# Evaluation of the Use of Ict in Agricultural Technology Delivery to Farmers in Ebonyi State, Nigeria.

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**Abstract**
This study evaluated the use of ICT as a source of technology delivery among farmers in Ebonyi State of Nigeria. Multiple-stage random sampling technique was used to select 120 respondents.  Primary data were collected using a well structured questionnaire and interview schedule.  Both descriptive and inferential statistics were employed in data analysis.  Results obtained showed that 55 percent of the respondents were males whose age brackets fall within 30 – 39 years. About 30 percent had secondary education.  Out of 45 percent of the respondents who were farmers, 41.7 percent were mainly crop farmers.  54.17 percent of the respondents had access to mobile phones whereas 57.50 percent had no access to computer. ICTs was used by 31.67 percent of the respondents to get information on new varieties, ICT was effective in information delivery in determining the quantity of farm inputs. A high co-efficient of multiple determination ($R^2$) of 76.6 percent was obtained.  This means that 76.6 percent of the total variables in the dependent variables were caused by the changes in independent variables included in the regression model. Infrastructural, technical, institutional and financial constraints were identified by factor analysis. In conclusion, overcoming the problems of information dissemination and communication, language barriers and limited economic resources would increase the use of ICTs in the study area.  Recommendations such as improvement of infrastructural facilities, periodic training of farmers, and extension agents, subsidizing ICTs facilities as well as organizing public enlightenment programmes should be carried out to improve the awareness and the use of ICTs in Ebonyi State.
**Keywords:** ICT, Agriculture, Technology, Delivery, Farmers, Ebonyi State.

## Introduction and Problem Statement

There is scarcely a field of human activity today that has not been touched by the dramatic changes in information and communication technology (ICT) for the past 10-15 years. Agricultural and agriculture related natural resources management are no exception.

In this era of globalization, Information and Communication Technology (ICT) has become a powerful tool for improving the delivery service and enhancing local development opportunities (Gorstein, 2003). As a broad tool for providing local farming communities with latest agricultural technology, information and communication technology heralds the formation of knowledge for societies in the rural areas of the developing world (Shark et al, 2004). Rural Communities require information on supply of inputs, new farming technologies, early warning of natural disasters, credit, market price and their competition. Such information knowledge, technology and service contribute to expanding and energizing agriculture (Munya, 2000).

Absence of functional agricultural technology delivery system is a major constraint to agricultural development in Nigeria. Aina (1989) identified non-provision of necessary agricultural information as a key factor limiting agricultural development in Nigeria.  According to Kenny (2001), local communities need to be involved in the designed universal access programmes by participating in decision about particular information and communication access outlets.  Indeed, most studies found out that the most effective way of ensuring the economic success of ICT in rural areas is to encourage focal participation and create social institution in support of the new technologies. Lack of encouragement of the local communities and social institutions make the farmers to reject the new technologies because most of the farmers are illiterate and need to be guided and encouraged properly to the effectiveness of the ICT in technology delivery to be successful (Munya, 2000).  A great understanding of existing information system to ascertain how information is gathered, stored, shared, concretized and evaluated amongst poor communities will aid the appropriate application of  ICTs. It should be pointed out that rural farmers are ready for information and communication but the prevalent problem identified by Farinde (1999) was non availability and lack of access to some information source.

The lack of information probably led to the conclusion drawn by Akinwande (1998) from evidence of his research, that problem of information dissemination and communication contact associated with limitation,

dissemination expectations are obstacles of geography, fragmented audience, language barriers, and limited economic resources are sophisticated strategies of face to face contact.

Disseminating important agricultural information to farmers has been an integral part of agricultural development strategies for years. In an ICT enabled approach, information dissemination and communication techniques from institutionalized knowledge sources will continue to be important, but the real transformation that ICT make possible is to allow feedback and return flow of information from users that tells information suppliers (extension agents) whether the information they supplied was useful or relevant and offer guidelines to improve it (Faride, 1999). Hence, it is critical to evaluate the effectiveness of the use of ICT in agricultural technology delivery and the constraints encountered in the delivery and adoption.

Based on what have been mentioned by Noor Shariferh (2006), it seems that ICT has a big role to offer in increasing agricultural productivity. But do agro based entrepreneurs in Nigeria use ICT? To what extent do they use it? Frequent, seldom or they never use it? If they are seldom and never use it, what are the factors that contributed to these problems?

According to previous studies done by M. D. Salleh et al (2009), the level of ICT usage such as internet among developing countries was still at a low level and a number of factors are related to this. Rechandson, D (2006) IICD (2006) and Hayrol et al (2009) indicated that agricultural communities prefer to use traditional ways instead of using ICT, they prefer asking their neighbours and relying on traditional mass media such as television, radio and newspapers. Telg et al, (2005) identified language as one of the main problems faced by the rural people in using ICT. One possibility is that majority of the rural farmers nowadays are elderly with low education and could read and write, since most ICT application run in English (Ezhar et al, 2008). Pierson (2006) stated that low self esteem was also the main problem that must be overcome if agricultural community wants to be cultivated with ICT interventions.

It appears that specific attempt is yet to be made to empirically evaluate the use of ICT in agricultural technology delivery to farmers in Ebonyi State with a view to ascertaining constraints that farmers face in using ICT. It is therefore believed that an evaluation of the use of ICT in agricultural technology delivery to farmers in Ebonyi State will reveal some of the constraints to effective use of ICT as a source of information dissemination to agricultural development. The study therefore sought to proffer solution to the following questions: what is the role of ICT in dissemination of vital farm information among farmers? What is the viability and access note of ICT to farmers in the study area? How effective is the use of ICT as information source of farmers in the area? What are the factors that limit farmers to the use of ICT as a source of farm information in the study area?

**The Objectives of the Study include to**:
  i.     describe the socio-economic characteristics of the farmers
  ii.    determine the level of access to ICT as source of information on agricultural technology by the farmers ;
  iii.   analyse the effectiveness of ICT in the delivery of agricultural technology to the farmers ; and
  iv.    determine the relationship between the socio-economic characteristics of the farmer and their access to ICT as a source of information on agricultural technology.

$H_O$:     There is no significant relationship between the socio-economic characteristics of the farmers and their access to ICT as source information on agricultural technology.

The use of ICT in technology delivery to farmers without proper evaluation of its effectiveness does not really solve the problems of the farmers and the suppliers, hence the need for proper monitoring and investigation. The research provided solution to the users, and benefited students working on related areas. It also benefited agricultural policy makers in planning and implementing agricultural Information and Communication Technology (ICT) programmes and activities.

**Materials and Methods** :

The study area is Ebonyi State, Nigeria. Ebonyi State is made up of 13 local government areas and three agricultural zones: North, Central and South. The North Agricultural Zone has four (4) Local Government Areas – Abakaliki, Ebonyi, Izzi and Ohaukwu. The Central Agricultural Zone, has four (4) Local Government Areas – Ezza North, Ezza South, Ikwo and Ishielu and South Agricultural Zone, has five (5) Local Government Areas – Afikpo North, Afikpo South, Ivo, Ohaozara and Onicha.

The people are mostly farmers, artisans and civil servants. They grow variety of staple crops and vegetables such as yam, cassava, rice, maize, potatoes, groundnut, cocoyam, melon, tomatoes and Okro. (EBADEP 2002, EBMOI, 2003).

Multi-stage random sampling technique was used in selecting the respondents in the study area. Thirty five (35) from the North, thirty five (35) from the central and fifty (50) from the south, given a sample size of 120 respondents.

Primary data were collected from the respondents while secondary data were collected from Ebonyi State Agricultural Development Project and Ebonyi State Ministry of Information.

Objectives (i) and (ii) were analyzed using descriptive statistics such as percentage, frequency table and mean ; objective (iii) was analyzed with likert scale technique while objective (iv) was analyzed by multiple regression.

Model specification for multiple regression is as follows :

LA = F (ES, AG, SE, AW, FS, HS, FE, GM,

LA = $(a + a_1 ES + a_2 AG + a_3 SE + a_4 Ag + a_5 FS + a_6 HS + a_7 FE + a_8 Mg + et$

LA = Level of Access of ICT (number of ICT facilities accessed)

ES = Education Status

AG = Age (years)

SE = Sex

AI = Annual farm income

FS = Farm Size (Ha)

HS = House hold size

FE = Farming experience

GM = Group membership.

Likert scale model.

Likert formula = $\sum \dfrac{fn}{Nr}$

Where $\qquad \sum \qquad$ = summation

$\qquad\qquad$ F $\qquad$ = frequency of each response pattern

$\qquad\qquad$ n $\qquad$ = Likert nominal value

$\qquad\qquad$ Nr $\qquad$ = Number of respondents to each response category

**Result and Discussion**

The result of the study were presented in the subsequent tables as below.

Table1: Percentage Distribution of Socio-economic Characteristics of Respondents.

| Variable | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 66 | 55 |
| Female | 54 | 45 |
| **Age:** | | |
| Less than 29 | 8 | 6.7 |
| 30 – 39 | 44 | 36.7 |
| 40 – 49 | 39 | 32.5 |
| 50 and above | 29 | 24.3 |
| **Education attainment:** | | |
| No formal education | 34 | 28.3 |
| Incomplete Primary School | 20 | 16.7 |
| Complete primary school | 30 | 25 |
| Others | 36 | 30 |
| **Marital status:** | | |
| Single | 59 | 21.7 |
| Married | 26 | 49.2 |
| Divorced | 8 | 6.7 |
| Separated | 11 | 9.2 |
| Widowed | 16 | 13.3 |
| **House hold size:** | | |
| 1 - 3 | 20 | 17.7 |
| 4 - 6 | 40 | 33.3 |
| 7 - 9 | 28 | 23.3 |
| 10 – 12 | 22 | 18.3 |
| > 12 | 10 | 8.3 |
| **Occupation status:** | | |
| Farming | 54 | 45 |
| Trading | 20 | 16.7 |
| Civil service | 25 | 20.8 |
| Others | 21 | 17.5 |
| **Income per month:** | | |
| 10,000 – 20,000 | 22 | 18.3 |
| 21,000 – 40,000 | 50 | 41.7 |
| 41,000 – 60,000 | 30 | 25 |
| > 60,000 | 18 | 15 |
| **Types of framing practice:** | | |
| Livestock production | 20 | 16.7 |
| Crop production | 50 | 41.7 |
| Marketing farm product | 39 | 32.5 |
| Agricultural processing | 5 | 4.2 |
| Firb farming | 4 | 3.3 |
| Snail farming | 2 | 1.7 |
| **Members of co-operative society:** | | |
| Yes | 40 | 33.3 |
| No | 50 | 66.7 |

Source**:** Field survey, 2012.

**Gender**: The finding on table 1 showed that majority (55%) of respondents who use ICT were male while 45 percent were female.

**Age:** The respondent whose age were 30 – 39 was 36.7 percent, while those less than 29 years were 6.7 percent. 32.5 percent and 24.2 percent of respondents fall between 40 – 49 and above. This mean that majority of the respondents were still active and participated in the use of ICT in agriculture. It agreed with the findings of Munya (2001) that young people participate more in ICT in agricultural technology.

**Education attainment**: The above table showed that majority (71.7%) were literate while (28.3) were illiterate. This implies that majority of the respondents participate in new ideas and likely to adopt new innovation. This is in line with Asogwa (2006) which stated that educational status enhances efficiency of farmers.

**Marital Status**: The result indicated that 49.2 percent of the respondent were married, 21.7 single while 6.7 percent and 9.2 percent were divorced and separated respectively.

**Household size**: In table 1 above, majority (33.3 percent) of the respondents had a household size of 4-6 while 8.3 percent of the respondents had a household size of 12 and above. However, with a mean household size of 5.75, respondents was considered as having larger household size than others. This was of great importance as a source of cheap and affordable farm labour in farming.

**Occupation status**: Occupational status showed that majority (45%) of the respondents were farmers while minorities (16.7%) were traders.

**Income**: Table 1 also showed that majority of the respondents (41.7%) earned between 21,000 – 40,000 per month while 15 percent earned N60, 000 and above. Average income per month being N36, 625, it means that majority of the respondents were low income earners.

**Type of farm practice**: It was indicated in the table that 41.7 percent of the respondents practiced crop farming while 1.7 percent practiced snail farming.

Member of Co-operative society: Thirty three percent of the respondents were members of co-operative society while 66.7 did not belong to the co-operative society.

**Table 2: Percentage Distribution of Respondents Based on ICT Facilities Awareness in the study Area**

| Existing ICTs | Frequency | Percentage |
|---|---|---|
| Radio | 29 | 24.17 |
| Computer | 27 | 22.50 |
| Telephone (mobile) | 45 | 37.50 |
| Television | 10 | 8.33 |
| Internet facilities | 9 | 7.50 |
| Total | 120 | 100 |

**Source**: Field survey, 2012

The use of mobile phone in table 2 reveal that majority (37.50%) of the respondents were aware of the existence of mobile phone. Thus, mobile phone was more commonly used in obtaining and sharing agricultural information among the respondents in the study area.

**Table 3: Percentage Distribution of Respondents Based on their Access to ICT in the Study Area.**

| ICTS | ACCESS | | No – ACCESS | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| Radio | 40 | 33.33 | 30 | 25.00 |
| Telephone (mobile) | 65 | 54.17 | 25 | 20.83 |
| Television | 38 | 31.67 | 57 | 47.50 |
| Computer | 24 | 20.00 | 69 | 57.50 |
| Internet facilities | 23 | 19.17 | 39 | 32.50 |
| **Total** | **190** | | **220** | |

Source: Field survey, 2012.

**\*** Indicates multiple response.

Table 3 shows that 33.33 percent of the respondents had access to radio while 25 percent could not have access to radio. Mobile telephone was accessed by 54.17 percent but only 20.83 percent of the respondents could not have access to mobile telephone. Also 31.67 percent had television while 47.50 percent had to computer while only 20 percent made use of computer. Likewise 19.17 percent had access to internet facilities while 32.50 percent had no access to it. From the above result, greater number of respondents (57.50%) had no access to computer.

**Table 4: Percentage Distribution of the Use of ICT by Farmers in the Study Area.**

| Use of ICTs | Frequency | Percentage |
|---|---|---|
| Get information on new varieties | 38 | 31.67 |
| Get information on market situation | 29 | 24.17 |
| Exchange of knowledge and ideas with fellow farmers | 30 | 25.00 |
| Provision of agricultural information to extension workers | 20 | 16.67 |
| Acquire information from research institution | 15 | 12.50 |
| Acquisition of skill through training | 22 | 18.33 |
| Get information on farm inputs availability cost and where to obtain them. | 15 | 12.50 |
| Communication between extension agents and farmers | 23 | 19.17 |
| Searching for recent information or innovation on agriculture | 27 | 22.50 |
| Searching for places where my farm products are highly needed | 31 | 25.83 |
| Location of marketers for farm products | 20 | 16.67 |
| Total | *270 | |

Source **:** Field survey, 2012.

**\*** Indicates multiple response.

Table 4 showed that most respondents (31.67%) used ICTs to get information on new varieties while 12.50 percent get information on farm inputs availability, cost and where to obtain them.

**Table 5: Likert Scale Analysis on the Effectiveness of ICTs in the Farm Operation Delivery of Agricultural Technology in the study area.**

| Extent of ICTs Utilization | Mean Score | Decision |
|---|---|---|
| Physical farm measurement | 2.3 | Rejected |
| Quantities of chemical to use | 2.7 | Accepted |
| Quantities of seeds / set / cuttings to use | 2.8 | Accepted |
| How to estimate farm output | 2.5 | Accepted |
| When best to start land preparation | 2.6 | Accepted |
| Best planting techniques | 2.7 | Accepted |
| Best time to harvest farm produce | 2.9 | Accepted |
| Best processing method | 2.9 | Accepted |
| How to store produce | 2.2 | Rejected |
| Best chemical for storing produce | 2.6 | Accepted |
| Record keeping | 2.4 | Rejected |
| Improved seed variety | 2.9 | Accepted |
| Use of fertilizer | 3.0 | Accepted |
| Use of agro chemicals | 2.2 | Rejected |
| Information on credit needs | 2.7 | Accepted |
| Growing breeds | 2.1 | Rejected |
| Methods of disease prevention and control | 2.5 | Accepted |
| Pest control | 2.9 | Accepted |
| Market scanning | 2.8 | Accepted |
| Weather forecasting information | 2.2 | Rejected |

Source**:** Field survey, 2012.

Table 5 show that farmers in the study area utilized ICTs facilities in various agricultural activities. The agricultural activities where ICTs were mostly used were : quantities of chemical to use (2.7), quantities of seeds /sets/cuttings to sue (2.8), how to estimate farm output (2.5), when best to start land preparation (2.6), best planting techniques (2.7), best time to harvest farm produce (2.9), best processing method (2.9), best chemical for storing produce (2.6), improved seed variety (92.9), use of fertilizer (2.0), information on credit needs (2.7) method of diseases control (2.5), Pest control (2.9) and market scanning (2.8). These were accepted because they scored above the decision point.

The factors rejected were physical farm measurement (2.3), how to store produce (2.2), record keeping (2.4), use of agro chemicals (2.2), growing breeds (2.1) and weather forecasting information (2.2) because they score below decision point of (2.5).

**Table 6: Summary of Multiple Regression Analysis**

| Variable code | Variable names | Regression coefficient | Standard error | t-value | Level of sign |
|---|---|---|---|---|---|
| Bo | Constant | 3.278 | 0.001 | 0.685 | * |
| X1 | Education status | 0.006 | 0.0008 | 0.680 | NS |
| X2 | Age | -0.013 | -0.011 | 0.204 | * |
| X3 | Sex | -0.005 | 0.007 | 0.625 | ** |
| X4 | Annual farm income | 0.472 | 0.053 | 8.961 | * |
| X5 | Farm size | 0.007 | 0.000 | -1.530 | * |
| X6 | Household size | 0.014 | 0.009 | 1.552 | * |
| X7 | Farming experience | 0.060 | 0.018 | -0.510 | * |
| X8 | Group membership | 0.499 | 0.087 | 5.758 | * |

$R^2$ = 0.766 = 76.6% ; Adj $R^2$ = 0.749 = 74.9%

Standard error of the estimates (SEE) = 0.38351 ; Durbin - Watson Constant = 2.206

F - Statistics = 45.441

**Source**: Computed from field data, 2012.

\*          Indicates significant at 1%

\*\*          Indicate significant at 5%

NS          Indicates not statistically significant.

The result of the multiple regression in table 6 show a high coefficient of multiple determination ($R^2$) of 76.6%. This means that about 76.6 percent variation in the dependent variable was caused by changes in independent variables included in the regression model. The overall influence of the independent variables on the dependent variable was shown by the value of F-statistics (45.441) which was highly significant at 1% level of significance. Absence of autocorrelation was shown by the low value of Durbin-Watson constant (2.206); which means that the regression model was well specified since important variables were included. The low value of standard errors of the estimates (0.3851) as well as high value of significance of the independent variables are indications that the regression model as well as the result obtained are statistically reliable and dependable.

**Educational Status of the Respondents.**

The level of education ($X_1$) was positively signed but not statistically significant. This means that the higher the level of education of respondents, the higher their level of access to ICTs facilities as source of information on agricultural technology delivery in the study area. This is true and conforms to the a priori expectation because educated farmers can understand technical knowledge on ICTs utilization faster than uneducated ones.

**Age of respondents** :

The age of respondents ($X2$) was negatively and significantly related to the deponent variable. Its negative co-efficient indicates negative relationship. This means that the higher the age of the farmers the lower their access to and use of ICTs as a sources of agricultural information in the study area. This is true and conforms to the apriory expectations because older farmers are reluctant and uninterested in utilization of ICTs due to technical difficulty they usually encounter in its operations.

**Sex of the respondent**:

Sex of the respondents ($X3$) bore a negative co-efficient and was significantly significant at 5% level of significance. This negative sign obtained in regression analysis means that there is gender discrimination in the level of access and use of ICT as a source of agricultural technology delivery in the study area. It could be that male farmers had more access to ICT than their female counterparts.

**Annual income of the respondents**:

The result obtained indicated that the annual farm income of the respondent ($X^4$) was positively signed and highly significant at 1% level of significance. This shows positive relationship, meaning that the higher the respondents annual income, the more they utilize ICTs as a source of agricultural technology delivery in the study area. This is true and did not deviate form the a priori expectation because farmers whose annual income is high were able to afford ICTs and utilized them.

**Farm size of the respondents**;

The respondents' farm size ($X_5$) was positively and significantly related to the dependent variable at 1% level of significance. This shows that the higher the farm size of the farmers, the more they utilize ICTs as a source of agricultural technology delivery in the study area. This is true and had met the a priori expectations because farmers with higher farm size usually diversify into different types of crops and livestock production and could definitely seek for information from different sources using ICTs facilities.

**Household Size ($X_6$)**:

The result showed that the respondents household ($X_6$) had a positive coefficient and was significantly

significant at 1% level of significance. This means that positive relationship exists between the farmer's household size and their level of utilization of ICTs as a source of agricultural information in the study area. This is because farmers whose household size is high have many dependent. They need agricultural information on better technologies, marketing, improved varieties etc. so as to increase their level of production and as well take adequate care of their family members. Thus they seam to seek for information more readily.

**Farming experience of the respondent ($X_7$):**
The farming experience ($X_7$) bore a positive co-efficient and was significantly significant at 1% level of significance. This indicate positively relationship and means that farmers whose farming experience is higher sought for and utilized ICTs as a source of agricultural information more than those with lower farming experience, this is because those who are more experienced understood relevance of ICTs more than those with lower farming experience.

**Group Membership of the Respondents ($X_8$):**
The result obtained in table six indicates that group membership ($X_8$) bore a positive co-efficient, and was statistically significant at 1% level of significance. This means that farmers who belong to many groups had better access and utilized ICTs as a source of agricultural technology delivery in the study area. The result obtained was statistically significant at 1% level of significance as shown:

$$Y = 3.278 + 0.006X_1 - 0.013X_2 - 0.05X_3 + 0.472X_4$$
$$(0.001)\ (0.008)\ (0.011)\ (0.007)\ (0.053)$$
$$+ 0.07X_5 + 0.014X_6 + 0.0060X_7 + 0.499_{X_8}$$
$$(0.000)\ (0.009)\ (0.018)\ (0.087)$$

**Hypothesis Testing**
The null hypothesis which states that the socio-economic characteristics of the respondents do not significantly influence their level of access to ICTs as a source of information on agricultural technology was tested using F-test as shown.

F = cal        =        45.441
V1 = N – K     =        8 – 1 = 7
V2 = N – K     =        120 – 8 = 112
F – critical = 2.96 at 5% level of significance.

**Decision Rule =** If F-Cal > F-tab, reject null hypothesis otherwise accept. Since F-cal (45.441) > f-tab (2.96), the null hypothesis was reject while the alternative was accepted. This implies that the socio-economic characteristics of the respondents do significantly influence their level of access to ICTs in the study area.

**Conclusion**
This study revealed that the use of ICTs in agricultural technology delivery in Ebonyi State can lead to the much needed and emphasized agricultural transformation in Nigeria. Farmers in the study area were aware of ICTs and used them in various agricultural activities. However, the use of ICTs was limited by technical, infrastructural, financial and institutional constraints. Overcoming these challenges would ensure increased use of ICTs for agricultural activities. Therefore, efforts should be made to enhance the use of ICTs among farmers in Ebonyi State. Government could provide infrastructural facilities such as constant electricity, good roads pipe born water, health facilities and modern farm facilities to enable farmers utilize ICTs, ensure periodic training for both farmers and extension agents on the operation of ICTs, subsidize ICTs facilities and make available all networks in the study area in collaboration with the network providers, and constant public enlightenment programmes to intimate male and female farmers of the need to employ ICTs in their agricultural activities.

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