

Predictors of ICTs Adoption as Source of Market Information Accessibility and Rice Crop Production Among Small Holder Youth Farmers in Morogoro-Tanzania

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Abstract: Innovation of information and communication technology in the agriculture brought about opportunities among rural farmers globally. This paper focused on analyzing determinants of adopting the ICTs as means of accessing the market related information on rice crop production. The study employed a fourth stage sampling design to select a representative sample of 600 youth. By fitting chi-square and logistic regression model, the results revealed that the decision of farmers to adopt ICTs is mainly influenced by personal and economic factors such as education level, household size, personal income, cost of technology and land size. It was further revealed that technological and institutional factors are also significant predictors of farmers' decision. The findings imply that the use of new technology, particularly ICTs in accessing market information, is a proper means of minimizing the related cost of production. This means that the use of ICT is a solution to the barriers on acquiring the appropriate market information timely.

Keywords: ICTs adoption, Market information, Rice crop production, Youth farmers.

1. Introduction

In now days, the whole system of agricultural process has been changed as a result of innovations of science and technology. The rural farmers who engage in crop production have been trying to adopt these devices that made them to save time and cost in the production process (Mittal, & Mehar, 2012). Agriculture is one of the potential sectors in Tanzania, and the sector can bring more benefits to the nation through emphasizing on the utilization of ICTs among rural farmers. The Information and Communication Technologies (ICTs) are essential in sharing market information among farmers. In sub-Saharan African countries, small scale farmers are facing inaccessibility to updated agricultural information on market matters which is vital for sustainability of the agriculture practice (Munyua et al, (2009)). The ICTs is a means of farmers in accessing relevant information that stimulate the whole agriculture process particularly rice crop production that. The introduction of pre-paid credit has enable the users of mobile phones to communicate themselves and save the cost of

travelling from one area to another searching for particular information. The essential information on market data have been accessible through messaging service of the mobile phone users in the rural areas. (Ogbeide, & Ele, (2015))

Since the time where the development of ICTs in Tanzania emerged in the 1970, this development has brought a bring change in social economic status of the country. The innovation of this machine was a key influential tool on updating the modern economy which goes together with integration of rural areas and general informal sectors into global economy.

The Government of Tanzania have taken different measures to stimulate the utilization of ICTs in rural areas such as the development of National ICTs Policy in 2003 with the goal of regulating the utilization of ICTs to different users including farmers. The policy was followed by the establishment of the Tanzania Communication Regulatory Authority (TCRA) as an organ of monitoring the use of ICT among different group of people. This body facilitated the adoption of ICTs in different sectors through creating awareness to citizens and issuing licenses to different ICTs companies (Mwakaje, 2010). Regardless of the initiatives taken by the government, the adoption of ICTs in rural areas is not satisfactory. The farmers on using ICTs is very low compared to the developed countries (Krone, Dannenberg, & Nduru, 2016). Thus, there is need to study the reasons behind to the low level of adopting new technologies with particular focus on what variables are influencing the use of ICTs in rural areas.

The revolution of science and technology has been a driving force towards facilitating development of various economic sectors. ICTs are modern device useful to transform or collect data in easier way. It is term that includes computers, mobile phone, radio and television, Internet, satellite systems, Geographic Information Systems and Camera (Ayim et al., (2022)). The use of ICTs plays great role on social and economic development of the nation. In recent years, the adoption of ICTs has been raising to a reasonable speed in different part of the world particularly developing countries

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including African continent. Farmers, like part of community living in rural areas have been coping with revolution by owning different device such as computer, mobile phones. However, the leading device which is frequently operated by farmers is mobile phone

Different studies documented the factors influence the use of ICTs among farmers. A study by Akpabio *et al* (2007) reported that poor infrastructure, high cost of owning ICT device, high cost of electricity power system was among the variables that negatively influenced ICT adoption in Nigeria. In Kenya, Mwombe *et al* (2014) found that income and demographic factors such as age and gender influenced the adoption of ICTs among small holder banana famers. A study by Mittal, & Mehar (2012) on socio-economic factors affecting adoption of modern ICT's in India revealed that education, age and farm size influenced the small farmers' decision on utilizing a particular ICT device. The findings further implied that farmers utilized multiple information sources, and that relying on a single source of information does not meets the needs of the farmer.

Warren (2002) pointed out that the use of ICTs among farmers was influenced by age, education level and ownership of farmland. The finding showed that ICT use in agribusiness had played important role in stimulating and transforming agriculture in the competitive environment to cope with the advancement of science and technology, and in improving welfare among agricultural society. In the work done by Taragola, Van Lierde, & Gelb (2009) complexity which is associated with poor skills of some farmers, and high cost of affording ICTs were found to have negative relationship with the use of ICTs by farmers. Okello *et al.*, (2012) pointed out that behavior of farmers on using ICT device depends on age, primary occupation of the farmer, transport expenses to the market area, accessibility of electricity, farming experience and production trends. The study further reported that gender of farmers, education level, the household size, ownership of the mobile phone affects the decision on using ICT. On the other hand, relative advantage, simplicity, compatibility, social influence and

Innovation of ICTs in the agriculture brought about opportunities among rural farmers and thus the major challenges faced this group is on coping with the advancement of science and technology. Although it is well documented that ICTs are easy means of accessing agricultural related information to farmers, the response of farmers on utilizing these devices is very low (URT, 2010). Thus, this draws attention on investigating what factors hinder the adoption of ICTs among farmers. Similarly, the existing studies in the literature reported the factors affecting adoption of ICTs while focusing only on social economic factors while ignoring the other technological and environmental factors. Unlike the existing studies in the literature, an attempt was done in this study by investigating not only social economic factors but also, technological and environmental factors influencing the adoption of ICTs among youths. It was also focused on establishing the relationship between of ICT and rice productivity.

2. Objectives

The study aims at determining the factors which influence adoption of ICT on accessing market information and its impact on rice crop production. The specific objectives of the study are as follows:

- To examine the link between ICTs and rice crop production among youth farmers.
- To determine the influence of social economic factors on use of ICTs for accessing market information.
- To determine the influence of technological factors on use of ICTs for accessing market information.
- To determine the influence of environmental factors on use of ICTs for accessing market information.

In relation to the specific objectives, the paper was guided by the following hypotheses:

- H₁₁: Personal factors have no influence on use of ICTs for accessing market information.
- H₁₂: Technological factors have no influence on use of ICTs for accessing market information.
- H₁₃: Environmental factors have no influence on use of ICTs for accessing market information.
- H₁₄: Economic factors have no influence on use of ICTs for accessing market information
- H₁₅: There is no relationship between ICT adoption and increase in rice crop production.

3. Research Methodology

A. Research Design

The study employed cross sectional survey method for analyzing the predictors of ICTs device as source of accessing agricultural market information and the link between technology adoption and increase in rise crop production. The design is popular of its strength of observing several variables at a time.

B. Population and Sampling

The targeted participants for this study were youth farmers in different districts of the Morogoro region. The region was selected for its high potential on rice cultivation. In addition, many youth groups of farmers can be accessible easily. Probability sampling design particularly multistage sampling technique was used. Each technique has some merit and demerit depending on different factors. One technique can be preferred over the other in one situation while in different situation the preference can be vice versa. Four stage sampling design was employed. Three rice growing districts, were selected in the first stage. Then, the wards/villages were selected in the second stage. In the third stage, a group of farmers were selected from each of the wards/villages. Finally, the fourth stage involved selection of the target respondents from each of the selected groups. In total, a sample of 600 participants was selected using the following formula:

$$n = \frac{z^2 pq}{e^2} = \frac{1.96^2 \times 0.6 \times 0.2}{0.03^2} = 600 \quad (1)$$

n = Estimated sample size
 Z=Standard normal value (1.96) corresponding to 95% confidence interval
 P=assumed proportion of the main response (0.5)
 q=1-p
 e = margin error (3%=0.03)

The justification of using this formula is based on the fact that the population size is unknown and thus the appropriate formula is Cochran formula for determining sample size for infinite population.

C. Data Collection

Survey questionnaires were used for data collection. The questionnaires were designed based on the objectives of the study by involving only questions which were relevant to the aim of the study. The first part of questionnaires included closed ended questions on social demographic profile of farmers. Likert scale ranging from 1 to 5 were used whereby 1 stand for strongly disagree, 2 for disagree, 3 for moderately agree while 5 for strongly agree. The second section included several items to capture the responses for construct of environmental factors. Likewise, the third section presents the other items as component of social economic factor. The fourth section focused on technological factors.

Then, the questionnaires were distributed to the farmers with the help of group leaders. To guarantee maximum response rate, the objectives of the research and instructions on how to respond to the questions were explained to farmers.

D. Data Analysis

Before data analysis the necessary steps were implemented including data cleaning and entry. The Statistical Packages software, Statistical Package for the Social Sciences (SPSS) - version 20 was used to run different statistical models namely binary logistic regression model and chi-square test. The model can statistically be presented as follows:

$$\log it(\pi_i) = \left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \sum_{j=1}^4 \beta_{ij} x_{ij} \quad , \quad i = 1, \dots, 600 \quad (2)$$

$$\log it(\pi_i) = \beta_0 + \beta_1 \text{Personal characteristics} + \beta_2 \text{Technology} + \beta_3 \text{Environment} + \beta_4 \text{Economy} + \epsilon \quad (3)$$

4. Results and Conclusion

A. Results

1) Chi-square Goodness test of model coefficient

Like many statistical models, the logistic regression needs to be evaluated to check the goodness fit of the model. Two tools were used for model diagnosis namely omnibus test and classification table. The test examines whether the adding any independent variable can have significant impact to the model.

Table 1
 Omnibus test of model coefficients

Chi-square	df	Sig.
70.264	4	.000

Thus, the model tests the hypothesis that inclusion of any variable does not contribute to the significant ability of the model. The table 1 revealed a lowest p value of 0.000 which implies that the overall model is significant the situation that provide a good base of proceeding with further analysis of evaluating individual variables.

The evaluation on the significance of the model on predicting determinants of ICT adoption was evidence by classification table. The results revealed that 99% of the ICT adoption was correctly predicted while the non-ICT adoption category was also correctly predicted by 15%. Generally, accuracy of the model to predict explanatory variables was 88%, implying that the model was correctly classified as indicated by table 2.

2) Logistic regression results

Prior to individual evaluation of explanatory variables, overall model was examined and results showed that the model was significant. The next part was to evaluate the statistical significance of the independent variables.

Table 3 shows the output of binary categories namely adoption and non-ICT adoption. The results revealed that when unit of personal factors increase, it multiplies the odd of farmers to adopt ICT by 2. 319. The value of Wald statistic is 24.875 with lowest p-values indicating significant influence of the personal variables to the decision on either adopting or non-adopting. Similarly, the technological factors were found to be significant variable influencing farmers on choosing to use ICTs as shown by odd ratio of 1.57, p-value, 0.00 < 0.05.

Table 2
 Classification table

Observed		Predicted		
		Adopting status		Percentage
		Adopting	Non adopting	
Adopting status	Adopting	516	6	98.9
	Non adopting	66	12	15.4
Overall percentage				88

Table 3
 Logistic regression outputs

Factors	B	S.E.	Wald	Sig.	Exp(B)	95% C. I	
						Lower	Upper
Personal	0.841	0.169	24.875	0.000	2.319	1.666	3.228
Technology	0.451	0.2	5.094	0.024	1.57	1.061	2.323
Environment	-0.763	0.15	25.983	0.000	0.466	0.348	0.625
Economic	-0.464	0.13	12.796	0.000	0.629	0.488	0.811
Constant	-2.489	0.54	21.243	0.000	0.083		

Table 4
Association between ICT adoption and increase in rice crop yield production

ICT adoption	Crop yield improvement					Chi-square value	p-value
	Very high	High	Average	Very low	Low		
Adopting	48	102	186	102	84	22.711	0.000
Non adopting	12	30	12	12	12		

Environment surrounding farmers such as presence of agricultural extension services was evidenced as a significant influential variable (Odd Ratio (OR) = 0.575, p-value, $0.00 < 0.05$). The results of the binary regression model further revealed that the decision on adopting ICTs depends on economic factors facing farmers. This was proved by an interesting results of odd ratio value of 0.629, p-value, $0.00 < 0.05$).

3) Relationship between ICT adoption and increase in rice production

Technological advancement could lead to improvement in different sectors including agriculture. Tables 4 provides the findings of the analysis on whether the improve in rice production can be connected with the adoption rate of ICT as major source of accessing market information for rice crop products

Table 4 indicates the chi square test results for association between ICT adoption and crop yield production. The large test statistic value of 22.7 with p value, $0.000 < 0.05$ indicate significant association between adoption and crop production. This result implies that as the farmers focus on using ICTs as key source of market information for the crop products, they would have access to reliable market information and thus be motivated to grow more crop.

The findings revealed that personal characteristics of farmers such as education level and household size are significant influential drivers of ICT adoption. Basic knowledge on operating some potable ICT device like smart phone is essential requirement for using the device and enjoy the updating information on market information for crop production. The Findings are consistent with Strong et al (2014) who concluded that the education level is one of the main significant factors that influence the decision on accepting new technology particularly ICT devices. Similarly, Doss and Morris (2001) reported that education level plays a major role in technology adoption among farmers. The primary knowledge is necessary for accepting new technology as a means of accessing agricultural market information. Nzonzo, & Mogambi, (2016) elaborated those farmers characteristics such as level of education is a significant predictor on possibility of farmers adoption on new technology. Level of education of individual influences decision on adopting new technology since the high education level increases the chances to access and use the technology. This implies that the higher the education level of the farmers the higher the possibility of copying with new technology. On the other hand, the farmers with low level of education lack competence on operating the scientist devices like smartphone and laptop computers, the situation that make them lose confidence of adopting ICT device on accessing agricultural market information. The findings also show that individual factors such as household size could be significant explanatory variable that influence the adopting of ICT. It was

pointed by Wole (2015) that the household size and education level are among social economic factors that determine the action of farmers on accepting new technology

Tanzania like many other developing countries utilized ICTs as a modern means of disseminating relative information to farmers. However, adoption of these ICT is much influenced by several factors including nature of the technology. The result concurs with the findings by Adegbedi et al., (2012) who pointed out that the dissemination of agricultural input information is influenced my different factors including compatibility and simplicity of the technology together with characteristics of the farmers. The complexity and compatibility of the technology were found to be significant determinant of technology adoption. It is a tendency of farmers to evaluate a particular technology to check whether the device fits with their needs. A work done by Mignouna et al. (2011) argued that the technology that are user friendly are much demanded by farmers unlike the one which is too complex. Thus, the features of technology play great role in determining the chances of individual to cope with the ICT device. Simin & Janković (2014) reported that the adoption of new technology by a particular society can be examined by considering personal profile, social factors and characteristics of the innovation. It is therefore expected that when the new technology provides a maximum satisfaction to users then there will be high possibility of the rise in adoption rate. The perception of the adopters on accepting new technology which is technically termed as compatibility depends on the quality, experience and needs of the users. Thus, when the needs of the users match with the innovation then the said technology might be accepted to a great extent.

In some situations, farmers could have the willingness and desire to own and utilize ICT device for accessing market information but the major obstacles remain inability to afford that device. Thus, the individual income and the cost of technology are determining variables that predict the adoption desire. The study revealed a significant influence of economic factors namely land size, cost of technology, and personal income on the adoption of ICT devices as the main source of agricultural market information. A study by Olumba & Rahji (2014) concluded that the farmers decision to adopt particular technology is much determined by several factors including land size and farmers income. Therefore, the level of adoption on new ICT device depends largely on economic situation of farmers. The cost of ICT device such as mobile phone and service charges can predict the rate of rural small holders' farmers to utilize and access the agricultural market information

Some environmental factors which can also be referred as organization factors have significant contribution to the adoption rate of farmers on ICTs as source of accessing agriculture market information. The study revealed that the decision on adopting ICTs is influenced by accessibility of

source for agriculture information channels, relation between farmers and extension services. The study by Charles et al (2017) reported that the rate of technology adoption is largely depends on extension services that encourage farmers on the benefits of utilizing ICTs

The study further indicates significant association between using ICTs device for accessing market information and performance on rice crop production. The p-value of $0.000 < 0.005$ proved that relying on receiving market information from ICTs source ensures the quality of information as a result of this input, farmers can be motivated and focusing on growing more crop with the confidence of securing market

B. Conclusion

This study investigated the factors influencing small scale farmers on adopting ICTs as means of accessing agricultural market information in Tanzania. It employed binary logistic regression model to study the drivers of technology adoption among farmers, and chi square test to assess the significant association between ICTs adoption and increase in rice crop yield production. The findings indicate that the decision of farmers to adopt ICTs is mainly influenced by personal factors such as education level and household size. It was also found that economic factors such as personal income, cost of technology and land size are significant predictors of ICTs adoption. In addition, the study revealed that technological and institutional factors are also significant predictor of farmers decision to use a particular device. These results imply that the use of new technology particularly ICTs in accessing market information is a proper means of minimizing the cost of getting the needed information. This implies that the use of ICT is a solution to the barriers on acquiring the right market information on time. The results from this study is an input to policy makers to find possible initiatives that will make these ICT accessible and affordable to farmers

Based on the results from this study, it is recommended that the public awareness on the benefits of using ICTs for accessing agricultural market information can be done through both the Government and Private sectors particularly Non-Government Organization (NGOS). This would help farmers to minimize cost of getting market information and hence improvement in their production. The collaboration between Government and private sectors especially ICTs service providers needs to be enhanced to ensure that the market information can be accessible through ICTs and promote farmers to own the ICT devices.

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