Mobile phones in agricultural information delivery for rural development in Eastern Africa: Lessons from Western Uganda

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Information is a key component in improving smallholder agricultural production and linkages to remunerative markets, thus improve rural livelihoods, food security and national economies. The dynamics of using phones among farmers linking them to market outlets and other service providers are discussed. . The paper isolate strength, weakness and threats while analysing insights associated with results patterns. The findings showed that rural communities appreciated the use of phone as easy, fast and convenient way to communicate. Phone usage was accompanied by positive outcomes and opened opportunities like strong collective action among social groups for effective natural resource management.

Keywords: *agricultural information; mobile phone usage; natural resource management; rural information access.*
ACM Classifications: *J3, J4, K4.2*

1 Introduction

The livelihoods of millions in the developing world depend heavily on agriculture and small businesses. The agricultural sector as the mainstay of most African economies accounts for about 60% of the total labour force, 20% of the total exports and 17% of the GDP and provide livelihoods to over 70% of the population (ACACIA, 2006). Agricultural production for local consumption and export in East Africa plays a critical role in national economies; making up 40% of the sub-region's Gross Domestic Product (GDP). It employs nearly 80% of the people who are mostly smallholder farmers. In particular, smallholder farmers have poor market infrastructure, inadequate marketing experience, and agricultural inputs (Munyua, 2007). These farmers need to access information about new technologies before they can consider adopting them and thus look up to research and extension agents as sources of new technologies. Access to appropriate information and knowledge is an overriding factor for successful agricultural production and thus rural development. However, the traditional approach of providing agricultural information through extension services is overstretched and under-resourced. Knowledge and innovation are now widely regarded as key drivers of economic growth and it is clear that information and communication technologies (ICTs) are deeply implicated in knowledge flow and innovation (Verlaeten, 2002). It is in working with and improving these information and communication systems that ICTs can be used to enhance the delivery of these services (ACACIA, 2006).

Agricultural information is a key component in improving smallholder agricultural production and linking increased production to remunerative markets, thus leading to improved rural livelihoods, food security and national economies. Improvement of agricultural productivity will be realised when farmers are linked to market information. However, one major problem in many rural areas is that farmers and small entrepreneurs generally have no way of knowing the prices before they travel to the market due to poor communication facilities. They

often have to rely on middlemen who take advantage of this ignorance. Accurate and timely market information, particularly of perishable items, can significantly reduce transaction and travel costs. There have been quite a few studies that explored how mobile phones impact livelihoods of farmers (Rashid and Elder, 2009). Correspondingly, a positive view that mobile phones offer good value for money appears to support the uptake of mobile phone applications. The importance of knowledge and information sharing in research for development (R4D) settings has been firmly established through research.

In recent years, there has been a rapid growth of mobile phone networks in developing countries. Currently mobile telephony is the predominant mode of communication. Africa achieved the impressive growth rate of 46.2 percent of the mobile subscriber between 2001 and 2005 (ITU, 2007). Recent study by *Research ICT Africa! Network* has shown that Africans are willing to pay a higher proportion of their income than in developed countries for access to telephone; this indicates, among other things, a significant, unfulfilled demand for telephone (Gillwald and Esselaar, 2005). Another study by Wade (2004) showed that now almost one in five Africans owns a phone. The widespread use of mobile phones should add to more use of voice and SMS solutions as they offer easy accessibility. However, Gakuru *et al.* (2009) asserts that mobile users also face challenges because the SMS carries only a limited amount of information and requires a basic level of literacy.

Mobile phones are widely recognized as a potentially transformative technology platform for developing nations. Mobile phones are transforming the lives of many users in developing countries and are widely recognized as an important current and future technology platform for developing nations (Lehr, 2007). Mobile phones are considered important for development because they offer benefits such as mobility and security to owners (Donner, 2006). Also due to their unique characteristics of working using the radio spectrum they need not to rely on physical infrastructure such as roads and phone wires, and base-stations can be powered using their own generators in places where there is no electrical grid (Economist, 2008). Mobile phones only require basic literacy, and therefore are accessible to a large portion of the population. Finally, mobiles enjoy some technical advantages that make them particularly attractive for development. In addition to voice communication, mobile phones allow for the transfer of data, which can be used in the context of applications for the purposes of health, education, commerce or governance (Rashid and Elder, 2009).

Uganda has a rapidly growing ICT market with several internet service providers (ISP), privately owned radio and television stations, several ICT training institutions and many donor-funded ICT initiatives. Prior to the growth of inexpensive telecommunications and the internet, information was costly to acquire and disseminate. The mobile market in the country is the biggest and has proved to be the fastest growing. By 1996 there was telephone capacity of 45,145 fixed lines and 3,000 mobile phone lines as compared to the situation in 2004 where telephone capacity for fixed lines was 71,056 and 1,040,420 mobile phone subscribers (Tusubira *et al.,* 2005). As mobile penetration rates increase rapidly in developing countries, there has also been an increase in the extent of research on mobile phone usage. Recent study (Mendes *et al.,* 2007) indicates that in 2007 the mobile connection in Uganda was at 3,054,179 subscribers. With such fast growth, mobile telephone can be used to deliver agricultural information that could stimulate increased production by linking farmers to remunerative markets. This shows how the spread of mobile telephone can impact on economic growth of the country. It has also been argued that increase in mobile phone penetration rates promotes economic growth and national development (Waverman *et al.,* 2005). Bayes (2001) found higher returns of using mobile services for the poor compared to the non-poor. Analyzing the Village Phone service in Bangladesh, he shows that the consumer surplus of the poor users, measured by taking into account factors of time saved, transport and opportunity costs, is 50% higher than that of the non-poor. The fast growth of mobile phones in Uganda provides a better environment for its application in various sectors including agriculture. This paper discusses the role of mobile phones in improving communication and information delivery support to agricultural development for improved rural livelihoods with reference to Rubaya Sub-county of Kabale district in Western Uganda.

2 Methodology

The study was conducted in Rubaya sub-county in Kabale district. Rubaya is one of 19 sub-counties in Kabale District. It has 6 Parishes namely Kitooma, Rwanyena, Mugando, Buramba, Kibuga and Karujanga (Figure 1). The project was conducted in all the 6 Parishes where village information centres were established. The Sub-county telecentre is in Mugandu Parish where the Sub-county headquarters is located.

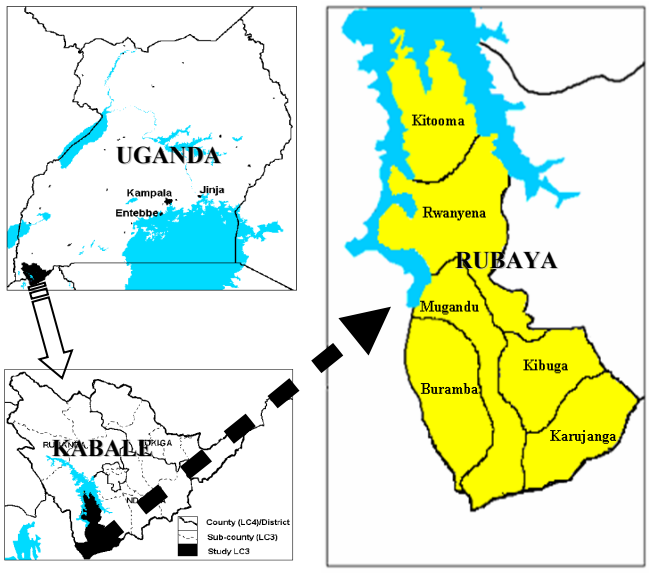


Figure 1: Location of the Study area

Mobile phones were distributed to the rural communities in Kibuga, Karujanga, Rwanyena and Mugandu parishes. Systematic action research and process documentation were used in this study to monitor the use of various information and communication technologies. The approaches facilitated communication and information flow between farmer institutions at different levels, (farmer groups, parish, sub-county and district levels), between farmer institutions and the telecentres and between information sources and the telecentres or information hubs. Information needs assessment protocol was used to identify farmers' information needs and tested with farmer groups in Rubaya sub-county. The protocol was then used to collect information needs on agro-enterprise, agriculture, NRM and markets. Monitoring and evaluation process was used to examine the usage of mobile phones through village phone usage tracking forms. Three information delivery methods were employed in the study area including paper based technology (leaflets, brochure, posters), telephone and radio. Each method had its potential and challenges in delivering the information to the communities. The scope of this paper is to discuss how mobile phone was used to enhance access of information to rural farming communities of south-western Uganda.

3 Findings

3.1 Mobile phone usage in rural information access

Through the use of phones the capacity of rural communities to access ICTS in the study area was built. The usage of mobile phone was found to benefit farmers in different areas. Most conspicuous areas are productivity, market access, natural resource management and knowledge base.

3.1.1 Phone usage and productivity

The general findings showed that there was a peak usage of phones during planting and harvesting seasons. Majority of the farmers used the phone to call stockists, technocrats and traders due to the fact that crop husbandry is one of the most important livelihood activities in the study area. Early in the season, the phones are used to inquire about time of planting, source and availability of seeds and other inputs. During mid season, most farmers use the phone to inquire about availability of pesticides for pest and disease management. Later in the season during harvesting, the phones are used to inquire about the prevailing market prices for agricultural commodities.

3.1.2 Phone usage and market access

The farmers reported that presence of the phone made it easier for them to communicate with their older customers by informing them on the availability and quantities of agricultural produce especially Irish potato which is the major cash crop in the area. Through this communication, the real tradable quantities of produce were ascertained and farmers were able to mobilize themselves to bulk their produce and sell as a group. This increased cooperation among farmers within the village. Phones also enabled farmers to know the prevailing market prices of agricultural commodities in various markets in Kabale and elsewhere, which enabled them to negotiate and sell produce at competitive prices. It is probable that new contacts with buyers were established during these transactions. The link to market was also related to acquisition of inputs (seed and pesticides) from stockists and accessing price and market information in order to match harvesting (and bulking) of potatoes and beans with better prices. Studies by de Silva (2008) and Ashraf *et al.* (2005) assert that mobile phones can facilitate a greater export orientation in agricultural practices and marketing, potentially bringing higher incomes

for farmers.

3.1.3 Phone usage and NRM

The phone was not specifically used to seek information or advice on natural resource management because such information was thought to require lengthy explanations which would be expensive to follow on phone. It was evident that there was a service provider contracted by the NAADS to provide natural resources management related services to the farmers in Rubaya. Therefore, calls indicated to target natural resource management were basically calls made to the service provider.

3.1.4 Phone usage and knowledge base

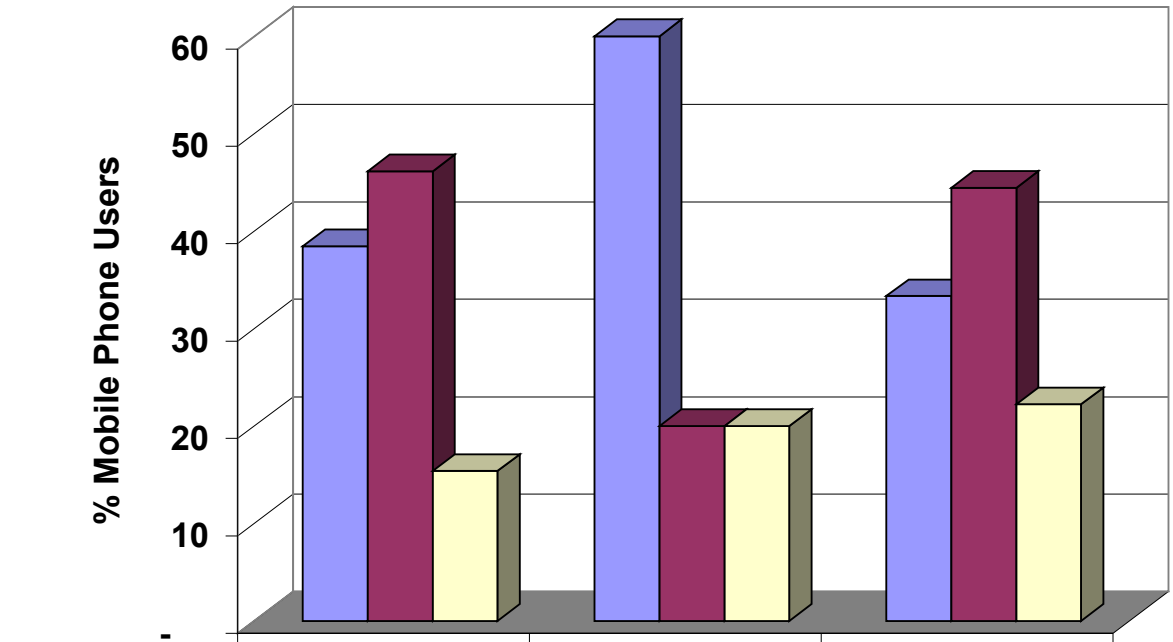
The presence and usage of the phones built self confidence in the farmers some of whom managed to buy their own. The experience in using the village phone contributed to building confidence in using any other phone, knowing phone alerts, for example, when the phone is busy, not available, dropped calls, low credit, low battery, unstable network and using extra phone features like short message services (sms), checking credit, alerting (beeping), playing phone games and changing ringing tones. The greatest contribution of phone usage especially on accessing markets is farmers realizing the necessity of prior knowledge of prevailing market prices so as to enhance negotiation for better prices for their commodities.

3.2 Tracking of usage of mobile phone

The results of the phone tracking in three parishes showed that the general phone usage was as follows Rwanyena (48%) Kitooma (33%) and Mugandu (19%). Higher usage at Rwanyena is attributed to cheap rates per calling for the project phone as compared to other pay phones in the parish. The low usage in Mugandu is attributed to network problem for MTN phones, which rendered the phone to be unusable for most of the times. In Kibuga Parish the analysis showed that on average, about 7 people used the phone every week. However, frequency of use intensified during planting and harvesting time. The farmers in Kibuga reported a very remarkable usefulness of the phone when there was an outbreak of foot and mouth disease whereby a few farmers raised concern to the community based facilitator who then called the district veterinary officer to vaccinate all animals in the Parish.

3.2.1 Purpose of Mobile Phone Usage in the Study Area

The general analysis of the purpose of using the phone showed that most farmers in Rwanyena (46%) and Kitooma (44%) used the phone to request information on markets than for other purpose, contrary to farmers in Mugandu who used the phone mostly on social issues (60%) like calling relatives. This is attributed to the fact that Mugandu parish is more urbanised because it host the sub-county headquarters therefore there is more social interaction with other outside communities. Also the presence of the sub-county headquarters offers market opportunities because there is high influx of people from other communities and access to frequent transport to major urban centres. Social issues were also found to take second priority in both Rwanyena and Kitooma indicating that they are very important in day to day lives of people (Figure 2). Studies by Souter *et al.* (2005) and Donner, (2004) reported that direct impact are less obvious in most other studies which show greater use of mobile phone for social purposes and emergencies, rather than dedicated economic activity such as calling suppliers or customers. Social issues may be very important and could have negative effect on productivity or market issues if not well attended.

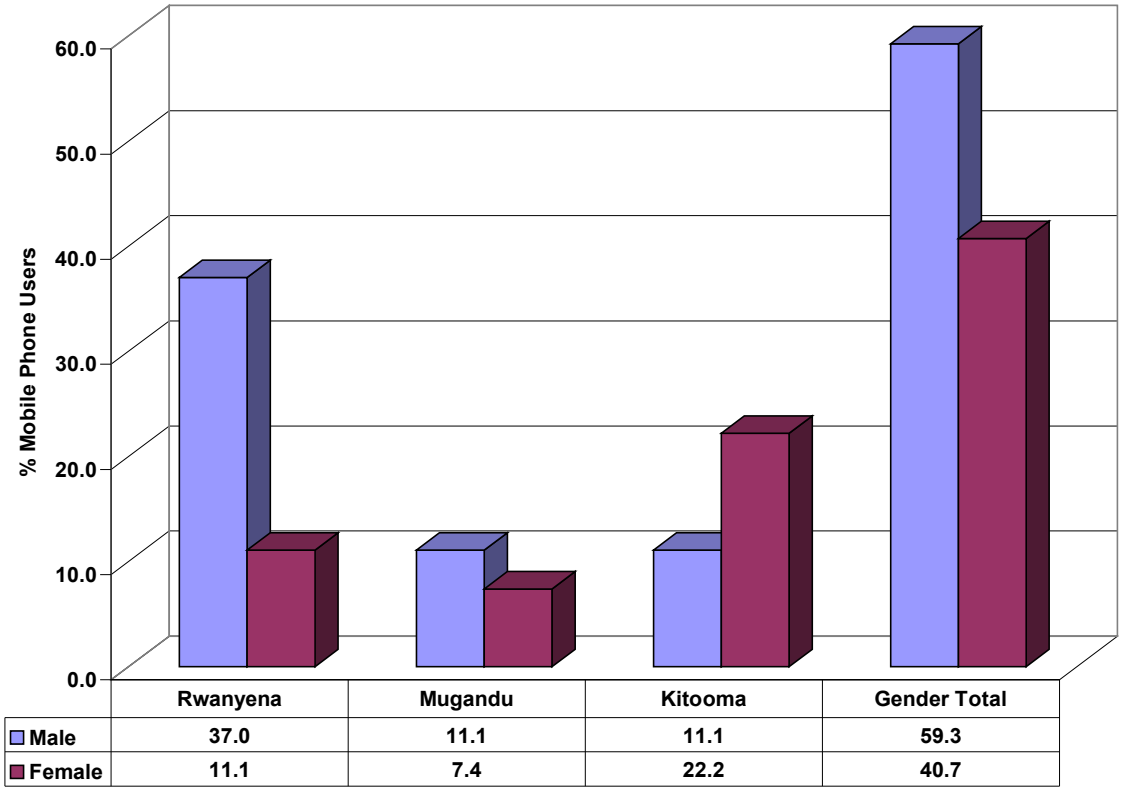


	Rwanyena	Mugandu	Kitooma
Social	38	60	33
Markets	46	20	44
NRM/Agric.	15	20	22

Figure 1: Purpose of Mobile Phone in each Parish

3.2.2 Gender factor on use of parish level (VICE) mobile phones

The tracking exercise enabled to find out who has been using the phones and for what purpose in the three parish groups. The results are presented in Figures 3, 4 and 5. The overall gender analysis of phone usage showed that more male farmers (59.3%) made use of the phone than female farmers (40.7%) (Figure 3) except for Kitooma. Similar findings were reported in West Africa (Mottin-Sylla *et al.,* 2005 as quoted by ACACIA, 2006) that women had 36% fewer ICT-related opportunities and benefits than men.



	Rwanyena	Mugandu	Kitooma	Gender Total
Male	37.0	11.1	11.1	59.3
Female	11.1	7.4	22.2	40.7

Figure 2: General Use of the Mobile Phone across the three Parishes and Gender

The analysis of gender in the usage of phones across the parishes indicate that more male farmers made use of the phones in two parishes (Rwanyena – 76.9% and Mugandu - 60.0%) while more female farmers (66.7%) made use of the telephone in Kitooma parish (Figure 4).

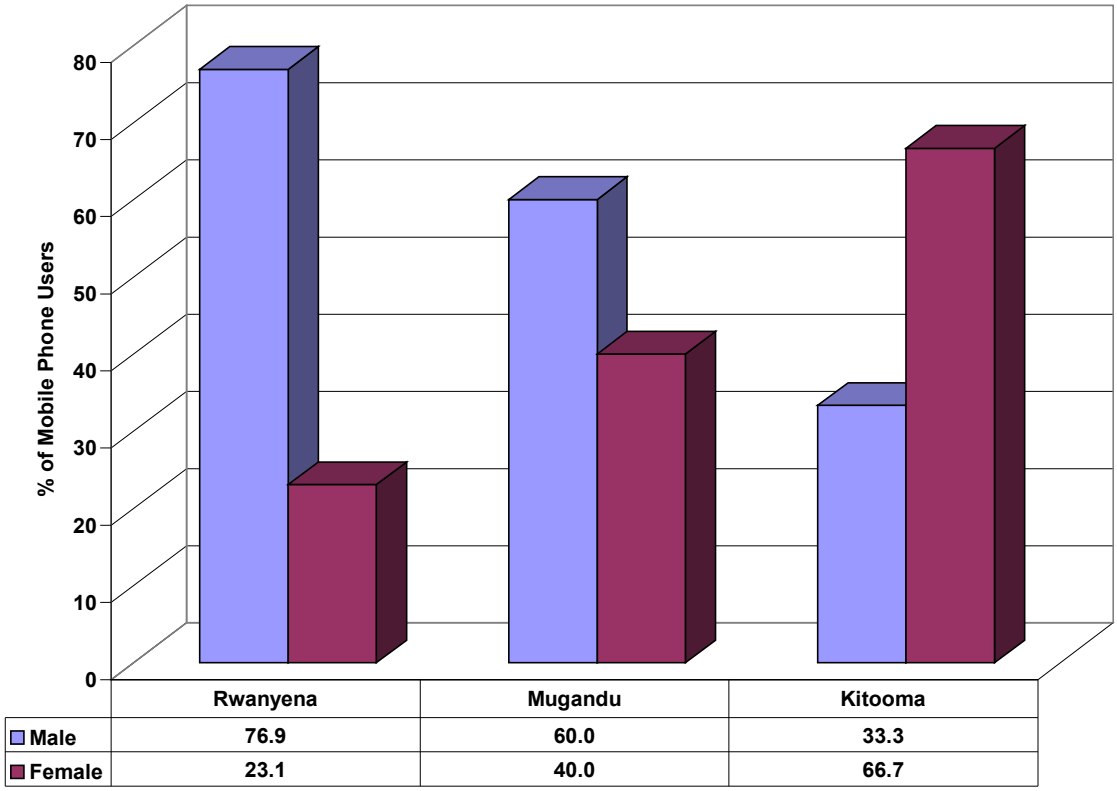


Figure 3: Mobile Phone Usage by Gender for each Parish

The general analysis of the purpose of using the phone showed that women used the phone to request information on NRM and agriculture more than men across the three parishes, while more men used phones for personal and search for market information (Figure 5). This is attributed to social set up in most traditional rural Africa whereby women are involved much in agricultural productivity but do not have mandate to market the produce. Men as head of households are more responsible in marketing of agricultural produce, mainly the traditional cash crops. In the other hand women also are involved in production and marketing of some crops like vegetables and local fruits.

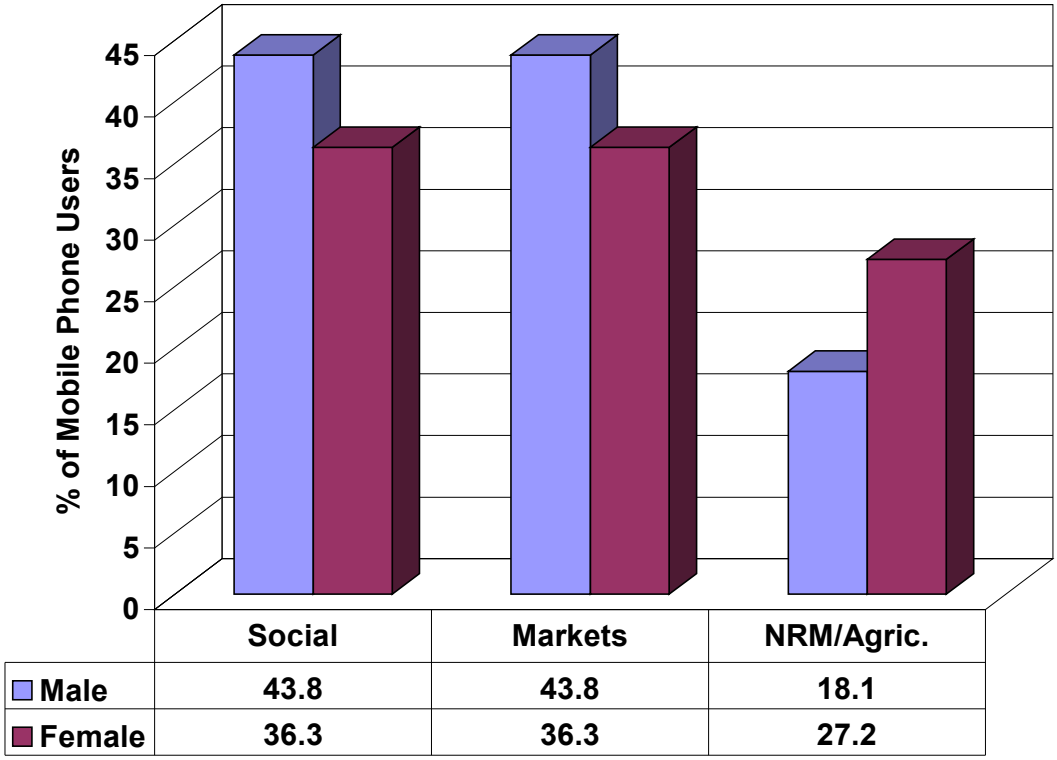


Figure 4: Purpose of Mobile Phone Usage by Gender

3.3 Mobile phone usage and rural communities' livelihoods

Study farmers reported a positive influence in their livelihoods due to improved communication. About 80% of respondents reported improvement in food security, household assets and increased welfare spending. Social capital was built as manifested by emergence of strong and well organised social groups including credit and microfinance schemes in Kitooma and Rwanyena Parishes, and women groups such as *Buramba-Bakyala Kweterana* Women Farming Group and *Ryabakuza Bakyala Tweyombekye* in Buramba and Rwanyena Parishes respectively. The building of social capital has resulted into establishment of potato collection centres, by farmers who joined forces to profitably market their produce. It is probable that new buyers/contacts were established during these transactions hence building more social capital with outsiders.

The farmers reported that they were able to build financial and investment capitals through increased income as a result of bulk marketing. The use of the phone has enabled farmers to know the lucrative markets and prevailing prices of agricultural commodities in various markets in Kabale and elsewhere, which enabled them to negotiate and sell their produce at competitive and relatively higher prices. This has potentially ascertained the real tradable quantities of produce and mobilized farmers to bulk their produce and sell as a group.

There was increased information and knowledge amongst rural communities as a result of interaction between different actors within the production chain. We can conclude by saying that the greatest contribution of phone usage in agriculture is the access to markets and prior knowledge of prevailing prices that enhanced bargaining power among the smallholder farmers when selling their commodities.

3.4 Challenges of mobile phone usage in agriculture

Main challenges that the rural communities have faced is impeded mobile application due to language barrier and illiteracy. It was reported in Ghana (Frempong *et al.,* 2007) and in Kenya (Ashraf *et al.,* 2005) that lesser extent of SMS usage by farmers was due to higher rate of illiteracy. The DrumNet study in Kenya which revealed that only 9% of the respondents know how to send an SMS for business purposes (Ashraf *et al.,* 2005)

while the corresponding figure in Ghana was 21% (Frempong *et al.,* 2007). It was reported by Rashid and Elder (2009) that in addition to the higher rate of illiteracy, other factors such as the stated complicated nature of SMS, very small displays and less functional user interfaces explain the lag in SMS adoption. In the current study, a number of trainings were conducted to familiarise the farmers with some important feature that could allow them use the phone appropriately. These include reload airtime and writing and sending and receiving SMS. Training manuals were prepared in local vernaculars.

Poor signal of the earlier service provider network in the area was a challenge. MTN was the first phone service provider and during the inception of the project, all the phones were connected to its network. Fifty percent of the parishes (Kitooma, Buramba and Mugandu) reported unreliable network as one of the major problems that greatly hindered the optimum performance and utilization of the phones and hence its impact. Assessment of the strength of signals and network from three phone companies (MTN, Uganda Telecom (UTL/MANGO) and CELTEL - presently Airtel) showed considerable variations from parish to parish and in different locations within the parish. For example, Kitooma and Buramba parishes which had MTN lines were found to have stronger network with CELTEL and MANGO respectively. Currently, the area is well served by Airtel network which has strong signals in the area. Due to that the project facilitated each Parish with one extra phone which is connected to Airtel. The farmers also reported some challenges they face in using the technology as high cost per call which most farmers cannot afford and unfavourable locations of the phones to most farmers as some of the challenges they are facingin using this technology. There are only two project phones in each parish thus some farmers have to walk long distances to make calls.

Farmers also reported problems in charging the phone batteries for parishes that are not connected to the national electricity grid. The only place with electricity was Rubaya sub-county headquarters (Mugandu Parish) which is relatively far from other parishes. This means that the group had to provide transport and lunch to the person willing to take the phone for charging (Uganda shillings 1,500 /= for transport and 500/= for lunch) in addition to the 500/= for the actual phone charge fee (1 USD = 1875 Uganda shillings at the time of the study). As a result, some phones made very little or no profits and savings for sustainability. This problem was solved by supplying the parishes with solar chargers. The farmers pointed another challenge as inaccessibility: This was attributed to difficult terrain; large parishes with big populations had only one or two functional phones. For example, Kitooma Parish with a population of 3,293 persons had only three public phones in 2006 (two from the project and the other was privately owned).

3.5 Opportunities for agricultural development from mobile phone usage

Access to ICTs gives farmers the chance to develop their agricultural production and thus increase their incomes and increase food security. Agricultural production is part and parcel of a long product chain which involves a number of partners who need information from each other. Mobile phone usage has proved to be potential to link these partners. As most of the agricultural production systems in this region are rainfed, use of mobile phones in weather updates would boost agricultural productivity as farmers will be aware and plan when to plant appropriate crops to adapt to climate patterns. With establishment of rural telecentre, mobile phone could be a solution to internet connectivity because most rural areas lack communication infrastructure. Internet connectivity using mobile phone is an opportunity that the farmers in Rubaya sub-county and any other rural areas could explore to improve communication with outside world. Rural communities have embraced the issue of microfinance. With increase in microfinance schemes M-banking facilities like M-Pesa, M-Sente, Z-Pesa, Zap and the like is an opportunity farmers in rural areas could use to reduce transaction costs when one has to travel all the way to urban centres just for bank services. This will save the cost of transport for the person and even risk of theft in the process. Improvement of extension services in Uganda where farmers are lead players in extension service delivery through public-private partnership, there are opportunities for farmers to use phone to contact service providers once they have a problem. For example use of phone web systems can be a convenient medium of communication between farmers and extension workers. Also a multimedia messaging service (MMS) application can help farmers to take a photo in case of disease incidences and send it to extension worker to enable more specific and precise advisory service delivery. On the other hand, in case of farmer learning groups, consultations with subject matter specialists could be enhanced through a group teleconference using a hand free application of the mobile phone where a group could ask questions directly to the technical person and receive answers promptly.

4 Conclusions and Recommendations

The findings of this paper are simply a glimpse into the potential role mobile phones could play in improving agricultural production and access to lucrative markets. The study above underscores the critical role mobile

phones can play in improving efficiency for farmers in rural setting. One of the key findings in this paper is that mobile phones are increasingly accessible to lower-income groups in rural areas. From the discussions and observations made, it was found that farmers were more excited about using the phone to access information on agriculture, natural resources management and marketing. This, calls for various actors along the product value chain to look into the opportunities that mobile phones can best be utilised to boost agricultural development given the fast growth of mobile connectivity in the country. Opportunities emerging from the proliferation of mobile phones experienced in most developing countries like Uganda need to be explored especially in the absence of other ICT infrastructure, like fixed phones and internet. Given the growing interest in smallholder access to information, we recommend mobile phone service providers to plan for capacity building programmes for rural communities on the emerging innovations in mobile phone application in order to realise their usefulness in agriculture.

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