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THE ROLE OF MOBILE PHONES IN IMPROVING COMMUNICATION AND INFORMATION DELIVERY FOR AGRICULTURAL DEVELOPMENT: LESSONS FROM SOUTH WESTERN UGANDA

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Role of mobile phones in improving communication and information delivery for agricultural development: Lessons from South Western Uganda

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Abstract: Agricultural production for local consumption and export in East Africa plays a critical role in national economies. The sector employs nearly 80% of the people who are mostly small-scale farmers and depend on agriculture for their livelihoods. Agricultural information is a key component in improving small-scale agricultural production and linking increased production to remunerative markets, thus leading to improved rural livelihoods, food security and national economies. The paper discusses the dynamics of using portable phones among smallholder farmers to link them with market outlet and other service providers who contribute in one way or the other into agricultural productivity. The paper isolates strength, weakness and threats while analysing insights associated with results patterns. Research findings showed that use of phone was appreciated by rural communities as easy, fast and convenient way to communicate and get prompt answers of respective problems. Farmers were more excited about the use of phone than other information and communication technologies. Use of mobile phones to access information differed from one parish to another. Information on marketing is on higher demand (100%). There is generally more use of phones by male than female farmers, yet more female farmers requested information on NRM and agriculture as compared to male farmers. Despite some obvious challenges the use of phone in the study area was accompanied by positive outcomes and opened opportunities such as emerging of strong collective action among social groups. Farmers are coming together to market their produce. Based on these results the increased mobile penetration rate in the country provides opportunities for actors along commodity chain to look into possibilities of using mobile applications to boost agricultural development that accounts for 30.2 % of the county's GDP.

keywords: 1.Agricultural information 2.Mobile phone 3.Rural information access.

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 small-scale farmers and depend on agriculture for their livelihoods. These smallholder farmers need to access the information about new technologies before they can consider adopting them and thus look up to research and extension agents as sources of new technologies. However, the traditional approach of providing agricultural information through extension services is overstretched and under-resourced. 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 small-scale 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 regions is that farmers and small entrepreneurs generally have no way of knowing 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. In particular, small-scale farmers have poor market infrastructure, inadequate marketing experience, and agricultural inputs (Munyua, 2007). 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. Access to appropriate information and knowledge is an overriding factor for successful natural resource management (NRM) planning, implementation and evaluation processes, and it is known to be one of the most determinants of agricultural productivity. 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).

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 in the developing world. In 2004, Africa became the fastest growing mobile telephone market in the world. 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 indicates that in 2007 the mobile connection in Uganda was at 3,054,179 subscribers (Mendes *et al.*, 2007). 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 evidence 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 cost, and opportunity costs, is 50% higher than that of the non-poor. The fast growing 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 project 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 6 Parishes where village information centres were established. The Sub-county telecentre is in Mugandu Parish where the Sub-county headquarters is located

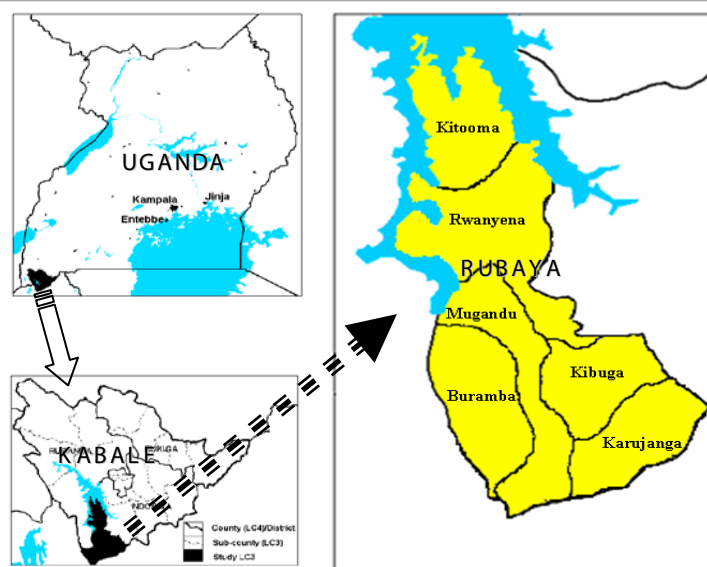


Figure 1: Location of the Study area

Mobile phones were distributed to the rural communities in Kibuga, Karujanga, Rwanyena and Mugandu parishes. A systematic action research and process documentation was used in this study to monitor the use of various information and communication technologies to facilitate 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 protocols 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 an 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, these include 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 in the study area the capacity of rural communities to access ICTS 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 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 used the phone to inquire about availability of pesticides for pest and disease management. Later in the season during harvesting, the phones were used to inquire about prevailing market prices for agricultural commodities.

3.1.2 Phone usage and market access

The farmers reported that presence of the phone made 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 buyers/contacts 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 as 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 that some 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 where by 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 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. However social purposes may be very important if not attend to in such a way that they could affect productivity or market issues.

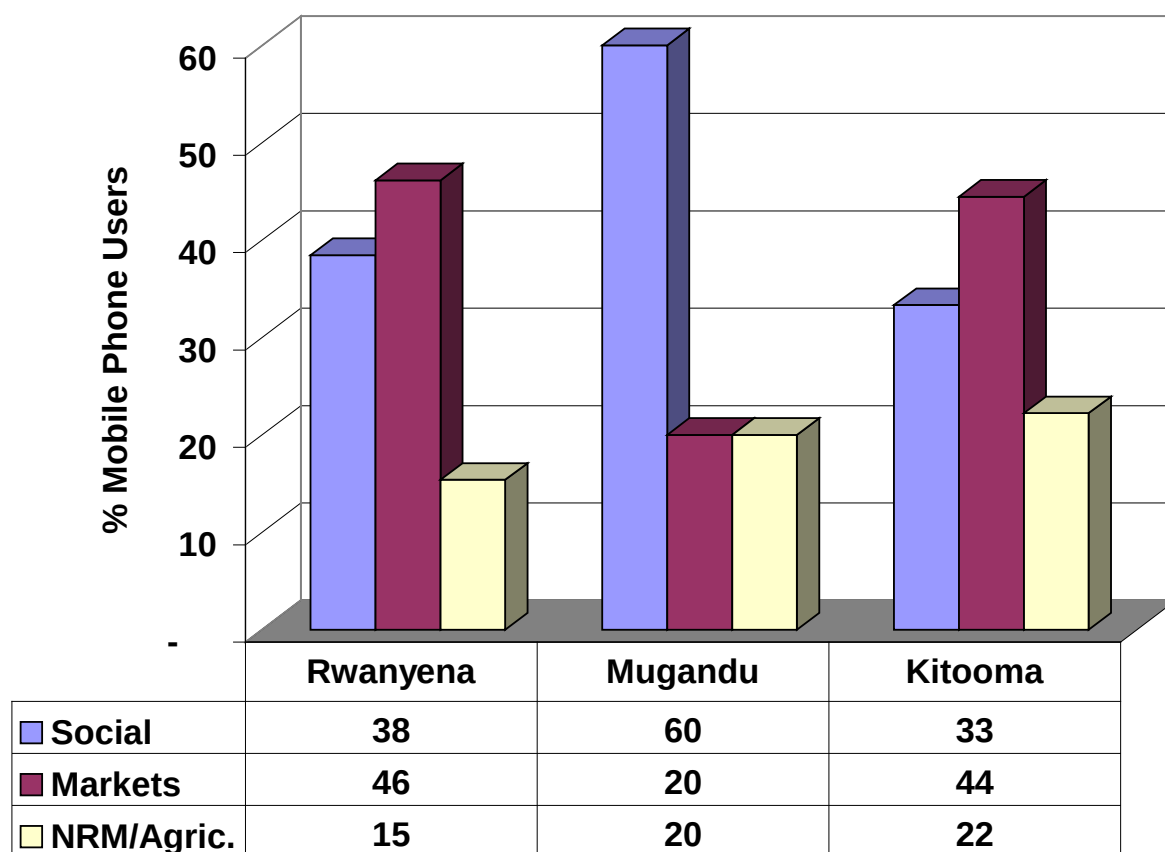


Figure 2: Purpose of Mobile Phone in each Parish

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

The tracking exercise enabled to assess 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 usage of the phone showed that more male farmers (59.3%) made use of the phone than female farmers (40.7%) (Figure 3). Similar findings were reported by the ACACIA-funded research that in West Africa where by women had 36% fewer ICT-related opportunities and benefits than men. (Mottin-Sylla *et al.* 2005 as quoted by ACACIA, 2006).

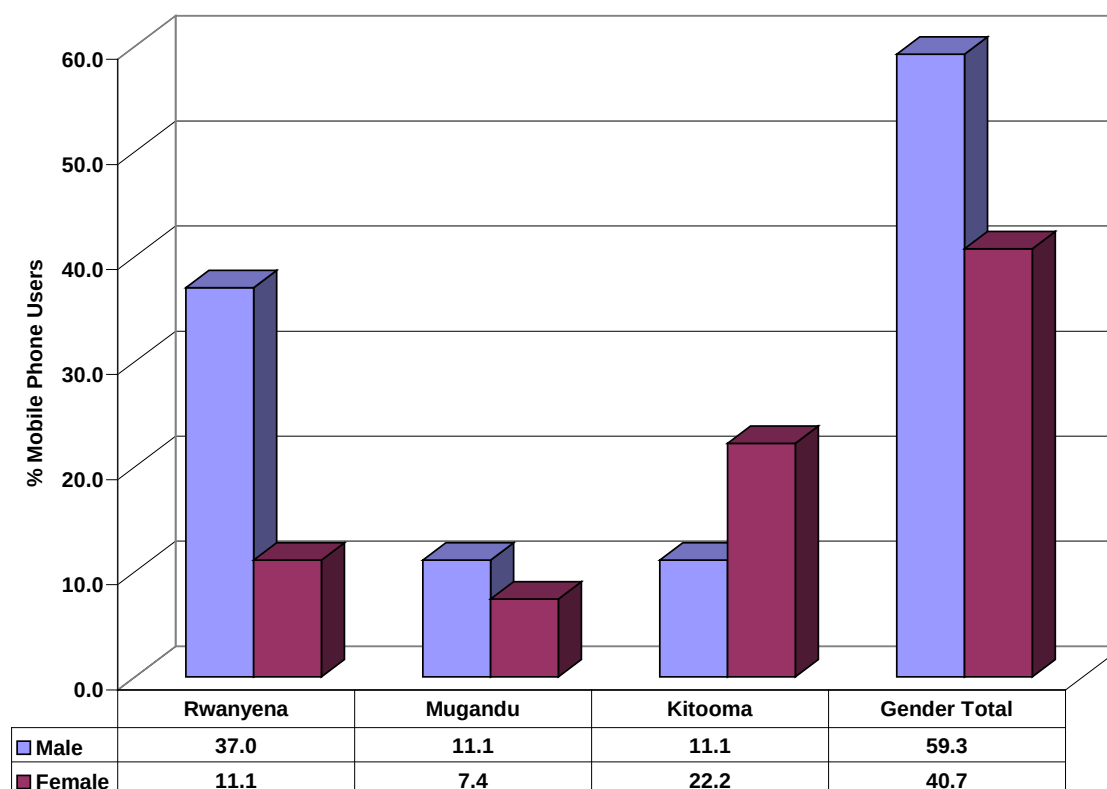


Figure 3: General Use of the Mobile Phone across the three Parishes and Gender

The analysis of gender in the usage of the phones across the parishes found 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).

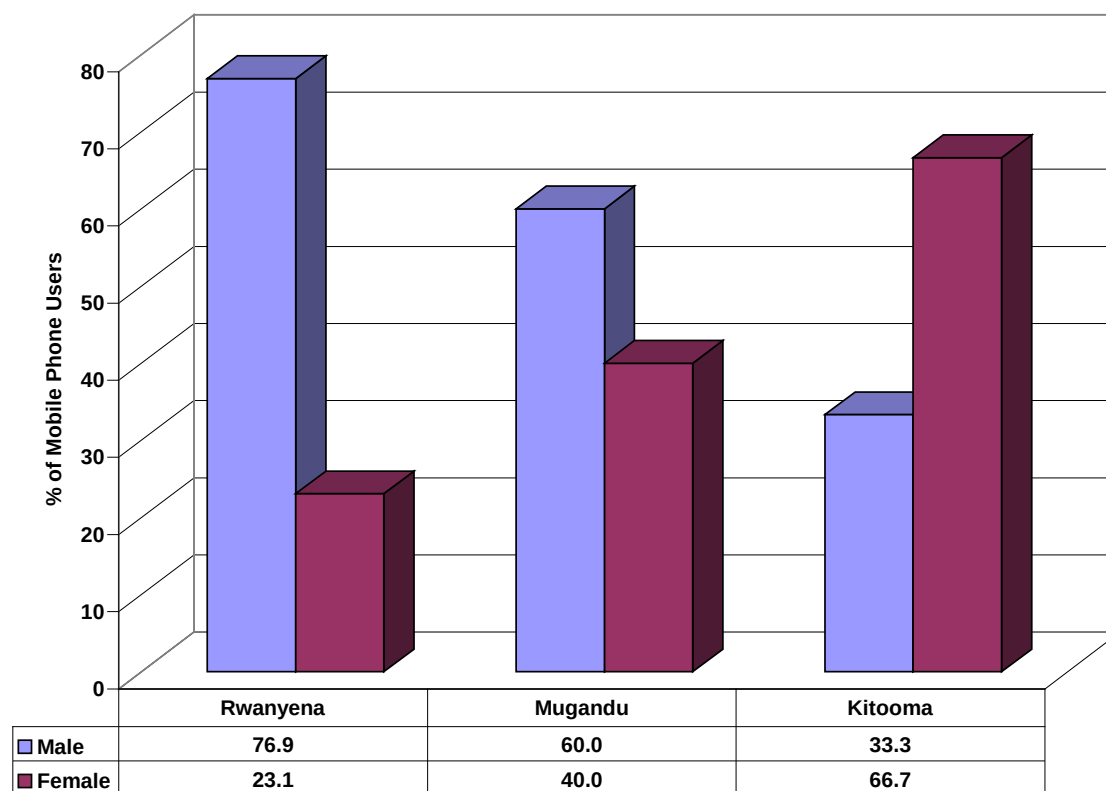


Figure 4: Mobile Phone Usage by Gender for each Parish

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 for personal and search for market information (Figure 5).

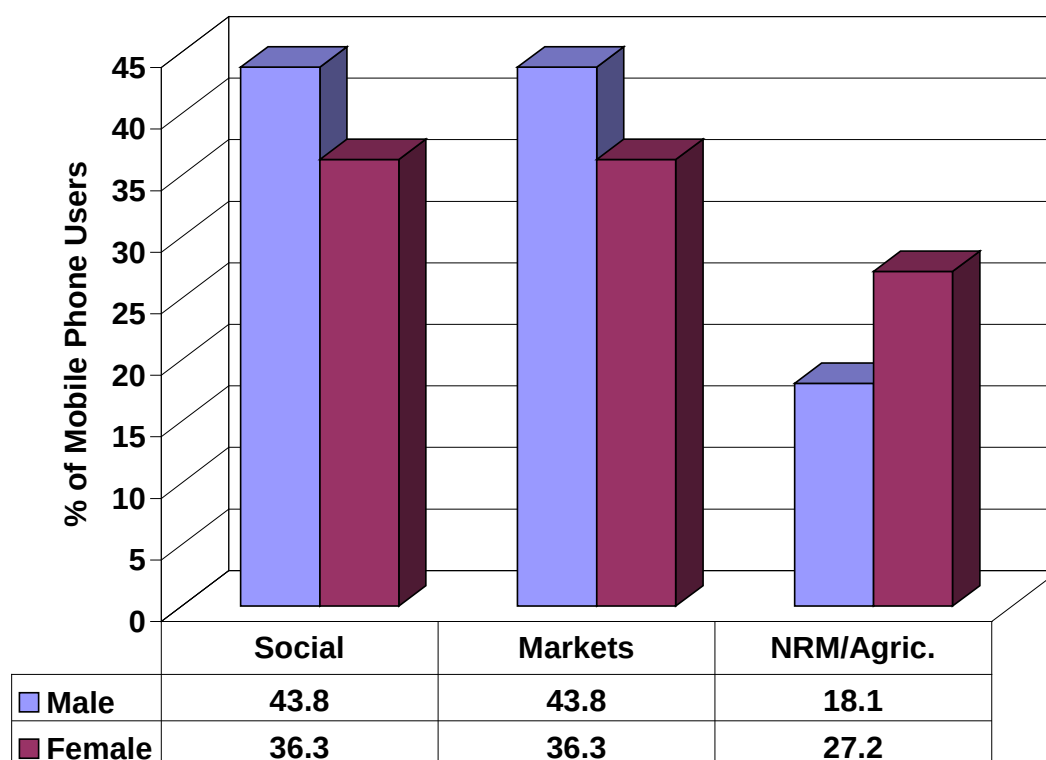


Figure 5: Purpose of Mobile Phone Usage by Gender

3.3 Mobile phone usage and rural communities' livelihoods

The farmers have reported a positive influence in the livelihoods of the rural communities in the areas. About 80% of respondents reported improved in food security, household assets and increased welfare spending. On the other hand social capital was built as manifested by emergency of strong and well organised social groups including credit and microfinance schemes in Kitooma and Rwanyena Parishes, women groups such as Buramba-Bakyala Kweterana Women Farming Group and Ryabakuza Bakyala Tweyombekye in Buramba and Rwanyena Parishes respectively. The social capital has resulted into establishment of potato collection centres, where by farmers joined forces to conquer market of their produce. It is probable that new buyers/contacts were established during these transactions hence built 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 in search for lucrative market had potentially ascertained the real tradable quantities of produce and mobilized farmers to bulk their produce and sell as a group thus built social capital among farmers within the villages. 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 their produce at competitive and relatively higher prices.

There was reported an increased information and knowledge amongst rural communities as a result of interaction among different actors within the production chain. The greatest contribution of phone usage in agriculture is especially on accessing markets

where by farmers realized the necessity of prior knowledge of prevailing market prices that enhanced negotiation for better prices of their commodities.

3.4 Challenges of mobile phone usage in agriculture

Main challenge that the rural communities have faced is impeded mobile application due to language barrier and illiteracy. Similar studies by Frempong *et al.*, (2007) and Ashraf *et al.*, (2005) reported that the extent of SMS usage by farmers lesser due to higher rate of illiteracy. They gave an example of the Drum Net study which revealed that only 9% of the respondents know how to send an SMS for business purposes while the corresponding figure in Ghana was 21%. In the case of this 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, sending and receiving SMS. Training manuals were prepared in vernaculars.

Poor signal of the earlier service provider network in the area was a challenge. MTN was the first phone service provider 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 CETEL - presently ZAIN) 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 ZAIN network which has strong signals in the area. Due to that the project facilitated each Parish with one extra phone which is connected to ZAIN. The farmers also reported some challenges they face in using the technology as high cost per call which most farmers cannot afford; unfavourable locations of the phones to most farmers. 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 national 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 (1,500/= for transport and 500/= for lunch) in addition to the 500/= for the actual phone charge fee. As a result some phones made very little or no profits and savings for sustainability. This problem was solves 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 (two from the project and the other was privately owned).

3.5 Opportunities for agricultural development from mobile phone usage

Internet connectivity using mobile phone is an opportunity that the farmer in Rubaya sub-county and any other rural area could explore to improve communication with outside world. With establishment of rural telecentre mobile phone could be a solution to internet

connectivity because most rural areas lack communication infrastructure like landlines. Rural communities have embraced the issue of microfinance. With increase in microfinance schemes M-banking facilities like M-Pesa, Z-Pesa, Zap and the like could be an opportunity to explore to reduce transaction costs someone travelling all the way to urban centres just for bank services. This will save the cost of transport for the person and even risk of burglary in the process. Improvement of extension services through public-private partnership, there are opportunities of using of phone web systems and MMS (in case of disease incidences) in agriculture. As most of the agricultural production system in this region is rainfed, use of mobile in weather updates would boost agricultural productivity as farmers will be aware and plan when to plant their crop. On the other hand, in case of farmer learning groups, consultations with subject matter technocrats could be enhanced through a group teleconference using a hand free application of the mobile phone where by a group could ask question directly to the technical person and receive prompt answers.

4 Conclusions and Recommendations

The findings of this paper are simply a glimpse into the potential role mobiles could play in improving agricultural productivity and access to lucrative markets. The study above underscores the critical role mobile phones can play in greater 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 that accounts for more than 30 % of the county's GDP given the fast growth of the mobile 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.

5 References

- ACACIA (2006). ACACIA Prospectus 2006-2011. http://www.idrc.ca/acacia/ev-113431-201-1-DO_TOPIC.html
- Ashraf, N., Gine, X. and Karlan, D. (2005) Growing Export Oriented Crops in Kenya: An Evaluation of DrumNet Services. Ottawa: IDRC.
- Bayes, A. (2001). Infrastructure and Rural Development: Insights from a Grameen Bank Village Phone Initiative in Bangladesh, *Agricultural Economics*, 25: 261-272.
- de Silva, H. (2008) Using ICTs to Create Efficiencies in Agricultural Markets: Some Findings from Sri Lanka. Paper presented to IDRC 23 May 2008. Ottawa.
- Donner, J. (2006) The Social and Economic Implications of Mobile Telephony in Rwanda:

An Ownership/Access Typology, Knowledge, Technology, & Policy, 19, 2, 17-28

Donner, J. (2004). Micro-entrepreneurs and Mobiles: An Exploration of the Uses of Mobile Phones by Small Business Owners in Rwanda. *Information Technologies and International Development*, 2: 1, 1-21.

Economist (2008) The Limits of Leapfrogging. http://www.economist.com/opinion/displaystory.cfm?story_id=10650775.

Etta, F. and S. Parvyn-Wamahiu, (eds.). (2003). Information and communication technologies for development in Africa: The Experience with Community Telecentres. International Development Research Centre, Ottawa.

Frempong et al., (2007) Frempong, G., Essegbey, G. and Tetteh, E. (2007) Survey on the Use of Mobile Telephones for Micro and Small Business Development: The Case of Ghana. Accra: CSIRScience and Technology Policy Research (STEPRI).

Gakuru, M, Winters, K., and Stepman, F., (2009). Innovative Farmer Advisory Services using ICT. W3C Workshop "Africa Perspective on the Role of Mobile Technologies in Fostering Social Development" April 1-2 2009, Maputo, Mozambique.

Gillwald, A., and Esselaar, S. (2005). "A comparative analysis of ICT access and usage in 10 African countries". In: Gilwald (ed.) Towards and African e-index household and individual ICT access and usage across 10 African countries. The LINK Centre, Wits University School of Public and Development Management, South Africa.

Lehr, D. (2007) Going Wireless: Dialing for Development (working paper). Retrieved <http://mobileactive.org/dialing-development-new-report-mobile-phone-use-base-pyramid>.

Mendes, S., E. Alampay, E. Soriano, and C. Soriano, (2007). The innovative use of mobile application in the Philippines – Lessons for Africa.

Munyua, H. (2007). *ICTs and Small-scale Agriculture in Africa: A Scoping Study*. Ottawa: IDRC.

Rashid A. T and Elder, L. (2009). Mobile Phones and Development: An Analysis of IDARC-Supported Projects. *The Electronic Journal on Information Systems in Developing Countries* (EJISDC) 36: 2, 1-16

Souter, D., Garforth, C., Jain, R., Mascarenhas, O., McKerney, K. and Scott, N. (2005) The Economic Impact of Telecommunications on Rural Livelihoods and Poverty Reduction: A Study of Rural Communities in India (Gujarat), Mozambique, and Tanzania. Commonwealth Telecommunications Organisation for UK Department for International Development.

Tusubira, F., Kagwagwa, I. and Ongora, J. (2005). "Uganda". In: Gilwald (ed.). Towards and African e-index household and individual ICT access and usage across 10 African countries The LINK Centre, Wits University School of Public and Development

Management, South Africa.

Verlaeten, M.-P., (2002). Policy Frameworks for the Knowledge Based Economy: ICTs, Innovation and Human Resources – An OECD Global Forum, OECD, Paris.

<http://www.oecd.org/dataoecd/49/11/1961062.pdf>

Wade, R.H. (2004). Bridging the Digital Divide: New Route to Development or New Form of Dependency, In: Avgerou, C. Ciborra, C. and Land, F. (eds), *The Social Study of Information and Communication Technology Innovation, Actors, and Context*. 185-206. New York: Oxford University Press.

Waverman, L., Meloria M. and Fuss, M. (2005). The Impact of Telecoms on Economic Growth in Developing Nations. In Africa: *The Impact of Mobile Phones*. The Vodafone Policy Paper Series, 3: 10-23.