Factors Underlying the Choice of Information and Communication Technologies among Small holder Farmers in Tanzania

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Abstract

Information and communication technologies (ICTs) are increasingly being adopted and integrated in agricultural activities. The use of ICTs is likely to be influenced farmers' assessment of its attributes. The relative importance of these attributes tends to vary across users' socio-economic variables and perceptions. However, there is dearth of studies that have comprehensively assessed and delineated the use of ICTs in Tanzania according to farmers' profiles. This study examined factors underlying farmers' choice between using either radio only, mobile phone only and the combination of these using a multinomial logit. Results reveal that males are more likely to use mobile phones or both radio and mobile phones ($p < 0.1$). Young farmers are more likely to use mobile phone ($p < 0.05$) or both radio and mobile phones ($p < 0.1$). Increase in farmers' income can facilitate the use of mobile phones ($p < 0.1$) while high cost of use can significantly reduce the likelihood of using these devices ($p < 0.1$). Poor access to electricity can reduce the prospect of using any of the technologies within the choice domain ($p < 0.05$). Inappropriate programme or content can undermine the use of mobile phones or both radio and phones ($p < 0.1$). Illiteracy is another factor that can undermine the use of mobile phones only ($p < 0.1$), radio only ($p < 0.05$) and

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both radio and mobile phones ($p < 0.1$). The implication of the findings is that there are common and user-specific leverage points for promoting the dissemination of information and knowledge in farming communities. These include understanding and addressing needs of potential users (content); enhancing access to electricity and making ICT programmes more user-friendly. Future studies could incorporate more variables and attempt to identify the actual use of these technologies.

Key words: *Choice, ICTs, Smallholder Farmers, Multinomial Logit Model*

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1.0 Introduction

There has been a dramatic shift from face-to-face mediated communication to the use of radio and more recently newer forms of information and communication technologies (ICTs) (De Jong, De Ruyter and Lemmink, 2003; Lwoga, 2010 ; Sanga *et al*., 2013; Sife *et al*., 2010). A significant number of ICT devices in Africa and other emerging and least developed countries (LDCs) have been acquired during the last two decades (Campbell, 2001; ITU, 2002). These technologies are increasingly being adopted and integrated in various endeavours of human life including agricultural activities. Since many of the owners of ICT devices are new, the devices are likely to be mainly used for sharing knowledge and information than production purposes (Mbarika, 2002). Integration of ICTs in production activities is therefore an important milestone towards business applications that require acquisition of relevant skills by users.

In general, there is a consensus that ICTs are ideal means to reduce communication and coordination costs and transform farmers' lives. These technologies can be customized to allow the provision of agricultural services that are usually offered through face-to-face interactions (Richardson, 2005; Sanga *et al*., 2014). This potential can only be realized if farmers are willing

and able to use the technologies. However, there are many factors underlying farmers' choice of ICTs which in turn influence the use of such technologies. For instance, literature shows that the technologies that farmers adopt tend to vary according to perceived usefulness, appropriateness, reliability and effectiveness (Aleke, Ojiako and Wainwright, 2011). Moreover, the actual choices that farmers make have also been associated with factors other than the technology itself (Amin and Li, 2014), although the relative importance of these factors tend to vary according to users' socio-economic and perception variables.

There is substantial coverage of the extent of use and business applications of ICTs in literature (Esselaar *et al*., 2006; Duncombe and Boateng, 2009; Madon, 1997). However, there is dearth of studies that have comprehensively assessed and delineated the use of ICTs according to users' profile (O'neill, 2010). Thus, there is a need for community-wide evidence to assess potential effects of users' socio-economic variables on the use of ICT devices. The objective of this study was to examine factors underlying farmers' choice between using various ICT-based means of communication. The intent was to assess factors underlying the choices of these means in Tanzania using data collected directly from individual farmers. Since there is no single measure of ICTs use, the study treats the uses of radio and mobile phones separately as well as the combination of these as surrogates of ICT use. An understanding of factors influencing people's choice of the ICTs is crucial in crafting appropriate strategies for effective sharing of knowledge and information in farming communities. This in turn serves as a basis for selective dissemination of user-tailored agricultural information.

2.0 Literature Review

2.1 Factors influencing farmers' decision to use technologies

Technology adoption theory reveals that farmers face unique preferences, risk attitudes and circumstances that influence their innovations and technologies they use (Amin and Li, 2014; Duncombe and Boateng, 2009; Esselaar *et al*., 2006). The adoption and use of a technology is normally influenced by its attributes along with appropriateness or compatibility with farming environment, availability of technical support, perceived cultural influences and economic motivation (Kilima *et al*., 2010; Nwaobiala, 2014). The theory also suggests that the relative importance of these factors differs markedly across locations and reflects diversity in social,

cultural, economic, environmental, and institutional contexts that govern farmers' decision-making processes (Kilima *et al*., 2010).

There are several socio-economic variables that determine the means through which farmers receive information. One of these variables is farmers' income. Poor farmers are often compelled to use those means of communication they can afford even if other advanced means are available (Aker and Mbiti, 2010). On the other hand, the probability of having appropriate ICT transmission infrastructure is associated with demand factors such as population density and per capita income (Buys *et al*., 2009). With regard to age, young and old people exhibit different preferences and risk attitudes. Morris and Venkatesh (2000) reveal that the use of ICTs among younger people is more likely to be influenced by their ability to acquire and use the devices whereas subjective norms6 and perceived behavioural control are likely to influence the use of such devices for older people. The value that users attach to devices such as mobile phones is also influenced by age. Wilska (2003) noted that young people tend to attach higher value to ICT devices than old people. Moreover, young people are generally perceived as more pragmatic, knowledgeable, aware and open to new technologies than old people (Cant and Shen, 2006).

Men's and women's decisions to use technologies are often influenced by their perception of usefulness and ease of use (Venkatesh and Morris, 2000). Furthermore, Morris, Venkatesh and Ackerman (2005) argue that these differences might be more apparent among older than younger women. Thus there is a likelihood that technology adoption can vary not only between men and women but also between different age groups of women.

Literature reveals that level of education influences people's capacity to use technology (2006; Piccoli, Ahmad and Ives, 2001). Effective use of ICTs requires some levels of knowledge, skills and innovativeness that are acquired through formal training and experiential learning. Inability to understand language (e.g. English) can severely undermine one's ability to use ICT devices and understand some verbal and written communications. However, Baliamoune-Lutz (2003) argues that the diffusion and use of ICTs may not be correlated with user's level of education. It is important to note that skills for effective use may be acquired after adoption through repeated use and consultations with more experienced users.

6 Subjective norms can simply be defined as motivating influence on one's perceptions of what others want him/her to do.

There are several other individual-specific attributes including their perceptions about technologies that can potentially influence the use of ICTs (Gefen *et al*., 2003a). Perceived usefulness, defined as user's subjective assessment with respect to whether the application of ICT will increase performance of some core activities/businesses, is one of the variables under users' perception domain (Wang *et al*., 2003). Other variables are perceived ease of use and actual use behaviour (Davis, 1989; Gefen *et al*., 2003b). Perceived ease of use is defined as the degree to which ICTs are easy to understand and operate while use behaviour refers to users' behavioural intentions that are determined by his/her attitude towards the technology.

2.2 Conceptual framework

Models that seek to investigate people's intentions to use new technologies have significantly evolved over time. Earlier applications of these models were predominantly in disciplines such as psychology and sociology (Venkatesh *et al*., 2003). However, these models have been advanced to suit varied uses such as innovation diffusion, economic constraints and adoption perspective models that have extensively been used to model the adoption of agricultural technologies (Kilima *et al*., 2010).

The technology acceptance model (TAM) has been widely used to model the adoption and use of a wide range of ICTs (Aleke, Ojiako and Wainwright, 2011; Amin and Li, 2014; Davis, 1989; Dulle and Minishi-Majanja, 2011; Venkatesh and Davis, 2000). This model is considered to be robust, powerful and parsimonious for predicting acceptance in the information technology domain. In the context of this paper, the adoption of ICT devices is defined as a process through which potential users go through before the actual use. This process is bound to follow the five stages of technology adoption where they become aware of the technologies, gauge whether the technologies are for them or not, decide whether to adopt or reject before they actually acquire relevant knowledge and skills for effective use (Yoh *et al*., 2003). This process is likely to be influenced by all factors that are included in the TAM. This study, therefore, employed TAM to assess causal linkages between variables hypothesized to influence farmers' choice between using radio only, mobile phone only and the combination of these (Figure 1).

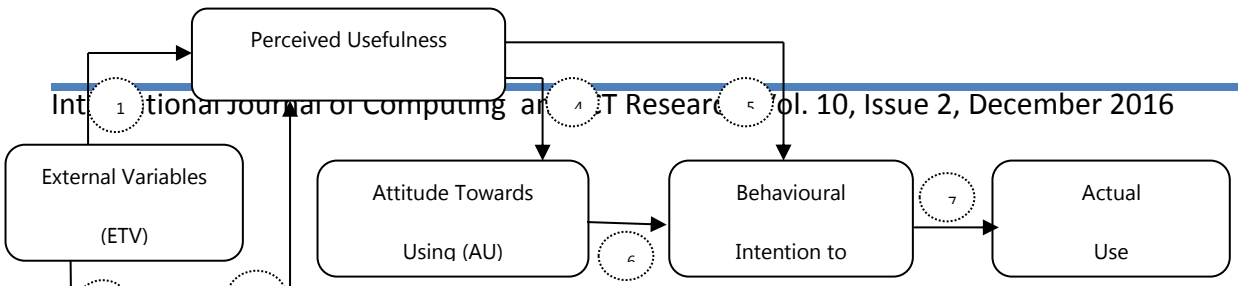

Figure 1: Technology Acceptance Model (Davis, 1989).

Figure 1 reveals presence of external factors underlying the use of the ICT devices considered. These factors include all socio-economic factors discussed in section 2.1 that determine the usefulness (loop 1) and the extent to which the devices can be understood and operated by famers (loop 2). Moreover, perceived ease of use can also influence the perceived usefulness of ICTs (loop 3). In turn, the perceived usefulness play a role in defining farmers' attitude towards the technologies (loop 4) and their behavioural intentions to use the technologies (loop 5). Like perceived usefulness, farmers' attitude towards using ICTs can also shape their behavioural intentions (loop 6) which will finally determine whether they opt to use radio and/ mobile phones (loop 7). The actual decision is then modelled following a random utility theory for a user with multiple choices/options.

2.3 Theoretical and empirical models

Economic theory shows that a user i makes a random choice from a set of available communication devices, $j = 1, 2, ..., k,$ to attain certain level of utility U_{ij}. The decision of whether or not to use a particular ICT device is usually made after weighing marginal benefits and costs from all alternatives. The outcome of the decision is normally the one that gives the greatest utility and is observable, although the utility underlying such a decision is not observable (Green, 2000).

This utility function comprises deterministic (V_{ij}) and stochastic components (ε_{ij})as shown in Equation 1:

$$U_{ij} = V_{ij} + \varepsilon_{ij}, \qquad \forall_{ij} \in N; \qquad (1)$$

The dependent variable (U_{ij}) is a random utility associated with the choice, and the deterministic

component is an index function representing an expected utility for an agent who is making this choice. The stochastic component is an agent-specific random error associated with his/her choice (McFadden, 1976).

Since the stochastic component is not observable, the choice made is not precisely predictable, although the probability associated with each of the *k* choices is derived upon estimation. Thus, an agent *i* will choose alternative *j* if and only if the utility associated with its use is greater than the utility derived from all other alternatives (Equation 2):

$$U_{ij} > U_{ik} \qquad \forall_j \neq k \qquad (2)$$

Analytically, the relationship between choices and factors influencing the choices is normally estimated using a multinomial logit model (Bardhan *et al*., 2012; Abdulai and Birachi, 2009; Winkelmann and Winkelman, 1997). This model is normally applied when the dependent variable has more than two mutually exclusive and exhaustive choices that cannot be ordered. This model assumes that the log-odds[7] of each outcome follow a linear model that is mathematically expressed as shown in Equation 3:

$$n_{ik} = \log \frac{\Pr\left(y_i = k\right)}{\Pr\left(y_{i1},...,y_{ik}\right)} = \alpha_k + x_i^{'} \beta_k \qquad (3)$$

Note that $\Pr\left(y_i = k\right)$ denotes the probability that the i^{th} response falls in the k^{th} category, $\Pr\left(y_{i1},...,y_{ik}\right)$, is the probability distribution of the counts of y_{ik} for all cases in the i^{th} category, α_k is a constant whereas β_k and x_i are vectors of regression coefficients and socio-economic and perception variables associated with the i^{th} decision maker, respectively.

To empirically estimate equation (3), the authors maintain the hypothesis that farmers' choice of ICTs is influenced by socio-economic and perception variables. A multinomial logit model is adopted to examine farmers' choice of ICTs where the choice of ICT device $\left(y_i\right)$ is treated as a

7 This ratio is literally defined as the probability of an event happening to the probability of not happening.

function of independent variables (x_i) that influence the choice of the i^{th} decision maker and is given as shown in Equation 4:

$$\Pr\left(y_i = k \mid x_{ik}\right) = \frac{\exp \beta_k x_i}{\sum_{k=0}^{3} \exp \beta_k x_{ik}}, \forall k = 0,1,2,3 \begin{cases} 0 = \text{If rely on face - to - face communication only} \\ 1 = \text{If uses radio only} \\ 2 = \text{If uses mobile phone only} \\ 3 = \text{If uses radio and mobile phones} \end{cases} \quad (4)$$

The authors acknowledge the likelihood of some farmers owning mobile phones with FM receivers implying that options 1 and 2 in Equation (4) are not necessarily mutually exclusive for these farmers. However, it is important to note the inclusion of option 3 within the choice domain that captures all those who use radio and mobile phones either as separate or combined devices. Independent variables that are included in this model are described in Table 1.

Table 1: Description of independent variable

Variable	Description	Types	Unit of measurement
AGE	Age of household head	Continuous	Number of years
SEX	Sex of household head	Binary	0=female, 1=male
INCOME	Annual income	Continuous	Tanzanian shillings
COST	Farmers' perception of the cost of using ICT devices	Binary	One for farmers reporting inability to meet cost of use as a constraint and; zero otherwise
ELECTRICITY	Farmers' perception of their access to electricity	Binary	One for farmers reporting poor access as a constraint to use ICT and; zero otherwise
PROGRAMME	Farmers' perception of whether programmes offered through the devices are appropriate	Binary	One for farmers reporting inappropriate programme or content as a constraint to use ICT; zero or otherwise

ILLITERACY	Farmers' perception of their literacy (a surrogate measure of explicit and tacit knowledge)	Binary	One for farmers reporting illiteracy as a constraint to use ICT and; zero otherwise

The prior expectation was that farmers who are relatively young might be more willing to use ICT devices because they are more willing to spend and take risk than those who are old. Sexual differences can influence the choices of ICT devices, but it is difficult to speculate which choices will be favoured by males or females. Farmers with more earnings are likely to be more capable of adopting and using the devices. However, those who perceive the cost of use, poor access to electricity and illiteracy as constraints are less likely to adopt the devices. It is important to note that the relative importance of these factors is bound to vary across the devices considered.

The model was estimated in STATA using a maximum likelihood estimation method after performing two robust tests. The first test was meant to test for the presence of self-selection bias as the choice made might be influenced by variables other than those included in the empirical model such as differences in risk attitude and human capital. These differences can significantly influence their abilities to learn about and use the technologies (Lapar, Holloway and Ehui, 2003; Mosley and Verschoor, 2005). When choices are manifested by these unobservable factors, farmers may predominantly choose some options than others leading to selection bias problem. The best way to account for this potential problem is to model the use of ICT as a two- step procedure with device choice first followed by a similar model that controls for the influence of unmeasured or unobserved factors (Green, 2000). Thus, a multinomial logit is adopted as a first-stage model to identify the determinants underlying the choice of ICTs. This model is then used to construct the selection- correction term i.e. Inverse Mill's ratios (IMRs) for farmers choosing alternative choices to control for potential selection bias. Previous applications of this correction method involving probability models have reported significant improvements in parsimoniousness of parameter estimates (Blacklow and Nicholas, 2008; De Vreyer, Gubert and Roubaud; 2010).

The second (Suest-based Hausman[8]) test was performed to evaluate whether the assumption that the ratio of the choice probabilities for any two alternatives for a particular observation is independent of any other alternatives. This assumption is technically referred to as "Independence from Irrelevant Alternatives (IIA)" (Ben-Akiva *et al*., 1997). The results revealed that the IIA assumption was not violated.

3.0 Data and Data Collection

Data on the variables included in the empirical model were collected in 2013 from a random sample of 1029 famers using a questionnaire. These farmers were randomly drawn from a population of farmers in 11 regions of Tanzania during the implementation research programme titled EPINAV[9]. The regions covered during the study were Arusha, Dodoma, Iringa, Kilimanjaro, Manyara, Mbeya, Morogoro, Njombe, Kilimanjaro, Simiyu and Singida.

The sample included 16% farmers who relied on face-to-face communication only. There were equal proportions (12% each) of farmers who relied on radio only and mobile phones only. About 59% of the farmers in the sample used both radio and mobile phones.

4.0 Results and Discussion

Results from the multinomial logit model, after controlling for self-selection bias, are presented in Table 3 and discussed in subsequent sections.

Table 3: Multinomial logit estimates for ICT device selection after controlling for selection bias

	(2)	**(3)**	**(4)**

8 The Hausman and Small-Hsiao tests were not performed because results from these tests may be inconclusive or even contradictory (Long and Freese, 2003 & 2006).

9 The programme for Enhancing Pro-Poor Innovations in Agricultural Value Chains (EPINAV) is a Norwegian Government Supported initiative that was implemented by the Sokoine University of Agriculture (SUA) and the Norwegian University of Life Sciences (NMBU) in collaboration with other partners within Tanzania and Norway.

VARIABLES	Mobile phones only	Radio only	Both radio and mobile phones
SEX	11.14*	7.191	9.542*
	(5.729)	(6.169)	(5.675)
AGE	-0.173**	-0.110	-0.158*
	(0.0861)	(0.0940)	(0.0855)
INCOME	1.53e-06*	1.07e-06	1.23e-06
	(8.68e-07)	(9.33e-07)	(8.59e-07)
COST	-4.723*	-4.210	-4.052
	(2.576)	(2.697)	(2.556)
ELECTRICITY	10.08**	9.727**	9.607**
	(4.405)	(4.472)	(4.390)
PROGRAMMES	-18.68*	-15.02	-16.69*
	(9.540)	(9.851)	(9.514)
ILLETERACY	-9.281*	-9.821**	-8.174*
	(4.847)	(4.953)	(4.837)
IMRs	-13.31*	-11.64	-12.33*
	(7.075)	(7.244)	(7.051)
Constant	-43.87*	-42.44*	-39.75*
	(24.07)	(24.48)	(23.98)
Number of observations	1029		
Log-likelihood χ^2	-157.60***		

The coefficients are relative risk ratios (rrr); standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Face-to-face communication is the base category.

The study findings in Table 3 show that males are more likely to use mobile phones only or both radio and mobile phones than women ($p < 0.1$). The findings reveal that being a male multiplies the odds of using mobile phone only rather than face-to-face communication by almost 11 times compared to being a female when other variables are similar. The odds of using radio and mobile phones rather than face-to-face communication are also multiplied by almost 10 folds for male than female users when all other variables are similar. The data shows that male users of mobile phone accounted for almost 23% of the total while female users accounted for almost three percent of the total number of mobile phone users. The proportion of male using both mobile phones and radio was almost four folds (44%) the portion of females using these communication devices. About 70% of the females suggested that the programmes that were offered through the mobile phones were inappropriate to their unique contexts against 57% of the male users who felt so. Also the data show that about 70% of females and 54% of male users of both mobile phones and radio reported the programmes offered through these devices to be inappropriate to their use contexts. These results imply that men and women have unique communication needs.

These results conform to those of earlier studies of this nature which found that men tend to rate advancement and earning power more highly than women who attach more weight to interpersonal aspects, quality of service and other physical and environment attributes (Lonner *et al.*, 1980). Evidence from developing countries reveals that women with similar education and income with men are less likely to listen to radio than men, despite being at home more often than men (Gillwald, Milek and Stork, 2010). Some of the reasons to justify this difference are related to their preferences, attitudes and behaviour (Mitra *et al.*, 2000; Wang *et al*., 2009; Morley, 2005). Other reasons are related to socially-based division of labour in those countries where women tend to be more occupied with family obligations (Nicholl, 2006; Rathgeber, 2000). Moreover, culture and norms that limits women's freedom to choose which programmes to listen to when male members of the household are present, have also been echoed (Gillwald, Milek and Stork, 2010).

In the context of this study programme is defined to mean all user-tailored services and/contents that are either in-built or provided through the ICT devices (e.g. contents of radio broad cast). A detailed analysis of its relative importance as shown in Table 3 reveals that inappropriate

programme or content can undermine the use of mobile phones or both radio and phones ($p < 0.1$). The odds of using mobile phones only and both radio and mobile phones instead of face-to-face communication are 19 times and 17 times lower, respectively among farmers perceiving programmes offered through these means of communication to be inappropriate relative to those who do not. There is sufficient evidence that users of ICT devices have unique preferences with respect to content of programmes. Cooper (2006) argues that educational software might be more appealing to boys than adult males and females. Similarly, programmes that are watched by men may differ markedly from those watched by women. Certainly, these preferences could vary across profiles of users considered, based on a wide range of their socio-economic and perception variables including those discussed in this paper. The implication of these findings is that programmes and/software that are in-built or installed in ICT devices can influence the actual use. There is a need for providers of the ICT mediated communication and regulators of these services to team up in identifying real needs (both in terms of content and software) and thrive to devise appropriate business models to meet these needs.

In terms of skills to use the mobile phones, this study found a higher proportion of women (81%) reporting being less skilled than men (65%). Similarly the proportion of female users of both mobile phones and radio reporting these deficiencies was higher (76%) than that of male users of these two devices (66%). Moreover this study found a higher proportion of male users (6.4%) of both mobile phones and radio than male users (2%). Other studies have also found higher level of competence in using ICTs among men than women (Alazam *et al*., 2013) as they tend to have higher levels of education (Tata and McNamara, 2016; Geldof, 2011). The findings of this study support the view that the prospect of using ICTs is higher among males than females.

According to the results presented in Table 3, illiteracy can undermine the use of mobile phones only ($p < 0.1$), radio only ($p < 0.05$) and both radio and mobile phones ($p < 0.1$). The odds of using mobile phones only and radio only instead of face-to-face communication are 9 times and 10 times lower, respectively among farmers perceiving illiteracy to be a constraint in using the devices relative to those who are not. Gender analysts have revealed notable differences between male and female users of ICTs in developing countries with respect to their literacy along with competencies to use these devices (Dickhäuser and Stiensmeier-Pelster, 2003; Vekiri and

Chronaki, 2008). This study also found higher literacy among male than female users of ICT devices. The differences could be an outcome of a complex relationship with variables such as farmers' income and education levels among others. In general, these findings underscore that deficiencies with respect to practical skills and language can discourage some of the potential users from using mobile phones and radio as means of communication. A long-term solution to these deficiencies could be to enhance their knowledge levels and skills through user-tailored capacity building programmes.

The results presented in Table 3 show that young farmers are more likely to use mobile phone ($p < 0.05$) or both radio and mobile phones ($p < 0.1$). The results show that the odds of using mobile phones instead of face-to-face communication decrease by almost 17% for each additional year among those who are actually using the ICT device. The decrease is slightly lower (about 16%) for those using both radio and mobile phones. The data show that about 47%, 47% and 49% of users of both mobile phones and radio, mobile phones only and radio only were below 45 years, respectively. About 28% of the users of mobile phones and radio, 37% users of mobile phone only and 33% users of radio only were 45-60 years. Users above 60 accounted for the smallest portion of users under each of the three categories of ICT devices considered in this study. It is important to note that the proportions of users of the ICTs among those below 45, 45-60 and above 60 years reporting high cost of acquisition and/use of the ICT devices as constraint were 46%, 49% and 54%, respectively. Several other studies have found higher preference for ICT use among younger people in farming communities or rural areas (Dhaka and Chayal, 2010; Adekoya, 2006; Geldof, 2011). The higher preference for ICT use among younger farmers is attributed to their higher propensity to spend, willingness to try new things and their higher ability to learn and acquire new skills. This implies that the design and promotion of ICT mediated communication should embrace these potential differences. Identifying communication needs of different age groups would be an ideal entry-point in promoting the use of ICTs in Tanzania.

The results show that an increase in farmers' income can facilitate the use of mobile phones only ($p < 0.1$) while the perceived cost of use can significantly impede its use ($p < 0.1$). Table 3 reveals only a marginal increase in the odds of using mobile phones only instead of face-to-face

communication as farmers' income increases. The chances increase by less than 1% for each unit increase in annual income among farmers who use these devices. The odds of using mobile phones only instead of face-to-face communication are 5 times lower for farmers perceiving to be incapable of meeting the cost of use relative to those who are capable when other variables are held constant. Previously, Chabossou *et al.* (2009) established that expenditure on ICT devices such as mobile phones is inelastic with respect to income, implying that people will progressively spend smaller proportions of their incomes as their earnings increase. Additional evidence reveals that communication products have generally been perceived as luxury goods in many developing countries as compared to developed countries where these products have been regarded as necessary goods (Milne, 2006). Like previous studies, the findings of this study support the view that reducing the cost of acquisition and use of ICT devises is ideal in promoting ICT mediated communication.

The findings in Table 3 reveal that poor access to electricity can reduce the prospect of use of any of the technologies within the choice domain ($p < 0.05$). The odds associated with the use of radio only, mobile phone only or both instead of face-to-face communication, are almost 10 times higher for farmers perceiving poor access to electricity as a problem relative to those who are not. The data revealed that only 30% of all those relying on phase-to-face communication had access to electricity at home as opposed to about 60%, 51% and 43% of those using both mobile phones and radio, mobile phone only and radio only, respectively. Sources of electricity for these respondents included the national power grid (minor) and solar energy (major). Studies conducted in Tanzania and elsewhere in Africa reveal that users of ICTs residing in areas with poor access to reliable supply of electricity pay more for these technologies than those with better access to this utility service (Kenny, 2002; Mwakaje, 2010). This cost differential can potentially serve as disincentives for people with poor access to electricity to use the ICTs devices. The use of ICTs in Tanzania could be promoted further through enhancing farmers' access to reliable sources of electricity.

Overall, the model fitted the data well. The findings suggest that the ultimate choice an ICT user makes is likely to be jointly determined by several variables including those found to have potentially significant effects. The overall effect of variables hypothesized to influence the

choices seems to be consistent with the existing literature.

5.0 Conclusion and Recommendations

The study assessed the relative importance of various socio-economic and perception variables in influencing the use of radio and mobile phones. The results have shown varied influence of factors hypothesized to affect the use of ICT devices. However, access to electricity and illiteracy seem to have common influence on the use of all ICT devices. The implication of these findings is that there are common and user-specific leverage points for promoting the dissemination of information and knowledge in farming communities. These include understanding and addressing information needs of users, enhancing access to electricity and making ICT programmes more user-friendly.

Future studies of this nature could provide additional information on this subject through assessing the influence of variables that are not included in our empirical model. Such studies could also attempt to identify the actual use of these technologies along with attributes of the software or content preferred by different groups of farmers and the actual use of information they obtain through these devices.

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