Constraints Faced by Rice Farmers and Extension Workers in Applying Selected Information and Communication Technology (ICT) Tools in Extension Service Delivery in Benue and Niger States, Nigeria

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Abstract
This study was carried out to investigate the constraints to application of selected information and communication (ICT) technologies in extension service delivery among rice farmers and extension workers in Benue and Niger States, Nigeria. Adopting a multistage sampling technique in four stages, 202 respondents were selected to form the sample size. Data were collected using a well structured questionnaire, and analyzed using both descriptive and inferential statistics, particularly frequency, percentage, mean, standard deviation, Mann-Whiney, Chi-square and Factor analysis. Findings revealed that there was no significant relationship between level of knowledge in application of selected ICT by the respondents X^2 *Cal = 2.86 <* X^2 *Tab = 5.991) at 0.05 level of probability. Results also indicated that there were three categories of constraints, namely socio-economic constraints (Factor 1), environmental constraints (Factor 2) and administrative constraints (Factor 3). Provision of internet network; procurement and installation of ICTs and supportive services in all ADPs should be assured. Also, the constraints to application of ICT should be addressed by the government.*

Keywords*: Extension, Food security, Information Communication Technologies, Rice Farmers*

Introduction

Global attention has been directed towards agriculture because of emerging challenges of food insecurity. This is necessary because of long negligence of current measures of disseminating information on appropriate technology. Improved agricultural production is one of the major instruments in the fight against poverty and world hunger. Modernization of agriculture can be enhanced through the use of research generated technologies to solve inherent problems (Enwelu*et al*., 2014). Small scale farming is dominantin the developing countries but there is the need to improve farming techniques by acquiring adequate knowledge and information (United Nation, 2005). Rice farmers in Nigeria need quick attention and access to emerging technologies as they are faced with many challenges in their production.

The development and use of information and communication technologies (ICTs), particularly, the internet has resulted to massive change in the life of people living in industrialized countries, which

has led to a process of transition from an industrial society to information society (Umar and Bakare, 2018). Improved agricultural production is one of the major instruments in the fight against world's hunger and absolute poverty. Agricultural extension service delivery in developing countries is meant to improve productivity (to attain food self sufficiency/security) and livelihood of rural farm families.

Information on different agricultural technologies can be effectively and efficiently disseminated to end users in a comprehensible and utilizable manner with the help of extension agencies. It is an established fact that, there exist huge volumes of research findings, which are not readily accessed by rural farmers and extension workers. At the same time, access to information holds the key to successful agricultural development. According to Okeh (2002), the quality of life of rural dwellers can be highly improved by effective provision of relevant information to rural communities. This scenario calls for the key players in the extension agencies whose services involve transferring useful information to farmers in order to acquire the needed knowledge, attitude and skills for effective utilization of innovations that can cause a noticeable turn-around.

Although there are other organizations saddled with extension service delivery, the Agricultural Development Programs (ADPs) nationwide remains the main agencies responsible for public extension service delivery at the grassroots. The sole reason of agricultural extension program is to have via communication, information conveyed to farmers to co-opt them into increased agricultural production (Yakubu *et al*., 2013). Extension services are indispensable mainstay for agricultural development across the globe. Agricultural extension directly influences seven of the United Nations Sustainable Development Goals (UN, 2015). As a result, the fundamental role of agricultural extension cannot be overrated. Chowdhung*et al.* (2014) asserted that agricultural extension services play a significant role in, and are often credited with improving food security, reducing poverty and improving livelihoods.

Arokoyo (2005) noted that agricultural extension service delivery depends on informationexchange between extension agents and farmers but this happening has a setback which is negatively affecting rural agricultural production especially in rural Nigerian settings. Limited ICT use still remains a major problem for agricultural development which the consequences for not using ICT is linked to economic benefits that are not perceived. Information and communication technology is a powerful tool for information delivery, rural agricultural service delivery and also enhancing local development opportunities, and eventual transformation into knowledge based society (Rajveer *et al*., 2023).

In Nigeria, the introduction of modern information and communication technologies (ICTs) in agricultural extension service delivery has greatly improved efficiency of research-extension-farmer-linkages. 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 (Chizoba *et al*., 2018). The role of ICT tools in enhancing food security and in supporting farming activities cannot be ignored in the study area (Ogori*et al*., 2024). 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).

Cultivation of improved rice varieties in Nigeria can curb or reduce the importation of rice to the barest minimum if ICTs are fully embraced by extension workers for extension service delivery to rice farmers in the study area. Nigeria is lagging behind in the application of the fastest means of technology transfer because up till now, Nigeria still depends on Training and Visit (T&V) extension approach that has been challenged by low ratio of agricultural extension workers to farmers due to inadequate extension personnel among others. For instance at the inception of the State-ADPs in 1980, the extension agent- farmer- ratio ranged from 1:2000 to 1:3000. This was expected to reduce to between 1:800 to 1:1000 by the completion date and the withdrawal of World Bank Support (Adejo*et al*., 2014). This target was not achieved nationally though the Agricultural Extension Research Liaison Service (NAERLS) reports that the extension agent-farmer ratio was between 1:848 in Ogun State in South-West Ecological zone and 1:1650 in Katsina State in the North-West Ecological zone (Adejo*et al*., 2014). The current extension-farmer ratio in Nigeria is between 1:5000 and 1:10 000 (Davis *et al*., 2019).

It is therefore obvious that no matter how effective extension service delivery could be, it can never be efficient and cost effective in a developing country like Nigeria whose estimated population is over 200 million (World Bank, 2020).Adejo*et al.* (2014) opined that telephone use in extension services delivery even with the launch and explosion of Global System of Mobile Communication (GSM) is very limited as most ADPs even at the head offices do not have functional lines. Despite the revolution brought about by information and communication technologies in recent times in Nigeria, most extension workers in Nigeria in general and in the North Central Nigeria in particular still depend on the old methods of disseminating information on agricultural innovations to the rural dwellers (Sennuga, 2019). The low application rate of ICTs by different stakeholders is perturbing, because farmers in Nigeria have little or no access to agricultural information (Hosseini *et al*., 2009).

The use traditional means of communication such as farm/home visit, personal letters and the use of contact farmers to disseminate agricultural information as enshrined in the T & V extension approach is becoming less successful (Ufiobor, 2017).Hence, this study determined the significant relationship between extension workers and farmers on knowledge in application of selected ICTs on rice production. Also, the research identified constraints faced by rice farmers and extension workers in applying selected ICT tools.

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 $6^0$25′and $8^0$8′ N of the equator, and longitude $7^0$47′and 10^0E 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 23º-30ºC, 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 3rd of February, 1976 and lies on latitude 8.00 -11.300 N and Longitude3.30 -7.400 E (Wikipedia, 2021). The State has a land mass of about 76, 469.903 km^2 (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^o 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 plus 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).

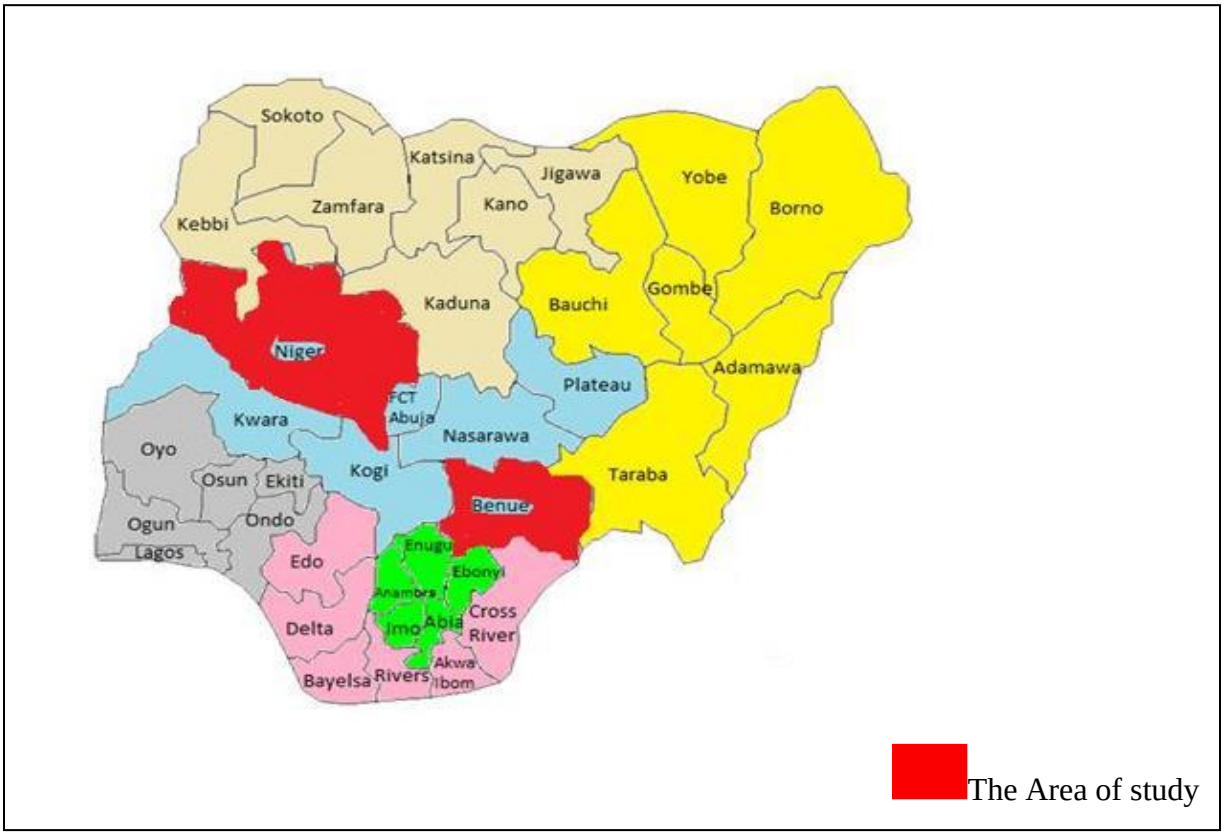

Figure 1 Map of Nigeria showing the location of Benue and Niger States

Method of Data Collection

Primary data for this study were collected 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.

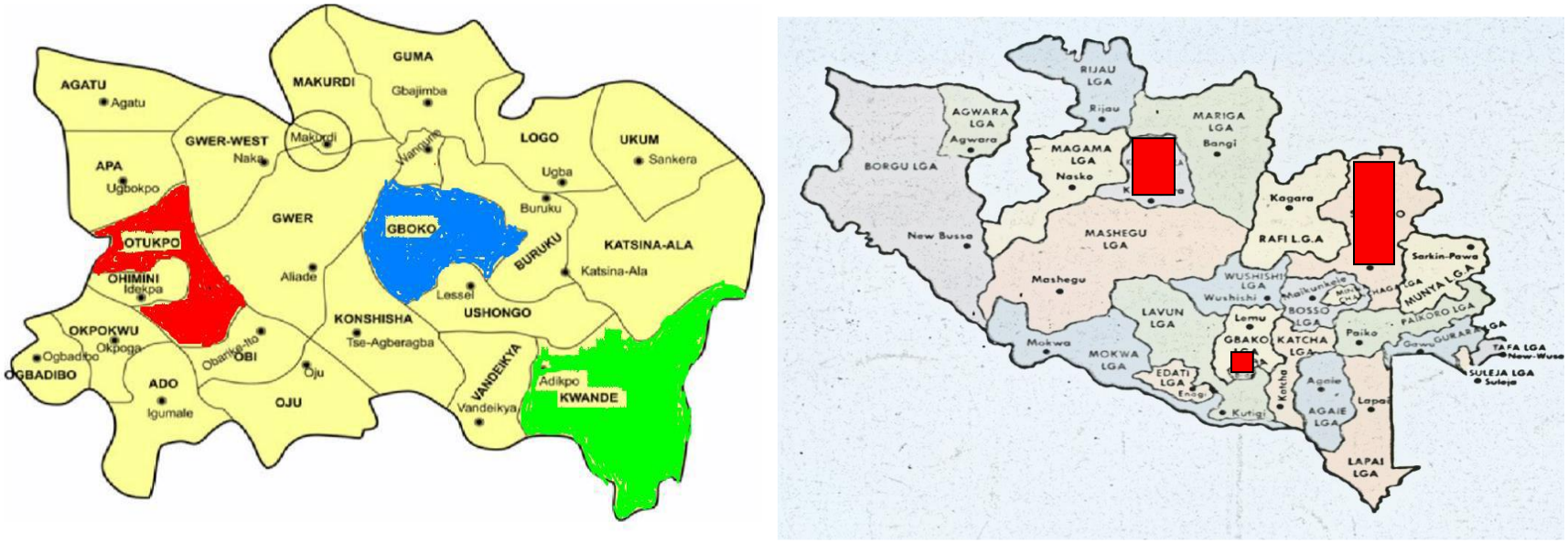

Figure 2 Map of Benue and Niger States showing the locations of the study area

Table 1 Sample Size Selection Plan

State	Zones	LGA	Communities	Sampling frame for RiceFarmers	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	33
	Northern	Gboko	Yandev	245	24	14	14	38
	Western	Otukpo	Upu	210	21	13	13	34
Niger	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

Adapted 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:

$$U = N1 \text{ x } N2 + N1\frac{(N1 + 1) - R1}{2}$$

Where
U=Mann-Whitney (U) statistics
N1=Number of observations in Benue State
N2=Number of observations in Niger State
U1= N1 x N2 - U for conversion of U to U1
R1= Rank of observations

Results and Discussion

Knowledge of ICTs Application by Respondents

Tables 2 shows that there is no significant relationship between rice farmers and extension workers in Benue and Niger States in terms of level of knowledge in application of selected ICTs in the production of rice ($p>0.05$). The Chi-square (x^2) test conducted using a 3×2 contingency Table reveals that x^2 Cal. (2.86) < x^2 Tab. (5.991) at 0.05 level of probability. This implies that there is no significant relationship between Benue and Niger State' rice farmers and extension workers in terms of level of knowledge and its application in delivering of extension services This could be due to the fact that Benue and Niger States are not contiguous and lack of contiguity of these two states accounts for this no significant relationship. It could also be low extension-farmers ratio, there are only 38 extension workers rendering extension services to over 1.5million farmers in Benue State (BNADA, 2022). In Niger State, the extension-farmers-ratio is 40 which is also very low, hence lack of significant relationship between these two states.

Besides, the annual budgetary allocation to extension service delivery may differ between these States and this can affect extension service delivery. The result does not support the report of Badilescu-Buga (2013)who identified knowledge gap as a key element in adoption of innovation. This result also contradicts the findings of Khondokar (2015) who found that there was a positive significant relationship between farmers knowledge on ICT based farming. Ajayi (2013) also found the same result in his study. This contradictory result was also reported by Saadu *et al.* (2021) that adequate knowledge of any given technology is key to the successfulimplementation and usage of the technology, and thereby corroborating Mukhtar *et al.* (2019) and Abraham (2007) earlier reports. This implies that adequate knowledge of rice farmers and extension workers have a significant relationship with ICT application for rice production in the study area.

Table 2 Contingency Table Showing Relationships between Benue and Niger States in Terms of Knowledge in Application of Selected ICTs

States	High Knowledge	Low Knowledge	No Knowledge	Total
Benue	32(33.45)	26(27.42)	10(7.13)	
Niger	29(27.55)	24(22.58)	3(5.87)	56
Total	61	50	13	124

x^2·Cal. (2.86) < x^2 Tab. (5.991) df=2 at 0.05

Fo: Observed frequency outside bracket

Fe: Expected frequency inside bracket

Test of hypothesis

The hypothesis which states that there is no significant relationship between level of knowledge and its application of selected ICTs by rice farmers and extension workers in Benue and Niger States. It was found that, there was no significant relationship ($p > 0.05$) between Benue and Niger States in terms of knowledge and its application of selected ICTs in the production of rice. The Chi-square (x^2) test conducted reveals that x^2 Cal. (2.86) < x^2 Tab. (5.991) at 0.05 level of probability, hence the null hypothesis was accepted. This implies that Benue and Niger States are not contiguous and have different extension-farmers-ratios and varying annual budgetary allocations to extension service delivery. This result supports the findings of Badcoc-Walter (2014) who claimed that knowledge does not equal to change. Ajayi *et al*. (2013), however presented a contrary findings among extension agents knowledge and perception on ICTs use in Ondo State, Nigeria reporting that there was a significant relationship ($r=0.656:p\leq0.01$) that existed between the respondents on level of knowledge and ICT application.

Constraints to application of selected ICTs by extension workers and farmers

Table 3 shows that there were three major categories of constraints to application of selected ICTs among extension workers and rice farmers in Benue and Niger States which were Factor 1, Factor 2 and Factor 3. Variables under Factor 1 were named socio-economic constraints, while those under Factors 2 and 3 were classified as Environmental and Administrative constraints, respectively.In Factor 1, socio-economic constraints to application of selected ICTs among rice farmers and extension workers in Benue and Niger States included lack of training on ICTs (0.726), lack of competence in handling ICT facilities (0.825), low level of education (0.682), lack of ICT skills (0.747), complexity of ICTs (0.590, high cost of ICTs (0.540), language barrier (0.770), lack of interest among extension workers and rice farmers (0.725) and chronological age of extension workers and rice farmers (0.798).

In Factor 2, environmental constraints to application of selected ICTs among extension workers and rice farmers in Benue and Niger States were poor communication network (0.659), and lack of accessibility to internet (0.415).In factor 3, the significant administrative constraints included erratic power supply (0.713) and poor state of infrastructure (0.561). The above findings have several implications. Firstly, the socio-economic constraints such as lack of training on ICTs, lack of competence in handling ICT facilities, low level of education, complexity of ICTs, high cost of ICTs and lack of interest on the part of rice farmers and extension workers could mar effective

delivery of extension services and subsequent application of these technologies. These findings agree with Age (2015) who stated that low level of education, complexity of innovation and high cost of innovations can adversely affect application of innovation.

Secondly, environmental constraints such as poor communication network and lack of accessibility to internet can prevent extension workers and rice farmers in Benue and Niger States from effective extension service delivery and subsequently application of improved agricultural technologies. Thirdly, administrative constraints such as erratic power supply and poor state of infrastructural facilities can adversely affect usage of ICTs in Benue and Niger States.

Table 3 Factor Analysis of Constraints to Application of ICTs by Farmers and Extension Workers in Benue and Niger States

Variables	Factor 1	Factor2	Factor3
Lack of training on ICTs facilities (LTICTs)	0.726*	0.056	0.172
Lack of competence in handling ICTs (LOCHICTs)	0.825*	0.259	-0.015
Low level of education (LLE)	0.682*	0.151	-0.015
Poor communication network (PCN)	-0.221	0.659**	0.309E-02
Lack of ICT skills (LOICTS)	0.747*	0.120	-0.123
Erratic power supply (EPS)	0.036	0.042	0.713***
Complexity using ICT facilities (CUICTF)	0.590*	0.415E-02	-0.036
Lack of accessibility to internet (LAI)	0429E-0.2	0.415**	0.651E-02
High cost of ICTs (HCICTs)	0.540*	0.443E-02	0.160
Poor state of infrastructure (PSI)	0.306E03	0.244	0.561***
Language barrier (LB)	0.770*	0.077	0.132
Lack of interest among extension workers and rice farmers (LIAEF)	0.725*	0.138	-0.006
Age of extension workers and rice farmers (AOEF)	0.798*	0.042	0.230

Ratios method: Varimax with Kaise's Normalization
*Factor 1: Socio-economic constraints.
**Factor 2: Environmental constraints.
***Factor 3: Administrative constraints

Conclusion

The study examined constraints faced by rice farmers and extension workers in applying selected information and communication technology (ICT) tools in extension service delivery in Benue and Niger states, Nigeria. The relationship among the respondents on knowledge in application of selected ICTs on rice production was also evaluated.

Findings showed that there was no significant relationship between rice farmers and extension workers on the level of knowledge in application of selected ICTs in extension service delivery. Factor analysis revealed three major categories of constraints to application of selected ICT among rice farmers and extension workers in the study area, namely: Socio-economic constraints (Factor1), Environmental constraints (Factor2) and Administrative constraints (Factor 3). Hence, there is need for government to make available an internet network services in the rural settings to facilitate ICT application for extension service delivery; make ICT tools simple by developingthem in local languages that farmer could understand and apply; provide adequate ICT facilities especially in the ADPs offices for easy accessibility and application; and ensuring employment of young vibrant youths who have ICT proficiency in the extension system.

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