THE POTENTIAL OF MOBILE PHONE USAGE IN DISSEMINATION OF AGRICULTURAL INFORMATION: A CASE OF KIKUYU DISTRICT, KENYA.

BY

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DECLARATION

This research project is my original work and has not been presented for a degree in any other University.

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To The Almighty God, whose everlasting grace and mercy enabled me to go through this program successfully.

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LIST OF ACRONYMS

CCK- Communication Commission of Kenya

DFID- Department for International Development

ICT- Information and Communication Technology

IC4D- Information and Communication Technology for Development

KACE- Kenya Agricultural Commodities Exchange

KEPHIS- Kenya Plant Health Inspectorate Services

KP&TC- Kenya Posts and Telecommunication Corporation

LINKS- Livestock Information Network and Knowledge System

SMS- Short Message Service

ABSTRACT

The rapid development of mobile technology, the large usage rates of mobile phones, increased penetration rates and the inherent characteristics of mobile phones are the reasons mobile phones are currently emerging as the first extensive form of electronic communication system in Kenya. Mobile phone can, therefore play a key role in disseminating relevant information to the rural people involved in agriculture and related sectors. To investigate the potential of mobile phone usage in agricultural information dissemination was the purpose of this research. The focus was on small scale farmers in Kikuyu District, Kiambu County in Kenya, where according to the Ministry of Agriculture, Kikuyu District 2010 Annual Report, three in every five farmers own a mobile phone.

In this study, a sample of 96 farmers was selected using purposive sampling. The survey was done through the use of structured questionnaires where farmers were involved directly. This study made use of descriptive research to answer the following questions: Are mobile phones being used for agricultural purposes in practice? What kind of agricultural information do farmers value most? Have mobile phones created opportunities for farmers? The answers to these questions have important implications for information service providers and policy makers.

The study found evidence that mobile phones are being used for agricultural purposes and in ways that create opportunities for farmers. However, to leverage the full potential of information dissemination enabled by mobile phones will require capacity building amongst farmers to enable them use information they access effectively and awareness- creation by mobile phone- based agricultural information service providers.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

African agricultural output stands at a meagre fifty six percent of the world's average. Lack of access to vital agricultural information, as well as training and advice on topics such as pests and diseases, proven farming practices and weather, has been cited as part of the causes of the current problems. For any strategy to address the whole question of poverty and food insecurity successfully, it must embrace broad-based growth and development of agriculture and by extension, development of rural Kenya. It must involve activities aimed at improving crops, livestock and fisheries production and real farm incomes, and at ensuring the availability of, and access to, food. Access to appropriate agricultural information is one such activity.

Information is a basic and fundamentally important element in any development activity. Finding ways to harness it more effectively to assist those making decisions affecting the sustainability, productivity and profitability of their livelihoods is a priority concern (DFID 2000). Information about food and agriculture is vital for both individuals and institutions in developing countries in order for them to make effective decisions on issues ranging from household level food security to local, district and national rural development strategies. Better information and information systems can greatly assist decision-making at all levels and enable the information that is available to be used more effectively where it is needed within the system.

The key to increased agricultural production ultimately lies with the nation's ability to disseminate relevant information to the farming community to facilitate ,the effective adoption of new production techniques, application of agricultural inputs, decision- making on markets, prices and methods of conserving water, soil and vegetable resources (Kiplagat, 1998).

According to information posted on policy brief of March 2009 of e-agriculture.org, almost 70 per cent of the world's mobile phone subscribers are in the developing world. As an affordable and accessible means of communication, both men and women are realizing the potential of this technology to create economic opportunities and strengthen social networks in rural areas. The mobile telephone is no longer just an audio communication tool but capable of providing additional integrated functions. The mobility, ease of use, flexible deployment, and relatively low and declining rollout costs of wireless technologies enable them to reach rural populations with low levels of income and literacy (Mohsen, et al, 2009).

Mobile telephony, therefore effectively reduces the distance between individuals and institutions, making the sharing of information and knowledge easier, faster and more effective. Social networks can be strengthened and individuals empowered through use of their handset. It also offers some unique opportunities, including: providing a direct global communication channel to rural communities, extending the impact of established rural media, such as rural radio, making local content available and making rural services more efficient (logistics, coordination, etc) and cost-effective.

These benefits are amplified by the fact that the spread of mobile technology in some rural regions has occurred much faster than with other information and communication technologies (ICTs).

According to a brief history of telephony in Kenya by Arunga (2007), we see that before 1998, all telecommunications in Kenya were controlled by the state-owned monopoly Kenya Posts and Telecommunications Corporation (KP&TC). In 1998, the Kenyan parliament passed the Kenya Telecommunications Act as proposed by the Communication Commission of Kenya (CCK), the regulatory body in charge of the telecommunications sector in Kenya. Consequently, the Act made KP&TC defunct. The Communications Commission of Kenya (CCK) came to the fore in 1999 as an independent regulatory body, separate from government, tasked with opening up the telecommunications industry. Its chosen route was a mix of corporatisation of the KP&TC state monopoly (rebranded as Kenya Telkom) and the release of new licences to allow competitors into the communications industries markets. There were 184,583 working exchange lines in operation in 1993, having doubled since 1983. However, this mere doubling comes within the context of 19 million cell phone subscribers in Kenya presently , starting from zero less than 20 years ago. There was a failing communication service in Kenya before the cell phone. By late 1999 to early 2000, availability and penetration of fixed line was barely 1% and mobile phone usage was not only a functional luxury but unavailable for the 30 million Kenyans. In 1990, only 48.1% of call attempts on the long-distance network were being completed successfully. Domestic calls were slightly better at 53.7% than the long distance calls.

In contrast with the above failure in service growth, when the telecommunication authority allowed some private companies to enter the market a much different outcome emerged. Currently, there are four private telephone companies namely, Safaricom, Airtel, Orange and Yu, all offering cell-phone services. The number of their telephone subscribers has risen rapidly over the past eight years. According to Communication Commission of Kenya report, in June 1999, Kenya had 15,000 mobile phone subscribers. By the March 2010, there were

more than 19.9 million subscribers. It is estimated that in Kenya, around one in two people has a mobile phone out of approximately 38.6 million people (Arunga, 2007).

The recent introduction of a number of mobile-enabled agricultural information services suggests it is time to take a fresh look at their impact on agriculture in Kenya. For instance, *Sokoni* project provides agricultural information through SMS for a fee. The project is run by the Kenya Agricultural Commodities Exchange (KACE), a private firm, in partnership with African mobile service provider Safaricom Limited. Information kiosks are located near where agricultural commodity buyers and sellers meet to provide low-cost access to farmers. KACE workers collect information on prices from these kiosks and then send it to the farmers, buyers and exporters through SMS. Although the entry costs and per-unit costs for a KACE user are low, farmers need to feel that they get value for their fees to sign up and for the service to be sustainable in the longer term (www.kacekenya.co.ke).

Another mobile phone application that provides agricultural information is 'KenCall' which launched the Kenya Farmer Helpline in October 2009 as a unique and innovative service aimed at providing agricultural information, advice and support over the phone to small holder farmers. The main objective was to provide high quality and reliable information to farmers to enable them to make more informed decisions throughout the land preparation, planting, pest management, harvesting, post harvest and marketing of agriculture produce including climate and weather information. The service establishes a two-way communication channel between farmers and agricultural experts and provides a reliable solution to the information deficit that farmers often face. While the primary targets of this information are the small holder farmers, it is also aimed at supporting the agricultural industry and related organizations, agencies and committees throughout the country and across the borders.

Through the information and data collected, it is hoped that local and regional business opportunities will be promoted by raising awareness to potential investors (www.kencall.com). A pilot insurance programme by mobile phone started in Kenya in 2009, dubbed 'Kilimo Salama Plus', is helping farmers to cushion their investments from drought, excess rain and other extreme weather events. Kilimo Salama Plus is a partnership between the Syngenta Foundation for Sustainable Agriculture, UAP Insurance, and Safaricom. The scheme deploys a low-cost mobile phone payment and data system that is linked to solar-powered weather stations. Currently, when a farmer purchases insurance, the agro-dealer uses a camera phone to scan a special bar code that sends the policy details to UAP Insurance over the Safaricom network. The farmer is then registered with a local weather station and receives a text (SMS) message confirming the policy. When data from a particular weather station indicates drought or other extreme conditions, including excessive rains, all farmers registered with that station automatically receive payouts through their mobile phone via Safaricom's M-PESA money transfer service. This eliminates the often lengthy claims process involving an agent visiting the farm to estimate losses. Kilimo Salama also has a helpline that is staffed by agriculture experts to provide callers with free advice on improving agricultural production and protecting their investments (www.new-ag.info).

A marketing information system was developed by the Livestock Information Network and Knowledge System (LINKS) to support livestock producers and traders. LINKS designed and implemented an information communication technology (ICT) infrastructure to collate data on livestock sales and prices from a network of different markets for dissemination using SMS messages (Kariuki, 2005). M-Farm, another application allows farmers to group together through their mobile phones to offer exporters and big retailers large quantities of produce. In addition, farmers save on the cost of inputs such as fertilizers and pesticides by buying in bulk. Other mobile phone- based information services that provide agricultural

information are from institutions such as Kenya Plant Health Inspectorate Services (KEPHIS), Kenya Seed Company and the Ministry of Agriculture. For instance, KEPHIS helps farmers identify genuine seed sellers and varieties via an SMS (short message service). 19.9 Million Kenyans , subscribed to mobile phone- service providers (CCK,2010). This, together with improvements in supporting infrastructure is an indication that mobile telephony has penetrated almost every part of Kenya.

Agricultural information disseminated through the mobile phone when used by farmers can have an impact on agricultural productivity and profitability. On the other hand, according to the 2010 Ministry of Agriculture, Kikuyu District annual report, the District has an estimated 50,000 farm families, majority of them being small scale farmers on small plots of land of less than 5 acres in size and who practise truck farming, which requires access to timely and appropriate information. Access to unreliable and untimely information, poor infrastructure, and high cost of inputs are some reasons for low productivity in agriculture. Mobile phones have a future to provide this kind of information, which according to personal communication with Professor Levi Akundabweni, connects the internalizable, conversational(voice and text), news-based, reference-suggesting and, cultural aspects.

Therefore this study aims at evaluating if information disseminated through the mobile phone could enhance extension activities and will confirm a significant impact to the current one-way information sources such as radio, television, and newspapers. In a conversation on 11th July,2011 with Professor L. Akundabweni, he stated that the 5-ring information sharing model which borrows from Levern (2001), suggests that, where possible, the adequacy of information exchange must be at all 5-levels, namely: internal, conversation, news, reference and cultural. Mobile phone communication as a management strategy appears to address a number of the ring levels.

1.2 Problem Statement

Farmers are presently forced by prevailing circumstances to enhance production, improve the quality of their yield, and access markets within the shortest timeframes. Small-scale farmers especially have traditionally been starved from weather, livestock and crop information; have been at the mercy of middlemen; and have lacked timely market and price information to negotiate the best deal. Therefore, despite the long history of successful research and release of good varieties and technology packages, small-scale farmers continue to experience low incomes from agricultural production. Levels of technology adoption are low and farmer's yields are about 50% or less of what should be possible to achieve. It is, therefore imperative to maintain a certain level of development in the agricultural sector to ensure not only food security but also people's livelihood, enhanced by an effective and practical information-driven - phone e-environment. Appropriate improved technologies and information is the key to growth in not only agriculture but also in every other sector.

The lack of awareness about the available technologies and high levels of ignorance about such technologies among farmers suggest that the dissemination methods are yet to be effective in information exchange. Agricultural information dissemination has depended on conservative tools that were simple in technology, less costly, and slow to change. The dissemination channels addressed only few of the information and communication management strategies along Leverne's 5-ring information continuum. The effect of the said traditional dissemination to the present day agricultural producers (farmers) seems to limit their ability to keep up with globalized trends in information value to their agro-business growth. Access to mobile phones is growing dramatically even among those at the base of the economic pyramid, providing a powerful channel of communication and the ability to link previously excluded rural communities to updated information. But are smallholder farmers using mobile technology for agricultural purpose? The potential of the mobile phone warrants

a further study for its use in agricultural information dissemination in Kikuyu district - due to its centrality in truck farming.

1.3 Objective of the Study

The overall objective of this study was to establish the extent of mobile phone usage by farmers, and factors limiting this, in the dissemination and use of agricultural information.

Specific objective is:

- To identify limitations affecting mobile phone usage in optimizing agricultural information sharing among Kikuyu District farming clientele.

1.4 Purpose Of The Study

This research was undertaken to find out whether farmers have realised effectiveness of mobile telephony in helping them do their business. The mobile communication industry has grown in leaps and bounds, providing myriad solutions in many sectors, including education and finance. This study attempts to establish the extent to which this technology has been (if at all) applied in agricultural information sharing, and to understand what factors affect this.

1.5 Research Questions

1. To what extent is the mobile phone a means of agro-information management strategy in the Kikuyu District agro-clientele
2. What kind of agricultural information is needed among the Kikuyu District agro-clientele
3. Have mobile phones created opportunities for farmers in Kikuyu district?

1.6 Definition of Terms

Agricultural information: Refers to all published and unpublished knowledge on all aspects of agriculture. It can be categorised into technical/scientific information, commercial information, socio-cultural information, and legal information.

Mobile phone technology: A mobile phone allows calls into the public switched telephone system over a radio link. Modern cellular "cell" phones or hand phones make use of the cellular network concept, where frequencies are re-used repeatedly within a local area, allowing many more users to share access to the radio bandwidth. A mobile phone allows calls to be placed over a wide geographic area; generally the user is a subscriber to the phone service and does not own the base station. A mobile phone can make and receive telephone calls to and from the public telephone network which includes other mobiles and fixed-line phones across the world. It does this by connecting to a cellular network provided by a mobile network operator. In addition to telephony, modern mobile phones also support a wide variety of other services such as text messaging, multimedia messaging service, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming and photography.

Farmers' information needs: The information needs in the context of this study may be grouped into five categories: agricultural inputs; extension education; agricultural technology; agricultural credit; and marketing.

Agro-clientele: This term derives from the word client- a person or company receiving a service from a professional source in return to payment or some cost recovery. In this study, Kikuyu District is considered as a client (customer) base with farmers, marketers, input suppliers and so on, as the clientele.

1.7 Limitations

Dhaliwal and Joshi (2010) while discussing mobile phones as a potential boon to the rural social system, give some of the possible limitations of mobile phone technology as, (i) High costs, especially for the new generation of handsets, (ii) Limited network coverage in some rural areas, (iii) Limited capacity of rural folk to use the technology, particularly for more complicated applications such as the internet and cameras, and finally, (iv) Low awareness among rural populace of the availability and capability of such technology

CHAPTER TWO

LITERATURE REVIEW

An important use of mobile phones in rural areas is to access market information. In India, access to market information through mobile phones has allowed fishermen to respond faster to market demand and has increased their profits (Jensen 2007); in Niger, it has reduced price disparities in grain markets (Aker 2008). Jensen (2007) studies the market for sardines in the southern Indian state of Kerala. In the initial state, none of the agents had price information and arbitrage across markets was close to zero. In addition fish are highly-perishable goods, making rapid dissemination of information all the more critical. Exploiting the staggered roll out of mobile phones reveals a tight correspondence between the timing of the introduction across three regions and sharp, sudden changes in market outcomes, suggesting a lack of pre-existing differential trends or other omitted variables. Mobile phones led to significant increases in arbitrage, declines in price dispersion across markets, and waste (unsold fish in markets with high supply, averaging about 6 percent of daily catch prior to mobile phones) was completely eliminated. On net, fishermen's profits increased by 8 percent, consumer prices declined by 4 percent and consumer surplus increased by 6 percent.

A study by Abraham (2007), which also looked at Kerala fishermen, found that the widespread use of mobile phones increased the efficiency of markets by decreasing risk and uncertainty, although it noted that realising potential efficiencies depended on easy access to capital. Using mobile phones at sea, fishermen are able to respond quickly to market demand and prevent wastage from the catch – a common occurrence before the adoption of phones. Mobile phones help co-ordinate supply and demand, enabling traders and transporters to take advantage of the free flow of price information by catering to demand in undersupplied markets.

The de Silva and Ratnadiwakara (2008) study also found that Gherkin farmers in Sri Lanka were able to improve their incomes through simple mobile phone applications that helped reduce waste through a feedback system. The study found that up to 40 per cent of crop loss could be prevented with quick interventions facilitated by information received via SMS. Farmers also expressed their willingness to pay for such services if it would save their time and money. Mobile phone usage by farmers reduced the information search costs, thereby dramatically lowering transaction costs and enabling greater farmer participation in commercial agriculture.

Bhavnani et. al, (2008), pointed out that despite the increasing rural demand for relevant, timely agricultural information on the one hand and recent advances in quality and capacity of ICT services on the other, the benefits remained unevenly distributed among people. The main causes were the lack of a policy and regulatory environment and the poor availability of ICT and mobile infrastructure (Bhavnani et. al, 2008). The cost of the use of available infrastructure was also an issue, with those having resources and skills benefitted more than those who lacked the same endowment. Tenhunen (2008) study on mobile technology on Indian villages found that agricultural produce could also be sold by phone. Whereas deals were previously closed by signing a written contract well in advance of the products' delivery, sellers could continue haggling with various buyers until it was time to deliver the products. The prices were settled by phone at the very last moment, which decreased the middlemen's profit and benefited the farmers. One other obvious economic benefit of phones was that they helped people save time. One needed not be absent from work and travel to meet people in order to stay connected. This was especially important for daily labourers, for whom having to miss a day from work meant not being able to feed their family that day.

Tenhunen (2008) study also found that text messaging service (SMS), which most service providers offered cheaply or free up to a limit, were an under-used resource. Most villagers were not able to exchange messages because the majority of the phones required the ability to read and write, using Latin or Hindi characters instead of Bengali ones. Even those villagers who have studied Hindi and English were not comfortable reading and writing in vernacular. Mittal, et al (2010) studied the socio-economic impact of mobile phones on Indian agriculture. They concluded that as a telephonic device, the mobile phone enabled access to information sources that was not otherwise reachable.

Mobile phones-as information platforms that receive short message service, menu or voice message information-provide the ability to get connected to new knowledge and information sources not previously available with the possibility of real-time, highly tailored information delivery. Even at that early stage, mobile phones were being used in Indian agriculture and were starting to deliver agricultural productivity improvements, an impact that was enhanced by the new mobile-enabled information services. The most common benefit of mobile telephony found in the research was derived from the use of mobile phones as a basic communications device as for many of the farmers interviewed, it was the only convenient phone access they had. Realising the full potential benefits of mobile phones was limited, however, by a set of constraints that prevented farmers from fully leveraging the information they received. The constraints included shortcomings in physical infrastructure affecting access to markets, storage and irrigation. Issues regarding the availability of critical products and services including seeds, fertilisers, medicines and credit to small farmers also existed. Increased extension services and capacity-building efforts could complement information dissemination via mobile phones and associated services to accelerate the adoption of new techniques.

The study provided a first look at the potential offered by mobile telephony to raise productivity in the agricultural sector as a whole. It reported many examples of benefits created by the characteristics of mobility, customised content delivery and convenience. Mobile penetration continued to increase among farming communities and information services continued to adapt and proliferate. The scope existed for a much greater rural productivity impact in future, but achieving the full productivity potential, the study concluded that the future depended on reducing other constraints, which limit the use of the information farmers and fishermen were obtaining from their mobile phones.

TradeNet, a Ghana-based trading platform, allows users to sign up for short message service (SMS) alerts for commodities and markets of their choice and receive instant alerts, for offers to buy or sell, when anyone else on the network has submitted an offer by mobile phone. Users can also request and receive real-time prices for more than 80 commodities from 400 markets across West Africa. The Ghana Agricultural Producers and Traders Organization is a major beneficiary: in 2006 it concluded trade deals worth $60,000 with other producer and trader organizations in Burkina Faso, Mali, and Nigeria. These deals involved purchasing tomatoes, onions, and potatoes without middlemen, thereby substantially reducing transaction costs between buyers and sellers (World Bank 2007). Aker (2009) also exploits panel data and the staggered introduction of mobile phones across various regions in studying millet markets in Niger. In this case, mobile phones were primarily taken up by traders, not farmers. If the traders did not have market information before, this should still lead to a more efficient allocation of resources across markets, some of which could pass through to farmers. She found that mobile phones increased the number of markets over which traders searched. There was significantly reduced price dispersion (10-30 percent), a 29 percent increase in trader's profits (though unfortunately, there are no data on farmers), and improvements in consumer welfare (including a consumer price decline of 3.5-4 percent). She also suggested

that the enhanced market performance attributable to mobile phones is likely to have mitigated the consequences of a food crisis in 2005. These results are all the more important in that they show gains even for a grain, which is not as perishable as fish.

In a sense, spanning the spaces of goods from these other two studies, Muto and Yamano (2009) studied the introduction of mobile phones in rural villages on the marketing of bananas and maize in Uganda. They found that phones led to increases in the prices farmers received for bananas, but not maize. They argued that the greater perishability likely limited arbitrage in bananas when information was limited, but not maize, since it was easily transportable and the speed of information transmission was less important. They also found that mobile phones led to increases in farmer's incomes, particularly for farmers further from larger towns. The SMS-based '411 Get It' service, a joint venture between Safaricom, a Kenya- based mobile phone service provider, and the Kenya Agricultural Commodity Exchange (KACE), also provides farmers with information on agricultural produce and market prices, enabling them to identify favourable markets and cut out middle men (www.new-ag.info).

The literature surveyed so far highlights the fast growth of mobile telephony in the emerging developing countries of Asia and Africa and their key role in reducing information search costs and information asymmetries and increasing market efficiencies. The use of mobile phones has been found to encourage poor farmers of these countries towards greater market participation and diversification to high-value crops. This has helped increase their earnings through higher price realisation and reduction in wastages.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was conducted in Kikuyu District, Kiambu County in Central Province of Kenya (Appendix B). The district is new having been carved from Kiambu West District. It is a peri-urban area and borders Kiambu District to the North, Kiambaa district to the North East, Nairobi to the South East and Kajiado District to the South West. The district is 236.4 km^2 of which 18,447 hectares is arable. The district has 50,196 farm families out of a population of 263,112, that is, about 19%. It is divided into 4 administrative divisions, namely Kikuyu, Kabete, Karai, and Kinoo. The major agricultural activities undertaken intensively by farmers in the district are: commercial horticulture, dairying, poultry keeping, field cropping, mushroom and greenhouse farming. (Kikuyu District Agriculture Report, 2010)

3.2 Study Design

The study adopted both quantitative and qualitative research approaches in identifying the potential of mobile phone usage in agricultural information dissemination. The study focused mainly on small holder farmers who own mobile phones.Consequently, the research was designed to achieve the objectives set out. The study explored the problem using simple descriptive research which uses observation and surveys (Creswell, 1994). Thus the study design was used to obtain first hand data from the respondents so as to formulate rational and sound conclusions and recommendations.

3.3 Population and Sampling

The sample of famers to be interviewed for the purpose of this study was derived through purposive sampling method. A population of 16,942 small scale farmers in the target district was identified through the assistance of the Ministry of Agriculture, Kikuyu District Extension Office. Due to resource restrictions of time and money, homogenous sampling, a form of purposive sampling which is done to attain a smaller group of respondents with similar characteristics, was done. In this case, small scale farmers who have and use mobile phones in their daily farming activities. A final 96 farmers were selected to be interviewed from the agricultural units of Karai, Kabete, Kinoo and Kikuyu divisions; namely: Wangige, Kinoo, Ruku, Kirangari, Nachu, Gikambura, Nderi, Karura, Thogoto, Lusingeti, Kabete, Nyathuna, Kamuguga, Gathiga, Karai, Kikuyu, Lower Kabete and Karinde.

3.4 Data Collection

A structured questionnaire (Appendix A) was used as the survey tool for the study. This was pre- tested and comments and/ or suggested changes were collected. They provided a basis for the revision of the construct measures and modification of the wording and item sequence. The survey was conducted for three weeks in the month of June 2011 and comprised individual interviews with the 96 farmers. Secondary literature related to mobile telephony in agriculture in developing countries were also collected from a variety of university libraries and internet and were used as sources of information in the study.

3.5 Data Analysis

The data was entered in MS Excel and analyzed in SPSS (Statistical Package for Social Studies).

CHAPTER FOUR

RESULTS

4.1 Demographic Characteristics

4.1.1 Education Background

The study determined the education background of the respondents so as to know their literacy levels in the context of mobile phone use in the dissemination and use of agricultural information. All the respondents interviewed had attained basic education with majority (60.4%) or 58 respondents having secondary education. 12.5% of the respondents had primary education, 25% had tertiary education while 2.1% had reached university level of education. Figure 4.1 summarizes the findings.

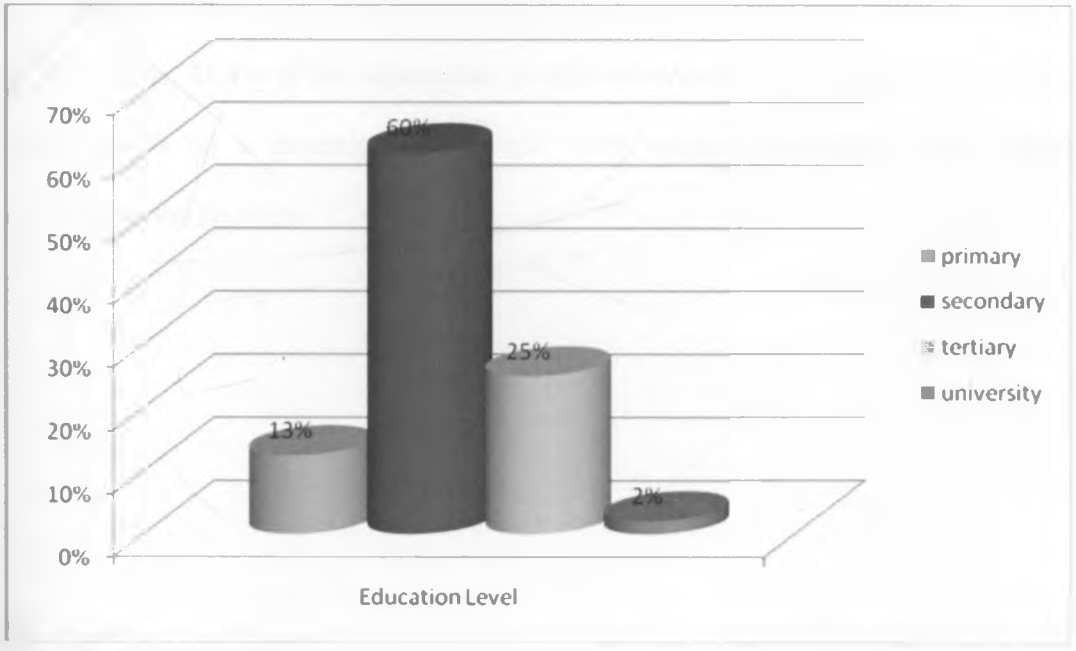

Figure 4.1: Education levels of the respondents

4.1.2 Age

The age range of the respondents was found to lie between 28 and 78 years ($\bar{x} = 47 \pm 11$). Thirty three percent fell in the range of 31 to 40, 28.1% between 41 and 50, 20.8% between 51 and 60, and 12.5% between 61 and 70 years of age. Age groups 21 to 30 years and 71 to 80 years had the lowest number of respondents at 3 and 2 respectively.

4.2 Use of Mobile Phones for Agricultural Purpose

On the question of whether respondents used mobile phones for agricultural purpose,100% of the respondents indicated that they used mobile phones for agricultural purpose besides other purposes.

4.3 Frequency of Seeking Agricultural Information using Mobile Phones

Respondents were asked how frequently they sought agricultural information using the mobile phone. 44.8% of the respondents sought information seasonally, 28.1% on a weekly basis, 21.9% on a monthly basis, while 5.2% sought information daily. Figure 4.2 summarizes the findings.

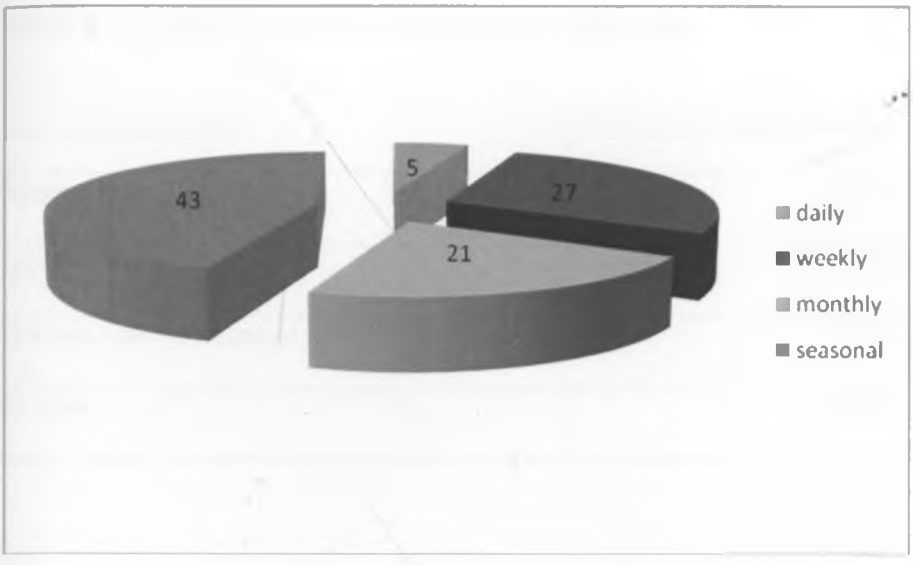

Figure 4.2: Frequency of information sought by actual number of respondents

4.4 Type of Information Valued Most by the Respondents

Respondents indicated that they had a wide range of information needs which varied with the enterprises they had. The type of information the respondents sought using mobile phones was categorised and found to vary by the percentages presented in Table 4.1. The study found that management information, especially best practices for production was highest sought followed by information on inputs such as cost, type and availability of inputs, information on disease and pest control, and the last in order being information on markets (Table 4.1). Low market information can be explained by the contiguity of the study area to Nairobi.

Table 4.1: Type of Information Sought by respondents

Type of information	Percent of respondents
Management	40.3
Inputs	25.5
Disease and Pest control	17.4
Market	16.8

4.5 Sources of Agricultural Information through the Mobile Phone

The survey also investigated what sources of agricultural information they have access to. The respondents indicated they have various sources of information namely agro-dealers, brokers, other progressive farmers, markets, government extension service providers, veterinary personnel, milk processors, and non- governmental organisations (Table 4.2). Findings show that government supported extension is still of main importance, agro-dealers rank second, and veterinary personnel third. The other 10% are as shown in Table 4.2.

Table 4.2: Sources of agricultural information

Source	Percent of respondents' response	Information Provided
Government extension service providers	39.2	Management
Agro-dealers	27	Inputs
Veterinary personnel	20.6	Disease control and treatment
Other progressive farmers	6.3	Management
Markets	3.7	Commodity prices and market outlets
Brokers	1.6	Marketing
Non-governmental organisations	1.1	Management and market
Milk processors	0.5	Management, milk and input prices

4.6 Mobile Phone-based Agricultural Information Services

On the question of whether the respondents used any mobile phone-based agricultural information service such as Sokoni, Kenya Farmer Helpline and Kilimo Salama Plus-to seek agricultural information-all of the respondents indicated they did not seek agricultural information from any mobile phone-based service.

4.7 Timeliness of Agricultural Information through the Mobile Phone

Respondents were asked to rate timeliness of information from the source of agricultural information through the mobile phone, that is, when information is made available to enable decision making. In this study, poor denotes receiving information after 12 hours or more; average is when information was made available within 3 hours; good is when information was made available within 1 hour; very good is when information was made available within 30 minutes; and excellent is when information was made available instantly. 29% of the respondents rated timeliness of information as average, 48% rated it as good, 20% rated it as very good, and 3% rated it as excellent, or instant. No respondent rated timeliness of information as poor. Figure 4.3 summarizes these findings.

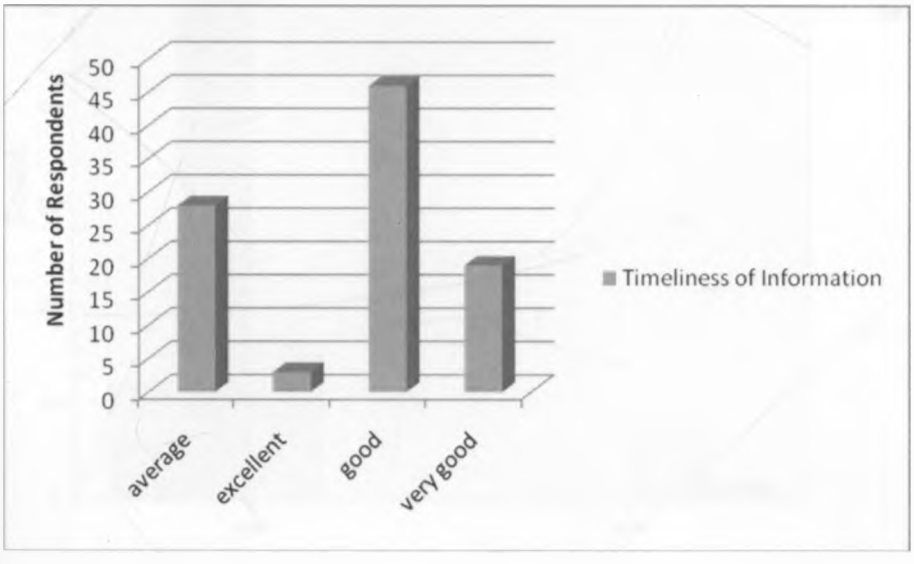

Figure 4.3: Timeliness of Agricultural Information

4.8 Voice versus SMS

The respondents were also asked how they preferred to source or receive agricultural information through the mobile phone. 90% respondents indicated that they preferred calls or

voice service for sourcing or receiving information while 10% respondents preferred using short messaging service (SMS).

From the findings of respondents' education levels and their calls versus SMS preference, more analysis was done on the relationship between the two. The results showed that respondents with primary and secondary education levels preferred to receive or source agricultural information by calling, while respondents with tertiary and university education preferred using SMS. Figure 4.4 summarizes these findings.

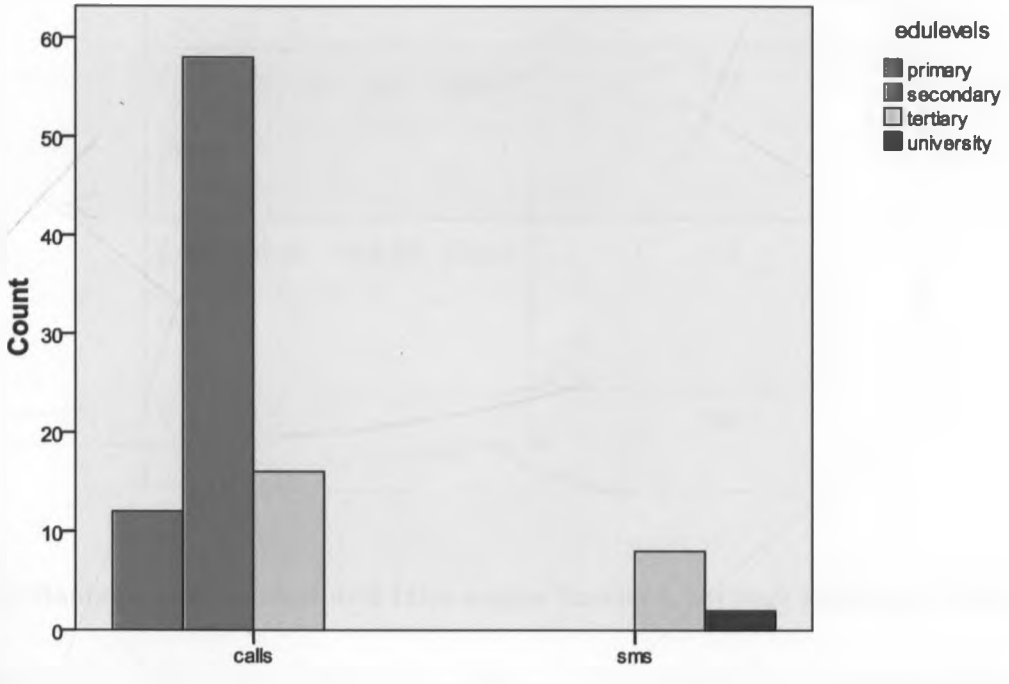

Figure 4.4: SMS versus Calls and Education levels

4.9 Value for Money from Mobile Phone Use

Respondents were asked whether they got value for the money they used to get agricultural information using mobile phones. All of the respondents indicated that they got money value by using mobile phones to get agricultural information. However, 74% respondents indicated that they would continue using mobile phone to source or receive agricultural information even when the cost of the service is doubled while 26% respondents indicated they would discontinue using the mobile phone. Table 4.3 presents the findings.

Table 4.3: Doubling cost of mobile phone service

Response	Frequency of respondents
Continue to use mobile phones	71
Discontinue mobile phone use	25
Total	96

4.10 Making Use of Agricultural Information Received Through the Mobile Phone

Respondents were asked whether they made use of information they received through the mobile phone. All 96 respondents indicated that they made use of information that they received through the mobile phone. Specifically, the respondents indicated that mobile phones helped them get connected to markets, adopt better agricultural practices, increase farm income and reduce wastage. In other words, it was obvious that cell phone's agro-information communication and management has a socio-economic value in the study.

4.11 Other Agricultural Information Needed through Mobile Phones

Respondents were asked whether they needed other agricultural information other than what they received through mobile phones. Top and bottom of the list are the following: 36.5% of the respondents indicated that they required up-dated agricultural information, especially on new technologies; secondly, 20.8% of the respondents indicated they required more information on the markets especially commodity prices; thirdly, 7.3% of the respondents wanted to practically see and have face-to-face interactions with the source of information in field days, agricultural shows, demonstrations and field visits. On the bottom of the list, 3.1% of the respondents indicated that they needed information on disease control and treatment for both livestock and crops, another 3.1% of the respondents wanted information on credit facilities, 1% needed information on weather patterns, 1% wanted to know how to deal with wildlife menace, and still another 1% needed information on soil testing and analysis. 26% of the respondents felt that the agricultural information they received through mobile phones was adequate, therefore needed no extra information. Figure 4.5 summarizes the findings.

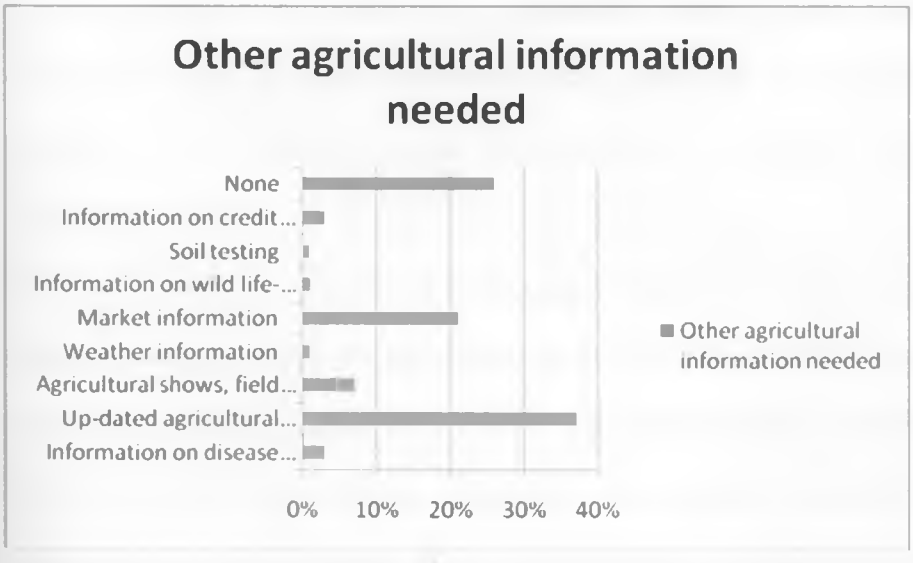

Figure 4.5: Other Agricultural Information Needed

CHAPTER FIVE

DISCUSSION

The results of the study indicated that the most frequent age group engaged in farming and who used mobile phones for agricultural purpose, was between the ages of 31- 40 years. These are individuals who are most active, at the peak of their working life and regarded farming as a job. Also, they possibly have children in school and other demands. All respondents in the study had basic education, while most had attained secondary education. This is a moderate literacy level which contrasts the participants' general preference for calls rather than SMS.

The SMS feature that makes mobile phones affordable was hardly used by participants, however, those using SMS were found to have higher levels of schooling than individuals not using SMS. Text messaging provides better information-accessibility than voice service since the information remains stored in the mobile phone and can be accessed any time. Stored information in an SMS is much easier to understand, follow and share with other farmers than a voice, which is often missed. Mere ownership of mobile phones without the ability or opportunity to use the SMS option makes this technology still largely inaccessible and expensive for the illiterate farmers. This evaluation is similar to the one obtained by Tenhunen, S. (2008).

While all respondents reported that they used their mobile phones primarily for social purposes, they also used it for agricultural activity, with some respondents citing significant productivity gains as a result. Respondents also reported benefits from being able to make and receive calls while working on the farm. This included the ability to describe plant diseases from the field to experts and to co-ordinate better with their hired labour.

Most participants in the study sought agricultural information through mobile phones seasonally or whenever a need arises. Most agricultural activities are seasonal, ,which would explain why farmers usually seek information on a seasonal-basis. Of the range of information valued by the respondents while using mobile phones, it was found that they prioritised management information, inputs, disease and pest control, and market information as the most important. Management information is valuable to farmers in deciding the best production practices, crop and animal choices and new crop varieties and animal breeds.

Most respondents in the study acknowledged that they needed other agricultural information that they did not receive through the mobile phone such as, weather and credit facilities. The source of this type of information required farmers to physically make visits. Agricultural shows, field days and demonstrations were other sources of information that respondents cited as inaccessible through the use of mobile phones but which required face-to-face communication. Weather information is particularly crucial for most of farmers especially those who lack access to irrigation and consequently, are highly dependent on rainfall and weather conditions for the success of their crop.

Most respondents acknowledged that they sought agricultural information using mobile phones from government extension service providers. This is an indication of the trust that farmers have placed in this source, probably due to its integrity, ability, credibility and reliability to provide accurate, timely, free and updated information. It could also be that this source is the only known by many people. Agro-dealers and veterinary personnel were other important sources of information for the respondents. Livestock farmers rely heavily on information provided by the veterinarian especially on disease control and treatment and also on artificial insemination (A.I.). Agro-dealers provide information mainly on input prices, application and availability.

All respondents in the study acknowledged that they have never used and therefore, are not aware of any mobile phone-based agricultural service. This suggests that mobile-enabled agricultural information providers have not done awareness campaigns for their services and are, therefore, not effective means to meet farmers' information needs. For instance, farmers did not know they can access information on recommended seed varieties and stockists through mobile phones by sending an SMS.

While the timeliness of information access via mobile phone, whether as a phone or an information platform, is ultimately dependent on the information source, the study did find that there was a perception that timely information was available because of mobile phone access. Where farmers took longer to access information in order to make a decision, the source may not have responded as a result of being committed to other activities or did not respect the enquirer or lacked answers or forgot to get back. Timeliness of information is therefore important for making decisions and for solving problems on the farm, while lack of it at the right time can be disastrous.

Respondents acknowledged that mobile phones can improve access to and use of information about agricultural technologies, thereby potentially improving their learning. Farmers have information needs at various stages and on various topics for the agricultural production process. Traditionally, farmers in developing countries have obtained such information from personal visits, radio and to a lesser extent, landlines and newspapers. Mobile phones, by contrast, can reduce costs of obtaining this information, thereby increasing farmers' access and use of information. Mobile phones could also potentially strengthen the link between farmers, extension agents and research centres, and vice versa, thereby overcoming criticism of the disconnect between the three in Kenya.

CHAPTER SIX

CONCLUSION

The research questions in this study focused on the way in which farmers in Kikuyu District of Kenya make use of the mobile phones to meet their information needs. The global trend in mobile phone technology development presents benefits to the farmers in terms of agricultural productivity. The study established that as a telephonic device, the mobile phone enables access to information sources that may not otherwise be reachable or that may be costly to seek out, analyse and integrate into existing farm-specific knowledge. As an information platform to receive text messages, voice messages and voice calls, mobile phones also provide the ability to get connected to new knowledge and information sources not previously available with the possibility of real-time, highly tailored information delivery.

The study also indicated that in terms of agricultural production, management, inputs, disease/pest control and market are the most telecommunicated information. The study established that farmers are not fully informed about the existing mobile-enabled agricultural information services and the various facilities under these services. Creating awareness among farmers regarding the range of services provided may help the service providers to reap the full potential benefits of mobile phones to disseminate information. From the results of the study it was apparent that farmers were faced with constraints that prevented them from fully leveraging the information they received through the mobile phones. The constraints included issues regarding the availability of critical products and services including seeds, fertilisers, drugs/chemicals and credit.

The study established that text messaging, a cheap feature of the mobile phone, was not readily accessible to most of the participants owing largely to low literacy capacities and a cultural preference for verbal communication, even though it offers significant advantage over voice-based service in terms of convenience and content flexibility. Information disseminated using the local language was preferred for it is easy to understand. Most of the farmers in the study were prepared to pay for information through mobile phones as long as they felt that they would get the information they wanted in a timely and reliable manner.

The most common benefit of mobile telephony found in the study was derived from the use of mobile phones as a basic communication device. As mobile penetration continues to increase among the farming communities and information services continue to adapt and proliferate, scope exists for a much greater agricultural productivity impact in future, but achieving the full productivity potential will depend on reducing other constraints, which limit the use of information farmers can obtain from their mobile phones. For instance, mobile phone operators in Kenya have developed a variety of mobile services and applications, such as mobile money transfers, for example M-PESA, and insurance. These applications can facilitate the delivery of other services to farmers such as credit or savings via m-banking services, and agricultural insurance, which can overcome some of the constraints that constrain technology adoption.

The quantitative and qualitative nature of the study which involved in-depth interviews was important in opening eyes to the various issues facing farmers. For instance, qualitative method derived information about an issue usually taken for granted: the daily struggle of the farmers just to provide the necessities of life, which they do because that is the way they have always lived. The additional challenge or blessing caused by access to mobile phones has thus blended into the farmers' daily routine of various struggles.

The study clearly established that leveraging the portability, flexible content delivery capability and two-way communication characteristic of mobile phones to deliver low-cost but highly customised information should be important to smallholder farmers in order to derive the potential value of mobile telephony.

Of interest to note is that respondents did not indicate universities as sources of agricultural information. An explanation to this is probably due to their inaccessibility to farmers, and whether universities seem closed-up to the ordinary public, unless one is a student, worker or collaborator with the particular university. It would be interesting and informative to understand the reasons behind this through further study

It is hoped that this study will prove informative and relevant to researchers and policy makers seeking ways to better serve Kenya's smallholder farmers.

CHAPTER SEVEN

RECOMMENDATIONS

- The mobile phone should be used as a management tool in addition to being a communication tool. Farmers should buy mobile phones that work for them. Today's mobile phone has applications that can facilitate farmers to manage farming activities efficiently and effectively. One application involves the use of camera phones to photograph crop/livestock diseases/pest infestations and send them to experts immediately for intervention, and also to document trainings or use loudspeaker function to permit a group of farmers to consult with experts. This visual information can improve diagnosis and advice. Having access to the internet through mobile phones is another application that farmers can take advantage of to source timely, reliable and updated information. This aspect must also be built into the agricultural extension training and government decisions such as those of the Agricultural Sector Development Strategy.

- The study results suggest that applications of mobile phones for agricultural purposes should emphasize voice-based communication and user interfaces that can be used by those with low literacy. In addition, incorporating mobile phone training, in particular SMS training, into agriculture training sessions is recommended. By providing this training, individuals will be better equipped to utilize the mobile phone for a greater spectrum of productive uses.

- The SMS platform can also be used for alerts, targeted to provide farmers with specific information, thereby creating demand. They can also be used as precedents for extension service translation and for detailing and education for those inquiring.

- Mobile-enabled agricultural information service providers should aggressively advertise their services to farmers so as to provide updated information and advisory services. Kenya has some unique underutilized agricultural information applications such as M-Farm - which allows farmers to group together through their mobile phones to offer exporters and big retailers large quantities of produce – and Kilimo Salama – a UAP insurance product that enables farmers to insure their produce against adverse weather conditions.

- Constraints that limit the full potential benefits of mobile phone use in agriculture may require policy changes for intervention by the area of agricultural information and communication management. Also, increased extension services and capacity-building efforts can complement information dissemination via mobile phones and associated services to accelerate the adoption of new techniques. Additionally, information through mobile phones will need to be supplemented by a range of other activities such as demonstrations and broader communication efforts.

- In order for Kenya to realize Vision 2030 and the Agricultural Sector Development Strategy, she must be able to feed herself. Mobile phones should be an integral part of Kenya's Vision 2030 plan, which aims to improve economic, political and social development.

- There is need for a centralized information centre that synchronizes all agriculture-related information for easy access/ transmission to the farmers.

- It would also be prudent to evaluate the possibility of using the Unstructured Supplementary Service Data (USSD) technology in enhancing access to agricultural information by small scale farmers. The simplicity of this protocol as seen in some of its other uses such as in checking airtime balance on local networks means that it could be a useful and simple platform for hosting and accessing this information, in a way that would be easy for most rural farmers.

- Further research on the impact of and a more rigorous assessment of the benefits of mobile telephony with a much larger sample size is necessary to help provide policy inputs.

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APPENDICES

Appendix A: Questionnaire

The Potential Of Mobile Phone Usage In Agricultural Information Dissemination

Questionnaire No.....

Date.....

PART A: General Statistics- Know the Farmer

Name.....

Location .....

Age.....

Education background 1. None 2. Primary 3. Secondary 4. Tertiary institutions 5. University

Crops grown/Livestock kept

Crop/Livestock products Marketable as surplus

PART B: Mobile Phone Use for Agricultural Information

Q 1. Do you use the mobile phone for agricultural purpose? **Yes** **No**

Q 2. How frequently do you seek agricultural information using the mobile phone?

Daily **Weekly** **Monthly** **Seasonal**

Q 3. What type of agricultural information do you seek using the mobile phone?

Q 4. From which source do you seek agricultural information using the mobile phone?

Q 5. Do you seek agricultural information from mobile-phone based agricultural information services? **Yes** **No**

Q 6. How would you rate the quality of agricultural information provided by the mobile phone?

1. Poor; 2. Average; 3. Good 4. Very Good; 5. Excellent

Q 7. How would you rate the timeliness of the agricultural information provided using the mobile phone?

1. Poor; 2. Average; 3. Good 4. Very Good; 5. Excellent

Q 8. How do you prefer to source for or receive the information? **SMS** **CALLS**

Q 9. In addition to the mobile phone, what other information channels do you use for agricultural information?

Q 10. Are the information channels in Q9 better than the mobile phone? Why?

Q 11. Do you feel you get value for money from the mobile phone use? **Yes** **No**

Q 12. If the cost of the service is doubled, would you continue with it? **Yes** **No**

Q 13. Have you made use of the information received through the mobile phone service? If yes, how specifically? If no, why not?

Q 14. What other agricultural information do you need that you are currently not getting (or not getting with sufficient quality or timeliness) through the mobile phone?

Q 15. Do you ever share the information you receive with other farmers who are not users of mobile phones? **Yes** **No**

Rank them as **1: Not at all;** **2: Slightly;** **3 A lot;** **4 Manifold**

Q 16. Has the mobile phone helped you to

a). get connected to markets

b). to adopt better agricultural practices

c). increase farm income

e). reduce wastage?

Appendix B: Map of Kikuyu District