness on use of mobile technology are major factors that influenced adoption of the technology in accessing market information.

Educating farmers on use of modern technology and creating local technological platforms for easy information access by farmers were suggested by most farmers as ways to curb marketing challenges. Others were contract farming which entails a legal agreement between the buyers and the sellers and formation of own farmersô cooperative societies and/or export companies.

5.2 Recommendations

To be able to address the challenge of poor markets and market information access via mobile phone communication by horticultural farmers in Mwea, this study recommends the following:

From the findings, most farmers do not use mobile phones to access market information due to reasons such as lack of awareness and training on how to use the technology. Therefore, there is need for the government through the Ministry of Agriculture, Livestock and Fisheries and the Ministry of Information Communications and Technology as well as the private sector agricultural information providers to train farmers and increase awareness on use of mobile phone communication technology to access market information. This can be achieved through organizing trainings for farmer groups where the trainers could be extension agents from the Ministry of Agriculture, Livestock and Fisheries as well as agents from private agricultural information providers such as *MFarm*, *Airtel Kilimo,* Kenya Agricultural Commodity Exchange (KACE), among others. This will enable farmers fetch better prices for their produce, increase their income hence improve their livelihoods.

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APPENDICES

Appendix I: Questionnaire

EVALUATING THE ROLE OF MOBILE PHONE COMMUNICATION IN ACCESSING MARKET INFORMATION BY HORTICULTURAL FARMERS IN KIRINYAGA COUNTY

BY:

WINFRED N. MUGWIMI

A56/69226/2013

NOTE:

- ✓ Information collected by use of this questionnaire is strictly for academic purposes and shall be accorded high confidentiality.
- ✓ The respondent should be the household head, spouse or a member of the household who makes major decisions on the farm

Household ID:_____

Date:_____

Enumerator name:_____

PART 1: Household information

1. Name:_____
2. Mobile number:_____
3. What is your gender?
   - Male
   - Female
4. What is your age bracket?
   - 18-35 years
   - 36-55 years
   - Over 55 years
5. What is your level of education and the number of years that you have spent in school? é é é é years
   - No formal education
   - Primary level
   - Secondary level
   - Tertiary level

PART 2: Farming characteristics

6. What is the size of your land?.....acres
7. Which horticultural crops have you grown on the farm?

- French beans
- Soya beans
- Tomatoes
- Bananas
- Capsicum
- Passion fruits
- Others (specify)

8. Which other crops do you farm?

   i. .....
   .....

   ii. .....
   .....

   iii. .....
   .....

   iv. .....
   .....

   v. .....
   .....

9. How many years of horticultural farming experience do you have? é é é years

10. Have you sold any of the horticultural crops this year? 1= Yes 2= No

11. If yes to the question above, where do you market them? Indicate on the table below

Crops marketed (Kg)	**Market place 1=farmer cooperative 2=supermarkets 3=local open air market 4=middlemen 5=major town/city 6=others (specify)**	**Quantity sold per year**	**Price per unit (Kshs)**	**Total income (Kshs)**
French beans				
Soya beans				
Tomatoes				
Bananas				
Capsicum				
Passion fruits				
Others (specify)				

12. Please indicate other sources of income and the average income per annum from other sources apart from horticultural farming?

12 a. Source of income	**12 b. Amount earned per annum (Kshs)** **1= < 100,000** **2= 100,000-250,000** **3= 250,000- 500,000** **4= >500,000**

1=Salaried employment	
2=Off-farm business	
3=Casual labor on other farms	
4= Sales from other crops e.g. rice, maize	
5=Others (specify)	

PART 3A: Access to market information

13. Indicate the extent to which you have the following market information using the following likert scale.

Variable	**Very great extent**	**Great extent**	**Moderate extent**	**Low extent**	**Very low extent**
Prices of horticultural crops					
Places where there is ready market for horticultural crops					
Buyers of horticultural crops					
Peak and off peak seasons for horticultural crops					

PART 3B: Extent of use of mobile phone in accessing market information

14. Do you have access to a mobile phone?

- Yes
- No

15. Do you use it to access market information?

- Yes
- No

16. If no to the question above, what are the reasons?
    i. é
    ii. é
    iii. é
    iv. é
    v. é

17. If you use mobile phone communication to access market information, which application do you use and who is the source of the information? Use the following codes to indicate the source:

Mobile application	**Tick all that applies**	**Source of the information** 1= Ministry of Agriculture extension officer 2= *MFarm* 3= KACE 4= Middlemen 5= *Airtel Kilimo* 6= Local community radio program
Short Messaging Service (SMS)		
Voice call		
Internet based applications		
Others (specify)		

PART 3C: Other communication tools and channels used to access market information

18. Among the following other communication tools/channels which one do you use to access market information and to what extent? Use the following likert scale

Communication tool/ channel	**Very great extent**	**Great extent**	**Moderate extent**	**Low extent**	**No extent at all**
Farmers cooperative					
Middlemen (brokers)					
Radio (specify the station and the program)					
Television (specify the station and the program)					
Newspaper					
Computer internet					
Farmer field schools					
Extension agents					

PART 4: Factors influencing adoption of mobile phone communication in accessing market information

19. Indicate whether the following characteristics influence use of mobile phone communication in accessing market information

Factors	**Tick appropriately**
I am not aware of such technology	
It is difficult to use	

It is costly	
I have not been trained on how to use it	
I prefer other communication methods compared to mobile	
I do not trust the information	
Socio economic characteristics (age, education and income)	
Technology is biased towards large quantities yet I produce small quantities	
There is ready local market	
Others (specify)	

20. What challenges do you face in marketing of horticultural produce?
    i. é
    ii. é
    iii. é
    iv. é
    v. é
21. What would you suggest as ways to improve and enhance access to market information?
    i. é
    ii. é
    iii. é
    iv. é
    v. é

Thank you

Appendix II: Interview guide

1. Which information do you communicate to the farmers and at what frequency?
2. Which channels do you use in disseminating agricultural information to the farmers in the area?
3. How do you rate the adoption of mobile technology in accessing market information by farmers in the area?
4. What are the factors that influence farmersô adoption of the technology?
5. What challenges do you face in disseminating agricultural innovations to farmers?
6. What do you think can be done to improve this?
7. What are the challenges faced by farmers in accessing markets and market information for their produce?
8. What do you think can be done to improve this?

Thank you