Impact of Agricultural Extension on Adoption of Modern Technologies by Rice Farmers in Gboko Local Government Area of Benue State, Nigeria

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Abstract:- **The study examined the impact of agricultural extension on adoption of modern technologies by rice farmers in Gboko Local Government Area of Benue State, Nigeria. Random sampling technique was adopted in data collection. Five (5) districts were selected and these include Mbatiav, Mbateriev, Mbayion, Ipav and Yandev. The study utilized Primary datawhich were obtained through survey using well-structured questionnaires which were randomly administered to 120 farmers. Secondary information were soueced from documents, journals, internet, and proceedings among others. Adopters of rice technologies forms the unit of sample in the study area .The data collected were analyzed using descriptive and inferential statistics. Results of the analysis revealed that 34 percent of the respondents were between the ages of 31to 40 years, 75pecrent were married, 46 percent were full time farmers, 26 percent were secondary leavers 34 percent had farming experience of 11-15years.Most respondents (38%) had farm size of between 1-3heatares, 40percent utilized family labor, 34 percent have household size of between 11-15, and 21percent obtained income less than ₦30, 000. The results also showed that all the respondents are aware of the rice technologies introduced in the area. However, the adoption rate of these technologies by these farmers is very low. Only fertilizer application had relatively high adoption rate (50%). The rest of the technologies had less than 50% adoption rate. The result showed that there was a difference in the output of rice before and after adoption of technologies with a mean difference in output of 520.11kg which was statistically significant (t=2.22: P<0.05). The results of the logit model analysis used to determine the effect of socio-economic characteristics of farmers on adoption showed that farming experience and household size were not significant, while level of education, farm size, access to credit, age, and extension services were found to be the major determinants of adoption of modern rice technologies in the study area. It is recommended that, agricultural technologies should be directed towards younger and large scale farmers since they are more likely to adopt innovations than aged farmers and small-scale farmers.**

Index Terms: **Extension, Service, Impact, Adoption, Technologies.**

I. INTRODUCTION

One of the basic needs of human beings is food. As food formed the basic weapon of hunger, agriculture is concerned basically with the husbandry of crops and animals for food and other purposes. Agriculture has gone a long way in the provision of food in this direction. However, agriculture is one of the oldest industries and its origin can be traced to the earliest human societies. In the Nigerian context, agriculture forms the most basic source of employment to individuals. Despite this, Agriculture in Nigeria is characterized by low level of efficiency of the farming techniques and traditional attitudes among others which sometimes work against the progress of agriculture (Obinne, 1994).

Agricultural extension is the most important public service institution with the widest range of responsibilities for agricultural and rural development. For this reason, the performance of this agency has been a matter of great concern to different categories of people but particularly to those who are directly involve with the immediate problems of transforming the traditional to the modern –system of agriculture in this country (Adefolu, 1976).According to Ugwu (2008), extension is a service way of getting knowledge developed from one environment to the other and extension services are employed in the diffusion of innovations to different people who have limited access to information needs. Thus agricultural extension brings about changes, through education and communication in farmer's attitudes, knowledge and skills. The impact of agricultural extension involves dissemination of information; building capacity of farmers through the use of a variety of communication methods and help farmers make informed decisions (Koyenikan, 2008).

Extension has a vital impact in ensuring that the agro economic and social environment of farmers and day to day production problems faced by farmers are appreciated by research and this feedback function of extension facilitates the continuous re-orientation of research towards the priority needs of farmers and early resolution of important technological constraints (Akpollo 1999).The contribution of extension to economic growth is seen through improved efficiency in production and better use of resources. More so, extension helps to bring about rural development as leadership training is acquired by the rural people through extension education and training, and some youth activities are started

and encouraged through extension services. Thus agricultural extension lays veritable base as the spring board for rural industrialization and development, has multiplier effect of mobilizing the rural farmers into joining the vanguard of cooperative societies (lawal,1971).

Scientific knowledge and improved technology exist for the production of rice which if properly combined and appropriately applied, could lead to higher productivity. Thus, an extension service is needed to explain new technologies to rice growers and teach them how to adopt improved production practices in order to increase their production and income (Kyiogwom, 1996).Rice production in Gboko Local Government Area is in the hands of peasant farmers, who are poor, lack appropriate technology development, finance and credit facilities among others. Agricultural extension services therefore, have to perform its function by educating farmers to increase rice production in order to meet the demand and also to feed the growing population. It is against this backdrop that the study examines the impact of agricultural extension on adaptation of modern technologies by rice farmers in Gboko Local Government Area of Benue State, Nigeria.

The specific objectives are to:

i. examine the socio-economic characteristics of rice farmers in the study area;
ii. ascertain farmers' awareness and their adoption of improved rice technologies in the study area ;
iii. idenify the factors hindering the adoption of technologies in the study area;
iv. estimate the output of rice before and after the adoption of modern technologies by rice farmers; and
v. assess the socio-economic determinants of adoption of agricultural technologies in the study area.

II. METHODOLOGY

The study was conducted in Gboko Local Government Area of Benue State, Nigeria. Gboko local Government lies between latitude 7^0 19'30 N and Longitude 9^0 0' 18 E with landmass of 2,036,855.5 square kilometer. It is bounded with Buruku and Katsina Ala LGAs to the East, Gwer LGA to the South and Konshisha LGA to the West. The Local Government has a population of 361,325 People (NPC, 2006). Gboko Local Government Area is endowed with low and broken range of hills such as the Mkar and Iwen hills, and streams like Konshisha, Kontyen, Ambirr, and Muetc., which flow into the river Benue. The people of the area are mostly farmers who grow crops such as rice, soybean, cowpea, cassava, yam beniseed and other Nigeria staples. Livestock reared include goats, sheep, swine and poultry. They also engage in local craft like pottery, cloth weaving, basket weaving, blacksmith and mat weaving. Gboko town is the divisional headquarters of the Tiv division.

Data for this study were obtained from both primary sources. Secondary data were obtained from books, journals, magazines, proceedings, internet and document. Primary data were collected by survey using structured questionnaires which were validated and administeredrandomly. Five (5) districts were randomly selected, and in each district, twenty (24) respondents were selected. A total of 120 rice farmers were randomly interviewed. The data collected were analyzed using descriptive and inferential statistics. The binary logit regression model was employed as inferential statistics. If the estimated coefficient of a particular variable is positive, it means that higher value of that variable result in a higher probability of adoption or participation. The determinants of technology adoption was studied through the logit model in which the dependent factor (modern technology adoption) is dichotomous i.e., adoption or not adoption.Pi is assumed to be the probability that the rice technology is adopted and, therefore, 1-Pi represents the probability of not adopting rice technology (Gujarati & Porter, 1999). Thus the logit model for the present analysis is specified as:

$Pi= F(Z_i) =F(\alpha+\delta X_i) = 1/[1+\exp(-Zi)]$---------- **(1)**

Where:

F (Zi) =the value of the logistic cumulative density function associated with possible value of underlying independent index Zi;

Pi=the probability that an individual farmer would be willing to adopt the technology given the independent variables as Xi;

X=intercept;

And δX_i=the linear combination of independent variables

$Z_i=\log [P_i/ (1-P_i)] =\delta_0+\delta_1X_1+d_2X_2+\ldots+\delta_nX_n+e$

Where: i=1, 2….n observations

Z_i= the observed index level or the log odds of choice for the i^{th} observation;

X_n= the n^{th} explanatory variable for the i^{th} observation;

δ=parameter to be estimated; and

e=the error or disturbance term.

The dependent variable Zi in the above equation is the logarithm of the probability that a particular choice will be made.

Following Pindyck and Rubinfeld (1981), the empirical form of the model is written as:

$Y=\alpha+\beta_1X_1 +\beta_2X_2 +\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+X_7 +e$ --------- **(2)**

Where:

Y=Adoption index

a= constant

X_1=access to credit (1 if access, 0otherwise)

X_2=age of respondents (years)

X_3=household size of farmers (number)

X_4= educational status (number of years in school)

X_5=farm size of farmers (hectares)

X_6=access to extension services (1 if access to extension workers, 0 otherwise)

X_7=farming experience (years)

$\beta_1\beta_2$…..β_6 are coefficient of variation X_1, X_2…..x_6 respectively.

III. RESULTS AND DISCUSSION

Socio-economic Characteristics of Farmers

The socio-economic characteristics of sampled farmers in the study area are presented in Table 1. The results showed that 34% of the respondents are between 31-40 years of age. This suggests that majority of the respondents were young, active and productive farmers who could still actively engage in agricultural activities. This is an advantage for adoption and spread of innovative technologies and practices since young people have a lot of energy which can be bound for agriculture and are likely to accept innovation easily. This is in conformity with Fabiyi *et al*. (2007) and Oladejo *et al*. (2011) who stated that young people are actively and highly involved in food production. The study revealed that, 46% of the respondents are full time rice farmers. There are no available opportunities for white collar jobs; therefore, people in the study area are subjected to farming. This confirms Anonymous, (2011) who reported that the main occupation of the people of Benue state is farming.

Majority (87%) of the farmers are literate with one form of formal education or the other while 13% are illiterate, with high proportion(34%) having 11-15years of farming experience. This implies that, there is a higher tendency for farmers who are educated to adopt modern technologies in rice production compared to those who are illiterates. This result was expected because literate farmers have the advantage of understanding and interpreting recommended packages to enhance their productivity. Most (38.0%) of the respondents are small- scale farmers with farm size ranges from 1-3 hectares and utilizing mostlyfamily labor (40%) and hired labor (22%) with household size of mostly 11-15 (34%)persons.

This is advantageous because households with larger family active members can offer farm labor in the household and to other people to get income to increase the scale of their operations. The higher the number of persons in a household, the higher its labor force (Immaculata *et al*., 2011).According to Effiong (2005) relatively large household size enhances the availability of family labor which reduces constraint on labor cost in agricultural production. Most (21%) of the respondents earned very small amount of money (less than ₦30, 000 per annum) which can hardly take care of their large family size.

Table I: Socio-economic Characteristics of Farmers in the Study Area (n=120)

Variable	Frequency	Percentage
Age (years)		
20-30	21	22
31-40	32	34
41-50	26	27
51 above	16	17
Marital status		
Single	17	18
Married	71	75
Widow	2	2
Widower	1	1
Separated	2	2
Divorced	2	2
Occupation		
Full-time	44	46
Student	7	7
Civil servant	32	34
Others	12	13
Educational level		
Illiterate	12	13
Non formal education	18	19
Primary	23	24
Secondary	25	26
Tertiary	17	18
Farming experience (years)		
1-5	12	13
6-10	16	17
11-15	32	34
120	28	29
21 and above	7	7
Farm size (ha)		
1-3	36	38
4-6	30	32
7-9	13	14
10-12	8	8
13-15	6	6
>15	2	2
Source of labor		
Family	38	40
Hired	21	22
Group	19	20
Communal	12	13
Age grade	5	5
Household size		
1-5	8	8
6-10	18	19
11-15	32	34
16-20	13	14
21 and above	24	25
Annual farm income (₦)		
Less than 30,000	20	21
30001-60000	18	19
60001-90000	14	15
90001-120000	12	13
120001-150000	13	14
150001-180000	8	8
180001-210000	5	5
210001-240000	3	3
240001 and above	2	2

Source: Computed from Field Survey Data, 2018

Farmers' Awareness and Adoption of Improved Rice Technologies

All most all the farmers in the study area are aware of the seven technologies of rice introduced in the area. However, the result of the analysis (Table2) reveals disproportion in adoption of disseminated rice technologies in the study area .Result in Table 2 shows high adoption rate on technology like fertilizer (50%) and weed control measures (62.5%). This may be due to the perception of fertilizer as an indispensable factor of production by the farmers. The rest of the technologies were poorly adopted by the farmer. The result reveals on the average that 21.7% of the technologies were adopted indicating very low adoption rate of rice technologies by the respondents. The low adoption rate obtained in this findings may be due to financial constraints of the farmers to acquire these technologies. Other constraints to adoption of new technologies may include illiteracy, culture and belief amongst others.These findings are in agreement with Obinne (1994), which stated that culture and belief affect some people in adoption of some improved technologies.

Table 2: Distribution of Respondents According to Awareness of Improved Technologies and Adoption by Farmers

Improved Rice Technologies	Awareness Frequency	Adopted Frequency	Not Adopted Frequency
Use of tractor	120(100)*	20.0(16.7)	100.0(83.3)
Fertilizer application	120(100)	60.0(50.0)	60.0(50.0)
Use of improved varieties	65(54.2)	12.0(10.0)	108.0(90.0)
Weed control measures	82(68.3)	75.0(62.5)	45.0(37.5)
Pest/disease control	77(64.2)	9.0 (7.50)	111.0(92.5)
Rice processing and storage	120 (100)	47.0(39.2)	73.0(60.8)
Correct date of planting rice	63(52.5)	40.0 (33.3)	80.0(66.7)

*Source: Computed from Field Survey Data, 2018*Values in parenthesis represent percentage*

Factors Hindering Adoption of Rice Technologies

The mean analysis in Table 3 reveals that educational level (M=3.22), complexity of processing method, (M=3.01), lack of access to land (M=2.85), high cost of inputs (M=2.78), farm size (M=2.71) and lack of capital (2.62) had mean score greater than cut-off mean (2.50). This result implies that the respondents did not adopt most of the transferred rice technologies in the study area because of the complex nature of some transferred technologies or lack of finance which limited their adoption. Factors such as marital status, age and household size did not hinder adoption of rice technologies in the study area.

Table 3: Factors Hindering Adoption of Rice Technologies in the Study Area

Variables	Mean	Rank
Marital status	1.88	9th
Age	2.11	8th
Lack of capital	2.62	6th
Farm size	2.71	5th
Household size	2.34	7th
Educational level	3.22	1st
Lack of access to land	2.85	3rd
High cost of inputs	2.78	4th
Complexity of processing method	3.01	2nd

Source: Computed from Field Survey Data, 2018, Cut-off score Mean (M=2.50)*

Rice Output Before and After Adoption of Modern Technologies.

The results of the analysis(Table 4) indicated that majority (46%) of the farmers obtained low yield before the adoption of modern rice technologies while only 16% obtained average yield before the adoption. There was increased yield after the adoption as reported by 65% of the farmers. None of the farmers experience no effect/decrease yield in the adoption of modern rice technologies. More so, the result showing the difference in the output of rice before and after adoption of technologies shows a mean rice output of farmers before adoption and after adoption as ₦430.71 and ₦950.82 respectively, which was significantly different (t<2.22:P<0.05). This clearly indicated that, adoption of modern rice technologies enhance high yield.

Table 4: Distribution of Farmers According to Rice Yield/Output Before and After the Adoption of Modern Rice Technologies

Variables	Frequency	Mean Output	Mean Difference	t-value	sig.
Yield before Adoption		**430.71**			
Low yield	44(46)				
Very low yield	36(38)				
Average yield	15(16)				
Yield after Adoption		**950.82**	**520.11**	2.22**	0.028
Increased yield	62(65)				
Moderate yield	33(35)				
No effect/decreased yield	0(0)				

*Source: Computed from Field Survey Data, 2018Figures in parentheses are percentages**P<0.05*

Determinants of Adoption of Rice Technologies

The results of the logit regression model showed that the R^2 for the model is high enough 0.734. This means that 74% of the variation in the response variables was explained by the explanatory variables in the model (Table 5). The result of analysis indicated that farming experience and household size showed positive but non-significant relationship with adoption of rice technologies. Age has a negative sign in the model, meaning as a farmer advances in age, they turn to adopt less technologies as compared to the young farmers. This is because, as farmers grow older, there is an increase in risk aversion and a decreased interest in long term investment in the farm. As a farmer advances in age their adoption rate for rice technology decreased by (8%). This was statistically significant at (P<0.05). This result confirms a prior

expectation and agrees with the study by (Mauceri *et al.*, 2005) which indicate that older farmers are averse to technology adoption.Farm size has a positive relation with the adoption of rice technology. The model showed a positive sign indicating that a unit increase in farm size will result in farmer's adoption in rice technology. This means rice technology should target farmers with large rice farms since they have the potential of adopting the technology. This agrees with the study of (Uaiene *et al.***,** 2009) who observed that farmers with large farm size are likely to adopt a new technology as they can afford to devote part of their land to try new technology, which when successful would cause them to adopt the technology fully, unlike those with less farm size. A unit increase in farm size will result in about 5% chances of adopting the rice technology and statistically significant at (P<0.01).

The result showed that farmers who had access to credit were more likely to accept rice technology relative to those without access. Credit to farmers enables them to purchase the inputs that are required in production hence its influence on farmer's adoption technology. From the results, access to credit gives farmers 17% chances of adopting rice technology relative to those without access. This result confirms the finding by (Simtowe and Zeller, 2006) which indicates that access to credit promotes the adoption of risky technologies through relaxation of the liquidity constraint as well as through the boosting of household's-risk bearing ability.

The results showed that level of education has a positive coefficient and at 5% level (P<0.05) implying that an increase in educational level increases the probability of the farmer to adopt technologies. This is because education level of a farmer increases his ability to obtain, process and use information relevant to adoption of a new technology. This result agrees with the findings of (Okunlola *et al*., 2011) who found that the level of education has a positive and significant influence on adoption of technologies by fish farmers. Higher education influences farmers' decision, hence making them more open, rational and able to analyze the benefits of new technology. This findings agreed with Obinne (1991),who reported that educational level and farm size are positively related to adoption of improved farm technologies. Similarly, Jibowo (1980) agreed that education is among other socio-economic characteristics of farmers that are significantly related to the adoption behavior of farmers. There was a positive and significant relationship between services and technology adoption (P<0.01). This agrees with the findings of (Uaiene *et al.*, 2009) who reported that exposing farmers to information based upon innovation-diffusion theory is expected to stimulate adoption.

Table 5: Logit Estimates for Factors Influencing Adoption of Rice Technologies in the Study Area

Variables	Coefficients Sig.
Access to credit (X_1)	-0.176 0.012**
Age(X_2)	$8.12x10^{-5}$ 0.015**
Household size(X_3)	0.0210.106
Educational level(X_4)	0.820 0.061*
Farm size(X_5)	$5.54x10^{-5}$0.018**
Extension access (X_6)	1.528 0.010**
Farming experience(X_7)	0.0043 0.735
Constant	-7.016 0.019

Source: Field Survey, 2018 * (P<0.01), ** (P<0.05) *** (P<0.1) Adjusted R square = 0.724R Square = 0.734 T= b/s.d = 0.9063

IV. CONCLUSION AND RECOMMENDATIONS

The success of promoting rice production or any other agricultural technologies among farming communities to large extent depend on the performance of extension workers. Technology adoption among farmers is higher when extension services are made available. Through extension services farmers get to know the benefits of new technology through extension agents who acts as a link between the innovators of the technology and users of that technology. This helps to reduce transaction cost incurred when passing the information on the new technology to a large heterogeneous population of farmers. A good extension network should be supported by the efficiency of farmers to adopt modern technologies in rice farming so as to boost production in the State in particular and Nigeria at large. Furthermore, production of agricultural commodities, rice inclusive would no doubt contribute tofood security in Nigeria particularly if all things being equal.

Based on the findings the following recommendations are pertinent:

- Provision of basic education /training to build farmers' entrepreneurial skillsthat will enhance their productivity
- The number of extension staff should be increased to achieve more effective extension farmer's contact.
- Increase mobilization of farmers into cooperative, a strategy for agricultural development will not only enhance adoption but will assist the farmers efficiently secure credit facilities and better bargain for their farm output and hence profitability.
- Farm inputs and mechanized farm implement should be directed to farmers at subsidized rate by the government, organizations and private individuals.
- New technologies should be directed towards large scale farmers since they are likely to adopt innovations than aged farmers and small-scale farmers.

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