INTEGRATED INFORMATION AND COMMUNICATION TECHNOLOGIES FOR FARM-LEVEL ACCESS TO NATURAL RESOURCE MANAGEMENT INFORMATION: CASE OF SOUTH WESTERN UGANDA


a African Highland Initiative, P. O. Box 26416 Kampala, Uganda
b World Agroforestry Centre (ICRAF), Box 30677 - 00100 Nairobi, Kenya
c African Highlands Initiative, P. O. Box 239, Kabale, Uganda
d International Development Research Centre, eastern and southern Africa Office, P. O. Box 62084 00200, Nairobi, Kenya

* Corresponding Author Email: k.masuki@cgiar.org; Tel: +256 414 220 611

Abstract

Small-scale farmers inhabiting the highly dissected highlands in Kabale district, Uganda lack access to appropriate information necessary to apply methods and technologies for sustainable land management for increased agricultural productivity. The farmers’ information needs are characteristically changing over time while access to information is often poor due to limitations in communication services. To address this shortcoming, African highlands Initiative (AHI) implemented a project which integrated information and communication technologies that connected farmers to appropriate information using multiple information sources and media including telecentres and village information centres. The centres were equipped with portable phones, printed materials like leaflets, brochures, pamphlets, research reports and books. This paper discusses the dynamics of using integrated information and communication technologies among smallholder farmers isolating challenges and opportunities while analysing insights associated with results patterns. Research findings showed that rural communities appreciated the use of integrated information and communication technologies as convenient way to communicate and get desired information. Farmers were more excited about the use of phones than other information and communication technologies like radio and the print media. There was a dynamic use of mobile phones for accessing information at parish level. The radio messages also offered prices of selected commodities in different markets within the district and in other neighbouring towns in the region. The information enabled the farmers to bargain for higher produce prices. Print media were particularly useful for information on sustainable land management. Different print media in the form of leaflets, pamphlets, booklets and posters were developed both in English and local languages and disseminated to village information centres and telecentres.

Key word: Integrated information and communication technologies, knowledge management, mobile phone, radio, print media.

1.0 Introduction

The agricultural sector remains the mainstay of most African economies and occupies a pivotal role in the development of the continent. The sector 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 information is a key component in improving small-scale
agricultural production. 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 is power and agriculture is no exception. Knowledge and innovation are now widely regarded as key drivers of economic growth. However, information and communication technologies (ICTs) are deeply implicated in knowledge flow and innovation (Verlaeten, 2002). New approaches of promoting access to agricultural information are being explored. Information and communication technology and its applicability to extension service have recently attracted interest. Many authors share the view that ICTs can be used to deliver agricultural information that could stimulate increased production by linking farmers to remunerative markets (Masuki et al. 2008a; Bertolini, 2004; Asingwire, 2003; Mayanja, 2002), thus leading to improved rural livelihoods, food security and national economies.

The past decade has seen remarkable progress in the use of ICTs in agriculture in developing countries, especially in the area of farmers’ access to market information (CTA, 2009). Recent experiences in the application of ICT in extension services in countries like India are examples of the emerging use of the technology to reach rural communities (Anandajayasekeram et al., 2005) including participation and empowerment of farmers and communities, linkages between groups and institutions, innovative learning and communication, and supportive policy environment and political commitment. In most developing countries, ICT applications based on digital technologies still face considerable constraints. There are challenges of access and literacy when it comes to reaching out to small-scale producers. Moyi (2003) points toward lack of access to physical resources and infrastructure and stresses the importance of prioritizing information flows via pre-existing networks of communication. There is growing recognition that farmers and members of rural communities have needs for information and appropriate learning methods that are not being met (Greenridge, 2003; Lightfoot, 2003). It is in this premise that the thought of integrated information and communication technology is derived.

Integrated information and communication technologies (IICT) as used in this paper refers to all information handling communication technologies both digital and non-digital, which are far more widespread, particularly in the rural areas of developing countries. Davenport and Prusak (1998) explained information handling technologies/ICTs to include digital ICTs (mostly referred to as “new ICT”) but also encompass hard technologies such as radio, television and analogue telecommunication networks, and soft technologies based on information held as the written word such as used in books, manuals, and newspapers. The relevant ICT such as radio, TV, telephone and email provide information to the poor, which help them to improve on their productivity and income (Ssewanyana 2007a). Scott et al. (2008) reported that mobile phone can often work well when integrated with more traditional means of communication in African rural setting. Bertolini, (2004) argued that innovative ways of combining ICT-based information sources (such as agricultural information systems) with traditional ones (such as radio broadcasting) should be considered when looking at the costs and benefits of ICT development.

Despite such enormous challenges, there are some unique success stories in the region that demonstrate how the new information and communication technologies (ICT) can play a significant role in rural development by empowering the rural farmers with new knowledge, up-to-date information and entrepreneurship skills. Parvyn-Wamahiu and Etta (2003) observed that telecentres have the potential to transform the lives and livelihoods of many in the developing world and especially those in remote locations. The work by Grameen Foundation in Uganda shows that use of mobile application has given farmers a broad range of information (Gantt and Cantor, 2010). The foundation works with a network of community knowledge workers (CKWs) who provide farming advice, market data, pest and diseases control training plus weather forecasts. The potential of village information centres (VICES) as promoters of integrated information and communication
technologies was demonstrated in 6 parishes of Rubaya sub-county in Kabale District, South Western Uganda over a period of six years since 2004. The goal was to improve the livelihoods of farmers through enhancing information access and use through improved flow of information between farmers, service providers, community members, and NGOs on NRM, agriculture and market. This paper discusses some key findings of this project on work that was facilitated by AHI in partnership with district level development institutions to improve information access to farmers. This project was designed to address the problem of limited access of critical information on NRM, agriculture and market.

2.0 Methodology

The project was conducted in Rubaya sub-county in Kabale District. Rubaya is one of 19 sub-counties in Kabale District, south western Uganda. The sub-county has 6 parishes namely Kitooma, Rwanyena, Mugandu, Buramba, Kibuga and Karujanga (Figure 1). The project was conducted in all 6 parishes.

Participatory action research methodology was used in this study where by various tools such as meetings, focus group discussions, key informants, and interviews were conducted between several stakeholder involved in the project especially, local communities, service providers, extension agents, and NGOs. A systematic process documentation approach was employed to monitor the use of various ICTs to facilitate communication and information flow between the various levels of farmer institutions, (farmer group, parish level, sub-county and district), between farmer institutions and the telecentres and between information sources and the telecentres (Masuki et al., 2008b).

The action research method was found to be useful in empowering farmers to participate in information needs assessment to foster demand driven information process. The action research featured four main steps namely; diagnostic, planning, implementation, and evaluation/reflection (Figure 2).
The diagnostic phase involved about 56 farmer groups with a total of 107 farmers (66 males and 41 females) at parish level who identified their information needs. Checklists were developed and used to guide the collection of information needs on agriculture, natural resource management (NRM) and markets. The main research questions formed basis to guide the focus group discussions and designing the protocol for survey. The research questions were (i) What are the community level (collective) information needs in natural resources, agriculture and markets?, (iii) What is the farmers’ preference on communication channels/media for different type of information needs domain? (iii) How effective are communication channels in promoting access to information and improving the livelihoods of smallholder farmers? and (iv) What is the role of exiting governance structure in facilitating farmers’ access to demanded information?

The planning phase at lower level involved prioritising village level information needs for passing on to the parish level for further prioritisation. Implementation involved having a service provider who worked of the needs assessment by collecting the relevant information as needed by farmers and packaging and disseminating it in a proper way that the farmers could access and understand. The processed and packaged information was channelled through existing information infrastructures in the district level. A quality assurance committee which involved a number of stakeholders in the information value chain were involved in the participatory monitoring and evaluation process which included farmers to monitor how the information was processed, packaged and disseminated by the service providers and ensure its relevance and ease of use by end users (farmers). This also included reflection on the applicability of the existing ICTs in fostering farmers’ access to information.

Three information delivery methods were employed in the study area, these include print media (leaflets, brochure, posters), and electronic media (telephone and radio). Monitoring and evaluation process was used to examine the usage of these ICTs through some designed tracking forms, library registers and semi-structured interviews. A general monitoring and evaluation was conducted to
assess the effect of use ICTs on agricultural production, access to markets, natural resources management and knowledge base in Rubaya Sub-county. This was done through a household survey involving a total of 66 respondents purposefully selected from monitoring data. The criteria for selection of respondents were as follows: at least 50% should be people who have used the VICE more than two times, 25% should be local community leaders and VICE operators while the remaining 25% included those who have not used the VICE. The data was descriptively analysed to define important trends emerging from this study.

3.0 Findings

3.1 The Sustainable Land Management Information Needs

Farmers in Kabale district identified three information domains that are related to their day-to-day livelihood activities. These are agriculture, natural resource management (NRM) and markets. The sustainable land management (SLM) information needs are mainly on agriculture and natural resources management; however, market information was also important and mostly preferred to catalyse SLM activities on the ground through the ‘pull effect’. Table 1 shows the details of particular information needed by farmers in each domain.

<table>
<thead>
<tr>
<th><strong>AGRICULTURE</strong></th>
<th><strong>NATURAL RESOURCES MANAGEMENT</strong></th>
<th><strong>MARKETING</strong></th>
</tr>
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<tbody>
<tr>
<td>Source of quality seeds</td>
<td>Soil erosion prevention and control</td>
<td>Where to sale produce (market)</td>
</tr>
<tr>
<td>Knowledge on what grows in which soils</td>
<td>Soil fertility management</td>
<td>Sorting and grading</td>
</tr>
<tr>
<td>Source of pesticide and its application</td>
<td>Soil moisture control</td>
<td>Market prices</td>
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<tr>
<td>Management of diseases and pests in animals and crops</td>
<td>Tree planting</td>
<td>Customer care</td>
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<tr>
<td>Nursery bed preparation</td>
<td>Control and management of water sources</td>
<td>Sales promotion</td>
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<td>Post harvest handling</td>
<td>Byelaws formulation</td>
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<td>Formulating byelaws</td>
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The detailed analysis of NRM information needs indicated that in the case of tree planting (niche compatible tree species, nursery management, trees for soil erosion control and trees for springs protection), soil and water conservation (terracing, trenches, composting, enhancing spring recharge, vegetative contour), bye-laws (how to formulate your own bye-laws, how to improve enforcement of bye-laws), water (water use, water quality control, water harvesting), participatory planning and watershed management (reducing NRM conflicts, improving management of farm boundaries and drainage and controlling grazing) were more preferred by farmers.

Results of assessment and priorities of the SLM information needs are summarised in Figure 3. The results suggest that priority information needs were on NRM focusing on bylaw formulation, making trenches, planting grass strips (71%), soil analysis using local indicators (63%), fertilizer management and application (55%) promoting use of local farmyard manure, (47%) beekeeping (42%), use of organic matter (24%) and soil sampling using local indicators (18%).
Figure 2: Summary of farmer priority SLM information needs in Rubaya sub-county, Kabale District (N = 56 parish groups)

More in depth needs assessment indicated that particular detailed information needs in agriculture included matching crop production with soil type, nursery beds establishment, grafting and fruit trees management, integrated pests and diseases control and management in crops; endo and ecto-parasite identification and management in animals, maintaining soil fertility, reliable sources and efficient utilization of agro-chemicals for crops and livestock, identifying sources of quality planting materials, promoting modern agronomic methods in agriculture and selection of quality planting materials.

3.2 Structure for enhancing Information Access to Farmers

Under the National Agricultural Advisory Delivery Services (NAADS) framework in Uganda, agricultural related advisory delivery services are implemented through contracted service providers. In Kabale district, a telecentre was established and designed to link all relevant development partners at district level. These partners serve as information sources and are engaged in facilitating information delivery on NRM, agriculture and market information for farmers. At village and Parish levels, farmer groups access a variety of information through village information centres (VICEs). The VICEs are equipped with a small library and mobile telephone which help communities to access the demanded information. From parishes to Sub-county level the parish coordination committees (PCCs) facilitate information flow by compiling information needs from all the farmer groups and determine the information priorities at the parish level with respect to enterprise selection. These priorities at the parish level are then submitted to the Sub-county farmer forum (SFF). From the Sub-country the prioritised needs are sent to the district processing hub using the quality assurance committee (QAC). At the sub-county level the telecentre receives all the information from parishes and responds by providing the needed information which is available at the telecentre or send information needs to the district level telecentre for identification and
packing of the information. Figure 4 shows the NAADS management structure linked to rural information centres in the district.

![Diagram of NAADS M&E Framework]

**Figure 3: Farmer institutions and management structure through NAADS**

### 3.3 Use of the ICTs to access sustainable land management information

Most ICTs used by the local communities included phones, print media and radio. Evaluation of the effectiveness of the ICTs was conducted among the local communities and results indicated that phone usage was high during planting and harvesting seasons. Majority of the respondents reported that they used the phone to call service providers, technical staff and traders during these periods to look for information on crop husbandry, which was one of the predominant livelihood activities in the area. Early in the season, the phones were used to enquire about appropriate planting time, source and availability of planting material (seeds) and inputs like fertilizers. During mid season, the telephones were used to enquire on information about pest and disease management and availability of pesticides. Later in the season, the phones were used to enquire about the prevailing market prices of the agricultural commodities during harvesting time. The presence of the phone simplified communication with older customers when it was necessary to let them know of the quantities and availability of agricultural produce. Use of the phone ascertained the real tradable quantities of produce and mobilized farmers to bulk their produce and sell as a group which has 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 or where a relatively higher price was prevailing. It is probable that new buyers/contacts are established during these transactions. Results indicated that high phone usage was mostly in Rwanyena Parish (48.1%) followed by Kitooma (33.3%) and Mugandu (18.5%). This pattern especially at Rwanyena is attributed to cheap calling rates and stronger network accessibility as compared to other pay phones in the parish while the low usage pattern in Mugandu is attributed to network problem, which rendered the phone unusable for most of the times. However, this was addressed after the introduction of new network (celtel that is currently Zain) and a replacement done. Currently network accessibility has improved.
Radio messages were reported to be important in providing general information like spacing of beans and control of rats especially on beans, how to rear and keep quality pigs, construction of goat houses, benefits of early planting, quality of good potato seed, weather forecast and seasonality and soil types suitable for respective crops. The radio messages often had prices of selected commodities in different markets within Rubaya sub-county, Kabale town and other towns in the region. The information enabled the farmers to bargain for higher produce prices. It was also reported that other radio programmes advised farmers to form marketing groups and associations for easy bulking and effective bargaining power. The analysis on the access to radio broadcasting showed that farmers in Kibuga parish accessed two radio stations which are Voice of Kigezi (VoK) and Uganda Broadcasting Corporation (UBC). Farmers listened to different programmes; however, as a way of promoting access to marketing information, prices of commodities such as potatoes, meat, beans, green banana (*matooke*), chicken, cabbage, carrots and wheat from Kabale and Katuna markets were broadcasted during the program. In Karujanga parish two radio stations, VoK and Radio West were accessible. The most favoured radio station was VoK because of clarity and the popular programme of “enkubito” that talked about HIV/AIDS and family planning. Farmers reported that they prefer a full program that provided information package especially on soil and water conservation, pests and diseases especially for newly introduced crops like apples. Farmers preferred if a renowned farmer presents such programmes on a live talk show that allows live phone calls from listeners for clarifications, discussions, questions and sharing of experiences. Earlier studies conducted in Uganda showed that a combination of mobile phones and radio has enabled the population to participate in phone-in programs over important issues in the country, that include political debates, health issues, agriculture, education, environment and gender issues, which have a high impact on their lives (Ssewanyana, 2007a).

Print media were instrumental in helping farmers make decisions and gain skills in the selection and use of clean planting seed, proper spacing, pesticides use and proper fertilizer application. About 25% of respondents indicated that increased production of potato was attributed to knowledge acquired from reading materials about clean seed production from leaflets developed and placed in the VICEs. The print media were also useful in guiding and instructing the farmers on dehauling of potatoes, construction of storage facilities as well as proper livestock husbandry, especially rearing of goats, pigs and poultry. They were also used to access information on selection, sorting and grading of potato seeds and regular list of prices of selected commodities from various markets within and outside Rubaya sub-county. The print media were particularly useful for information on making “fanya chini and fanya juu” trenches, selection and management of different agro-forestry trees, making compost manure, preparing tree nursery beds and general sustainability of farming systems. The print media had stepwise instructions from which the farmers followed and learnt how to mix and spray chemicals, group dynamics and general knowledge on commercial versus extensive farming.

### 3.4 Farmers’ preference on medium for dissemination of information

The results of the farmers’ perceived effectiveness of various dissemination media are presented in Figures 4-6. In general farmers have indicated their preference of various media used to disseminate information. From print media they identified pamphlet, poster, newspapers and booklets; from interactive methods they identified extension services – e.g. NAADS service providers, exchange visits and interaction with fellow farmers. They also identified physical observations (i.e. field demonstrations) and electronic media such as radio, phone exchange and telecentres. The analysis shows that print media contribute much on the dissemination of SLM information. Forty (40) percent of the respondents preferred disseminating information on agriculture using print media (i.e. pamphlets, posters and booklets), 28% direct physical observation (demonstrations), 27% interactive methods (extension services) and 5% preferred electronic media (more particularly
radio) (Figure 5). This pattern is attributed to the fact that agricultural information that farmers needed was directly linked to land husbandry which is a process that needs detailed information which can be referred to when needed, and it is only print media that could offer that in the rural settings. The leaflets and pamphlets offered systematic procedural steps to implement certain practices like construction of storage facilities, selection and management of different agro-forestry trees, making compost manure, preparing tree nursery beds and general sustainability of farming systems.

![Dissemination Method Preference](image)

**Figure 4:** Preferences on methods to disseminate information on Agriculture.

A similar trend was observed in dissemination of NRM information. The print media (pamphlets, posters and booklets) were important in the dissemination of the information as they accounted for 47%. Demonstrations accounted for 36%, followed by radio (10%), interactive methods (extension services and exchange visit/fellow farmers) accounted for 7% (Figure 6). Use of print media will remain an important channel for dissemination of information due to several obstacles that stand in the way of ICT use in developing countries. Access to telephone and electricity networks in rural areas is limited and telecentres which offer broader ICT services and training are scarce because of the disproportionately high investment and operating costs required. Similar findings were reported by Ssewanyana (2007b) who found that the usage of ICTs in developing countries is low due to the high cost of required investment, limited knowledge and skills, and being very responsive to taxation. Developments in solar technologies might see cheap sources of power for running telecentres in rural areas.
A different scenario was observed with regard to dissemination and accessing the market information. The trend showed that most farmers preferred dissemination of market information through electronic media (phone, radio and telecentres) as they account for about 64% of all media used (Figure 7). This is attributed to the fact that electronic media provide real time information, which supports farmers in making timely decision on the running of the farm enterprise. As it was discussed earlier, use of phone was at high peak during harvesting time which is the critical time for preparation for marketing the agricultural produce. Print media and interactive methods also play a role in informing the farmers about market information as they account for about 16% and 15% respectively. Direct physical observations (demonstrations) account for only 5%.

Figure 5: Preferences on methods to disseminate information on Natural Resources Management.
3.5 Lesson learnt

The presence of telecentres and village information centres has enabled farmers to look for appropriate information for their agricultural products. Integrated use of phone, library and radio to deliver information in NRM, agriculture and market has changed the outlook of most farmers on how to improve productivity. Through the use of phones in the study area the capacity of rural communities to access ICTs was built and strengthened through trainings. It was also noted that phones were very useful in linking farmers to markets; reaching veterinary services and keeping in touch or communicating with relatives. Farmers reported that the presence of the phone has made it easier to communicate with their older customers by informing them on the availability and quantities of agricultural produce. The linkage to market was mainly related to acquisition of inputs (seed and pesticides) from stockists and accessing price and other market information in order to match harvesting (and bulking) of potatoes and beans with better prices.

Reports from farmers also indicated that there was a positive influence in the livelihoods of the rural communities in the areas attributed to access to relevant information. About 80% of respondents reported improvement 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 built resulted into establishment of potato collection and marketing centres, where by farmers joined forces to solicit better markets for their produce. New buyers/contacts were established during these transactions and more social capital built with outside markets.

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 of lucrative market had potentially ascertained the real tradable quantities of produce and mobilized farmers to bulk
their produce and sell as a group thus building social capital among farmers within the villages. Use of phone 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.

The farmers reported increase in information flow and knowledge sharing amongst rural communities due of interaction and social networks among different actors within the production value chain. The greatest contribution of phone usage in agriculture is especially in accessing markets information. Farmers appreciated the importance of having prior knowledge of prevailing market prices for enhanced negotiation for better prices of their commodities.

4.0 Conclusions and Recommendations

Through this study, it is observed that farmers’ information needs on sustainable land management are mostly based on improving their natural resources (soil, water and vegetation) and agriculture in general. Increased access to this information will be achieved when it is channelled through existing institutional arrangement under current decentralised structure. The complex nature under which smallholder farmers operate in the rural setting has triggered use of different ICTs as means to access desired information by local communities. Rural communities appreciated the holistic approach in the use of ICTs as convenient way to communicate and get desired information. This has demonstrated strong integration of different communication media, as evidenced by farmers’ preferences to use different media for different sets of desired information. Print media and demonstrations are preferred to access information on natural resource management and agriculture while electronic media are preferred in accessing information on markets.

It is therefore recommended that integration of print media, electronic based media and physical demonstrations in disseminating SLM information may be an innovative way of looking at the costs and benefits of ICT development in rural areas when it comes to improving livelihoods of smallholder farmers in developing countries like Uganda. Establishment of rural information systems needs to involve local producers to decide which system suit their needs and thus determine the local level buy-in and sustainability of the smallholder production system.

5.0 Literature


