

## Information and Communication Technology for Rural Farmers Market Access in Tanzania

Agnes Godfrey Mwakaje<sup>1</sup>  
University of Dar es Salaam  
Tanzania

### Abstract

*This paper discusses the impact of information and communication technology (ICT) for rural farmers' market information access in Tanzania with the case study of Rungwe District. Two hundred farmers were selected randomly to provide information about ICT use for accessing agricultural market information. A structured questionnaire was used to gather information at household level. There were also consultations with key informants, service providers and government officials. Findings show that market information sources are still dominated by the farmers themselves, relatives and traders. Nevertheless, a considerable number of farmers (23%) used ICT to access market information. The use of ICT by farmers was significantly related to the quantity produced ( $P < 1\%$ ), income level ( $P < 1\%$ ), type of crop marketed ( $P < 5\%$ ) and gender ( $P < 5\%$ ). Farmers who used ICT obtained higher prices ( $P < 1\%$ ) than farmers who did not use ICT for accessing market information. The use of ICT is constrained by costs, accessibility and reliability.*

**Keywords:** Rungwe district, agriculture, farmers, development.

### Introduction and background

#### Introduction

The past decade has witnessed a revolution in the use of ICT in Developing countries. Many people and offices as well as rural farmers own ICT facilities such as personal computers and mobile phones. The largest increases in the use of ICT has been in mobile telephony where subscriptions in developing countries increased from about 30 percent of the world total in 2000 to more than 50 percent in 2004 and to almost 70 percent in 2007 (Cieslikowsk, Halewood, Kimura, & Zhen-Wei Qiang, 2009). While internet use has not increased as rapidly as mobile communication, it increased tenfold in developing countries in the same period (Cieslikowsk et. al., 2009). Other ICT facilities such as telecast, radio FM and information centers have also increased in number remarkably during the same period.

A study by Farrell & Isaacs, (2009) on ICT in 53 African countries revealed the wide use of ICT in the region with countries such as Algeria, Egypt, South Africa and Botswana leading in

ICT use. In East Africa, Rwanda is probably the most advanced country in terms of ICT use with 65% of its population being covered by mobile telephony. The country has also a high level of internet use and access to television and radio broadcasts. In Kenya, Uganda and Burundi the use of ICT is also well advanced, especially for mobile phone subscribers, TV and radio listeners (Farrell & Isaacs, (2009). This high use of ICT is likely to stimulate economic development in developing countries, including the agricultural sector where a high proportion of the African population derives their livelihoods.

Before 1990, ICT use in Tanzania was mainly limited to radio and landline telephones. New ICT started in the mid 1990s, and by 2001 it was estimated that Tanzania's ICT industry had generated USD 300–350 million per year. There are now a number of ICT development initiatives in the country funded by the government, donor countries and the private sector. Such initiatives range from telecenters and mobile phones in rural Tanzania to e-Government initiatives being implemented in the major cities and towns of Tanzania. Currently, the following ICT providers are in the market:

- Tanzania Telecommunication Company Limited
- Internet Service Providers (ISPs)
- Web Content Providers (ASPs)
- Mobile phone companies (Vodacom, Zain, Tigo and Zantel)
- Radio, TV and Newspapers
- NGOs

By 30th June 2009, about 13.9 million Tanzanians owned voice telephone lines (Newslog, 2010). Mobile voice telecommunication leads the market by having more subscriptions (98%) than to fixed line services (2%) (TCRA, 2007). The use of the internet is also increasing, especially in cities and towns. Being one of the poorest countries in the world, ICT in Tanzania is acknowledged as having the potential to accelerate the socio-economic development of the country (Esselaar, Hesselmark, James, & Miller 2001). The cost of such technologies has declined steadily, making it possible for the 21<sup>st</sup> century farmers in developing countries to own mobile phones, as well as accessing other ICT facilities such as the internet, radio and television to mention a few (Campbell, 2005).

The question, however, is to what extent has this ICT revolution helped rural farmers in Tanzania to access market information for their farm products? Knowing this is important. While the liberalization of agricultural markets has brought many opportunities, nevertheless it has also introduced new challenges to farmers, especially poor smallholder farmers in rural areas. Accessing market information has proved difficult for many. The lack of market information represents a significant impediment to market access, especially for smallholder poor farmers in rural areas; it substantially increases transaction costs and reduces market efficiency

For any one crop, the marketing chain consists of multiple middlemen, each taking a margin at every stage of the chain, and price variations in space and time are often large and erratic (Mukhebi et. al., 2007). But despite having this ICT revolution in Sub-Saharan Africa are rural farmers any better at accessing market information and what has been the impact on farm incomes, new technologies and/or the adoption of new crops?

The objective of this study was therefore to come up with empirical evidence of the impact of ICT on market information access and its effect on incomes, trade volumes and the adoption of new farming technologies by rural farmers in Tanzania. To achieve this, the following activities were undertaken: to document the existing ICT networks in the study area; to identify people who use ICT to access markets; to assess the impact of market access through ICT on agricultural producer prices, trade volumes and the introduction of new crops and to investigate factors that are influencing and/or constraining the access to ICT by rural farmers.

The study was conducted in Rungwe District, Mbeya Region, Southwest Tanzania. The choice of the district was purposive based on the high potential for agricultural production and its remoteness. Dar es Salaam which is about 1000 km from the district is the main city consuming food from the district, and most of the exports from Rungwe are channelled through Dar es Salaam. Accessing market information by farmers in the district and other remote areas in Tanzania has been a challenge. It is hoped that the developing ICT would play a key role for market information to rural farmers in places like Rungwe district. The ICT considered in this study included both the new (computers, Internet, and mobile phones) and old (radio, TV, newspapers) facilities.

The findings from this study will help to provide valuable information to policy and decision makers on how best to develop ICT in order to benefit rural farmers in accessing market information. This work also adds to the literature on ICT, rural markets access and poverty alleviation, and provides useful information to service providers and development partners.

### **The study area**

Rungwe District is located at Longitude 8° 30E and 9° 30E and Latitude 33°S and 34°S in the Southern part of Mbeya Region. According to the 2002 National Population and Household Survey Census, the District had 307,270 people with an annual growth rate of 0.9%, and population distribution was estimated to be 139 inhabitants per sq.km (URT, 2010). According to this study the district showed a high dependency ratio. Children under-14 years comprised 41.9% and those above 59 years comprised 8.9% while the labour force between 15 to 59 years comprised 49.2% (URT, 2010). With such a high dependency level it is necessary to enhance labour productivity through agriculture, the main economic activity in the district. Currently per capita productivity is still low (URT, 2010).

The District covers a total area of 2,211sq.km, of which 1,668.2sq.km or 75% of the total area is arable land. Rungwe district has good climatic conditions with reliable rainfall that favours the production of a variety of agricultural products. The dominant crops in the district include tea, banana, sweet potatoes, cocoa, maize, round potatoes and vegetables. Pineapple and avocado are the main fruits grown in the District.

The production of many agricultural crops in the district has increased since the 1990s. Tea production for example has increased by 67%, from 11,618,134 tons in 2005/2006 to 17,393,582.2 tons in 2007/2008. A similar trend has been seen for other crops like banana, maize, round potatoes and cocoa. The productivity of maize increased from 1.7 tons per ha to 2.1 tons per ha in 2005/6 and 2006/7, respectively. In terms of banana, its productivity increased from

12.5 tons per ha to 13.4 tons in 2006/7 and 2007/8, respectively. The observed production and productivity of these crops is probably due to market liberalisation, which has improved efficiency in marketing some farm crops but has affected others. Also the revolution in the use of ICT might have improved farmers' to market information access which has translated into increased farm incomes.

However, the production of coffee and rice declined during the period of 2003/4 to 2007/8 (URT, 2010). This is likely to be related to prices. The price for coffee declined in the district partly due to the deteriorating quality of the commodity at farm level, and the low bargaining power of farmers relative to traders has also led to low prices (Mwakaje, 2009).

The ICT that is available in the district includes Tanzania Telecommunication Company Limited (TTCL), offering more than 169 lines, the Post office and there are also sub-branches of the cellular phones operators like TIGO, ZAIN, VODACOM and ZANTEL. In addition, a considerable numbers of people in the towns own television and radio sets, internet cafés and telecenters. Rungwe district is connected to the National Electricity Grid. However, as the problem of electricity in Tanzania is characterised by frequent power cuts and sometimes power rationing, this affects the performance of the economy, including ICT use.

### **ICT, market access and its implications for rural farmers**

The importance of the role of market information in terms of economic efficiency and performance as well as equity is widely acknowledged. Helmberger, Campbell and Dobson (1981), observed that accurate and timely market information enhances market performance by improving the knowledge of market actors. An equal balance of knowledge provides a more equal distribution of the gains from efficient market price formation.

Access to ICT can help farmers in a number of ways. Traditional media and new ICT have played a major role in diffusing information to rural communities and now have much more potential (Munyua, 2000). The pre-paid credit has enabled mobile phone users to send relatively cheap SMS text messages across distances that would otherwise take days to travel, hence changing life for the better (Aloyce, 2005). By using mobile phones and messaging technology, farmers get access to valuable market data (Campbell, 2005). Studies in Pakistan show that widely available information on prevailing market prices for seed cotton strengthened farmers' position when bargaining with traders (Lohano, Smith, & Stockbridge, 1998). The availability of market information also enables farmers to check on the prices they receive *vis-à-vis* the prevailing market prices.

In Indonesia, for example, vegetable farmers fixed prices following the rate that was being broadcast by their local radios and lower prices than that broadcast were not accepted by these farmers (Shepherd, 2000). The broadcast prices were subsequently used as a starting point in negotiating with traders the following day. Studies in Chile show that an internet network among farmer organizations has dramatically increased farmers' incomes by providing information about crop status, weather, global market prices and training (UNDP, 2001).

The literature also indicates that information made available to traders reduces the price difference across markets. In Albania, for example, studies show that information that is available to different markets has reduced price differences across markets (Shepherd, 2000). The adoption of mobile phones by fishermen and wholesalers in South India was associated with a dramatic reduction in price dispersion and near-perfect adherence to the Law of One Price (Jensen, 2007). Souter et al (2005) in his three country study (India, Tanzania and Mozambique) finds significant correlations between telecommunications and indicators of socio-economic development,

ICT can accelerate agricultural development by facilitating knowledge management (Rao, 2007). Farmers can take full advantage of ICT to enhance productivity and generate more income by adopting new technologies, including new varieties, adding value and marketing their products. Timely access to market information via communication networks also helps farmers make well informed decisions about what crops to plant and where to sell their produce and buy inputs. The benefit of ICT extends to economic aspects such as better earnings or production (Cheryll & Soriano, 2007). The adoption of modern industrial inputs in agricultural production relies on the information and communication infrastructure (Lio and Liu, 2006). ICT capital has contributed positively and significantly to output and productivity for large US firms (Brynjolfsson & Hitt, 1995) while radio programmes in the Philippines have increased business and agricultural productivity (UNESCO, 1996).

But the literature also warns about the likely negative impact of ICT on the rural poor and disadvantaged groups if not well planned and implemented. ICT can result in the marginalization of economically disadvantaged groups within both developing and even developed countries (Wensheng, 2001). One of the reasons is that different communication methods and different information sources are valued differently by rural farmers (Souter et al., 2005). Also policy and infrastructural issues play a key role in ICT adoption by rural farmers and by gender (Souter et al., 2005). The issue here is when, where, how and which ICT should be used for rural farmers to access market information.

For instance, Djankov, McLeis, Nenova, and Sheifer (2001) report that independent radio broadcasting services have been found to be positively and significantly correlated with a range of development outcomes, including improved lives and better functioning markets. In Zambia, 90% of the 21,000 farmers who were interviewed testified that information given by radio was relevant, and more than 50% credited radio programmes with having increase their crop yields through extension and education (Dodds, 1999). Studies in rural Thailand and Columbia (ITU, 1999) show that the introduction of telephones enabled farmers to check prices regularly which led to a doubling of farm incomes while in Columbia, community telephone access increased trade, employment and government service delivery (ITU, 1999).

Other studies show that most young people preferred use mobile phones and computers; women preferred listening to the radio and watching TV while adult males preferred listening to news on both the radio and TV, and watching football matches (Economic and Social Research Foundation, 2008). This suggests that as the CT infrastructure grows and connectivity and hardware costs decline, the critical constraints are likely to be the development of an appropriate policy and institutional environment for the creation and delivery of information and knowledge

to the end users (Rao, 2007). Thus, identifying suitable ICT for a specific rural segment is of paramount importance.

### A conceptual framework for ICT use and market access in Rungwe District

Knowledge is becoming an increasingly significant factor in production and marketing for small scale agriculture. Timely, knowledge about who is buying the farm products, how much is being offered, who the potential buyers are and what the expected costs including transport, is important for the decision making of rural farmers.

In this study agricultural market information is expected to be accessed through ICT such as the internet, radio, telephone, television, newspapers, and magazines (Figure 1). It is expected that access to market information through ICT will have an impact on farmers' adoption of new crops and new technologies, the quantity marketed, prices and incomes. Figure 1 represents a conceptual framework for ICT impact on agricultural market access and poverty alleviation in rural areas.

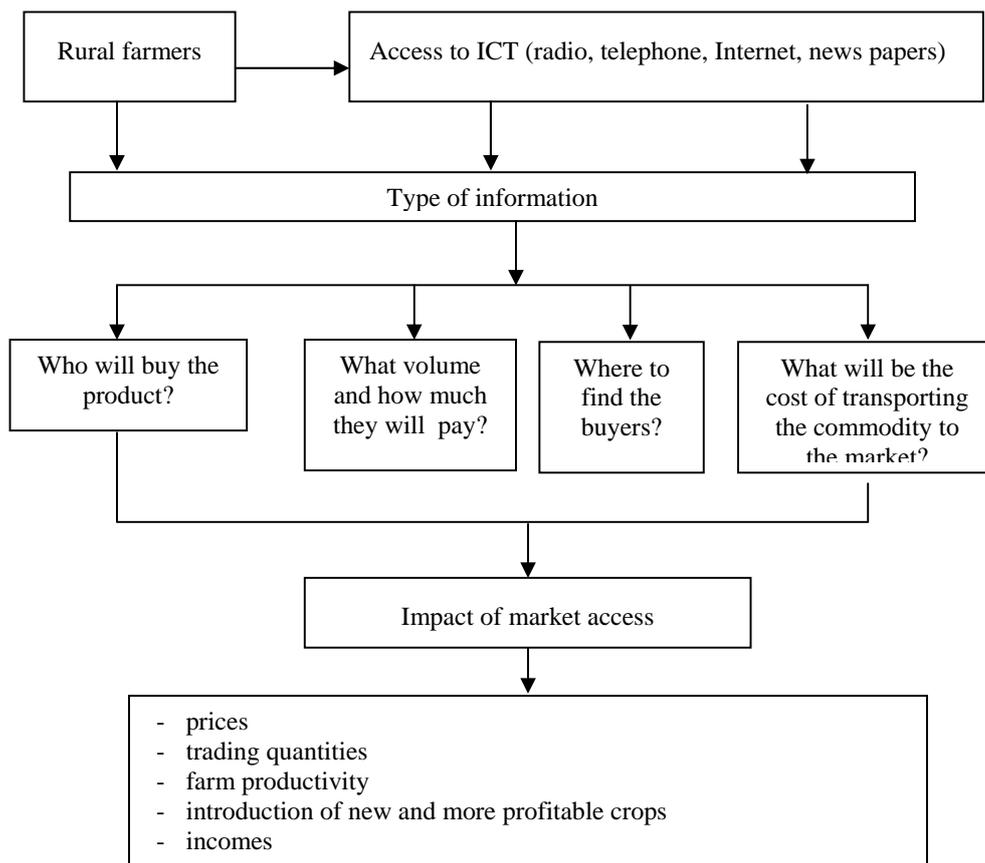


Figure 1. Conceptual Framework

## Methodology

Secondary data were collected from the literature review and document that were obtained from different sources including the Ministry of Livestock Development, Ministry of Agriculture and Food Security, Ministry of Industry and Commerce, Academic institutions, Mbeya Region, Rungwe District and cooperative unions in the District and villages within the area of study. Also information on ICT services was collected from service providers, traders, organizations and NGOs.

Primary data were collected from six wards, constituting fourteen villages altogether. The selection of the wards and villages was based on the ownership of at least one ICT facility. From the 14 villages, 200 farmers (each having at least one type of ICT) were selected randomly for interviews. The number of respondents per ward ranged from 14 to 71. In addition, there was an extensive consultative meeting with regional and district officials, policy makers, ICT service providers, NGOs, key informants and other relevant stakeholders.

Data collected included the type of ICT owned by the farmer, production levels, prices, sources of market information, distance to the market, cost of getting market information, wealth of the households (asset ownership and incomes), family size, type of crop marketed, new crops adopted, and cost related to ICT use. Interviews were conducted using structured questionnaires (for households), semi-structured questionnaires and checklists (for focus group discussions and key informant interviews). Data was analyzed using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel. The study was conducted between July and September 2009.

## Results and Discussion

### Characteristics of sampled farmers

Of the total sample, 134 (67%) were male and 66 (33%) were female. Age-wise, most of the respondents were between 21-45 years (60.5%), followed by those between 46-60 years (27%). Respondents between 14-20 and over 60 years were 1.5% and 11%, respectively. The low number of respondents between 14-20 years could be explained by the fact that a high proportion of this category is still pursuing primary education.

Regarding education levels, most of the respondents had completed standard 7 (69.5%) followed by secondary school (23.5%) and those with advanced secondary education (5%). Respondents who had not received any formal education as well as those who had received post secondary education constituted 1% each. The figure for secondary school leavers is almost double the national average which is 12% (URT, 2005). Rungwe District is one of the districts in the country which are doing relatively well in terms of education.

### Economic activities and income levels

Over 90% of the people in the sample were farmers growing a number of crops including maize, bananas, beans, rice, wheat, tea and coffee. Many farmers also keep livestock including dairy cows. Off-farm activities included petty business mainly related to agriculture i.e. buying and

selling farm crops. The household per capita annual income was Tshs. 674, 075 (\$449 USD). This is slightly lower than the national average which is USD 480. About 28% percent of the respondents were earning below one dollar a day, therefore living below the poverty line. Compared with the national data these findings suggest that the number of people who live below the poverty line in the district is considerably lower than the national average of 35.4 % (URT, 2005) but much higher than the average for Dar es Salaam region which is 17.6% (URT, 2005). Dar es Salaam is a commercial city and the richest region in terms of per capita income and contribution to the national GDP.

### **The agricultural marketing chain**

The marketing chain for different farm products was highly diverse. Producers were selling their crops to any buyer of their choice, including fellow farmers, local traders, and buyers coming from Tukuyu, Mbeya, other regions, or neighbouring countries. Also some farmers hired trucks to take their products directly to the big markets in Mbeya or Dar es Salaam, although only very few farmers did this. At the local level, selling took place at the farm gate, local and weekly markets (*gulio*).

It was noted that marketing was very much dominated by personal relationships. Local traders acted as facilitators or middlemen between many local producers and traders from other regions. Traders were reluctant to do business with unknown partners due but rather it dates back to the pre-industrial era (Sheth & Parvatiyar, 1995). In the study area middlemen were employed in several parts of the supply chain to relay information about where to find what type of produce, and the price being offered. The use of middlemen intended to reduce the transaction costs of searching for information and transacting agricultural products (Gabre-Madhin, 2001; Mwakaje, 1999). Middlemen can reduce inefficiency in the market where there are adverse selection problems (Biglaiser, 1993).

To market the food local traders were driving into villages and collecting the products from different producers, after which they took the produce to a collection point along the trunk road, ready for large-scale buyers. The goods were also collected by buyers from Dar es Salaam if they happened to know the local producers. Once the products had been bought, either from the producers or the local traders, transportation to the main market was arranged.

Farmers were also selling their agricultural products to the bordering countries of Malawi and Zambia. The crops sold to these countries were mainly maize and beans. In return the traders brought back other commodities, including sugar and soap.

Regarding cash crops, marketing arrangements varied from one crop to another. In the case of coffee marketing, traders across the country were prohibited from buying coffee at the farm gate and were required to establish permanent coffee buying posts (CBPs) in all the villages where they intended to operate. Farmers were therefore selling their crops at these posts. However, despite this restriction of using CBP, in reality, farmers from remote areas continued to sell their coffee at their homes and normally were selling to unregistered traders and fellow farmers. This was partly done because traders were reluctant to go to these remote areas, especially where production of coffee was low. The marketing of tea was very well organized. Dates for picking

and selling tea leaves (including hours for collection) were well known to farmers and payment were effected on a monthly basis.

Other crops like cocoa were sold without any proper marketing arrangements. Farmers were selling to companies, individuals and cooperatives, and normally the transactions were taking place at their residences.

### Existing ICT infrastructure in the District

Almost all types of mobile phone networks (i.e. Celtel, Vodacom, Tigo, Zantel) were available in the study villages. Television was found to be watched only in towns with electricity. TV stations available in the district included Independent Television (ITV), National Television (TVT) and Mbeya TV while radio broadcasting was received from Radio Tanzania, Radio One, Radio Free Africa and Radio Maria. Also, two Internet café services were available in Tukuyu, the capital of the district, and computers connected to the Internet were available in some public and private offices in Tukuyu. There was one TTCL telecenter and other private entrepreneurs in Tukuyu. Nevertheless, there were no agricultural market information centers in the district.

### Respondents who owned or had access to ICT services

Out of the 200 farmers interviewed, 72 owned mobile phones and 169 had radio sets. In addition, 17 respondents were buying ICT services, for example airtime from telecenters, fellow farmers or friends. Ten respondents said they were buying newspapers as a source of information, including market information. Television owners comprised only 3 out of the 200 respondents and no respondent used internet services and/or computers connected to the internet (Table 1).

Table 1. Proportion of respondents with access to ICT services

Type of ICT available in the study area	Own at least one ICT (persons)	Buy ICT services (persons)
Own at least one item of ICT	200	19
Internet café	0	0
Mobile phone	72	17
Landline telephone	0	0
PC-Internet connected	0	0
Television	3	0
Radio	169	0
Newspapers	0	10

The findings also show that the majority of respondents with access to ICT were male, where 25% had mobile phones and 60% had radio sets, compared with 11% and 40% for female

respondents. Most of the respondents aged between 21 to 60 owned at least two types of ICT (radio and mobile phone) compared with those of other ages who had mainly one and normally it was a radio set. These findings partly tally of Nielinger (2003) who found that the utilization of ICT in Kasulu, Magu, and Sengerema, in Tanzania is related to age and sex.

### **Source of market information for farmers**

Farmers were asked to list the sources of market information. Farmers received marketing information mainly from fellow farmers (88.8%), relatives (56%) and traders (37.5%) and a considerable number of respondents that is of 25% and 23%, used mobile phones and radios, respectively to get market information. Farmers who received market information through newspapers and primary cooperative societies comprised of 9% and 2.5%, respectively. These findings tally with those of Kleih, Okoboi, and Jonowski (2004; Souter et al., 2005). Studying in Uganda, Kleih et al., (2004) reported that agricultural marketing there was inter personal dominated, confirming that on the African continent information from fellow farmers, traders and relatives is highly appropriate in many ways, although it can also be constrained and insular (Duncombe & Heeks, 2001). Molony (2006) concludes that the need for direct, personal interaction through face-to-face contact, the traditional pre-ICT aspect of African business culture, is unlikely to change for some time.

However, these findings contrast with those of Kenny (2002; Dodds, 1999). Kenny (2002) reported that a larger number of respondents were receiving market information through radio broadcasts rather than from persons. Broadcasting market information through radio could have also been the most suitable and effective way in Tanzania (as many farmers own radio sets), but there are no proper market dissemination strategies. Mwakaje (1999) highlighted three limitations of using radio sets for disseminating market information in Tanzania. First, the price announcement is made once a day and is given very short air time, consequently making it difficult for farmers to time it regularly. Another problem is that the price information is given in Kiswahili, which some farmers in the country do not understand. Also a high proportion of farmers with radio sets fail to use them regularly due to the lack of dry batteries and other maintenance aspects.

### **Regression analysis for factors affecting ICT use for market information access**

A regression analysis was run to determine the significance of determinant factors for using ICT which included quantity produced type of crop, income, level of education and gender (Table 2). The results from the model were significant ( $P < 1\%$ ). Through its  $R^2$  value the model was explained by only 45.3% of the variation in the factors affecting the use of ICT for market information access due to the fitted predictors and the remaining 54.7% due to predictors not included in the model.

The estimated coefficient attached to the quantity produced by a farmer was statistically significant as regards ICT use for market information access ( $P < 1\%$ ). This suggests that an increase in production of farm crops will increase the propensity of rural farmers to use ICT for market information access, because a high quantity of sales is likely to increase the benefits. Also there was significant difference ( $P < 1\%$ ) between ICT use and income level of the respondents.

Farmers with high incomes had more than one ICT (normally radio and mobile phone) and therefore were in a better position to access market information through these items than those with less income who had only one type of ICT. This suggests that low-cost access to ICT such as information centers is a necessary prerequisite for the successful use of ICT by the poor (Cecchini & Scott, 2003). Statistics were also significant concerning the type of farm crop sold (such as banana, beans, Irish potatoes) ( $P < 5\%$ ) and gender ( $P < 5\%$ ). Crops like banana, beans and Irish potatoes are consumed widely and therefore farmers use ICT to fetch buyers from different areas nationally and internationally. Regarding gender, on average women tend to be more marginalized than men, and are therefore less likely to make frequent use of ICT (Souter et al, 2005).

However, there was no significant difference in the use of ICT for market access across education levels, adoption of new technologies and years in the agricultural marketing business. The significant lack of impact of education could be explained by the fact that a high proportion of the respondents had about the same level of education i.e standard seven. On the other hand, the reason why the number of years in business had no significant impact is not clear.

One explanation could be that in this science and technology era people are using ICT continuously to search for market information and new opportunities, including new markets that are emerging daily. The adoption of new technologies was also not significant because of the short time in which ICT has been available in the district. Most of these facilities especially mobile telephony only started to spread in rural areas after 2005.

Table 2. Dependent variable: Demand for ICT use for market access

Predictor	B	SE	t-ratio	Significance
(CONSTANT)	43.884	13.320	3.120	0.003
Type of agricultural commodity	0.245	0.003	2.225	0.028 **
Quantity produced	0.508	0.000	4.981	0.000 ***
Gender	0.274	8.998	2.767	0.008 **
Period in business	0.250	0.264	0.503	0.015 NS
Level of education	0.021	2.211	0.206	0.015
Adoption of new farming technologies	0.081	0.05	0.824	0.351
Income	0.325	0.049	4.560	0.000***

$R^2=45.3\%$  Adjusted  $R^2=38.6\%$  SE 16.73 F-value 6.42\*\*\*

\*\*\* significant at  $P < 1\%$  \*\* significant at  $P < 5\%$

### Impact of ICT use on quantity sold and price

It was important to find out whether using ICT had had any significant impact on the quantity sold and price received (Table 3) as these parameters are important for poverty alleviation. The results show a significant difference ( $P < 1\%$ ) in the quantity of beans sold through ICT market information access and a significantly higher price ( $P < 1\%$ ). On the other hand, there was no significant difference in the quantity of bananas sold but a significant difference ( $P < 5\%$ ) in price. This is probably because the area under banana cultivation is limited in the district. With such constraints, farmers have only one option of increasing their incomes and that is through good prices. These findings also show a high standard deviation in the quantity of goods sold and price received, suggesting that very varied market information was being received by farmers (Shepherd, 2000).

Table 3. Use of ICT, quantity sold and price received

	Did not use ICT		Used ICT		Level of significance
	n	Mean	n	%	
Quantity of beans sold (kgs)	65	3450 (8100)	34	8700 (11100)	***
Price	65	1198 (1650)	34	2198 (1955)	***
Quantity of bananas (tons)	25	23.5 (42.8)	21	29.8 (60.8)	NS
Price	25	540000 (980000)	21	850000(790000)	**

Note: Figure in parentheses indicate standard deviation,

\*\* Significant at 5% probability level (t-test)

\*\*\* Significant at 1% probability level (t-test)

### Cost of using ICT

The cost of using ICT includes recharging mobile phones, buying dry cell batteries, settling electricity bills, buying newspapers, and paying for air time in telecenters. The findings show that the costs incurred in using ICT were Tshs. 48,556.8 per respondent per marketing season, with standard deviation of Tshs. 97,468 indicating very high variations in the cost of using ICT by rural farmers. Compared with the benefits of using ICT for market information access the cost of using ICT is modest.

### Reasons for not using ICT to accessing market information

In a multiple response question, farmers were asked to give reasons why they had not been using ICT to access market information, and their responses are presented in Table 4. A large number of respondents (68%) said that they did not have money to buy the ICT facilities or services. This

was especially the case for mobile phones, internet and television, as only a small proportion of the respondents owned such gadgets. Also as many as 54% said they did not have access to electricity for operating ICT (watching TV, charging mobile phones), while others said that some of the ICT networks were either not available or not reliable in their villages (15%). Respondents also mentioned other constraining factors such as running costs (8.5%), timing in accessing broadcasted information (7.5%), and power cuts (6.5%). Others admitted that they did not know how to use ICT (4%) as well as how to access such facilities (3%). Indeed, the cost and availability of telecommunications determine the extent to which new ICT facilities are used, and these access costs are often higher in poorer countries (Wolf, 2001). Gollakota (2008) adds another important point in that information alone is not sufficient but structural and financial solutions are required as well.

Table 4: Factors hindering farmers' access to ICT

	Respondents	
	N	%
Lack of money	126	68
No electricity to operate	108	54
Service is not available	30	15
Costly to run	17	8.5
Unfavourable radio broadcasting time	15	7.5
Power cuts	13	6.5
Lack of knowledge to use ICT	8	4.0
Unable to access information	6	3.0
Total	N=200	100

Source: Survey data, 2007

### Summary and Conclusion

The development of ICT use for market access in Rungwe district is still in its infancy but the future is promising. A high proportion of farmers interviewed in this study received market information from fellow farmers, relatives and traders. The few farmers who used ICT to access markets were mainly those who produce large quantities of crops or have crops that are in great demand. The results also show that people who used ICT to access market information sold a lot more and received relatively better prices, which has a positive impact on poverty alleviation.

A number of factors are constraining the spread of ICT technology which include cost, availability, knowledge and reliability. Also the lack of electric power in many rural areas is a dictating factor in relation to the spreading of ICT.

The study recommends that rural electrification is invested both by the government as well as private sector which will definitely boost ICT investment in rural areas. There is also a need to ensure that efforts are concentrated more on renewable energy sources because they are relatively cheap and sustainable.

Low-cost access to information infrastructure is a necessary prerequisite for the successful use of ICT by the poor. Reducing the price of these facilities through innovative production of affordable but efficient ICT will enhance their use by rural farmers.

Strengthening farmers' groups for marketing is important to facilitate access for ICT facilities. Establishing market information centers and telecenters in rural areas could boost access to market information. Also the government should promote private and community provision of broadcasting services through widening access to telephone services and establishing telecenters so that they can effectively play this intermediary role.

### References

- Aloyce, M. (2005). ICT for improved crop marketing in rural Tanzania: Project summary. Retrieved from <http://www.uneca.org/aisi/iconnectafrica/v2n2.htm>.
- Biglaiser, G. (1993). Middlemen as experts. *RAND Journal of Economics*, 24(2), 212-223.
- Brynjolfsson, E., & Hitt, L. (1995). Information technology as a factor of production: The role of differences among firms in economics of innovation and new technology. *Journal of Economic Perspective*, 3(4), 83-199.
- Campbell, A. (2005). Mobile phones for small African farmers. Retrieved August 6, 2010, from <http://smallbiztrends.com/2005/03/mobile-phones-for-small-african.html>.
- Cecchini, S., & Scott, C. (2003). Can information and communications technology applications contribute to poverty reduction? *Lessons from rural India, information technology for development*, 10(2), 73-84.
- Cieslikowski, D.A., Halewood N.J., Kimura, K., & Zhen-Wei Qiang, C. (2009). Key trends in ICT development (World Bank Report). Retrieved August 7, 2010, from the Communication Initiative Network website: [www.comminet.com/en/node/298770/307](http://www.comminet.com/en/node/298770/307).
- Djankov, S., McLeish, C., Nenova, T., & Sheifer, A. (2001). Who owns the media? *Journal of Law and Economics*, 46(2).
- Dodds, T. (1999). Non-formal and adult basic education through open and distance learning in Africa. University of Namibia, Center for External Studies.

- Duncombe, R., & Heeks, R. (2001). Enterprise across the digital divide: Information systems and rural micro-enterprise in Botswana. *Journal of International Development*, 14(1), 61-74.
- Economic and Social Research Foundation (ESRF). (2008). *Enhancing the livelihoods of the rural poor through ICT: A Knowledge Map* (infoDev Working Paper No. 14). Retrieved May 5, 2010, from <http://www.infodev.org/en/Publication.517.html>
- Esselaar, P., Hesselmark, O., James, T., & Miller, J. (2001). Final report: A three-country ICT survey for Rwanda, Tanzania, and Mozambique. Retrieved from <http://www.trigrammic.com/downloads/SIDA%20Final%20Project%20Report.pdf>.
- Farrell, G., & Isaacs, S. (2009). Survey of ICT and education in Africa: A summary report, based on 53 country surveys. *infoDev / World Bank*. Retrieved from <http://www.infodev.org/en/Publication.353.html>.
- Gabre-Madhin, E.Z. (2001). The Role of Intermediaries in Enhancing Market Efficiency in the Ethiopian Grain Market, *Agricultural Economics*, 25(2-3), 311-320.
- Gollakota, K. (2008). ICT use by businesses in rural India: The case of EID Parry's Indiagriline. *International Journal of Information Management*, 28(4), 336-341.
- Helmberger, P.G., Campbell, G.G., & Dobson, W.D. (1981). Organisation and Performance of Agricultural Markets. In Martin, L.R. (ed.), *A Survey of Agricultural Economics Literature, Economics of Welfare, Rural Development and Natural Resources in Agriculture, 1940 to 1970s*. Minneapolis: Agricultural Economics Association.
- International Telecommunication Union. (1999). General principles: Particularities of rural environments and their implications for telecommunications. *Handbook on New Developments in Rural Telecommunications*. Geneva: ITU.
- International Telecommunications Union. (2009). ICT Statistics Newslog - Tanzania ends Q1'09 with 13.9Mn mobile subscribers. *ITU Telecommunication/ICT Statistics*. Retrieved July 21, 2010, from <http://www.itu.int/ITU-D/ict/newslog/Tanzania+Ends+Q109+With+139Mn+Mobile+Subscribers.aspx>.
- Jensen, R. (2007). The digital divide: Information (technology), market performance, and welfare in the South Indian fisheries sector. *Quarterly Journal of Economics*, 122(3), 879-924.
- Kenny, C. (2002). Information and communication technologies for direct poverty alleviation: Costs and benefits. *Development Policy Review*, 20(2), 141-157.
- Kleih, U., Okoboi, G., & Jonowski, M. (2004). Farmers and traders' sources of market information in Lira District. *Uganda Journal of Agricultural Science*, 1(9), 693-700.
- Lio, M., & Liu, M.C. (2006). ICT and agricultural productivity: evidence from cross-country data. *Agricultural Economics*, 34(3), 221-228.

- Lohano, H.R., Smith, L., & Stockbridge, M. (1998). Cotton and Wheat Marketing and the Provision of Pre-harvest Services in Sindh Province, Pakistan: In Dorward, A., Kydd, J. and Poulton, C. (Eds). *Smallholder Cash Crop Production under Market Liberalisation: A New Institutional Economics Perspective* (pp. 177-239) U.K.: CAB International.
- Molony, T. (2006): 'I don't trust the phone; It always lies': Trust and information and communication technologies in Tanzanian micro- and small enterprises. *Information Technologies and International Development*, 3(4), 67-83.
- Mukhebi, A.W., Kundu, J., Okolla, A., Wambua, M., Ochieng, W. & Fwamba, G. (2007). Linking farmers to markets through modern information and communication technologies in Kenya. *Proceedings of the 2<sup>nd</sup> International AAAE Conference*, Accra, Ghana.
- Munyua, H. (2000). Information and communication technologies for rural development and food security: Lessons from field experiences in developing countries. *CAB International, Africa Regional Center*. Retrieved from <http://www.fao.org/sd/cddirect/cdre0055b.htm>.
- Mwakaje, A.G. (1999). *Traders' response to traditional agricultural export commodities market reform: A study of contractual arrangements in the smallholder coffee industry in Rungwe District Tanzania* (Doctorial dissertation). Wye College, University of London, U.K.
- Nielinger, O. (2003). Rural ICT Utilization in Tanzania Empirical Findings from Kasulu, Magu, and Sengerema. *ICT for Development: The Case of Tanzania*. Retrieved from <http://www.giga-hamburg.de/iak/de/content/forschung/pdf/projekt Nieltext6.pdf>.
- Njehia, B. K. (1994). *The impact of market access on agricultural productivity: A case study of Nakuru District, Kenya*. Springer-Verlag, Berlin, Germany.
- Parvatiyar, A., & Sheth, J.N. (1995). The Evolution of Relationship Marketing. *International Business Review*, 4(4), 397-418.
- Rao, N..H. (2007). A framework for implementing information and communication technologies in agricultural development in India. *Technological Forecasting and Social Change*, 74(4), 491-518.
- Shepherd, A.W. (2000). Marketing and rural finance farm radio as a medium for market information dissemination. *First International Workshop on Farm Radio Broadcasting*. Retrieved July 12, 2010 from <http://www.fao.org/docrep/003/x6721e/x6721e22.htm>.
- Soriano, C.R.R. (2007). Exploring the ICT and rural poverty reduction link: Community telecenters and rural livelihoods in Wu'an, China. *The Electronic Journal of Information Systems in Developing Countries*, 32.
- Souter, D., Scott, N., Garforth, C., Jain, R., Mascarenhas, O., & McKemey, K. (2005). The economic impact of telecommunications on rural livelihoods and poverty reduction: A study of rural communities in India (Gujarat), Mozambique, and Tanzania (Report of DFID KaR Project 8347). Project managed for Dfid by CTO.

- TCRA. (2007). Tanzania Communication Regulation Authority: Creating a level playing field. Retrieved August 9, 2010, from <http://www.tcra.go.tz/publications/telecomStatsJune07.html>
- UNDP, (2001). Making new technologies work for human development. *United Nations Development Programme*. Retrieved from <http://www.undp.org/hdr2001>.
- UNESCO. (1996). *Information and communication technologies in development: A UNESCO perspective* (Submission to the UNCSTD Working Group on Information Technologies for Development and the ITU Development Study Group 1 C11-96/WS/6). Retrieved from <http://www.unesco.org/webworld/telematics/uncstd.htm>.
- URT. (2005). Poverty and Human Development Report 2005. *United Republic of Tanzania, Tanzania's Poverty Monitoring System Research and Analysis Working Group*. Tanzania: Mkuki na Nyota Publishers.
- URT. (2010). Rungwe district profile: District investment profile. Retrieved from September 3, 2010 [http://www.mbeya.go.tz/index.php?option=com\\_docman&task=cat\\_view&gid=53&Itemid=179](http://www.mbeya.go.tz/index.php?option=com_docman&task=cat_view&gid=53&Itemid=179)
- Wensheng, W (2001): Bridging the digital divide inside China. *National Agriculture Research Center of Japan, Department of Information Science and Technology*. Retrieved from <http://zoushoku.narc.affrc.go.jp/ADR/AFITA/afita/afita-conf/2002/part7/p533.pdf>
- Wolf, S. (2001). *Determinants and Impact of ICT Use for African SMEs: Implications for Rural South Africa*. Paper presented at Trade and Industrial Policy Strategies (TIPS) 2001 Annual Forum, South Africa. Retrieved from [http://www.tanzaniagateway.org/docs/Determinants\\_and\\_Impact\\_of\\_ICT\\_use\\_for\\_African\\_SMEs.pdf](http://www.tanzaniagateway.org/docs/Determinants_and_Impact_of_ICT_use_for_African_SMEs.pdf)

---

<sup>1</sup> Dr. Agnes Godfrey Mwakaje is a Senior Lecturer and Researcher at the Institute of Resource Assessment, University of Dar es Salaam. She can be reached at: Institute of Resource Assessment, University of Dar es Salaam. P.O Box 35097 Dar es Salaam Tanzania. E-mail address: [amwakaje@udsm.ac.tz](mailto:amwakaje@udsm.ac.tz); Res. Phone: +255 222 410 489; Office Phone: +255 222 410 144; Mobile Phone: +255 784 391220; Fax +255 222 410 393.

Page left blank