THE USE OF A MOBILE PHONE AS AN AID TO THE GROWTH OF AGRICULTURE IN UGANDA

A CASE STUDY:

LOGOBA VILLAGE IN MOYO DISTRICT

BY

ATIMAKU HARRIET

BBC/31896/102/DU

atimakuah@gmail.com

A RESEARCH REPORT SUBMITTED TO COLLEGE OF ECONOMICS AND MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF BUSINESS COMPUTING OF KAMPALA INTERNATIONAL UNIVERSITY

AUGUST, 2013

DECLARATION

I, **Atimaku Harriet,** hereby declare to the best of my knowledge that the work presented here is my original copy and has never been submitted for any award to any University or Institution of higher learning.

Signed..... Date. 23/05/2013

Atimaku Harriet

APPROVAL

This research entitled "the use of a mobile phone as an aid d to the growth of agriculture in rural areas: a case study of Logaoba village in Moyo district" submitted by Atimaku Harriet in partial fulfillment of the requirements for the Award of Bachelors Degree in Business Computing in Kampala International University has been examined and recommended for acceptance and approval

Signed..... Date.....27/08/2013.

Supervisor: **Dr. Tom Mulegi**

School of Business and Management

Kampala International University

ACKNOWLEDGEMENT

Any project like this is always a team effort. There is no way I could pay back many people who have actually encouraged and assisted me in my contuing quest to make things more effective. In doing so, I would like to extend my most profound thanks to people who helped me to this craft this research paper.

Am very much grateful to the department of agriculture in Moyo district for their support in availing me with the necessary support.

To the respondents for honestly cooperating with me

To the continuing assistance of my friends and colleagues especiallyMr. Toorach Henry, Mr. Okao Charles, and Mr. Ogwal Robine for being with me through the time frame.

I am with great joy indebted to Dr. Mulegi Tom; my supervisor for the painstaking effort of checking this paper.

I would like to dedicate this research paper to my family especially my Uncle Lt Col. Abdullah Adebasiku , my mother Mrs Margaret Assa for their continued support and encouragement for the writing , Moyo district, for giving me an opportunity to attend University education through the Kampala International University Bursury Scheme, and Mr. Tamanini Thomas.

And finally to God, Almighty, the Beginning and the End, for the talents, ideas and wisdom bestowed upon me in the formulation of this paper.

TABLE OF CONTENTS

List of Figures

List of Tables

ABSTRACT

Mobile phone emerges as a great tool to enhance the system of transfer of information in agriculture, so an effort in this study has been made to enumerate the uses of mobile phones in growth of agriculuture in Logoba village in Moyo district which is based on combination of ICTD and diffusion theories to understand mobile phone adoption in a holistic manner. In doing so, the presented findings provide insight into why individuals within resource-constrained environments can adopt mobile phones, and what barriers and opportunities appear in the diffusion process.

50 respondents; 39 farmers, 9 local councilors, 1 agriculutural extension worker, and 1 local council chairman selected through simple random sampling technique and purposive sampling technique were contacted for interview, data collected were summarize, coded before being analyzed using a Statistical Package for Social Science (SPSS). Primary data was also collected to know the opinion and preferences of farmers towards the use of mobile phones in agriculture.

The study found that, mobile phone technology acceptance to rural Logoba village was high enough for one to accompany it with a predictable positive economic impact. In terms of access to agricultural information through mobile phones, it was evident that, people in the study area capture the advantages of increased number of mobile phone to access information related to their farming business. Data shows that farmers preferred information on marketing most. According to farmers, Private agencies such as NGOs and farmers cooperatives are the most credible source of information while governmental agencies are least. Majority of the farmers preferred SMS as the best way of providing information as they can read and save it for its future use. Most of respondents valued mobile phones as easy, fast and convenient way of communicating agricultural information. Factors that influenced mobile phone use in communicating agricultural information included mobile phone ownership, type of agricultural information to be communicated, farming system practiced, network coverage, and respondents' socio-economic characteristics. On the other hand, lack of electricity, poverty and lack of knowledge limited respondents' mobile phone ownership and use.

Based on the conclusions, the researcher recommended that the government, NGOs and other development agencies should introduce public phone booths especially in rural areas through which farmers could be capable to communicate agricultural information, government should

provide the subsidized phones to the farmers with necessary functions and also provide facility of free/subsidized agricultural messages should be provided to the farmers since from thee report, farmers rated SMS high as a way of delievering information

CHAPTER ONE
THE INTRODUCTION

1.0 Introduction

This study examined the use of mobile phone as an aid to agriculture growth among farmers in Logoba village- Moyo district, Uganda, where 56% of farm households now have a mobile phone (An annual report on agriculuture in Moyo district, 2010, Pg 7). In the study, 50 farmers were interviewed and data collected to know the opinion and preferences of farmers towards the use of mobile phones in agriculture.

1.1 The background

As an affordable and accessible means of communication, rural communities are realizing the potential of mobile phone to create economic opportunities and strengthen social networks. And since Agriculture, the backbone of Uganda provides principal means of livelihood for over 80% of Uganda's total population (CIA, 2009); quick and adequate measures need to be implemented to ensure a better extension and mass communication system to support the rural farmers. Mobile phone as one of the forms of ICT emerges as a great tool to enhance the system of transfer of information in agriculture in a developing countries, i.e Uganda.

A mobile phone by definition is a device that can make and receive telephone calls over a radio link while moving around a wide geographic area. It does so by connecting to a cellular network provided by a mobile phone operator, allowing access to the public telephone network. Modern mobile phones also support a wide variety of other services such as text messaging, MMS, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming and photography.

Mobile phones are but one form of ICT. Personal computers, laptops, the Internet, television, radio, and traditional newspapers are all used to promote improved rural development. The most obvious answer as to why I the researcher chose mobile phone is the sheer scale of adoption. In the ten years before 2009, mobile phone penetration rose from 12 percent of the global population to nearly 77 percent. (Figure2) A series of innovations drove this adoption, especially in developing countries, which had 73 percent of the world's mobile phones in 2010. In Africa, 650 million people use mobile phones out of the 1 billion Africans. Technology in Africa is foremost about solving problems rather than sharing social trivia, about survival rather than entertainment – although these are flourishing too. In their various

designs and capabilities, mobile phones are cheap, easy to carry and use that's why it can be owned by the poor and rich alike thus it growth in the rural parts of Uganda.

Uganda has more than 17 million phones, close to 60% of the population, own a mobile phone. (Figure2) The mobile phone is doing more than revolutionizing communication for a Ugandan. Mobile phone use in Uganda is on rise in 2008, there were 168,500 main telephone lines in use in Uganda, making; Uganda one-hundred and twenty eighth in terms of countries having the most main telephone lines. In 2008, there were 8.555 million mobile telephones in use, making Uganda sixty eighth in terms of countries having the most mobile telephones in use. This was an increase from 2006 when there were 108,600 main telephone lines in use in Uganda, and from 2007 when there were 4.195 million mobile telephones in use. As of 2011, mobile phone use jumped to 16.697 million making her hold the 52nd position in the whole world in mobile phone use. (CIA, World Fact Book). Like other digital technologies, mobile phones benefit from Moore's law, which states that computational power doubles approximately every two years. The newest smartphones are far more sophisticated than the more affordable models populating poor regions, but those simple phones are still leaps and bounds ahead of devices that were cutting edge a decade ago—and they are entirely relevant to agriculture.

Nowadays, almost 70 per cent of the world's mobile phone subscribers are in the developing world (E-agriculture, 2009). 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.

According to Wei and Zhang (2009) the use of mobile phone offers real benefits to rural residents. In particular, connectivity to the outside world has been made so easy as well as unnecessary commuting to urban centers has been tremendously reduced.
Mobile phone-based services have proliferated in recent years, providing new ways to access price and market information, and coordinate input/output resources including transport and logistics, finance and production techniques (Gakuru, Winters & Stepman, 2009). Successful innovations have been tailored to be market-driven, i.e. provides electronic means to pull data (concerning market prices, buyers, sellers, inventory, transport, etc) and push it back via mobile phone interfaces to thousands of small-holder farmers that are participating in a wide range of produce markets. Personal use of the mobile phone has also enabled rural producers to interact directly with end-user markets, traders, suppliers, extension services and with each

other. Thus, there is a need to understand as to how far the mobile phones are able to address the farmers need so that better solutions can be developed to address them.
Therefore given the increasing ownership of mobile phones in the rural areas, this study identified how mobile phones may be used to facilitate access to information, such as market information, especially for buying and selling, enabling efficient coordination during agricultural emergencies, and enhancing the administration of agricultural-based development activities among farmers.

Agriculture is fundamentally multi-functional (as cited in Wanmali and Islam 2002). More sustainable agricultural system therefore tends to a positive effect on natural, social and human capital and also produces food, fibre, oil etc. In many countries, agriculture accounts for the overwhelming majority of rural employment. And in Uganda particular, over 80% of the population is engaged in agriculture. (CIA, 2009). The manifold benefits that accompany improvements in agricultural productivity are well known: Farmers' incomes rise, food prices fall, and labor is freed for additional employment. In some instances productivity improvements have proven elusive, as climate change and uncertain commodity prices have worsened agrarian conditions for many rural communities. Development practitioners have rightly focused on the difficult situations of many farmers, especially smallholders, who have little room for error and even less protection from social safety nets. Technical innovation, most prominently demonstrated in the Green Revolution, has been key to improving agricultural markets in the developing world. Mobile phones, despite their recent entry into agrarian communities, are already helping those communities improve their agricultural activities.

1.2 Statement of the problem

Foundations such as Grameen foundation and other partners have helped to provide modern farming practices and inclusive technologies in some parts of rural Uganda to foster rural growth. Wireless communication networks and GIS-based agro-software technology have reached rural Uganda giving them access to vital and updated information on weather, farming technologies, latest technical know-how, commodity prices, market trends, international trade, and etc. but Logoba village has not had this opportunity thus this study examine how mobile phones which are the highest and readily available form of ICT in the village can be used to boost agriculutural growth by critically analyzing the existing constraints and opportunities inorder to establish whether or not these can be translated into socio-ecnonomic aspects of developments to the rural farmers.

1.3 The purpose of the study

The purpose of the study investigated the use of a mobile phone as an aid to the growth of agriculture in rural area- Logoba village where the individuals who are handicapped interms of resources can adopt mobile phone usage in agriculutur.

1.4 Specific Objectives of the Study

a. To identify the information farmers can send and or receive using mobile phones
b. To ascertain how farmers can use the information acquired
c. To verify how the farmers can generate income from the use of the use of a mobile phone

1.5 Research questions

1. What type of information can famers access through using a mobile phone?
2. How does a mobile phone enable a farmer use the acquired information in agriculture?
3. How can the use of a mobile phone in agriculture increase a farmer's income?

1.6 Scope of the Study

1.6.1 Geographical Scope

The study was carried out in Logoba village in Moyo district. Moyo District is bordered by South Sudan to the north and east, Adjumani District to the south, across the waters of the White Nile, and Yumbe District to the west. The district headquarters at Moyo, are located approximately 455 kilometres (283 mi), by road, northwest of Kampala, with a projected population of 253,200 people by 2010. The village is located in moyo Sub County; it has a population of relatively 4,086 people. Like in most other Ugandan districts, agriculture forms the backbone of the district economy. Over 90% of the district population are involved in agricultural activities,(Moyo district Local Government, 2010, pg 9) with 86.6% of the population involved in some form of subsistence production. Most agricultural production is for household consumption. Some of the agricultural produce is sold, particularly maize, cassava and simsim. The main crops grown in the district include: Sweet potatoes, Sorghum, Cassava, Simsim, Groundnuts, Millet, Maize, Peas, Beans. The Nile River is the main source of fish within the district. Some cattle, goats and chicken are kept, mostly on a subsistence level. Bee keeping, for honey production, is gaining popularity in the district.

1.6.2 Time Scope

This study covered ten months from June 2012 to April 2013. This time range was enough for our study to make a fair assessment on how on how the use of a mobile phone can boost agriculture in the region.

1.6.3 Subject Scope

This study mainly centered on how using a mobile phone can boost agriculture and further highlighted the types of information needed by the farmers and layed down strategies on how to achieve the listed objectives. The specific areas of concern were on using a mobile phone to acess and easen market for food products, enabling efficient coordination during agricultural emergencies and enhancing the administration of agricututural- based development activities among farmers

1.7 Significance of the Study

- The research study is very important because it is among other things that are required from me in order to be awarded a bachelor degree of Kampala international university.
- This research paper will be beneficial to the rural as whole since they are also partners in the fight against poverty in the communities in which they operate in as a way of improving people's standards of living.
- This research study will also in one way or the other be beneficial to the government as poverty eradication is one among other goals of the government in improving rural people's well-being through agriculture so this study will come up with recommendations and suggestions on how to improve agriculture in Logoba village found in Moyo district which is amongst the poorest districts in the country.
- The study will also be helpful to academicians who may also conduct further research on the same subject.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

Numerous studies by academician and researchers have documented the capability of mobile phones to aid in agricultural growth in rural areas, (Donner, 2006; Hudson, 2006; Saunders et al., 1994, etc). The researcher's interest, therefore, was to identify literature gaps and builds on past findings and ideas that have been proposed by numerous researchers in the field mobile phone use in agriculture that may help the reasearcher understand the in depth of the problem under investigation. This related literature was guided by objectives of the study, and the research questions.

2.1 Theoretical Framework

There are two theory-building areas to which the researcher hopes this research will contribute. The information and communication technologies for development (ICTD) theory and diffusion theory are the two theoretical dimension used. This study used a combination of ICTD and diffusion theory to understand mobile phone adoption in a holistic manner. In doing so, the presented findings provide insight into why individuals within resource-constrained environments can adopt mobile phones, and what barriers and opportunities appear in the diffusion process

2.1.1 Information and Communication

The intentional use of communication to foster development is not new. So-called Development Communication research during the 1960s and 1970s set the ground for most existing development programs and institutions in the field of ICT4D, with Wilbur Schramm, Nora C. Quebral and Everett Rogers being influential figures in this academic discipline. As information and communication technologies evolve, so does ICT4D: more recently it has been suggested that Big Data can be used as an important ICT tool for development and that it represent a natural evolution of the ICT4D paradigm.

Technologies for Development (ICTD) Researchers studying ICTD often argue that ICTs have the potential to aid in rural development and poverty reduction (Donner, 2008; Duncombe & Heeks, 2002; Hudson, 2006; Saunders et al., 1994). Past investigations of the perceived attributes of mobile phones within developing countries have focused on their ability to encourage efficient and informed action, leading to greater productivity over current practice (Hudson, 2006; Saunders et al., 1994). Researchers (Albu & Scott, 2001; McNamara,

2003) stress that mobile telephony can be an asset for development by enabling the rural poor to respond more efficiently to external economic opportunities or threats through an increase in access to information.

Scholars argue that mobile phones improve the productivity of individuals and organizations within resource-constrained environments due to increased *efficiency, effectiveness,* and *reach* (Burrell, 2008; Hudson, 2006; Saunders et al., 1994). Research has expanded the efficient and productive uses of the mobile phone to include the following: 1) obtaining information advantage for sound decision making (e.g., dissemination and retrieval of market information, especially for buying and selling); 2) conducting a coordination function (e.g., coordination of transportation, especially during emergencies); and 3) networking and taking advantage of social capital (e.g., agricultural specialists and veterinarians can readily exchange information to improve crop yields and livestock production) (Hudson, 1997; Saunders et al., 1994).

2.1.2 Diffusion Theory

The diffusion of innovations approach, as outlined by Rogers (2003), was used to expand understanding of reasons for adoption, usage patterns, and communication objectives that are and can be met by the mobile phone in a developing country. This includes how and why an innovation is adopted, and especially the unique reinvention of an innovation to the changing needs of the individual (ibid., pp. 180–187). Understanding an innovation's perceived attributes—and especially the perceived relative advantage, the compatibility, and the reinvention of an innovation to the local circumstances— will uncover uses capable of dealing with a greater spectrum of needs (ibid.).

Adoption of a technology may be measured by "both the timing and extent of new technology utilization by individuals" (Sunding & Zilberman 2001, p.229). *Diffusion*, in turn, is defined as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, p.5). The timing of adoption and diffusion can be split into three levels, i.e. the decision process of the farmer whether to adopt or not (or to abandon a technology once adopted), the innovativeness of the farmer in terms of when to adopt in the diffusion process, and the rate at which a technology is adopted in the system (Rogers 2003). The extent of adoption can be measured by intensity of cultivation e.g. in terms of number of farmers, total area, area within farms or harvest (CIMMYT 1993).

Like all technological devices, mobile phones may have a differential impact on people and societies. While much has been written on the global digital divide between rich and poor countries, considerably less is known about the local digital divide within poor countries (Jensen, 2007, p. 881). Rural women, due to low levels of education, high rates of illiteracy, and lack of assets (such as credit and agricultural inputs), constitute the majority of the world's poorest (FAO, 2009). These factors may delay the capabilities of women to use mobile phones for agricultural purposes. Additionally, earlier adopters of innovations tend to be leaders and have more heterogeneous networks (Rogers, 2003, p. 288)

Two main reasons have been identified as to why residents of rural areas adopt ICTs (Korsching, 2001; Sun and Wang, 2005; Akca et al., 2007): (a) ICTs can lead to improved productivity and (b) ICTs can reduce isolation and therefore can eliminate much of the misery of rural living and hardships of rural entrepreneurship

2.2 Accessing agricultural information that farmers send and or receive using mobile phones

2.2.1 Types of information accessed

Historically, the complex information needs of rural producers have been pursued through Ndiwalana et al (2010) identify information gaps outside of the economic sphere that are equally, if not more critical, for farming households. This expands the definition of needs into a more diversified set of livelihood concerns that are important for overcoming the broader social, political, location and environmental-climatic constraints that rural producers face. A similar perspective was taken by Masuki et al (2010) highlighting how differences in the cultural and social make up of different parishes within the same district of Uganda gave rise to different needs for information, as well capabilities to make use of information. These livelihoods perspectives support the view that fostering sustainable rural production involves addressing a wide range of interconnected constraints which may be longstanding and entrenched within the realities of rural life, and reach into broad and diverse development concerns of environmental protection and conservation, gender imbalances, political participation, health and education (Feder, Birner & Anderson, 2011).

Whether information is actionable depends especially upon what capital and what social connections are required to make use of it. Information may also be viewed differently by recipients than by providers. For example, recipients may not view information as a distinct

resource, but as broader advice, the veracity and utility of which, is strongly associated with the source, and most commonly demonstrated through human interaction (Burrell & Matovu, 2008). In this regard, mobile phones are strongly linked in the literature – and in the eyes of users – to maintaining and improving social networks – particularly family and personal ties – due to the greater scope of communication they afford (Sife et al, 2010; Goodman, 2007; Donner, 2007; Souter et al, 2007).

In Logoaba village, agriculture is majorly practiced on small scale basis although some farmers are now embracing it for commercial use. From the study, famers were greatly interested in information such as better price, Input supply, weather information, management practices, etc.

The use of a mobile phone for information gathering, storage and distribution is illustrated in image------below

Figure 1: the agriculture Package in Nokia Life Tools

Source: Nokia

Agricultural inputs

Mobile phone use helps in facilitating access to agricultural technologies and associated inputs. Several of these services enable farmers to purchase agricultural technologies, either bilaterally or collectively, coordinating access to agricultural inputs, including agricultural training, seeds, livestock, and pesticides from local dealers, governmental and nongovernmental agriculture extension agents, and community members. The *CKW* programme in Uganda, for instance, provides a directory of input suppliers, including location and contact information, which farmers can access by contacting a CKW or through an SMS-searchable database. There are also examples of service providing price information on inputs, such as the *National Farmers Information System* in Kenya. For example, in the past, an individual would have paid to travel to a seed dealer, only to find that all seeds had

been sold. Now, the farmer is able to call ahead, determine availability, coordinate a meeting time, and agree on a price before expending time, energy, and money on travel. Coordinating access to agricultural inputs was likely found to be the leading agricultural use of mobile phones, due to the direct impact that access to inputs has on livelihood stability, productivity, and profitability.

A few services have been developed to support access to and use of water and energy. For example, mobile phones are being used to manage irrigation systems. In India, the *Nano Ganesh* device, which was developed by the Indian company Ossian Agro Automation and is being disseminated in collaboration with Tata Teleservices phones, allows farmers to switch water pumps on and off, thus saving them the journey to their fields (Ribeiro 2009). In Nigeria, a mobile phone-enabled irrigation system is also being developed for horticulture farmers (African Science 2012). In other cases, mobile phones are used to pay for water, such as *Grundfos LIFELINK* in Kenya which allows farmers to charge a smartcard via m-payments (M-Pesa) which is then inserted into the water tapping unit.

Mobile phones also facilitate access to electricity, although somewhat indirectly. Mobile network operators have been providing excess power from their base stations to local communities, for instance in Kenya where Safaricom has laid min-grids to supply power for local infrastructure, such as water pumps and lighting (Roach & Ward 2011). Moreover, similar to water services, m-payments have been used to pay for electricity, such as *Shared Solar*, a project of the Modi Research Group at Columbia University, which allows users to credit their electric account via SMS similar to charging prepaid phones (Ulbricht 2011).

Financial services

Among mobile phone-enabled financial services, mobile payment systems are expanding most rapidly in developing countries. These systems are often initiated by mobile network operators which have the necessary communications and distribution network to run the service. More sophisticated services generally require collaboration with local banks (IFC 2011). Use of the mobile phone for monitoring financial transactions includes consulting with lenders on availability and guidelines of financial loans, reminding farm group members to repay loans accountable to the group as a whole, and monitoring domestic and business remittances.

M-services that link money transmission services with bank accounts are still less common, though also expanding. Such services would enable farmers to save money and earn interest on their savings. M-banking service may also be combined with loan services.

Finally, a few organizations are starting to develop mobile phone-enabled insurance schemes. In Kenya, for instance, *Kilimo Salama* was set up by the Syngenta Foundation in collaboration with Safaricom and UAP Insurance to insure crops against extreme weather events. To this end, weather stations linked to a central system monitor rainfall. In case of extreme drought or excess rain, pay-outs are automatically transferred to insured farmers via M-Pesa. The farmers pay an insurance premium of 5% of the retail price of insured inputs which is supplemented by 5% paid by the input suppliers. Another example in Northern Kenya is the *Index-based Livestock Insurance* developed by the International Livestock Research Institute in collaboration with local partners. The scheme – which compensates insured pastoralists in the event of livestock losses due to severe forage scarcity (determined through satellite data) – uses scanner-based mobile phones to register insurance contracts with livestock producers and upload their information in a central database

Market prices

Mobile phones provide information on markets prices for crops and (to a lesser extent) livestock, often as part of a broader information package. Such information might be sent on demand, such as in the case of *M-Farm* where farmers can send an SMS to a searchable database to obtain prices for specific crops. In other cases, farmers receive automatic updates for crop prices via SMS, for instance through *Esoko* in Ghana or *Nokia Life Tools* in India.

Agricultural emergencies

The Use of a mobile phone for agricultural emergency assistance include contacting a veterinarian or agriculture extension agent when livestock are ill or crops are diseased or pest-stricken.

Management practices

Mobile phone are used for consulting with expert advice from nongovernmental and governmental agriculture extension agents, such as the National Agricultural Advisory Services (NAADS). Consultation with expert advice may include using the mobile phone for information on livestock and crop maintenance, appropriate seed and livestock varieties,

timely planting relating to weather predictions, and proper planting and harvesting techniques.

2.2.2 Accessing information

Information is raw material for development for both urban and rural dwellers. Prosperity, progress, and development of any nation depend upon the nation's ability to acquire, produce, access, and use pertinent information. A report on older rural people (2008:3) indicates that, "Access to information and advice is a key resource for local people in maintaining active and independent lives. Access to information is also critical to letting people know their entitlements to welfare benefits and sources of support to overcome social exclusion."

Information is the lifeblood of any society and vital to the activities of both the government and private sectors. Bell (1974:4) holds the view that "the dependence upon information to create innovation and change, places a high premium on the ability of (developing countries) nations to access and use information to create advances in society". The development of countries globally cannot be achieved without the development of the rural community. This is because 75 to 80 percent of the people in developing countries live in the rural areas need positive, relevant and prompts attention in their daily activities.

Information regarding the existence of (new) agricultural technologies is of course a prerequisite for technology adoption. Such information can be obtained from various external sources, such as extension agents, fellow farmers or different media such as mobile phones, TV or radio. (Figure: 4).

Importantly, farmers also require the necessary information to assess the suitability of the technology for their farming system and to understand the potential risks associated with the use of the technology. For instance, farmers may be uncertain about the profitability of the new technology or differences in economic returns between new and old technologies. Such uncertainties may arise due to insufficient knowledge about yields of new technologies, the types and costs of needed inputs, or expected market prices and demand for the produce (Abadi Ghadim & Pannell 1999). Weather conditions and climatic shocks also increase uncertainty and risk, in particular among subsistence farmers who are dependent on rainfall (Kaliba et al. 2000).

Information from *external sources*, such as agricultural extension agents, m-services, radio, TV or newspapers, can play a central role in the assessment of suitability and risk of a technology. A study of maize adoption in Tanzania, for instance, showed that high intensity

of extension services was one of the major factors positively influencing the adoption of improved seeds (Kaliba et al. 2000). Farmers may also gather information through *experimentation* ('learning by doing'). Evidence suggests that imperfect knowledge of the technology as a barrier to adoption decreases with experience (Abadi Ghadim & Pannell 1999; Foster & Rosenzweig 1995).

Alternatively, farmers may also *learn from others* who are already using the new technology. Foster and Rosenzweig (1995) found that farmers with experienced neighbours were more likely to devote more land to new technologies. Vicinity alone may not be sufficient, however. Rather, farmers appear to learn through more limited social networks that are not based only on geographic proximity (Conley & Udry 2001).

2.2.3 How to send or receive the information

Since mobile phone is no longer just an audio communication tool but capable of providing additional integrated functions. The various features of mobile phone, which make it versatile, are:

SMS: The basic form of sending messages between mobile phones is a text message, or SMS, which is a network service available almost everywhere. SMS can be up to 612 characters, and are sent via an SMS centre to the recipient's phone via a signaling path. It is largely used for information based services. SMS has the maximum reach amongst the users, since all the mobile phones support SMS. An added benefit of SMS is that it can still work even in weak cell phone coverage areas where voice would not. One does not have to travel long distances to access the information as is the case with email and internet. The information here is instant.

MMS: Multimedia messages can take longer text, graphics, photos, audio clips, video or any combination of these, with certain size limits. They are not available on all phones, or networks. USSD offers a menu system to make a lot of information Literacy Information and Computer Education Journal (LICEJ), Volume 1, Issue 4, December 2010 available using SMS style technology and functionality and most networks support it.

GPRS: General Packet Radio Service is a technology that enables high speed wireless Internet and other data communications. Using packet switching, subscribers are always connected and always on-line, so services are easy and quick to access.

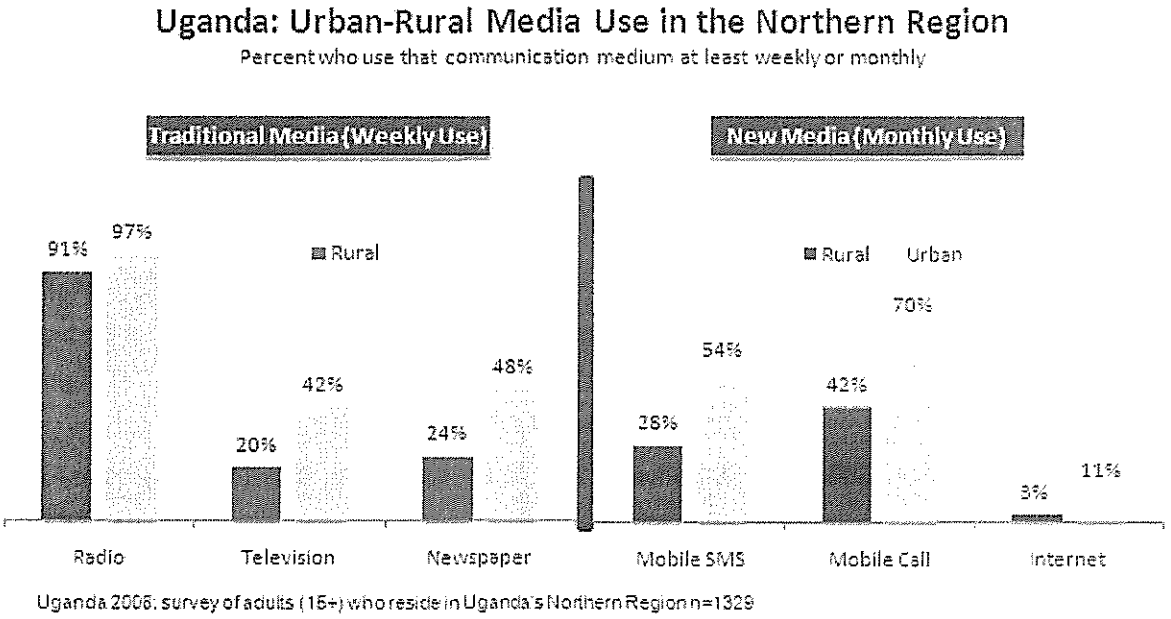
2.2.4 Platform for Service Delivery and Innovation

The numerous capabilities of mobile phones (table 1) provide ample opportunities to deliver traditional and innovative services. Traditional agricultural extension agents are increasingly being outfitted with mobile phones through programs to increase their effectiveness by

networking them to knowledge banks. Extension can reach more clients through mobile-based learning platforms—textual or richer platforms, such as video—that provide tips to farmers to improve agricultural skills and knowledge. The table summarizes types of mobile technologies and their availability

These mobile phone features has aggravated the use and ownership of mobile phones for agricultural use. This has been so because the famers find the phones easy to use, quick and time saving. Although mobile phone use helps a lot in fostering agriculture, each form of mobile communication has its strengths and weaknesses. For example, SMS requires some form of literacy and is limited to 160 characters (although some mobile information interfaces are striving to become more visually intuitive). Data transfer is inexpensive but not available on most phones.

Figure 2: Regional media use



Uganda 2006: survey of adults (15+) who reside in Uganda's Northern Region n=1329

Table 1: mobile phone capabilities

Technology	Description	Availability
Voice	The most basic channel; avoids most literacy or linguistic barriers	Basic phones
Short Message Service (SMS)	Ubiquitous text-based messaging limited to 160 characters	Basic phones
	A protocol used by Global Service for Mobile	

Unstructured Supplementary Service Data (USSD)	Communications (GSM) phones to communicate with the mobile network	Basic phones
Interactive Voice Response (IVR)	Computer programs that respond to the voice input of callers	Basic phones
General Packet Radio Service (GPRS)	Low bandwidth data service	Midrange phones
Software App (e.g., Java or iOS	Preinstalled or downloaded software of varied sophistication	Midrange, but increased sophistication with smartphones
Mobile Wireless Application Protocol (WAP)	A limited manner of browsing the Internet	Midrange phones
Multimedia Messaging Service (MMS)	SMS-based technology to transmit multimedia (including images and video)	Midrange phones
Camera	For capturing still or moving images	Midrange phones
Bluetooth	Protocol for transmitting data over short distances	Midrange phones
Mobile Web	Full-fledged web access	smart phones
Global Positioning System (GPS)	Technology allowing for location-based information	smart phones

2.3 Using the information acquired

2.3.1 How farmers can use the acquired information

Farmers require the necessary knowledge and information to use technologies. Some studies have found the adoption of new technologies to be positively correlated with the farmer's level of education (Feder & Umali 1993). This factor is likely to play a more important role the more complex the technology (CIMMYT 1993). In addition to schooling, farmers also benefit from the skills to use the technology that may be acquired in the course of their life

through learning (Marra et al. 2003). As mentioned above, sources of information and learning can encompass external sources (including m-services), experimentation and learning from others.

Moreover, use of the technologies require additional farm resources, such as labour, machinery, seeds, fertiliser, pesticides, energy, storage facilities and irrigation. Accessing these resources need well-functioning labour and input markets which can be a serious constraint in particular in remote areas. Also, where input demand is seasonal and small-scale, there may not be enough incentive to develop the necessary market infrastructure (Poulton et al. 2006). Collective purchasing of inputs, for instance through farmer organisations facilitated by mobile phones and related services, could help to address these shortcomings by creating economies of scale and reducing transaction costs (Poulton et al. 2006). Moreover, financial resources and services outlined in the previous section will facilitate the procurement of inputs.

The biophysical and agro-climatic environment can also be crucial for the success of new agricultural technologies, such as soil quality, water availability, topography, seasonal temperature changes or the presence of pests or diseases that could damage the crops. Experience has shown that these environmental factors and in particular the availability of and control over water resources are often the most important factors explaining differences in adoption patterns (as reviewed e.g. in Feder & Umali 1993, Barker et al. 1985). M-services are starting to be developed which aim to facilitate access to water, for instance irrigation pumps operated through mobiles or through m-payments for water.

Measures to manage associated constraints and risks can include the use of agricultural inputs, such as fertiliser, pesticides or irrigation systems. Moreover, information related to the production environment can help farmers to adjust their farming practices accordingly. Weather forecasts, for instance, can influence planting times or water usage while information on soil nutrients or disease outbreaks allows farmers to apply appropriate amounts and types of fertilisers and pesticides. Mobile phones and related services play an important role in this regard by facilitating access to information, e.g. on weather or disease outbreaks, as well as access to inputs. Also, as noted above, financial risks can be reduced through insurance schemes.

2.3.2 Factors that enable famers to use a new technology (mobile phone)

The decision by farmers to use a mobile phone is a choice between traditional and new technology. Theoretically, a farmer will adopt a new technology (use the mobile phone) if it offers greater benefits than the old technology. Farmers' decision to adopt a technology or otherwise is especially determined by the profitability of using the new technology and risks associated with it (Aloyce et al., 2000). Once a decision to adopt is made, farmers still face another hurdle which is the degree to which the new technology should be used (i.e., the intensity of use). While many smallholder farmers are turning to the use of new generation ICT tools in agricultural transactions, little is known about the factors driving this behavior. This study therefore tried to analyze and understand the altitude of a famer towards the use of a mobile phone.

Sex/ gender

Specific factors that have led to the recent adoption of mobile phones among women are unclear. According to the Food and Agriculture Organization of the United Nations (FAO), rural women constitute the majority of the world's poorest due to low levels of education, illiteracy, and lack of assets such as credit, agriculture extension training, and agricultural inputs (fao.org, 2009, pp. 6-7). The differences between men and women could be due to socio-economic factors. Diffusion theory states that individuals who are higher in socio-economic status are able to adopt innovations much more quickly than those with lower levels of education and fewer assets (Rogers, 2003, p. 288).

Education level

Education and income are closely related; the more educated a person is, the greater is the likelihood of a high income. Also, more educated people are better able to learn and use new technology and hence they are more likely to be innovative. With respect to farmers, Fuglie and Kascak find that diffusion of new technology among a community is relatively slow due to their low education level. Yet, the Jain and Hundal [23] study on rural India exhibits that a majority of the mobile adopters have average education level.

Incomes

In the study area, the income of the farmers is very low but mobile phone usage and ownership has been significantly spread even with the low income, thus meaning income is not an important factor for the adoption and use of mobile phones in rural Moyo

Individual characteristics

A person who has high self-efficacy achieves compatibility towards adopting a new technology over time by exerting the required efforts. People may even manage to buy a

mobile phone by taking loans from others or by saving money at the cost of sacrificing consumption of other essential goods.

Age

Age is one of the most discussed demographic factors in the technology adoption literature. However, Mallenius [50] suggests that the "keyword should not be age, but rather, functional capacity" which addresses the capacity to use mobile devices and services.

Behavioral intention and Use

Attitude, as a significant factor in the process of adoption, is found in the original studies of TRA (Fishbein & Ajzen, 1975) and TAM (Davis, 1989), but has been excluded from many other studies, even the later versions of TAM. Where social norms and perceived usefulness are strong, a person's innate unfavorable attitude may disappear and behavioral intentions will become more consistent with the social trends in a certain time and context (Kargin & Basoglu, 2007; Stiff & Mongeau, 2003). As subsequent action for adoption is concerned, Sarker (2003) finds continuity of use over time and resource commitment as the two outcomes, while some other studies describe these two as 'actual use' (Renaud & Biljon , 2008; Lu et al., 2007; Biljon & Kotzé , 2007).

Social influence

According to the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975; Qingfei et al. 2008) behavioral intention of a person is influenced by subjective norms which in turn are influenced by the significance of referents' perceptions (or normative beliefs) and motivation to comply with those referents. In addition to neighbors, there are some other sources of influence also evident in the literature, such as relatives, friends, and seniors or influential persons in the community (Wong & Hiew, 2005; Kargin & Basoglu, 2007; Biljon & Kotzé , 2007).

Culture and ethnicity

Considering the impact of culture on human behavior, Phillips et al. [52] argue that cultural affinity has a positive influence on technology adoption through perceived ease of technology use and therefore it is highly correlated with demand for products and services.

Tech-service Attributes

Tech-service attributes (TA) refer to the properties or characteristics of a certain technology, system, or service that distinguish it from other technologies, systems or services. Adesina and Baidu-Forson [9] find that farmers' perceptions of technology characteristics significantly affect their adoption decisions. Dishaw and Strong [30] also argue that users" perceptions about ease of use and usefulness are likely to be developed from rational assessments of the

characteristics of the technology and the tasks for which it could be used. Therefore, the variables related to this (TA) category are: Service Characteristics, Cost of handsets and services, Technology characteristics, Interface, Network Capabilities, Interface characteristics, Brand reputation, Flexible technology (e.g. CDMA or GSM)

Table 2: Farmers' activities and use of mobile phone

Period	Activity
Preparation for farming	• Coordinating labour pool (voluntarily – based, family members and neighbors) • Collect weather information • Investigating seeds prices • Preparing kraal manure for planting (mainly used by the farmers in the area during planting)
Farming period	• Pooling of labour for cultivation and weeding • Organizing manure for use during planting • Collecting and exchanging rain information • Hiring/borrowing farming implements (e.g hand hoes, ox, ploughs, harrows) • Investigating prices for tractors cultivation • Ordering and hiring of oxen cultivation • Collecting information about new types of seeds • Ordering seeds • Investigating labour cost for cultivation and weeding in neighboring villages organizing fertilizer • Collecting information about availability of extension officers and subsidized farm implements from local authorities • Coordinating information and deliveries of pesticides
Harvesting period	• Organizing and pooling labour for harvesting • Arranging for storage equipments and warehouses/stores • Arranging for and ordering of chemicals against mice and "scania"
Post harvesting (marketing and transportation)	• Organizing transport from the farm to the warehouse(tractors or ox trailers) • Calling markets centers, traders, dealers and check prices and stocks of crops before setting deals with middlemen/agents or deciding to travel to obtain better opportunities • Calling for and ordering transportation to markets • Selling crops via mobile phones • Contacting distant relatives/families (for decisions and money transfers) • Money transfer payments

Source: Furuholt and Matotay (2011)

2.4 Generating income from the use of the use of a mobile phone

The proliferation of mobile phones across the globe has impinged on agriculture in various ways. Mobiles are being used to help raise farmers' incomes, making agricultural marketing more efficient, lowering information costs, reducing transport costs, and providing a platform

to deliver services and innovate. Whether the potential of these trends can be realized more widely, especially in rural areas such as Logoba Village and in an equitable way, is uncertain. Every aspect of the technology is changing rapidly; the public sector, private sector, and private citizens are constantly experimenting with new applications for it; and governments are grappling with any number of strategies to ease the digital divide.

Several studies have highlighted the benefits of mobile phone ownership among better-off users. A study of micro-enterprises in Nigeria, for instance, concluded that there were few signs "of mobile telephony levelling the playing field; and more signs that it had been a technology of inequality" (Jagun et al. 2007, p.62). The most-resourced microenterprises who owned a mobile had gained through more and larger orders, faster turnaround and better quality of the final product, while the least-resourced without access to mobiles were losing orders. Similarly, Souter et al. (2005) concluded that the mobile phone had benefitted higher status groups in India, Mozambique and Tanzania most while "the most marginalised could well be left behind" (p.10).

On the other hand, a study of banana producers in Uganda showed that households that did not own a mobile phone could still benefit from the availably of mobile phones in the community (Muto & Yamano 2009). Based on an analysis of household panel data, the authors concluded that community-level possession of mobile phones had increased banana sales participation while household possession of mobile phones did not have significant impact. Thus, even those not owning a phone benefited from the network, for instance when one person in the village arranged collection of produce with a trader. The study also found that smallholder farmer had gained most from the extension of mobile.

2.4.1 Benefits of using mobile phone

But from this study, the use of a mobile phone for farming stems up with the following benefits;

Mobile telephony effectively reduces the distance between individuals and institutions, making the sharing of information and knowledge easier and more effective. Social networks can be strengthened and individuals empowered through use of their handset. Moreover, Mobile telephony offers some

unique opportunities, as:

- It provides global communication channel to rural communities

- It extends the impact of established rural media, such as rural radios
- It helps in making the local content available to the rural people.
- It makes rural services more efficient (logistics, coordination, etc) and cost-effective.

Helping Farmers Raise Their Incomes

In some instances, access to mobile phones has been associated with increased agricultural income. A World Bank study conducted in the Philippines found strong evidence that purchasing a mobile phone is associated with higher growth rates of incomes, in the range of 11–17 percent, as measured through consumption behavior (Labonne and Chase 2009). One reason for this finding is that farmers equipped with information have a stronger bargaining position within existing trade relationships, in addition to being able to seek out other markets. A study of farmers who purchased mobile phones in Morocco found that average income increased by nearly 21 percent (Ilahiane 2007).

Mobile phones seem to influence the commercialization of farm products. Subsistence farming is notoriously tenuous, but smallholder farmers, lacking a social safety net, are often highly risk averse and therefore not very market oriented.

A study from Uganda found that market participation rose with mobile phone access (Muto and Yamano 2009). Although better market access can be a powerful means of alleviating poverty, the study found that market participation still depended on what producers had to sell: Perishable bananas were more likely to be sold commercially than less perishable maize. Mobile phones can serve as the backbone for early warning systems to mitigate agricultural risks and safeguard agricultural incomes.

Making Agricultural Marketing More Efficient

At a fundamental level, markets are about distributing information. They do so through prices, which serve as a unifying signal to participants to allow for the coordination of dispersed producers and consumers. Underlying this powerful mechanism, though, is the assumption that everyone knows the market prices for commodities, which is not the case in much of the developing world. Farmers have little information about market prices in urban areas of their own countries, let alone internationally. The result of this information asymmetry is price dispersion—the same goods sell for widely different prices in markets merely a few kilometers apart. Mobile phones, in addition to other ICTs, can overcome this problem by informing both producers and consumers of the prices offered for agricultural products in various locations. A number of studies have shown that when mobiles are

introduced to farming communities that previously lacked any form of connectivity, prices unify as farmers learn where they can sell for a better price.

A striking example comes from the Indian state of Kerala. As mobile networks were rolled out in coastal regions, fishers who were previously ignorant of daily prices in different markets were able to contact various ports to find the best offer for their catch. The result was demonstrable welfare gains for fishers because fish were sold where they were more highly valued. Waste decreased and prices equalized throughout the regional ports; there were even small gains in consumer welfare (Jensen 2007).

Other studies have confirmed this effect. Despite having the lowest mobile phone penetration in sub-Saharan Africa, Niger has seen important effects on agricultural markets from mobile phone diffusion.

As mobile networks have expanded, grain price differences have decreased by 20 percent, traders' search costs have decreased by 50 percent, scarce resources have been better allocated, and consumers paid, on average, 3.5 percent less for grain, which is equivalent to 5–10 days of grain consumption annually (Aker 2010a). A small study in Morocco found that farmers with mobile phones increasingly dealt directly with wholesalers or larger-scale intermediaries than smaller intermediaries (Ilahiane 2007). These studies, in conjunction with a host of anecdotal and theoretical evidence, point to the promise of mobile phones in making markets more efficient.

Lowering the Costs of Information

The most obvious and cross-cutting way that mobile phones can improve agriculture is by improving access to information and making it less costly to obtain. In many rural areas, the arrival of mobile coverage is a radical change in the nature of the information ecosystem. Although simply having more information is not sufficient to make advantageous decisions (other resources may be needed to implement them), it is a necessary step toward access to knowledge. Transaction costs are present throughout agricultural value chains, from initial decisions about whether and what to plant, to all of the operations during the growing cycle, harvesting, postharvest and processing operations, and selling (to intermediaries, consumers, processors, exporters). These costs can account for a large share of the cost of a farm enterprise.

In a study that compared transaction costs throughout an extended period, 15.2 percent of the total cost of farming was transactional, and of that, 70 percent was informational (as opposed

to, say, the cost of transporting crops to market). Undertaken in Sri Lanka, where an inconsistent subsidy on fertilizer introduces considerable uncertainty, the study found that 53 percent of the informational transaction costs were incurred during the growing season, when farmers were attempting to ascertain fertilizer costs. As shown in figure 3.2, another 24 percent were incurred during the initial decision to plant or not, while only 9 percent of the costs related to information were incurred during the selling stage, where studies typically

Reducing Transport Costs

Mobile phones may help users to substitute phone calls for travel. Where safety standards are minimal, roads are in disrepair, and distances are great, substituting phone calls for travel reduces farmers' time and cost burdens. Time savings are important for agricultural households, because many crops have extremely time-sensitive and labor-intensive production cycles. Farmers who use mobiles can also save on transport costs (Overa 2006)—an effect that is stronger the more rural the area (Muto and Yamano 2009). Transportation cannot be avoided entirely: Crops need to get to customers. Although mobiles can inform farmers where they should travel to market their crops, evidence suggests that the wealthy maintain an advantage in their ability to make use of this information (Fafchamps and Hill 2004). In combination with improved rural roads, ICT will encourage larger truck-traders to visit harder-to-reach areas, connecting rural and urban regions.

A Platform for Service Delivery and Innovation

The numerous capabilities of mobile phones provide ample opportunities to deliver traditional and innovative services. Traditional agricultural extension agents are increasingly being outfitted with mobile phones through programs to increase their effectiveness by networking them to knowledge banks. Extension can reach more clients through mobile-based learning platforms—textual or richer platforms, such as video—that provide tips to farmers to improve agricultural skills and knowledge. Significantly, mobiles are also a platform for user innovation. Mobile money services, now so prominent in Uganda, and other countries such as Kenya and the Philippines, originally began as informal mechanisms between family and friends. Software engineers in developing countries are creating locally appropriate applications to be deployed inexpensively. This form of innovation is possible due to the functionality of mobile phones, but capacity needs to be grown and technological barriers, such as incompatible networks, need to be addressed.

Finally, the popularity of mobile phones means that previously excluded populations can have considerably more political voice, raising the level of interaction between policy makers

and their constituents. Mobile phones can be used to direct bottom-up insights towards the appropriate recipients; informing and improving governance.

2.4.2 How famers can generate income from the use of mobile phones

The ability to profitably sell surplus produce for income generation will depend on good access to markets. A prerequisite is the ability to physically access different markets which depends on proximity to and the transport infrastructure to reach the market. In addition, farmers may lack information on or access to alternative buyers or markets. Many farmers in poor areas are often forced to sell their produce to middlemen or may be required to sell to their creditors at pre-arranged prices. The use of a mobile phone may play a role in broadening their networks and facilitating contacts.

Farmers also often lack information on current market prices to be able to negotiate better deals. Disseminating price information, for instance through mobile phones, is seen as a way of reducing information asymmetries and increasing the bargaining power of farmers. Market participation may also be constrained because larger buyers tend to favour scale and may be unwilling to pay the transaction costs associated with sourcing from a large number of small dispersed farms (Pingali et al. 2005). Social networks supported through m-services could help to create the necessary economies of scale. In addition, the trust established between buyers and sellers plays an important role in business transactions (Molony 2006).

Moreover, savings from the sales would enable farmers to better deal with the seasonality of agricultural income and increase the choice of when and where to purchase inputs rather than being limited to the time when income is available or to the obtain inputs from their creditor. Banking facilities can help farmers manage and earn interest on these savings. However, similar to loans and insurance, banking with small-scale farmers incurs high transaction costs due to the small-scale deposits, dispersion of the population and poor infrastructure (Poulton et al. 2006). Such services may be more profitably delivered through m-services which can be offered through small agents rather than physical banking facilities used by conventional banks.

Looking at the use of mobile phones in agriculture more specifically, Furuholt and Matotay (2011) assessed how farmers took advantage of mobiles throughout the farming cycle. Based on semi-structured interviews with farmers and other informants, they found that mobile phones affected all stages of the cycle, including preparations, farming, harvesting and post-

harvesting (Table 2). Overall, farmers felt that mobile phones had helped to raise incomes by improving their ability to deal with risks and take advantage of income opportunities.

Several studies have identified opportunities for using mobile phones in the agriculture sector and to promote rural development. A report by Vodafone and Accenture, for instance, notes that mobile phone-enabled solutions for food and agriculture could assist producers to access financial services, obtain agricultural information, improve data visibility for supply chain efficiency and enhance access to markets (Vodafone Group & Accenture 2011) (Table 3). The greatest potential for cost savings were seen in mobile financial payments and mobile information provision. Donner (2009) distinguishes between different livelihood functions of mobile phones, including mediated agricultural extension, market information systems, virtual markets, financial services and direct livelihood support.

Table 3: mobile enabled solutions for agriculuture

Improving access to financial services	Mobile payement system	Increasing access and affordability of financial services tailored for agriculutural purposes
	Micro-insuarance system	
Provision of agricultural information	Mobile information platform	Delivering information relevant to farmers, such as agriculutural techniques , commodity prices, and weather forecast, where traditional methods of communication are limit
	Farmers helpline	
Improving data visibility for supply chain effeciency	Smart logistics	Optimizing supply chain management across the sector, and delievering efficiency improvements for transportation logistics
	Traceability and tracking system	
	Mobile management of supplier networks	
	Mobile management of distribution networks	
Enhancing access to markets	Agricultutral trading platform	Enhancing the links between commodity exchanges, traders, buyers, and sellers of agricultural produce.
	Agricultural tendering platform	
	Agricultural batering platform	

Source: Vodafone Group and Accenture (2011)

2.4.3 Current Challenges

Despite the developments and innovations, mobile phone use for rural development may face certain challenges:

High costs, especially for new generation sets.

Limited capacity of rural people to use the technology, particularly for more complicated applications for images, GPS data, etc.

Low awareness of the technology for educational purposes.

Technology limitations such as character limit for SMS (impact on complex information sharing), and the lack of available non-Roman scripts.

Electricity: Uganda rural areas suffer acute shortage of power (principally electricity) and this may make it a challenge for the rural farmers to charge their phones as they consume power.

Network: Limited network coverage and low bandwidth in some rural areas.

Sound evidence: References to the benefits and impacts of mobile phone in rural areas are generally anecdotal. Studies and analysis are mostly empirical and these do not provide substantial data to facilitate their analysis and evaluation.

Development of policies to expand rural coverage: In many countries of the region, the driver of telephone coverage has been prioritizing access to urban areas that are densely populated and have high economic activity. Thus, the more marginalized rural areas tend to have lower telephone density per capita. While some countries' investment in rural mobile telephony has gradually begun to improve access and coverage, in many other areas it continues to be limited.

So promotion of public policies that supporting sustained investment, consistent access and wide coverage is necessary.

Sustainability of mobile information services: Mobile service initiatives that target agricultural information to small holder farmers should consider factors necessary for financial sustainability from the initiation of any investment.

Capacity building: Development of mobile information services for agriculture must respond and adapt to the needs of rural people and their communities, while also taking into account the individuals' skills to use and take advantage of the services and applications in the field.

Payment mechanisms: It is necessary to establish a services payment mechanism that is both within the financial reach of farmers and also is easy for service providers to develop and adapt.

Private sector investment: it is typically difficult to attract the private sector to invest in such ventures in the village for the long-term because these entrepreneurs are primarily risk averse and therefore lack the incentives to continue to invest in an unprofitable project, thereby ensuring that projects are often of short duration. This is where the public sector and NGOs can play a huge role by fast-tracking these private enterprise initiatives and partnering

with local business so that the solution can be sustainable after the time frame of any given project

Harnessing different platforms: it is a challenge to make sure the information platforms are inter-operational. In an upscale each of the platforms on which farmers' information is delivered has various advantages and limitations, and is often an inadequate solution when used on its own. In other words, an effective solution must contain all these individual platforms organized carefully so that each falls in its place to fulfill a set objective. For the farmers' information service the elements of the information matrix include the following: (a) SMS (text) Platform; (b) Voice platform; (c) Web-portal; (d) Call centre; (e) Extension workers; (f) Libraries; (g) Researchers.

Technologies such as optic fiber, xDSL, WiMax,laser optics, 3G have served well in bringing broadband services to densely populated and urban environments. These access/last miletechnologies are rather very expensive to deployand maintain in rural settings where the population is scattered coupled with the different geographical and topological environment. Additionally, the backhaul to rural areas in Uganda also provides a challenge to broadband deployment. Most of the links to these areas are low bandwidth wireless microwave links and satellites which are relatively good for voice and low data traffic but not broadband services likevideo conferencing and streaming.

While there is need for more modern mobile phone services in rural areas such as broadband, the high poverty and low literacy levels, low ICT awareness and scarce population discourage deployment of telecommunication infrastructure to deliver such services.This will hinder the rural farmers to use the full benefit that may come with mobile phones.

The private sector is the main driver of the telecommunication (Mobile phones) industry in Uganda. Being foreign companies, priority is placed on ROI which favors mostly urban and densely populated areas leaving rural areas behind. At liberalization of the sector, one of the new entrants, MTN, as a policy had exclusive rights to cover the entire country with mobile telephone services. While mobile telephony was able to reach a greater part of the country, the rates were high and unaffordable for majority of the rural population, and further still, only part of the rural areas were covered.

CHAPTER 3
METHODOLOGY

3.0 Introduction

This chapter highlighst the methods used in the collection and analyzing of data. It proceeds with a brief description of the research design, area of study, population and procedures used in data collection, source and process of analysis and presentation and anticipated problems that were encountered during the study.

3.1 Study Design

The nature of the study involves qualitative and quantitative study techniques. This was chosen to help in establishing the distribution of the variables in the study population and the current status and nature of the phenomenon. The quantitative approach was used to quantify incidences in order to describe current Conditions and to investigate the effectiveness of mobile phone use in agricultural growth in the rural areas in relation to the information from the questionnaires. The qualitative approach was used to explain the events and describe findings using interviews and documentary analysis

3.2 Study population

The district has a popualtion of 354,300 (ministry of water and envoronment, pg 265, 2010) with Moyo su bcounty having a population of 23,700 (UBOS, 2011) and Logaba village has a total of 4086 (Moyo district Local Government, 2010, pg 11). Over 90% of the poulation in the village are farmers (Moyo district Local Government, 2010, pg 9) with only 20% involved in other income generating activities.

3.3 sample size

The sample size can be referred to as the number of people to be interviewed out of the total number of members in the Village. The sample size is therefore determined from the study population and not the whole study population is going to be interviewed but only Part of it. Therefore the sample size was 50 members from the whole village; 39 farmers, 1 agriculuture extension worker, 9 councillors and 1 local coucil chirperson.

3.4 Sampling Technique

Sampling is the process of selecting units (such as people and organizations) from a population of interest so that by studying the sample you can fairly generalize your results to the population from which the units were taken (Huberman, A. Michael & Miles, B. Mathew 1994). In this research study, the sampling techniques that were used are the purposive

sampling technique where the researcher from her own judgment select people to be included in the study and get information from and the simple random sampling technique.

3.5 Sources of Data

3.5.1. Primary source

Data was collected from the respondents using question in the field.

3.5.2 Secondary source

Secondary data was collected by means of a literature search and by analyzing the contexts and existing theories as advised by Walsham. In this case, both academic and general search engines was used. The researcher used various textbooks, references journals, reports, internet, newspapers and periodical publications relating to the research study. These point at the already existing data that was published regarding to the problem of the study and they will be used for comparison with the collected data

3.6 Data collection methods and instruments

During this research various methods of collecting data were employed to get or acquire the relevant information for the study and these included, interviews, questionnaires and observation they can be explained here below;

3.6.1 Interviews

Semi structured interviews was conducted with individuals who were believed to be knowledgeable about the study in question. Key informants interviewed were the farmers, Key informant interview guides was used and it enhanced the respondents to express their views in a detailed way which enabled the researcher to get the required data. Instruments like audio recorders, cameras, were used to help record the voices of the respondents and this was used in the final computation of the data and also as evidence

3.6.2 Questionnaires

These are set of both open minded and closed minded questions that was prepared on papers according to the objectives of the study before going to the field. They were used to obtain information from the primary respondents (farmers) where they ticked the right answers. The researcher also asked and ticked depending on the response. This is because the researcher found respondents who could not read or write. The questionnaires had sections on demographics, personal situation, farming situation including methods and produce, information and market needs and habits, and views and preferences regarding media and communication technology.

3.6.3 Observation

Observation refers to a method of data collection that employs vision as its main means of obtaining information (Mahr 1995). It involved collecting information-using senses such as hearing, seeing and listening. This method was employed to collect first hand information from the field in a non-verbal behavior. In addition, it enhanced the researcher to collect additional information concerning the way of life, conditions under which the famers undertake, and other relevant information. A check list was used to guide the researcher as she observes. Instruments like cameras and video recorders were used in collecting data concerning the materials handling systems, machinery being used hence therefore pictures and videos were necessary and will also act as a form of evidence.

3.6.4 Document review

Available documents in the field of study was reviewed, especially filed documents in the district agriculutural office, online documents. Document review helped the researcher collect important data which can't be collected easily and cheaply by the other data collection instruments.

3.7 Data Processing, Analysis and Presentation

In this case collected data were processed using special software called statistical package for social sciences (SPSS) it was used to enter data in the computer, sorting it, cleaning and presenting it in tables. Microsoft excel was also used to aid in drawing of tables that helped to clearly present the findings.

3.7.1 Editing

Here the researcher ensured that, all data was completed without any omissions, inconsistency and inaccuracy during the study. The researcher checked all the responses to avoid ambiguity and vagueness to make sure that they are meaningful for coding purposes.

3.7.2 Coding

The researcher coded the information only after editing it by entering it into different categories corresponding to each of the questions asked. The researcher employed the master sheet, which was in form of a general tabulation with several columns on the questionnaire.

3.7.3 Tabulation

The researcher put the data into tabular form after coding them. The tally system marks were given designating responses to their suitable codes. The researcher added the tally marks or scores under each category to establish the number of times each of the different answer were given to each category. The researcher however, calculated this information of tables and

percentages. This helped the researcher to draw up a clear conclusion of the research findings.

3.7.4 Data Analysis

Primary data was categorized according to the research objectives in general and the insights derived from the literature review. The categorized data was used to examine the existing concepts by a simple frequency analysis (i.e. percentage) and to establish some arguments based on the discussions, open-ended questions and observations. The comprehensive literature review and series of data collection efforts until the point of theoretical saturation in the study suffice the iterative and comparative characteristics of the qualitative research. The cleaned data were analyzed using Statistical Package for Social Sciences (SPSS); and it were used to come up with frequencies and percentages and also make cross tabulations that helped to establish the relationship between the variables under study.

3.7.5 Data Presentation

Microsoft word and excel were used in drawing, tables, so as to clearly present the findings of the study.

3.8 Ethical Consideration

The researcher followed the ethical considerations in the process of carrying out the research, by not reproduce other people's work, confidentiality, where respondent's names in the questionnaires and seeking permission from heads of departments.

3.9 Data Quality Control

Validity of instruments

Validity refers to the extent to which a method of data collection presents what it is supposed to do, or the extent to which a method of data collection measures what it is supposed to measure (Amin, 2005, Bell, 1997). To establish the validity of instruments, instruments were pre-tested by administering the questionnaires to friends. This helped to correct errors identified before the main study.

Reliability of Instruments

Reliability is the extent to which a test or procedure of data collection yields similar results under constant conditions on all occasions (Bell, 1997). According to her there are several devices for checking reliability in scales and tests such as re-test, alternative forms methods or the split half method. The researcher in this case provided the check questions in the questionnaires, where a respondent would be got if respondent unnecessarily.

3.10 Limitation to the Study

1. The researcher was limited by some people who were not cooperative, not willing to give or refused to release information in time, others gave shallow information, while others wanted some local booze (alcohol) in order to give information and this became a huge challenge.
2. The researcher also had problem meeting some people who were not be able to fill questionnaires because they did not know how to read and write. This shows the level of illiteracy in the area where about 70% -75% of the people are illiterate especially women and youth.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter presents the results of the study in relation to the study objectives. It is presented under the following sections namely: Background information, frequencies for the use of a mobile phone in the development of agriculture in rural areas. The study aimed at establishing the existing use of mobile phones among farmers, examine the agricultural information a famer can access using a phone, how a famer can use such information and how the use of information can generate income to the farmer. To achieve the above objective, data were collected from different categories of farmers in Logoba village using questionnaires and interviews guides and analyzed using SPSS and presented in frequency tables.

4.1.1 Background information

The table below represents the background information of the respondents which included; sex/gender, age, education, marital status and the length of years worked as a farmer.

4.1.2 Respondents' Socio-demographic Characteristics

Table 4: Respodents' social-demographic characteristics (N=50)

Characteristics	N	%
Respondents' sex		
Male	20	40
Female	30	60
Respondents' age		
Young ≤ 40 years	35	70
Old > years	15	30
Respondent's marital status		
Never married	10	20
Married	25	50
Divorced	8	16
Widow	7	14
Widower		
Respondents' education level		
No formal education	12	24
Primary education	29	58
Secondary education	9	18
Mobile phone ownership		
Have mobile phone	39	78
Male	20	40
Female	19	38
Does not have mobile phone	11	22
Male	5	10
Female	6	12

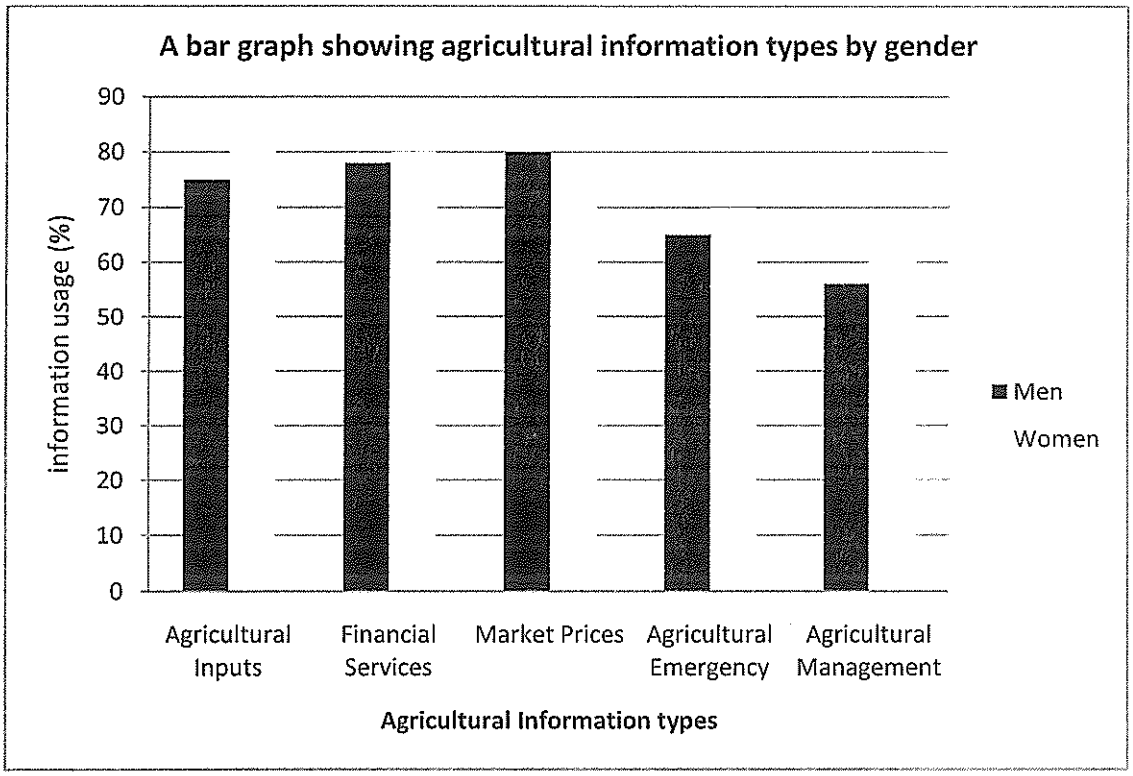
Source: primary data (2013)

Of the 50 respondents, 30 (60%) were females, while 20 (40%) were males. Of the 50 respondents, 25 (50%) were married, 10 (20%) never married, 7 (14%) widowed while 8 (16%) were divorced. Based on mobile phone ownership, most, 40 (80%) indicated that they owned mobile phones. Furthermore, of the 50 respondents, 35 (70%) were young, aged between 20-40 years old, 39(78%) owned mobile phones and 11(22%) did not have mobile phones. This implied that over two thirds of the young respondents owned mobile phones. Such findings agree with Souters *et al* [7] and Frimpong [8] who found that majority of ICT users tends to be young adults. In case of education, most respondents, 29 (58%) reported that they had attained primary education, 12 (24%) did not go to school and 9 (18%) were secondary school leavers. (table 4)

4.2.0 results on how farmers can identify agriculutural information

4.2.1 The types of information respondents can access

Figure 3: A bar graph agricultural information types by gender



Source: primary data(2013)

The majority of the respondents (78.5%) would use mobile phones to access agricultural inputs such as seeds, livestock, pesticides, etc from local seed dealers, Non governmental organizations (NGOs), and community members. They would also be able to use the phones to coordinate meetings including agricultural trainings.

Respondents indicated that mobile phones provided monetary savings over what they would normally have been spent on travel. For example, an individual would have paid to travel to a seed dealer only to find that all the seeds have been sold. With the use of a mobile phone, the farmer would be able to call ahead coordinate a meeting time, determine the price and availability.

Respondents (77.5%) also reported they would use a mobile phone to gain market pricing prior to negotiations and travels so not to buy or sell it at a loss. Females use mobile phones for market information less than the male (see figure 5)

Approximately (65%) of the farmers would use mobile phones for consultations, there is no significant difference between female s and males in the use of voice based applications of

the mobile phone for consultation with experts. The farmers also reported that they would use a mobile phone to coordinate group meetings. In particular, the farmers noted that they would not miss group meetings or training, because they would always be available through their mobile phones

4.2.2 preference for the type of messages suggested by farmers

Table 5: Preference for type of messages suggested by farmers

(N= 50)

Type of message	F	%
SMS	40	80
Voice message	10	10

Source: primary data(2013)

Majority, 80 per cent of the farmers suggested that SMS is the best way to provide information as it can be saved in the message box and can be read later on. Only 20 per cent farmers suggested that voice messages are best in fulfilling their information need because it is difficult for them to read

And majority of farmers were unaware about MMS and GPRS facilities as their mobile phones were devoid of this technology. An interesting finding was that farmers(most of them) would like to have the messages in their local language (Madi) for easy understandability

4.3.1 findings to ascertain how a farmer can use the acquired information

4.3.2 Factors that enable a farmer to use a (a new technology) mobile phone

Table 6: Factors that enable a farmer to use a mobile phone

Variable	**Used mobile phone**		**Did not use mobile phone**	
	N	**%**	**N**	**%**
Respondents' education levels				
Normal education	9	75	3	25
Primary education	21	72.4	8	27.6
Secondary education	7	77.8	2	22.2
Average daily income				
<dollar per day	34	87.2	9	23.1
>dollar per day	5	12.8	2	18.2

Farming activites involved				
Grow crops	20	80	5	20
Keep animals	1	100	0	0
Mixed farming	22	48	91.7	8.3
Agricultural information needed				
Better prices	11	28.2	1	9.1
Input supply	12	30.8	2	18.2
Management practices	9	23.1	3	27.3
Weather information	7	17.9	3	27.3

Source: primary data(2013)

Respondents identified factors influencing use of mobile phones in communicating agricultural information to include sex, education level, incomes, mobile phone ownership, type of farming practiced, type of agricultural information needed, and network coverage. Table 8 illustrates the results.

Of the 50 respondents, most (47) indicated that they would use mobile phones to communicate agricultural information, of these, 29 (58%) indicated to had attained primary education, while 9 (18%) had attained secondary education. An interesting finding from the study was that, all respondents with secondary education level owned mobile phones. Such results perhaps showed that education was a factor for owning and using mobile phones. Perhaps these results verify with those of Alampay [13] who found that, education determines the level of both access and use of ICTs. According to him, people with tertiary level of education could have higher access and use of public telephones and cellular phones than those of lower levels. Furthermore, of the 39 respondents who owned mobile phones, most, 34 (87.2%) mentioned to earning income less than a dollar per day, while 5 (12.8%) indicated to getting incomes greater than a dollar per day. Although mobile phone ownership was also common among respondents with low incomes, the study results found that use of mobile phones to communicate agricultural information was highly influenced by income levels.

4.3.3 credibility of source

Table 7: Credibility of the source of information according to respondent farmers **(N=50**

Source	**N**	**%**
Private agencies such as NGOs	25	50
Farmers' cooperatives	24	48
District agricultutre departments	1	2

Source: primary data(2013)

Respondents were interviewed to find which organization/person can deliever agricultural information better. The respondents considered private agencies such as NGO as the most credible source of information, followed by their small farm cooperatives or groups. They ranked district agriculture department to be the least interms of delievering information to farmers citing that there is beauracracy and corruption in governemental bodies thus there will be delays in service delievery. The farmers went on to note that NGOs are fast and if they work hand in hand with the farmers groups, needed information will be delivered to the farmers at the right timing.

4.4.1 Test to find out the benefits and challenges of using a mobile phone.

4.4.2 Advantages of using mobile phones

Table 8: advantages of using a mobile phone in communicating agriculutural information (N=50)

Variable	N	%
Helps to easily get agricultural information once needed i.e. market and price information, weather and input supply, etc	18	36
Saving time in dealing with related parties	8	16
Helps to exchange information anytime the need arose	9	18
Assist in obtaining agricultural information quickly	7	14
Ease contact with customers/suppliers	5	10
Allow more contacts among the farmers	3	6
Total	**50**	**100**

Source: primary data (2013)

The study finding revealed that mobile phones confer diverse of advantages as a communication link in isolated circumstances because of its distinct features of mobility. Table 8 shows that a third of the farmers, 37 (74%) reported that mobile phone would help them to easily obtain agricultural information they needed. They also named a number of virtues associated with the use of mobile phones. For example they noted that "specific" groups should be set up to enable them (farmers) communicate, share and discuss price information with direct buyers, instead of relying on middle people or few crop buyers prevailed in the study area. The respondents further noted that such groups would enable them to communicate range of agricultural information, specifically on better prices, input supply, better management practices and weather information which would help them to

make better choices on where and when to buy or sell their arm produce. Thus the use of mobile phone would enable a farmer make decisions on best time to sell crops and livestock because farmers could get instant information on prices at different market places

Like wise, Ashraf *et al.*[9] and de Silva[10] asserted that mobile phones can facilitate a greater export orientation in agricultural practices and marketing. The findings as well support Jensen [11] who found mobile phones to have an ability to save farmers' costs by providing quick access to agricultural information, communication with trade partners and open new markets possibilities. On the other hand, middle men showed that mobile phones improved their ability to deal with truck follow ups and ability to redirect produce shipments to other markets incase of changing markets prices

4.4.2 Problems of Using Mobile Phones in Communicating Agricultural Information

Table 9: Problems of using a mobile phone in agriculture

Problems	N	%
Expensive	15	30
Lack of electricity (constant charging system)	20	40
Poor network	30	60
Poverty	31	62
Illiteracy	26	52
Lack of awareness	28	56

Source: primary data(2013)

From table 9, of the 50 respondents, few, 15 (30%) reported that mobile phones were too expensive in terms of buying and running costs. Lack of electric power for charging mobile phones was mentioned by 20 (40%) of respondents, while 30 (60%) said that there was poor network coverage. Other studies also commented the same; for example, Samuel *et al.* and URT [1] have found a positive correlation between mobile phones ownership and access to electricity Aminuzzaman *et al.*[15] argued that, despite the positive effects associated with the use of ICTs tools for enhancing livelihood opportunities, electric power and cost are hindering factors. Respondents also pointed other limiting factors limiting mobile phone use to communicate agricultural information as poverty, illiteracy and lack of awareness of whom to call for particular information.

CHAPTER 5
CONCLUSION AND RECOMMENDATION OF THE STUDY

5.1 Conclusion

Mobile phones have diffused rapidly into the rural countryside of Uganda in the past five years, providing new opportunities for communicating information that will be helpful to limited-resource farmers and small agricultural businesses. This study has provided a first look at the potential of mobile phones in affecting the agricultural sector as a whole. The study has reported many examples of the benefits created by the characteristics of mobility, customized content delivery and convenience of mobile phones. As mobile phone penetration continues to increase among the farming community and information services continue to adapt and proliferate, sufficient potential exists for a much deeper rural productivity impact in future, but achieving full productivity potential will depend on reducing other constraints which limit the use of information that farmers can obtain through their mobile phones.

A total of 50 farmers in Logoba village, Moyo district, Uganda, were interviewed in June 2012 and April 2013 – 20 men and 30 women. The respondents used mobile phone to acess market information, agricultural inputs, agriculutural emergencies, agriculutural management, and financial services. This indicates a fairly broad use of mobile phones for a number of different agricultural purposes. These results indicate that mobile phones are used for a variety of purposes, and thus training and opportunities for future use should focus well beyond single uses such as getting market information. Farmers strongly believe that these devices are saving them money by avoiding wasted travel, seeking veterinarian advice by phone first, coordinating time working in the fields or at meetings, and recording key information such as agreements on loan repayments. From the study, majority of farmers would access information from Private agencies and farm groups as the information delievered in fast while governent bodies such as district agricultural centers are low ranked for information delievery.

One key element is that the service providers have to leverage the benefits of mobile phone such as portability, flexible content delivery capability and twoway communication to deliver low-cost but highly customized solutions. Farmers must be able to get information delivered to them at a time and place of their choosing. Even at this early stage of mobile phone revolution in Indian agriculture, the study has reported the signs of agricultural productivity improvements, an impact which is enhanced by the new mobile phoneenabled information

services. The most common benefit of mobile phone has been found as a basic device of communication because for many of the farmers, it was the only convenient access to information.

Realization of full potential impact of mobile phones is constrained by shortcomings in physical infrastructure affecting access to markets, storage and irrigation. Issues also arise with the availability of inputs and credit. Equally, to make full use of delivered information, farmers must have sufficient risk-taking capacity and willingness to experiment with new strategies and techniques disseminated. Social networks like ITC may play an important role in building trust and confidence required to influence the adoption of new mindsets and actions by small farmers.

Increased public and private investments will be necessary to bridge the critical infrastructural gaps. Policy changes may also be needed to encourage better access to high-quality inputs and credit for small farmers. Increased extension services and capacitybuilding efforts can complement information
dissemination via mobile phones and associated services to accelerate the adoption of new techniques. However, even in the case of poor farmers facing significant constraints, it has been found that there are opportunities to realize productivity gains from the adoption of new farming practices and actions to mitigate crop losses.

5.2 Recommendations

Based on the conclusions above, the study would recommend the following:

The study highlights significant potential for mobile phone use to facilitate agricultural growth in Logoba village found in Moyo district. Mobile phone offer opportunities to extend the reach of agricultural services to the poorest and marginalised due to the widespread access to mobiles among geographically dispersed users from diverse socioeconomic backgrounds. However, judging from the evidence gathered, the poorest and marginalised are less likely to benefit from phone usage as a result of lower income and education levels as well as social imbalances, such as gender inequalities.

Since mobile phones were found to have a bright future to farmers; the government should lessen mobile tariffs, particularly through encouraging rigorous competition between mobile

phone providers in rural areas so that many farmers afford both buying and running cost of mobile phones.

A discussion with key informants found that, provision of education to farmers concerning mobile phones use could make mobile phones better used in communicating agricultural information. Likewise, as portrayed in the results, education seemed to have an influence on both ownership and use of mobile phone by farmers in the study area. Therefore, provision of education to rural people on the use, modes of application and benefits associated with mobile phones could be important.

The government, NGOs and other development agencies should introduce public phone booths especially in rural areas through which farmers could be capable to communicate agricultural information

Government should provide the subsidized phones to the farmers with necessary functions and also provide facility of free/subsidized agricultural messages should be provided to the farmers since from thee report, farmers rated SMS high as a way of delievering information.

Significant research gaps remain in this area which will need to be filled in order to increase the effectiveness and expand the reach of mobile phone use in agriculture. Moreover, as phone sharing remains a reality in particular in rural areas, the associated dynamics need to be better understood, including within households, communities and organised groups such as cooperatives. More research is also needed to differentiate between users from different income and social groups when assessing the effectiveness of mobile phone use in order to better understand and address the particular opportunities and challenges of the poor.

Reference

Rogers, E. (2003). *Diffusion of innovations.* New York: Simon & Schuster.

Albu, M., & Scott, A. (2001). *Understanding livelihoods that involve micro-enterprise: Markets and technological capabilities in the SL framework.* Intermediate Technology Group. Retrieved from http://www.itdg.org

Burrell, J. (2008). *Livelihoods and the mobile phone in rural Uganda.* Grameen Foundation USA. Retrieved from http://www.grameenfoundation .applab.org/section/ethnographic-research

Donner, J. (2006). The use of mobile phones by microentrepreneurs in Kigali, Rwanda: Changes to social and business networks. *Information Technologies & International Development, 3,* 3–19

Abraham, R. (2007) Mobile phones and economic development: evidence from the fishing industry in India, *Information Technologies and International Development*, 4(1):5-17. [Online]
http://itidjournal.org/itid/article/view/241

Acker, J.C. & Mbiti, I.M. Mobile phones and economic development in Africa, *Journal of Economic Perspectives*, 24(3): 217-232.
Acker, J.C. (2010) Dial "A" for agriculture: using information and communication technologies for agricultural extension in developing countries, *Working Paper*, Tufts University, Economics Department and Fletcher School, Medford, MA. [On-line]
http://siteresources.worldbank.org/DEC/Resources/84797-1288208580656/7508096-1288208619603/Aker_Dial_A_for_Agriculture_P&S_PAPER.pdf

Aker, J.C. (2008) 'Does digital divide or provide? The impact of cell phones on grain markets in Niger', *BREAD Working Paper No 177*, University of California, Berkeley. [On-line]
www.cgdev.org/doc/events/2.12.08/Aker_Job_Market_Paper_15jan08_2.pdf

Aminuzzaman, S. Baldersheim, H. & Jamil, I. (2003) Talking back: empowerment and mobile
phones in rural Bangladesh: a study of the village pay phone of the Grameen Bank, *Contemporary South Asia*, 12(3):327-348.

Andrade, A.E.D. & Urquhart, C. (2009) The value of extended networks: social capital in an ICT intervention in rural Peru, *Information Technology for Development*, 15(2)108-132. Doi:10.1002/itdj.20116

Annamalai, K. & Rao, S. (2003) *ITC's E-Choupal and Profitable Rural Transformation*, World
Resources Institute, Washington, D.C, [On-line]
http://www.nextbillion.net/files/eChoupal.pdf
Barr, A.M. (2002) The functional diversity and spillover effects of social capital, *Journal of African Economies*, 11(2): 90-113.

Food and Agriculture Organization of the United Nations [FAO]. (2006). Agriculture, trade negotiations and gender. Retrieved Feb. 09, 2009, from http://www.fao.org.

Food and Agriculture Organization of the United Nations [FAO]. (2009). Bridging the gap: FAO's programme for gender equality in agriculture and rural development. Retrieved Feb. 10, 2010, from http://www.fao.org.

Global System for Mobile Communications [GSM]. (2008). *Universal access: How mobile can bring communications to all.* Retrieved Feb. 9, 2009, from http://gsmworld.com/documents/universal_access_full_report.pdf.

Hudson, H. (2006). *From rural village to global village: Telecommunications for development in the information age*. Danbury: Lawrence Erlbaum Associates, Incorporated.

The International Fund for Agricultural Devlopment [IFAD]. (2000). Uganda: Division of labour in agriculture. Retrieved Feb. 10, 2010, from http://www.ifad.org/gender/learning/role/labour/54.htm
Jagun, A., Heeks R., & Whalley J. (2007). Mobile telephony and developing country micro enterprise: A Nigerian case study. Institute for Development Policy and Management. Retrieved Mar. 24, 2009, from http://www.sed.manchester.ac.uk.

Jensen, R. (2007). The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector. *The Quarterly Journal of Economics*, *122*(3), 879-924. Koehler, J. (1999). *Agriculture and commodities: Gender issues proposed for research.* Retrieved Feb. 21, 2009, from http://www.unctad.org

Rogers, E. (2003). *Diffusion of Innovations.* New York: Simon & Schuster, Limited. 102-35.

Uganda Communication Commission. (2008). *Status of the Communications Market – December*

2008. Retrieved Nov. 22, 2009, from http://www.ucc.co.ug.

The World Bank. (2008). Agriculture for Development: The Gender Dimensions. Retrieved Feb. 10, 2010, from http://go.worldbank.org/190AB72AN0.

Agüero, Aileen (2009), 'Education, mobile phone use and production decisions: a rural case study in Peru', *"Mobile 2.0: Beyond Voice?" Pre-conference workshop at the International Communication Association (ICA)*,

Aker, Jenny C. (2008), 'Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger', *mimeo*, 61.

Ballantyne, Peter, Ajit Maru, and Enrica M. Porcari (2010), 'Information and Communication Technologies--Opportunities to Mobilize Agricultural Science for Development', *Crop Science*, 50 (Supplement 1),

Cantor, Eric (2009), 'Reaching the Hardest to Reach: Mobile apps for low-income communities', *Mobile Web Africa Conference*,

Cranston, Peter (2009), 'The potential of mobile devices in wireless environments to provide e-services for positive social and economic change in rural communities', *mimeo*, 35.

Cranston, Peter and Kevin Painting (2010), 'Mobile Services in aWirelessWorld: The CTA 2009 ICTObservatoryMeeting', *Agricultural Information Worldwide*, 3 (1), 44-50.

Appendix

Appendix A: Questionaire

Atimaku Harriet, a student of Kampala International University, pursuing Bachelor's Degree in Business Computing, is conducting a research that aims at understanding how the use of a mobile phone in agriculuture can aid the growth of agriculture in rural areas, the research will analyze the information a farmer can acess using his/her phone, how the information can be used by the phones, and how using the can generate more income to the farmer. The researcher kindly request you to answer these questions to the best of your knowledge. The researcher additionally, affirm that your response will be treated with the highest degree of confidentiality.

Instructions

The questions in boxes require ticking the appropriate answer and others require filling in your opinions.

SECTION A

BACKGROUND QUESTION

Please tick the most appropriate box

1. **Gender**

   a) Male ☐ b) Female ☐

2. **Age**

   a) 20 and Below ☐ d) 41-50 ☐

   b) 21-30 ☐ e) 51 and above ☐

   c) 31-40 ☐

3. **Marital Status**

   a) Single ☐ c) Divorced ☐

   b) Married ☐ d) Widow/widower ☐

4. **Do you have a mobile phone?**

a) Yes ☐ b) No ☐

5. Which service provider do you use?

a) warid telecom ☐ d) MTN ☐

b) Orange telecom ☐ e) Uganda telecom ☐

c) Airtel ☐

6. How often do you recharge your credit(air time)

a) Daily ☐ c) 3-5 times a week ☐

b) 5-10 times a month ☐ d) More than a month ☐

7. Would you (do you) share a mobile phone?

a) Yes ☐ b) No ☐ c) May be ☐

8. How long have you been working as a farmer?

a) Below 1 year ☐ c) 1-3 years ☐ e) 4-6 years ☐

b) 7-9 years ☐ d) 10 and above ☐

9. Do you do subsistence farming or commercial farming?

a) Subsistence farming ☐ b) Commercial farming ☐

10. Education Level?

a) Primary ☐ c) Tertiary ☐

b) Secondary ☐ d) University ☐

c) Others, (Specify).....

SECTION B

Types of agriculutural information accesses, how the information can be accessed and how income can be generated from the use of a mobile phone.

11. What do you use your mobile phone for?

a) Calling friends/relatives ☐ c) Texting ☐

b) For agriculutural purposes ☐ d) For business transactions ☐

12. Can you use your mobile phones for farming?

a) Yes ☐ b) No ☐ c) May be ☐

13. What type of information can/ would you use with your mobile phones?

a) Marketing/price information ☐ e) Financial information ☐

b) Management practices ☐ f) Agricultural inputs ☐

c) Agricultural emergencies ☐

d) Others (specify)

.....

.....

14. How would you send/ or recive agricultural information?

a) Sms ☐ b) call ☐ c) MMS ☐ d)GPS ☐

15. What would you make you as a farmer use a mobile phone for information access?

a) Education ☐ d) Gender ☐

b) Use of ease ☐ e) Income ☐

c) Social influence ☐ f) Individual characteristics ☐

16. How would you benefit from using mobile phone in agriculture?

.....

.....

.....

17. Can using a mobile phone increase a farmer's income?

.....

.....

.....

.....

.....

18. What are the current challenges of using a mobile phone in rural areas?

.....

.....

.....

.....

.....

19. Other than a mobile phone, what other telelcommunication devices (ICTs) would you use for farmining?

.....

Appendix B: Types of Mobile Applications by Subsector

This annex contains a listing of all m-apps for rural development in Uganda and other few countries worldwide arranged by Subsector and Segment. It also provides a basic description of each application, the target users, country or countries of implementation, and status (whether active, planning, pilot or no longer active).

bsector/segm t	Name of service/pro duct	Description/summary	Target users	Country	Status
griculture, imal sbandry, heries,& restry • Agro support	Farmer's Friend (Grameen)	Farmer's Friend (Powered by Google SMS) offers farmers an affordable and targeted way to search for agricultural tips through a SMS-based database. Keywords in the query are matched against the database and the farmer receives a reply with a tip related to his or her query terms.	Farmers	Uganda	Active
	Weather application (Grameen)	The application that allows anyone with a mobile phone to send and receive text messages to find out the local weather forecast by the city or districts	General public	Uganda	Active
	Esoko	The platform provided automatic and personal prices alerts buy and sell offers bulk SMS messaging, stock counts and SMS polling. Markets, commodities, languages, currencies are easily configured. Esoko also offers strategy, support and trainings to projects rolling out MIS	Agri-business, NGO, governments, farmers, traders	Uganda, N. Sudan, Burkina Faso, Ghana, Nigeria, Mali,	Active

				Rwanda, Tanzania, Zambia, Kenya, Madagascar, Mozambique, Malawi, Cote d'Ivoire,	
	Google trader(Grameen)	Google trader helps buyers and sellers to find each other. Users can broadcast a message by sending an SMS, allowing them for example to list the products they are selling or to find space on a truck to take their goods to the market	Rural producers, customers	Uganda	Active
	Foodnet and Farmgain	Data on process, traded volumes, market flow, growing conditions and other relevant information is collected from villages and markets centers and together with relevant national and regional information is dissemination in local languages by local FM radio stations. The project receives and disseminates instant reports through SMS on changing markets prices. Both the national and localized markets information projects are fully integrated, utilizing one central information processing facility , thus reducing costs and augmenting local information with national and regional market information of relevancy to the local target area.	Farmers, traders	Uganda	Active
	RATIN SMS	To assist the stakeholders in the grain industry that cannot access commodity prices through internet, EAGC initiated an SMS facility which has been tested and it's now operational. SMS codes for Kenya, Tanzania, and Uganda were set up and tested by CELLNET- Kenya ltd. RATIN SMS is a low cost, highly implementable cell phone based platform that seeks to redress lack of market information	Farmers	Uganda, Tanzania, Kenya	Active
	Info trade	Infotrade provides critically analyzed information collected from 20 district markets in Uganda covering a total of 46 commodities. Data is collected thrice weekly, verified and posted on a website. Information can be accessed by email, or	Farmers, traders	Uganda	Active

Appendix c: Figures

Figure 4: How a mobile works

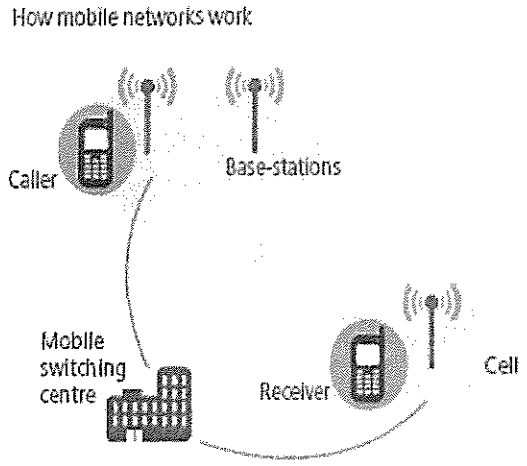
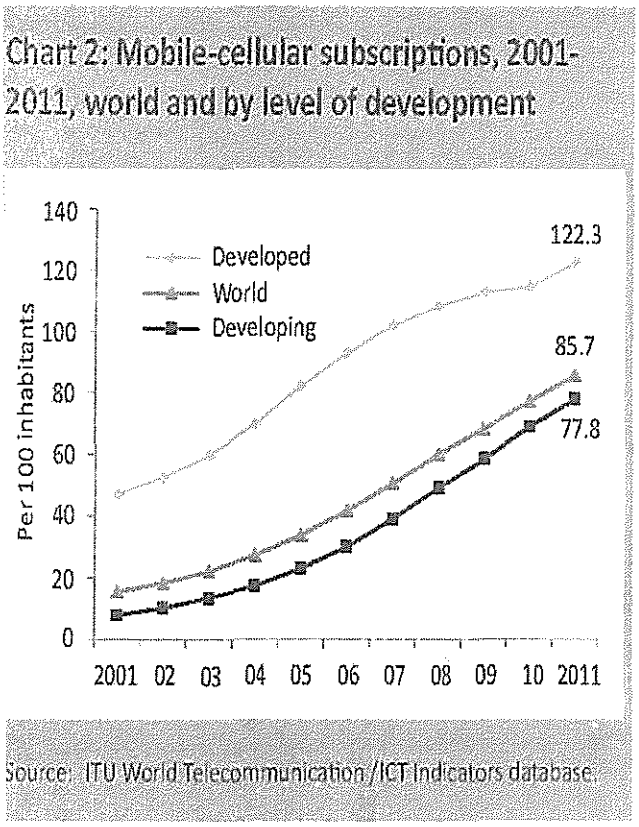


Figure 5: left; (Mobile phone ownership in sub Saharan Africa)… right (mobile phone subscription globally)…



Do you yourself have a cell/mobile phone?

Asked of adults in 17 countries in sub-Saharan Africa

	Yes
South Africa	84%
Nigeria	71%
Botswana	62%
Ghana	59%
Kenya	56%
Uganda	52%
Senegal	46%
Zimbabwe	44%
Cameroon	43%
Sierra Leone	37%
Tanzania	35%
Chad	32%
Liberia	22%
Mali	21%
Burkina Faso	19%
Niger	18%
Central African Republic	16%

2010

GALLUP

Appendix D: Observation check list on mobile phone use in agriculture

Tick the appropriate boxes

	Mobile phone use			
	Yes	Little	No	Comment
communication between extension workers and farmers				
Mobile phone usage by age groups				
monitor financial transactions				
market farm products				
agricultural emergency assistance				
Monitor weather information				
Contact customers/suppliers				
Frequency of SMS and voice call message usage				
Ability to write and speak English				
Support services by NGOs and government sectors to farmers				