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# Factors constraining rural households' use of mobile phones in accessing agricultural information in Southern Ethiopia

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This study examined factors constraining the use of mobile phones in accessing agricultural information by rural households in southern Ethiopia. A survey was employed to collect data from 320 randomly selected respondents. The result revealed that variables such as age, level of education, annual income, money spent on mobile phone per day; farm distance to the nearest town, ownership of mobile phones, mobile phone having handset FM radio and information need and seeking behaviour were important factors that affect the use of mobile phones in communicating agricultural information. The Bureau of Agriculture should consider these identified factors when designing strategies for dissemination of agricultural information using mobile phones.

**Keywords:** agriculture, agricultural information, mobile phone, Ethiopia

## Introduction

In Ethiopia, agriculture accounts for almost 48% of GDP and 85% of export earnings and it is the main source of income, livelihood and way-of-living for 85% of Ethiopians living in rural areas (World Bank 2012). Therefore, the country's development depends to a great extent on the speed of the agricultural development (Davis et al. 2010). Information is an important component for agricultural development. The success of any agricultural extension programme depends on sharing information, exchanging knowledge, and effective communication and interaction between researchers, agricultural extension agents and farmers (Eyob 2012).

Today, there is a rapid increase in the use of information and communication technologies (ICTs) such as mobile phones in agricultural extension systems. The use of mobile phones in agricultural extension is important especially now that its use has witnessed an upsurge in almost all areas of rural life in several African countries (World Bank 2011). Mobile phones 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 innovations (Kevin 2011; Sife, Kiondo, and Lyimo-Macha 2010; Donner 2007). 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 (Kevin 2011).

In Ethiopia, the task of providing agricultural information to farmers is primarily vested with government agencies or the public extension system. The Ministry of Agriculture (MoA) and the Ethiopian Institute of Agricultural Research (EIAR) are responsible for disseminating agricultural technologies and information to farmers. The information needs of the farming community are partly addressed by the public extension system in Farmer Training Centres (FTCs) supported by trained Development Agents (DAs). Over the past few years (from 2002 to 2007), the number of extension workers has also dramatically increased; over 60,000 DAs have graduated from the Agricultural Technical and Vocational Education Training (ATVET) colleges with a three-year diploma and assigned at FTCs (Davis et al. 2010). FTCs were designed as local-level focal points for farmers to get information, training, demonstrations and advice, and include both classrooms and demonstration fields. However, most of FTCs in the country are not functioning in the way they were designed.

Despite the fact that the number of extension agents is increasing in the Ethiopia's Southern Nations Nationalities and People's Region (SNNPR), there is evidence that most of these agents are poorly equipped in terms of communication gear and lack the necessary knowledge, skills and experience in using different extension methods like farm or home visits and use of contact farmers. Most agents use individual extension methods to communicate and to disseminate agricultural technologies and information to farmers. They are also working in areas characterized by lack of infrastructural facilities such as transportation (Asayehegn, Weldegebrial, and Kaske 2012). This suggests that the use of conventional communication channels such as farm or home visits and the use of contact farmers as the only method for communicating agricultural information does not provide the needed agricultural information on timely basis (Deribe 2011). Moreover, a single Village, where one DA for each of crops, livestock and natural resource management is deployed by Ministry of Agriculture, has approximately 800–1200 farm households. This large coverage makes it practically difficult to reach the farmers by face-to-face or individual contact methods. FTCs established in every village, which are also expected to form an important node between extension and farmers in the agricultural sector, have major constraints in basic infrastructure and resources. Generally, this situation

undermines the effective provision of relevant and accurate agricultural information on timely basis.

The abovementioned problems call for the use of ICTs to support agricultural extension services, because ICTs, particularly mobile phones, can be very effective in delivering timely and relevant information to farmers, even to those living in remote areas. In this regard, knowledge about factors that constrain the use of mobile phones in rural households is crucial in order for mobile phones to be used efficiently to facilitate agricultural extension services. Therefore, this study identified factors that constrain rural households in Ethiopia, particularly in the Southern Regional State, from using mobile phones as a means of accessing agricultural information.

## Literature review

Several studies dwell on factors affecting mobile phone use in developing countries (Falola and Adewumi 2011; Akpabio, Okon, and Inyang 2007; Yakubu et al. 2013; Hadi and Lee 2010), but these are limited in the Ethiopian context. Falola and Adewumi's (2011) study of the factors affecting the use of mobile telephone by small-scale farmers revealed that non-membership of an agricultural society, inadequate extension services, fluctuating telecommunication services, inadequate access to mobile services and lack of electric power supply were the constraints to use of mobile telephone services by the farmers. According to Akpabio, Okon, and Inyang (2007), constraints that affect the utilization of ICT for agricultural extension activities by agricultural extension officers include poor ICT infrastructure development, high cost of broadcast equipment, high charges for radio/television presentations, high cost of access/interconnectivity and electricity power problems. Similarly, a study by Yakubu et al. (2013) on socio-economic factors affecting the adoption of ICTs by extension workers revealed that education, income, training, awareness, access, age and membership of agricultural organizations were significant factors to ICT adoption. Hadi and Lee (2010) concluded that low farmer readiness, technological and organizational cultures and two demographic variables did affect mobile use.

## Conceptual framework of the study

The conceptual framework of this study was adapted from: (i) a research model used by Meso, Musa, and Mbarika (2005) that examined key factors that influence mobile ICT use by individuals in a developing country context; (ii) a technology acceptance model formulated by Venkatesh et al. (2003); and (iii) an information innovation adoption model which was used by Alvarez and Nuthall (2006) to investigate the use of computer-based information systems by dairy farmers in Canterbury, New Zealand and Florida, Uruguay.

The conceptual framework developed for this study consists of eighteen independent variables in four categories that might influence the use of mobile phones in agricultural extension. These categories are household head's socio-economic characteristics, farm's characteristics, mobile phone characteristics as well as attitudinal and behavioural characteristics. There are also variables under each category. These variables are assumed to be the major causes that affect the use of mobile phones by the household heads.

## Description of the study area

This study was carried out in Ethiopia in the SNNP Region (Figure 1). SNNP is a region of immense ecological diversity ranging from arid and semi-arid conditions to cool temperate zones. The rationale for selecting SNNPR as a study area is its proximity to Addis Ababa, the capital city of Ethiopia, which makes the region more accessible to mobile telephone and ICT services.

The SNNP Region Communication and Information Technology Agency (CITA) was established in 2010 and has been working in the region since then with the objectives of providing video conferencing; messaging and hosting service; establishing and administering a regional data centre; controlling domains of the regional NGOs and government organizations; networking, software and website development; providing exchange mail and internet service; establishing and controlling community information centres, free call centres, and community radios (Debub ICT 2012).

According to the SNNPR CITA yearly book (2012) and Newsletter (2012), out of the total 3321 rural villages in the region, 2120 villages have wireless telephone services (telecenters). With the help of the federal MCIT, the regional CITA has also developed websites for 38 various regional and zonal government offices. There are also 26 other regional government offices and NGOs that have developed websites using their own IT professionals and consultants.

The CITA has established 35 community information centres in the region with the aim of providing relevant and reliable information to the urban and rural community in the region including the farmers, pastoralists, traders, students, youth, women and co-operatives organization (Debub ICT 2012). It also supports the centres by providing technological equipment, computer hardware and software maintenance services and technical support.

Out of the total 16 community radio stations in the country, four are Kembata, Kore, Kaffa and Hawassa University community radio stationed in the region (EBA 2012). There are also free call phone lines (942) to give information on administrative and other issues. Initially they were developed for six regional bureaus but because of the high demand for information in communities, these free call lines now serve all government regional offices. Therefore, from anywhere in the region, people can call 942 free of charge to get information on agriculture, education, markets, good governance and other issues, and also can make comments or complaints about administrative services.

With the aim of facilitating cost-effective information exchange within the regional institutions, government has established an 'exchange mail' service to connect regional offices to district offices. Seventy-six districts have this 'exchange mail' service.

## Methodology

A cross-sectional survey design was employed. The study population included all household heads for both male and

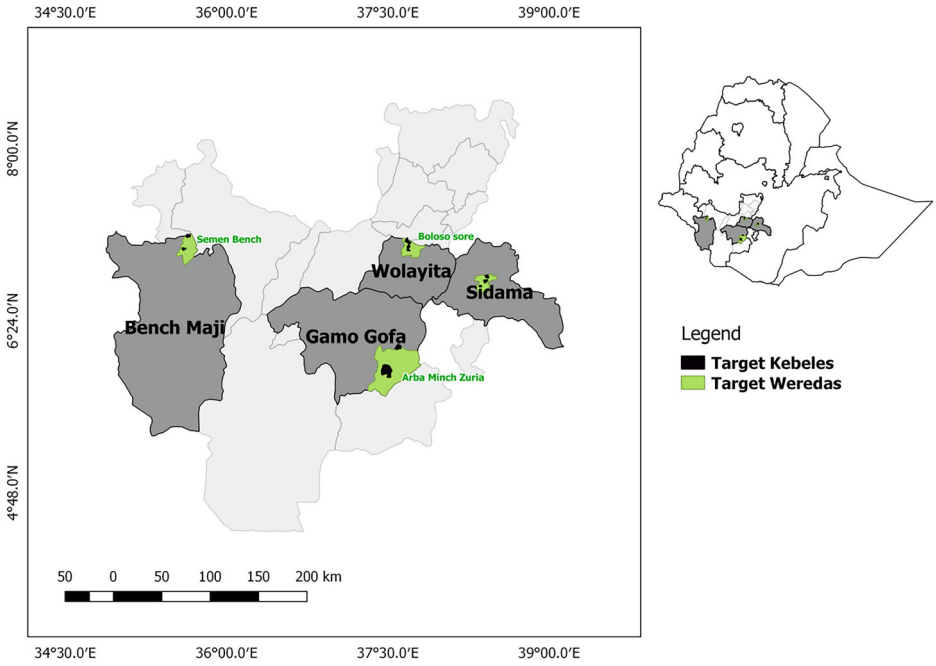


**Figure 1:** Map of the study area.

female headed households in eight sampled villages. The sampling frame consisted of all households (HHs) who owned mobile phones.

A multi-stage sampling procedure was employed to select the study sample. In the first stage, to select representative sample zones, the researcher adopted the classification that was already used by the Regional Bureau of Agriculture. Accordingly, the whole region was classified into four major zones (Western, Eastern, Central/Northern and Southern major zones). This classification was done based on agro-ecologies and similarities in the farming systems, road networks and contiguity of zones and *districts*. In the second stage, from these major zones, four sub-zones were purposively selected based on their mobile telephony service that is one sub zone from each major zone. These sub zones were namely Sidama (Eastern), Wolaita (Northern/Central), Gamo Gofa (Southern) and Bench Maji (Western). In the third stage, four *districts were selected*, one from each sub zone based on their mobile telephony services (Figure 1). In the fourth stage, from each sample *districts* two sample *villages* based on distance to the nearest town where there is access to agricultural information such as output market, input, and agricultural technologies(one close to the nearest town and the other far away from the nearest town) were selected making a total of eight *villages*. In the fifth stage, to select the sample respondents, with the help of village administrators and development agents working in the villages all the household heads in the villages were stratified in to two categories, those who owned mobile phones and those who did not. Basically, the sample size required depends on the required precision, the variance of variables among the total population and the sampling technique. In practical terms, however, the sample size is often restricted by the available resources, time and other related reasons. Therefore, considering financial constraints, time shortages, lack of transportation and other infrastructure accessibilities, an equal number of household heads from each village who owned mobile phone was randomly selected from each *village* (40 per village), making a total of 320 respondents the whole study sample.

Primary data were collected using a survey questionnaire. Among several types of validity measurements, content validity of the data collection instrument was estimated by gathering a group of experts together to review how the test items or questionnaire truly measured the construct it was supposed to measure. Then, based on the experts' comments, some of the items were revised and others were dropped from the list. The Cronbach's Alpha value for reliability of scale for overall variables was 0.678, showing good internal consistency reliability (Julie 2007). Quantitative data were analyzed using Statistical Product and Service Solutions (SPSS) computer software which involved both descriptive and inferential statistics.

A Multiple Linear Regression (MLR) model was used to analyze the influence among variables (i.e. single dependent variable and several independent variables) with the objective of using the independent variables whose values are known to predict the single dependent value. Therefore, the MLR model was fitted to estimate the influence of the hypothesized independent variables.

## Results and discussion

Pearson's Product-Moment correlation analysis and chi-square test were carried out to explore the relationship of continuous and discrete independent variables on the agricultural use of the mobile phone. Based on the correlation analysis and chi-square test, out of 18 potential variables that were hypothesized as likely to influence the use of mobile phones, 14 were selected as statistically significant variables. Of these, three were continuous variables (attitude towards mobile phone, perceived ease of use, and

perceived usefulness) and eleven discrete variables (age, sex, level of education, annual income, distance to the nearest town, farming experience, year of mobile phone ownership/ownership time frame, mobile phone has FM radio, money spent on mobile phone, information need and seeking behaviour and perceived mobile phone service reliability). The other four discrete variables, namely number of mobile phones household owned, household size, farm size and sharing of mobile phones within the family, were positively associated but had no statistically significant relationship to the agricultural use of mobile phones.

The fourteen selected significant variables were entered in to the MLR model and analyzed. Finally, as the result of the model output, the following eight variables were identified as variables that constrain the use of mobile phones (Table 1).

***Demographic characteristics of the respondents constraining the use of mobile phones***

The study findings in Table 1 indicate that about 76.9% of respondents were 40 years of age or younger. This suggests that the majority of them was in the active age group that is more receptive to new technologies such as mobile phones. As a farmer's age increases, it is expected that he/she becomes more conservative and less receptive to new technologies. In other words, younger farmers are believed to be more risk aversive due to an increased tendency to adopt new technologies. For instance, Bina and Giaglis (2005), cited in Biljon and Kotzé (2008) found that farmer's age and use of mobile phones were inversely correlated. Consistent with the prior expectation in this study, when the age of a farmer increases, the farmer's use of a mobile phone for agricultural purposes decreases. The results of the model analysis showed that, as age of the respondent increased by 1 unit, agricultural use of mobile phone would decrease by −0.038 units. This implies that the age of the household head and the household head's use of the mobile phone is negatively related. This means that as the household head gets older, the probability of using mobile phone for agricultural purposes decreases by 0.038 units. These results are in agreement with those of Venkatesh et al. (2003), Tembo (2008), Meso, Musa, and Mbarika (2005) and Alvarez and Nuthall (2006).

***Socio-economic characteristics constraining the use of mobile phones***

More than half (54.4%) of the household heads had attended secondary school, while 26.6% had a primary school certificate. According to the model results, the coefficient of model output (0.059) indicates that the level of education was positively and significantly correlated with agricultural use of mobile phones. A unit increase in level of education was accompanied by an increase in the agricultural usage of mobile phone by 0.059 units (Table 1). This means that an increased education level increased a farmer's ability to get access to information, which enhanced the farmer's decision to use a mobile phone for agricultural purposes. This is also complements Bina and Giaglis (2005) who confirmed that education influences mobile phone usage. The possible explanation is that educated household heads can better recognize the importance of communication and hence tend to use mobile phones as a means for better performance in agricultural activities.

In this study, distance was measured as the number of minutes it took a farmer to walk from his/her home to the nearest town. The distance between HHs' residences and the nearest town varied considerably in the study area. Towns are where there is access to agricultural information such as the price of output market, availability of agricultural inputs, and agricultural technologies. Towns often have a district office of agriculture or a development centre. The average distance between residences and the nearest town was 8.5 km (Table 2). Those respondents who were in the range of less than or equal to the mean distance were categorized as close to the nearest town and those who were more than the average distance away were categorized as far away from the nearest town. Accordingly, 54.7% of the respondents' residences were close to the nearest town and 45.3% lived far from the nearest town. This implies that more than half of the respondents lived close to the nearest town where there is a district office of agriculture or a development centre.

Contrary to the hypothesized statement, the coefficient of distance (−0.106) was negatively and significantly correlated with agricultural use of mobile phone. This means that holding the values of all other variables constant, a unit increase in distance to the nearest town was accompanied by a decrease in the agricultural use of mobile phone by −0.106 units (Table 1). This unexpected result implies that household heads who were close to town were more likely to make better use of mobile phones than those household heads far away from the nearest town.

Total annual income is an important variable for explaining the characteristics of households in that those who have relatively high incomes are more likely to use technologies such as mobile phones. The results of this study indicate that 42.5% of the respondents earned less than 5001 ETB (i.e. less than 263 USD) annually, followed by those who earned 5001–10,000 ETB (263–526 USD) (35.3%). Only 11.6% of the respondents earned more than 15,000 ETB (more than 789 USD) average income annually. This indicates that majority of the respondents are in the lower category of income group. They also earned less than Ethiopia's 2018 annual per capita income (783 USD) (WBG 2018). This study result also shows that as the annual income of a farmer increased by 1 unit, the usage of a mobile phone for agricultural purpose increased by 0.044 units. This confirms our expectation that the probability of mobile phone use increases with an increase in a farmer's annual income.

Regarding the length of years a mobile phone has been used, the attribute was categorized into four ownership time ranges and it was hypothesized to have a positive relationship with the agricultural use of a mobile phone. Those households that owned mobile phones for longer periods of time tended to use them more for agricultural purposes than those that owned them for shorter periods of time. This study revealed that 11.6% had been using

**Table 1:** Significant variables and model output ($n = 320$).

| Significant variables | Response | Frequency | Percentage | Unstandardized coefficients | | Standardized coefficients | T | Sig. |
|---|---|---|---|---|---|---|---|---|
| | | | | B | Std. error | Beta | | |
| (Constant) | | | | −.326 | .159 | | −2.049 | .041 |
| Age | 30 and below | 124 | 38.8 | −.038 | .018 | −.128 | −2.106 | .036 |
| | 31–40 years | 122 | 38.1 | | | | | |
| | 41–50 years | 51 | 15.9 | | | | | |
| | 51 and above | 23 | 7.2 | | | | | |
| Level of education | Illiterate (no formal schooling) | 15 | 4.7 | .059 | .014 | .196 | 4.232 | .000 |
| | Can read and write (adult education) | 16 | 5.0 | | | | | |
| | Primary school certificate | 85 | 26.5 | | | | | |
| | Secondary school certificate | 174 | 54.4 | | | | | |
| | Diploma or equivalent (tertiary) | 30 | 9.4 | | | | | |
| Distance of HHs' residence from the nearest town | Close to the nearest town | 200 | 54.7 | −.106 | .029 | −.190 | −3.695 | .000 |
| | Far away from the nearest town | 120 | 45.3 | | | | | |
| Annual average income | Below 5001 Birr | 136 | 42.5 | .044 | .015 | .162 | 2.978 | .003 |
| | 5001–10,000 Birr | 113 | 35.3 | | | | | |
| | 10,001–15,000 Birr | 34 | 10.6 | | | | | |
| | Greater than 15,000 Birr | 37 | 11.6 | | | | | |
| How long have you been using a mobile phone? | below 1 year | 37 | 11.6 | .037 | .011 | .186 | 3.501 | .001 |
| | 1–2 years | 81 | 25.3 | | | | | |
| | 2.1–3 years | 52 | 16.2 | | | | | |
| | 3.1–4 years | 80 | 25.0 | | | | | |
| | more than 4 years | 70 | 21.9 | | | | | |
| Amount of money spent on mobile phone per day on average | Less than 25 Birr | 306 | 95.6 | .134 | .059 | .102 | 2.279 | .023 |
| | 26–50 Birr | 14 | 4.4 | | | | | |
| | 51–100 Birr | – | – | | | | | |
| | More than 100 Birr | – | – | | | | | |
| Information need & seeking behaviour | Low | 8 | 2.50 | .066 | .028 | .105 | 2.396 | .017 |
| | Medium | 36 | 11.25 | | | | | |
| | High | 276 | 86.25 | | | | | |
| Does your mobile have FM radio | Yes | 185 | 57.8 | .187 | .025 | .343 | 7.382 | .000 |
| | No | 135 | 42.2 | | | | | |

Coefficients[a]

[a]Dependent variable: Agricultural usage of mobile phone.
$R = 0.674$; $R^2 = 0.455$; Adjusted R Square = 0.429; $F = 18.091$; $p = .000$.

**Table 2:** Distance of residence from the nearest town in kilometres.

| Distance in kilometres | Frequency | % | Category |
|---|---|---|---|
| 0.50–8.0 | 175 | 54.7% | (1) Close to the nearest town |
| 8.01–22.0 | 145 | 45.3% | (2) Far away from the nearest town |
| Total | 320 | 100.0 | |
| Mean | 8.5 | | |
| Min. | 0.5 | | |
| Max. | 22 | | |

mobile phones for less than one year, 25.3% had used them for 1–2 years, 16.3% for 2.1–3 years, 25% for 3.1–4 years and 21.9% for more than four years. Generally, more than 46% of respondents had used mobile phones for more than three years. Therefore, this shows that household heads in the study area had good experience in using mobile phones. According to the statistical analysis, for each one unit increase in experience in using a mobile phone, the usage of a mobile phone by household heads for agricultural purposes increased by 0.037 units. Therefore, the results of this study confirmed the theoretical expectations that households that owned a mobile phone for longer period of time tended to use the phone more for agricultural purposes than those that owned them for a shorter period of time.

Concerning the amount of money spent on mobile phone for calling per day, it was hypothesized that on average the additional money that a farmer spent on mobile phone usage would have a positive effect on the use of the phone. The results of this study revealed mixed findings. On the one hand, the survey data showed that nearly all (95.6%) household heads spent less than ETB 25 per day which was equivalent to USD 1.3. The rest (4.4%) spent ETB 26–50 (USD1.3–2.6) per day (Table 1). On the other hand, results from FGD revealed that ETB 25 Birr (USD 1.3) of airtime was used for at least 5–10 days by male-headed households and 10–15 days by female-headed households. According to FGD results, female farmers spent less money than male farmers on mobile phone. This study indicates that farmers in the study area spent less money on mobile use which, in turn, could affect their access to information on agricultural related issues. However, the model result showed that as money spent on mobile communication increased by 1 unit, agricultural use of mobile phones also increased by 0.134 units (Table 1). This implies that additional money spent on mobile phones had a positive effect on the use of mobile phones for agricultural purposes. Therefore, spending more money on mobile communication impacted positively on mobile phone usage.

***Behavioural characteristics constraining the use of mobile phones***

The study examined information needs and seeking behaviour among the respondents. The information needs and seeking behaviour is defined as the degree to which the respondent was eager to get information on agricultural activities from various sources such as development agents, local leaders, neighbours, family and friends, TV and radio (Deribe 2011). This was measured in terms of what agricultural information, how much and how frequently they sought it. The study findings indicated that the most important types of agricultural information that household heads wished to get was information on crop production technologies, diseases and pests, as well as weather forecasts and market information particularly current output prices. Regarding the frequency of seeking agricultural information, household heads sought information on technologies of crop production; technologies of animal husbandry and information about agricultural inputs most frequently, with these ranked first, second and third respectively. Information need and seeking behaviour was expected to have a positive relationship with the use of mobile phones. The information needs and seeking behaviour of households was classified into three levels of categories (low, medium, high). As hypothesized, of all the respondents, 86.3% were in the high level category of those who needed and sought information (Table 1). This shows that household heads in the study area were in great need of agricultural information and such behaviour in turn motivated them to use technologies such as mobile phones to access agricultural information.

As expected, an increase in a respondent's information need and seeking behaviour to get information on agricultural activities from various sources increased the respondent's agricultural use of a mobile phone. The model result confirmed that for every 1 unit increase in the information need and seeking behaviour of the respondents, their use of mobile phones for agricultural purposes increased by 0.066 units.

**Table 3:** Problem encountered when using mobile phones.

| SN | Types of problems encountered | Responses | Frequency | % |
|---|---|---|---|---|
| 1 | Lack of electricity for charging phone battery | Yes | 229 | 71.6 |
| 2 | Poor network and reception | Yes | 207 | 64.7 |
| 3 | High rate of pay for the service | Yes | 147 | 45.9 |
| 4 | High cost of maintenance | Yes | 128 | 40.0 |
| 5 | Language limitation | Yes | 106 | 33.1 |
| 6 | Application limitation | Yes | 76 | 23.8 |

### *Mobile phone characteristics constraining the use of mobile phones*

One of the mobile phone characteristics is its inclusion of a FM handset radio application. It was hypothesized that mobile phones with handset FM radio would have a positive relationship with the use of mobile phones for agricultural purposes. The study results showed that more than half (57.8%) of the respondents had a radio application in their mobile phones (Table 1). This indicates that household heads had access to FM radio broadcasts on their mobile phone. The model results also confirmed that a unit increase in the inclusion of a FM handset radio application on the respondent's mobile phone increased the probability by 0.187 units that the household head would use a mobile phone for agricultural purposes.

The respondents were also asked about the problems that they encountered when using mobile phones. The results showed that 71.6% of the respondents lacked electricity for charging their phone battery; 64.7% encountered poor network and reception; 45.9% faced high costs for the service; 40% encountered high costs of maintenance; 33.1% encountered language limitations and 23.8% encountered application limitations as major problems generally affecting their use of mobile phones (Table 3).

## Conclusions and recommendations

Mobile phones are becoming increasingly important in agricultural activities for different purposes. One of these is the dissemination of relevant and accurate agricultural information on a timely basis. The findings of this study show that eight factors, namely age, level of education, distance to the nearest town, average annual income, mobile phone ownership time frame, money spent on mobile phone per day, mobile phone having a FM radio application and the behavioural characteristics of a household head were the most influential factors in constraining the agricultural use of mobile phones.

The Regional Bureau of Agriculture, when designing strategies for effective and efficient use of mobile phones for disseminating agricultural information, should consider these factors identified as constraining mobile phone usage for agricultural purposes. This will also help the Bureau to find potential or feasible solutions to the problems and challenges that rural household heads face.

### *Suggested further research*

Among many opportunities for further research, exploring how organizational characteristics constrain the use of mobile phones is important. This is because understanding the organizational environment, such as relationships within the organization itself, characteristics of the job, interpersonal relationships with co-workers and ICT usage trends, are some of the important areas that might influence mobile phone usage and that need to be studied.

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