

## Factors Influencing Information and Communication Technologies Tools Usage Among Rice Farmers and Extension Workers in Benue and Niger States, Nigeria

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### Abstract

*This research studied the factors influencing information and communication technologies usage in extension service delivery among rice farmers and extension workers in Benue and Niger States, Nigeria. A multistage sampling technique was employed to select a total sample size of 202 respondents. Data were collected using a well structured questionnaire, and analyzed using both descriptive and inferential statistics, particularly frequency, percentage, mean, standard deviation and Mann-Whiney (U) test. Results revealed that mobile phone ( $\bar{X} = 2.85, SD = 0.44$ ), radio ( $\bar{X} = 2.75, SD = 0.47$ ) and television ( $\bar{X} = 2.66, SD = 0.54$ ) were the most popular and preferred ICTs by the respondents. It was also revealed that there was a significant difference between Benue and Niger States in the level of awareness of ICTs in extension service delivery on rice farming ( $U_1CaI = 16 > \text{Critical } U \text{ Value} = 0$ ) at 0.05 level of probability. The research further established a significant difference between respondents in Benue and Niger States in terms of ICT tools application ( $U_1 \text{ Cal} = 75.5, \text{Critical } U \text{ Value} = 2$ ) at 0.05 level of probability. It was recommended that mobile phone, radio and television be mostly used for extension service delivery since they were the most aware ICTs. Government should make provision for internet network, organize training on ICTs, implementing ICT policies and infrastructure to enhance ICT application. The allotment to procure ICTs and supportive services in all ADPs should be provided by the government. Also, the constraints to application of ICT should be addressed by the government.*

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### Introduction

Small-scale farm families play a vital role in increasing food production for our expected food security. Benue and Niger states are renowned as major food production areas of Nigeria. Rice and other cereal crops production are very prominent, particularly along the flood plains of the Benue and Niger rivers. Leveraging on the capacity of these areas in rice production would help to boost the country's food security. However, challenges of access to markets, knowledge, new technology and skills, new inputs, emerging value chains and other opportunities are faced by the farmers (Food and Agriculture Organization, 2013; Luu *et al.*, 2017). Hence, achieving improved and

sustainable agricultural production largely depends on the advancement of agricultural research and its effective applications in rice farmer's fields through a viable medium of technology transfer of which information and communication technologies serves as the best option.

The main purpose of agricultural extension services is to communicate relevant and useful information to the end users in order to persuade them to adopt that which will eventually lead to increase in agricultural production (Okunade and Oladosu, 2006). Dissemination of knowledge and technology are strategic goals for the scientific agricultural extension (Zulguarmain *et al.*, 2020). Presently, there is rarely a field of human activity that has not been touched by the remarkable changes in information and communication technologies (ICTs) that have taken place in the last 10-15 years (Agwu *et al.*, 2008). Information and communication technologies have ushered in much desired advantage of reaching a wider audience in creating awareness on recommended farm practices in most households in Nigeria (Obinne, 1994).

The role of ICT tools in enhancing food security and in supporting farming activities cannot be ignored in the study area. The development, awareness, and application of ICT tools offer ample opportunities to solve most of agricultural extension challenges. ICTs have significant effect on the delivery of agricultural information to farmers, and efficient feedback from farmers to extension agents and agencies (Amin *et al.*, 2013). The extension-farmers linkage can be reinforced using ICTs, as well as the link among extension agents (Salau and Saingbe, 2008). The application of ICTs will enable farmers and extension personnel to share their problems among themselves, and also share the solutions to identified problems. The introduction of various ICT can also help farmers to access market information, land resources and services, management of pest and diseases, rural development programmes (Meera *at al.*, 2004). ICTs can make access to agricultural information easier and also enable a large number of people to be reached in a short time, providing a remedy to the shortage of agricultural extension workers recorded in Nigeria (Diri *et al.*, 2016).

Thus, it is imperative to ascertain the level of awareness of selected ICT tools usage for extension service delivery in rice production by the respondents in the area of study and identify factors influencing ICT tools usage for extension service delivery in the bid to achieve substantive agricultural production and development that would engender sustainable economic and national development.

## **Methodology**

### **Research Design**

The research design that was adopted for this study is public opinion survey that made use of structured questionnaire for data collection.

### **The Study Area**

This study was carried out in Benue and Niger States. The two States are located in the North Central, Nigeria which is situated in the Southern Guinea Savannah agro-ecological zone. The

North Central consists of six States: Benue, Niger, Kogi, Kwara, Nasarawa and Plateau including the Federal Capital Territory (FCT), Abuja. Benue State is located between latitude  $6^{\circ}.25$  N -  $8^{\circ}.8$  N of the equator, and longitude  $7^{\circ}47$  E -  $10^{\circ}.00$ .E of the Greenwich meridian (BNARDA, 2005). With annual rainfall of about 100 - 200 mm and dry season which starts from November and ends in March coupled with annual temperature of  $23^{\circ}$ - $30^{\circ}$  C, the State lies in the Guinea Savannah belt with rich alluvial soils. Yam, rice, cowpea, cassava, sweet potato, maize, soyabean, sorghum, millet, sesame, cocoyam and also tree crops and vegetables are important crops produced in Benue state.

Niger State is named after River Niger; it is the largest State in the country in terms of land mass with its State capital in Minna. Niger State was created on the 3<sup>rd</sup> of February, 1976 and lies on latitude  $8.00$  - $11.30^{\circ}$  N and Longitude  $3.30$  - $7.40^{\circ}$  E (Wikipedia, 2021). The State has a land mass of about 76, 469.903 km<sup>2</sup> (about 10 % of the total land area of Nigeria) out of which about 85 percent is arable. Niger State experiences two distinct dry and wet seasons with annual rain fall varying from 1,100mm in the northern parts to 1,600mm in the southern parts. The maximum temperature (usually not more than  $94^{\circ}$  C) is recorded between March and June, while the minimum is usually between December and January.

### **Population, Sample Size and Sampling Techniques of the Study**

The population of this study consisted of all rice farmers and extension workers in Benue and Niger States. A total of 202 respondents was selected using multi-stage sampling technique. In the first stage, two States (Benue and Niger) were randomly selected out of the six (6) States in the North Central Nigeria including the Federal Capital Territory Abuja.

In the second stage, the population of each State was stratified into three agricultural zones based on the existing agricultural zones in each State. Thirdly, one local government area was randomly selected from each zone. In Benue State, Kwande was selected in Eastern zone, Gboko in Northern zone and Otukpo was selected in the Western zone while in Niger State, Bida was selected in zone A, Shiroro in zone B and Kontagora in zone C.

Fourthly, one rural community from each Local Government Areas was randomly selected. In Benue State, Adikpo, Yandev and Upu communities were selected while in Niger State, Wanwa, Kwanda and Tungan Kawo communities were selected. Fifthly, a sampling frame for each rural community was developed and using proportional allocation of 10 % (0.1) across board for rice farmers and 100 % across board for extension workers, a total sample size of 202 respondents was selected (Table 1).

### **Method of Data Collection**

Data for this study were collected from primary source using structured questionnaire in which Section B assessed respondent's level of awareness about ICT tools, Section C identified the selected ICT tools utilized by rice farmers and extension workers in the study areas and Section D dealt with the factors influencing ICT tools usage for extension service delivery by the respondents. Awareness of ICTs was measured in the number of selected ICTs the extension workers and rice farmers are aware of, categorized into high (3), moderate (2) and low (1). Factors

that influenced ICT Usage was measured using a 3-point Likert type scale of most, moderately and not influential to indicate the level of influence. These were summed to obtain 6 and divided by 3 to get mean of 2.0; 2.3-2.5 was deemed most influential factor, 2.0-2.2 was considered as moderately influential while < 2.0 was considered as not influential factor.

**Table 1 Sample Size Selection Plan**

State	Zones	LGA	Communities	Sampling frame for Farmers	Sample Size for Rice Farmers (0.1%)	Sampling frame for Extension Workers	Sample size for Extension Workers (100%)	Total sample size
Benue	Eastern	Kwande	Adikpo	231	22	11	11	34
	Northern	Gboko	Yandev	245	24	14	14	38
Niger	Western	Otukpo	Upu	210	21	13	13	34
	A	Bida	Wanwa	224	22	12	12	34
	B	Shiroro	Kwanda	200	20	17	17	37
	C	Kontagora	Tungan Kawo	155	15	11	11	26
Total				1,256	124	78	78	202

**Source: Adopted from BNARDA and NAMDA (2022).**

### Data Analysis Techniques

Data collected for this study were analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency, percentage, mean, standard deviation, and inferential statistics (Mann-Whitney, U test) were used.

### The Mann-Whitney (U) test

The Mann-Whitney U test is a popular alternative to the test of the difference between means of two independent samples (Emaikwu, 2011). We use this test when our measurements are weaker than interval scaling or when our samples are small and we have doubt about the distribution assumptions necessary for the U test and it is expressed as

$$U = N1xN2 + N1 \frac{(N1 + 1) - R1}{2}$$

Where

U=Mann-Whitney (U) statistics

N1=Number of observations in Benue State

$N_2$  = Number of observations in Niger State  
 $U_1 = N_1 \times N_2 - U$  for conversion of  $U$  to  $U_1$   
 $R_1$  = Rank of observations

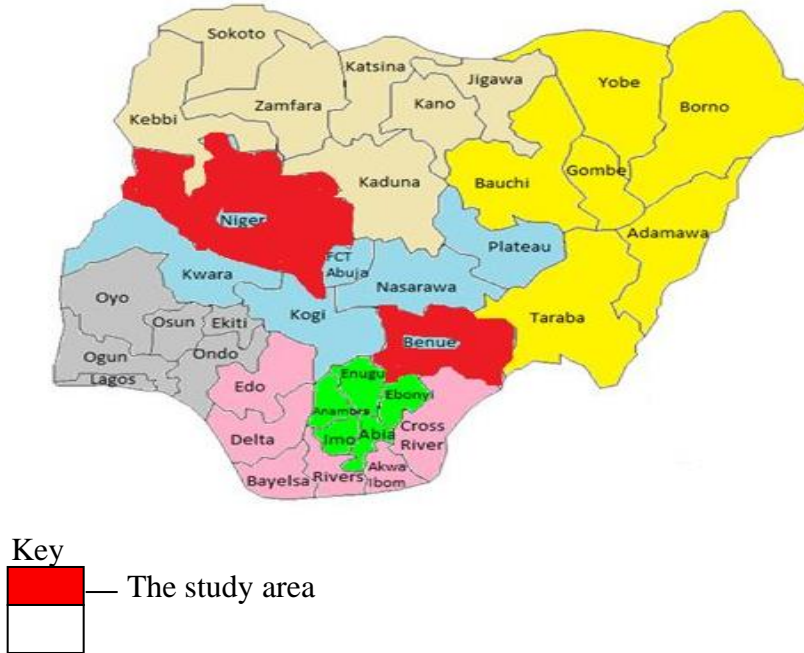


Figure 1 Map of Nigeria showing the location of Benue and Niger States

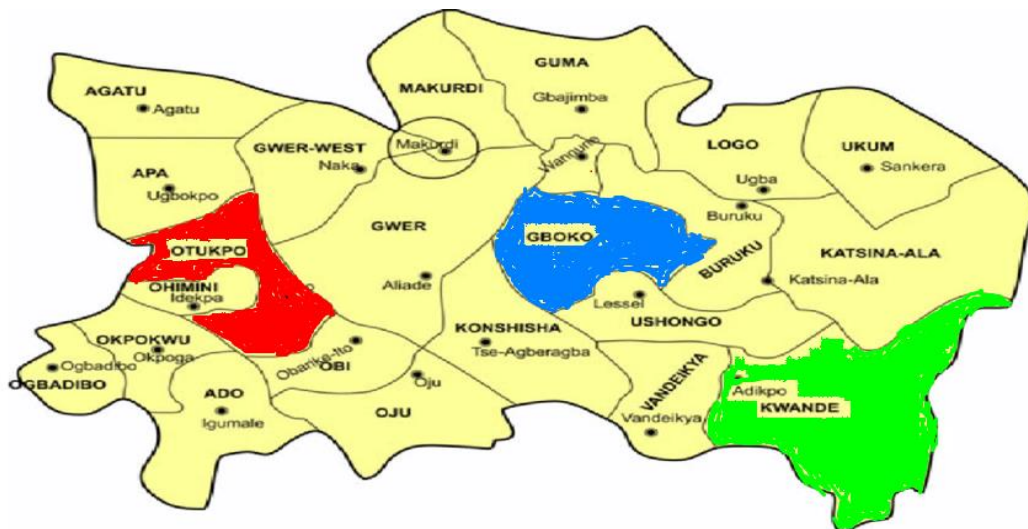
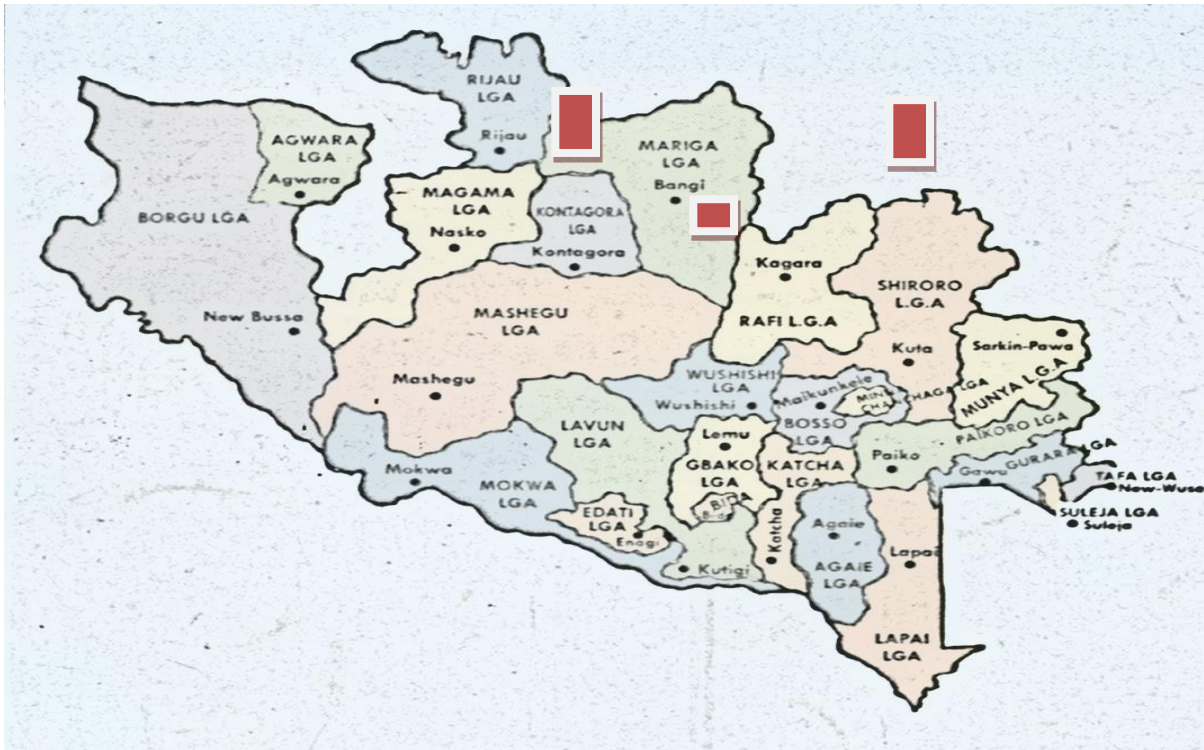



Figure 2 Map of Benue State showing the location of the study area



Key

 → The study area



**Figure 3 Map of Niger State showing the location of the study area**

## Results and Discussion

### Level of Awareness of Selected ICT Tools for Extension Service Delivery

Table 1 reveals that there was a significant difference ( $p < 0.05$ ) in the level of awareness about selected ICTs among rice farmers and extension workers in Benue and Niger States. The Mann Whitney (U) test conducted shows that  $U_{Cal.}$  (16) was greater than critical U value (0) and that  $ER_1 = 94$ , while  $ER_2 = 186$ , thus showing a great difference in the awareness levels of rice farmers and extension workers in the study area.

This implies that there is a great variation in the awareness level of rice farmers and extension workers about selected ICTs in Benue and Niger States. In other words, rice farmers and extension workers in Benue and Niger States were not aware of the selected ICTs at the same time. This finding aligns with the submission of Agwu *et al.* (2008) which stated that

researchers (72 %) and extension workers (63 %), had high level of awareness than farmers who only had (41 %) of awareness on major ICT tools in Abia and Enugu States, Nigeria. Joe (2016) also had a similar findings on a research carried out among extension workers and contact farmers in ADP Zone C in Niger State, reporting that the entire extension workers had 100 % awareness on majority of the ICT tools, while the contact farmers had 100 % awareness on few and are not aware of some of the ICT tools surveyed. This result affirms that extension workers level of awareness is different from that of the rice farmers since their level of education and exposure differs.

**Table 2 Analysis of level of Awareness of Selected ICTs for Extension Service Delivery**

<b>Selected ICT Tools</b>	<b>Benue Frequency</b>	<b>R<sub>1</sub></b>	<b>Niger Frequency</b>	<b>R<sub>2</sub></b>
Internet services	58	6	101	22
Email	82	15	92	18
Computer	100	21	89	17
Mobile phone	110	24	99	20
Radio	63	9	70	12
Television	77	14	103	23
Video recorder/ player	49	3	85	16
Cinema	52	5	65	11
Newspaper	64	10	72	13
Magazine	30	1	93	19
Leaflets	42	2	59	7
Posters	51	4	62	8
<b>U<sub>1</sub>=16</b>	<b>N<sub>1</sub>=12</b>	<b>ER<sub>1</sub>=114</b>	<b>N<sub>2</sub>=12</b>	<b>ER<sub>2</sub>=186</b>

**Test of Hypothesis 1**

The hypothesis 1 states that there is no significant difference in the level of awareness of selected ICT tools in extension service delivery on rice farming in Benue and Niger States. However, it was found that there was a significant difference in the level of awareness about application of selected ICTs in Benue and Niger States ( $p < 0.05$ ) since  $U_{Cal.} (16) >$  critical U value (0), the null hypothesis was rejected while the alternative hypothesis was accepted (Table 2).

This implies that there is a great difference in the awareness level of rice farmers and extension workers about selected ICT tools in Benue and Niger States. In other words, rice farmers and extension workers in Benue and Niger States were not aware of the selected ICTs at the same period of time.

**Test of Hypothesis 2**

There is no significant difference between rice farmers and extension workers in Benue and Niger States in terms of ICT tools applied in extension service delivery. However, it was found that there was a significant difference ( $p < 0.05$ ) between rice farmers and extension workers in Benue and Niger States in terms of ICT tools applied in extension service delivery

(Table 3). The hypothesis 1 states that there is no significant difference in the level of awareness of selected ICT tools in extension service delivery on rice farming in Benue and Niger States. However, it was found that there was a significant difference in the level of awareness about application of selected ICTs in Benue and Niger States ( $p < 0.05$ ) since  $U_{Cal.} (16) > \text{critical } U \text{ value } (0)$ , the null hypothesis was rejected while the alternative hypothesis was accepted (Table 3).

This implies that rice farmers and extension workers in Benue and Niger States were applying different ICT tools in extension service delivery for rice production. This result is in consonance with Akintunde and Oladele (2019) reported a significant difference in the application of ICTs by agricultural extension officers in Lesotho.

### ICTs Tools Utilized for Extension Service Delivery on Rice Farming

Result of the ICT tools utilized by the farmers and extension workers is presented in Table 3 reveals that there was a significant difference ( $p < 0.05$ ) between rice farmers and extension workers in Benue and Niger States in terms of ICT tools utilized in extension service delivery. The Mann Whitney (U) test conducted shows that  $U_{Cal.} (75.5) > \text{Critical } U \text{ value } (2)$  and that  $ER_1 = 99.5$ , while  $ER_2 = 153.5$ , thus showing a great difference. This implies that rice farmers and extension workers in Benue and Niger States were applying different ICT tools in extension service delivery. This result confirms a prior expectation that the use of ICT tools was higher among extension agents than rural farmers in Benue State, Nigeria (Gyata *et al.*, 2013). This may be because of their level of education and income status.

**Table 3 Analysis of ICTs Utilized for Extension Service Delivery among rice Farmers and Extension Workers in Benue and Niger State**

ICT Tools Used	Benue Frequency	R <sub>1</sub>	Niger Frequency	R <sub>2</sub>
Internet services	66	1	72	5
Email	90	10	102	14.5
Computer	80	6	89	8.5
Mobile phone	70	2.5	103	16.5
Radio	100	13	93	11
Television	70	2.5	71	4
Video recorder/ player	87	7	102	14.5
Cinema	103	16.5	99	12
Newspaper	118	22	89	8.5
Magazine	113	19	109	18
Leaflets	-	-	116	20
Posters	-	-	117	21
<b>U<sub>1</sub>=75.5</b>	<b>N<sub>1</sub>=10</b>	<b>ER<sub>1</sub>=99.5</b>	<b>N<sub>2</sub>=12</b>	<b>ER<sub>2</sub>=153.5</b>
		<b>5</b>		



**Factors influencing ICTs tools usage for extension service delivery**  
**Factors influencing ICTs Usage by Rice Farmers in Benue State**

Results in Table 4 indicated that implementation of ICT policies ( $\bar{x} = 2.42, SD = 0.52$ ) and organizing training on ICTs ( $\bar{x} = 2.34, SD = 0.59$ ) are the most influential factors to ICT tool usage by rice farmers in Benue State. Educational/ computer literacy ( $\bar{x} = 2.19, SD = 0.53$ ) and provision of ICT infrastructures ( $\bar{x} = 2.18, SD = 0.58$ ) are moderately influential factors to ICT usage by rice farmers while availability of internet network services ( $\bar{x} = 1.93, SD = 0.77$ ), affordability of ICT tools ( $\bar{x} = 1.94, SD = 0.67$ ) and adequate power supply ( $\bar{x} = 1.45, SD = 0.59$ ), are factors that are not influential to ICT tool usage by rice farmers in Benue State.

The result further revealed that availability of internet network ( $\bar{x} = 2.45, SD = 0.69$ ) is the only most influential factor to ICT tool usage by extension workers in Benue State. Organizing training on ICTs ( $\bar{x} = 2.29, SD = 0.69$ ), implementation of ICT policies ( $\bar{x} = 2.16, SD = 0.64$ ) and educational/ computer literacy level ( $\bar{x} = 2.13, SD = 0.84$ ) and provision of ICT infrastructures ( $\bar{x} = 2.80, SD = 0.67$ ) are moderately influential to ICT tools usage by extension workers in Benue State, while affordability of ICT tools ( $\bar{x} = 1.95, SD = 0.70$ ) and adequate power supply ( $\bar{x} = 1.90, SD = 0.51$ ) are factors that are not influential to ICT tools usage by extension workers in the study area. The result shows that implementation of ICT policies is the most influential factor to ICT tools usage by rice farmers while extension workers indicated that availability of internet network is the most influential factor to ICT tool usage in Benue State. The standard deviation for each of the statement is less than 1. This indicates the state of uniformity on the respondent's responses.

This implies that rice farmers in Benue State is likely to optimally use ICT tools in obtaining relevant agricultural information on rice production and sending feedback to extension workers if factors like implementation of ICT policies, organizing training on ICT tools and provision of ICT infrastructure and educational/computer literacy are addressed. More also extension workers will also use ICT tools effectively for extension service delivery if internet network services is available in the study area. This can facilitate their level of usage of selected in interacting and disseminating agricultural information to farmers. This result aligns with the submission of Daniel *et al.* (2021), who disclosed that the most crucial factors affecting extension officer's access to ICT in Ghana were weak telecommunication network connection, lack of ICT training opportunities and lack of ICT infrastructures to cushioning extension activities.

**Table 4 Factors Influencing ICTs Usage by the Respondents in Benue State**

Variables	Benue Farmers			Extension workers		
	Mean	Standard Deviation	Remarks	Mean	Standard Deviation	Remarks
Adequate power supply (APS)	1.45	0.59	NI	1.9	0.51	NI

Implementation of ICT policies (IICTP)	2.42	0.52	MI	2.16	0.64	MDI
Availability of internet network services (AINS)	1.93	0.77	NI	2.45	0.69	MI
Provision of ICT infrastructures (PICTI)	2.18	0.58	MDI	2.08	0.67	MDI
Affordability of ICT tools (AICTsT)	1.94	0.67	NI	1.95	0.7	NI
Organizing training on ICTs (OTICTs)	2.34	0.59	MI	2.29	0.69	MDI
Educational/ computer literacy level (ECLL)	2.19	0.53	MDI	2.13	0.84	MDI

Cut-off Mean = 2.0

Key: Most Influential (MI)  $\geq$  2.3; Moderately Influential (MDI) = 2.0-2.2;

Not Influential (NI) = < 2.0

### Factors influencing ICTs usage by Respondents in Niger State

Results in Table 5 shows that rice farmers in Niger State indicated that adequate power supply ( $\bar{x} = 2.33, SD = 0.66$ ) is the most influential factor to ICT usage in Niger State. The respondents also indicated that educational/computer literacy ( $\bar{x} = 2.14, SD = 0.79$ ), followed by availability of internet network ( $\bar{x} = 2.11, SD = 0.67$ ) followed by organizing training of ICT ( $\bar{x} = 2.04, SD = 0.80$ ) and affordability of ICT tools ( $\bar{x} = 2.02, SD = 0.74$ ) were factors that influenced ICT tools usage moderately in Niger State. Other factors like implementation of ICT policies ( $\bar{x} = 1.79, SD = 0.67$ ) and provision of ICT infrastructures ( $\bar{x} = 1.83, SD = 0.78$ ) were not influential to ICT tools usage by rice farmers in the study area. The most influential factor which was adequate power supply could be associated to the epileptic power supply in the study area, although it was acclaimed as the power State of the nation, Nigeria,

Result in Table 5 further revealed that all the seven (7) stated factors such as availability of internet network ( $\bar{x} = 2.26, SD = 0.76$ ), organizing training of ICT tools ( $\bar{x} = 2.28, SD = 0.60$ ), educational/computer literacy ( $\bar{x} = 2.28, SD = 0.60$ ), affordability of ICT tools ( $\bar{x} = 2.25, SD = 0.64$ ), implementation of ICT policies ( $\bar{x} = 2.05, SD = 0.64$ ), adequate power supply ( $\bar{x} = 2.23, SD = 0.66$ ) and provision of ICT infrastructures ( $\bar{x} = 2.03, SD = 0.83$ ) moderately influenced extension workers in using ICT tools for extension service delivery. The standard deviation for all the factors influencing ICT tools usage was less than 1. This means that there is no variation in their responses as indicated by the extension workers and rice farmers in the study area.

The possibility of extension workers and farmers sharing and receiving agricultural information with the use of ICT tools could be hampered if internet services are not readily available. This result is in agreement with the findings of Enwelu *et al.* (2014) which states that adequate power supply (83.3 %), implementation of policies (78.9 %) that will enhance

ICT development in rural areas, availability of internet network services (77.8 %) by the service provider are perceived factors that facilitates effective utilization of ICT in agriculture across gender.

**Table 5 Factors Influencing ICT Tools Usage by the Respondents in Niger State**

Variables	Niger Farmers			Extension workers		
	Mean	Standard Deviation	Remarks	Mean	Standard Deviation	Remarks
Adequate power supply (APS)	2.33	0.66	MI	2.23	0.66	MDI
Implementation of ICT policies (IICTP)	1.79	0.67	NI	2.05	0.64	MDI
Availability of internet network services (AINS)	2.11	0.67	MDI	2.25	0.76	MDI
Provision of ICT infrastructures (PICTI)	1.83	0.78	NI	2.03	0.83	MDI
Affordability of ICT tools (AICTsT)	2.02	0.74	MDI	2.25	0.64	MDI
Organizing training on ICTs (OTICTs)	2.04	0.80	MDI	2.28	0.60	MDI
Educational/ computer literacy level (ECLL)	2.14	0.79	MDI	2.28	0.60	MDI

Cut-off Mean = 2.0

Key: Most Influential (MI)  $\geq$  2.3; Moderately Influential (MDI) = 2.0-2.2;

Not Influential (NI) = < 2.0

### Conclusion

The findings have provided evidences to conclude that ICT tools are vehemently utilize for extension service delivery on rice production. Mobile phone was the most aware ICT at different level, and was mostly preferred in the list of selected ICTs. Availability of internet network, organizing training on ICTs, implementation of ICT policies and provision of ICT infrastructures were the significant factors influencing the use of ICTs in the study area. It is essential to make available an internet network services, adequate ICT infrastructures and put ICT training in place for them. These would facilitate ICT application for extension service delivery among the rice farmers and extension service deliverer.

### Recommendations

The following recommendations were made based on the results presented:

- i. Taking cognizance of the benefits derived from ICT application in the face of the challenge of low extension-farmer-ratio in Nigeria. Government and private sector should organize regular training for extension workers and farmers to build confidence in handling ICTs.

- ii. Information and communication technologies (ICTs) tools should be made simple by developing ICT tools in local languages that farmer could understand and apply
- iii Government, non-governmental organizations and private sectors should provide adequate ICT facilities especially in the ADPs offices and rural areas for easy accessibility and application.
- iv Government should employ young vibrant youths who have ICT proficiency in the extension system.

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