

# ASSESSMENT OF AWARENESS AND DETERMINANTS OF ANCHOR BORROWERS PROGRAM'S ADOPTION AMONG RICE FARMERS IN KADUNA STATE, NIGERIA

*Opeyemi Olanrewaju*

*University of Ibadan, (Autonomous), Ibadan, 21115 Oyo, Nigeria*

## Abstract

*Africa has found it compelling to focus on innovations and policy targeted at increased use of modern input to improve productivity. In tandem with this, Federal Government of Nigeria in 2015 established the Anchor Borrowers Programme (ABP). The study therefore assesses the awareness and adoption of Anchor Borrowers Programme (ABP) among rice farmers. Primary data was obtained from a total of 240 respondents with the aid of a well-structured questionnaire using a multi-stage sampling procedure. The data was analyzed using descriptive statistics and probit regression model. The results revealed that about only 40% of the respondents were aware of ABP. The result of the probit model also revealed that access to credit, engagement in off-farm work, membership of cooperative society were critical to adoption of ABP. Particularly, the study revealed that rice farmers' awareness of ABP significantly determines ABP adoption. Furthermore, rice farmers who engage in off-farm work were more likely of adopt ABP. Years of farm experience also had a negative relationship with ABP adoption, and could imply that rice farmers with several years of farming experience are risk averse, and may instead settle for their conventional means of rice production. The study recommends that calculated efforts should be made to communicate Government programs to rural areas where majority of the farmers are domiciled, so as to increase the awareness on the Program. This is so because, findings from the study revealed that majority of rice farmers in the study area were unaware of the Anchor Borrowers Program. In addition to this, adoption of this program has been*

*revealed to hinge on the level of Awareness on ABP by rice farmers.*

**Keyword: Anchor Borrowers Programme (ABP), Adoption, Awareness**

## 1. INTRODUCTION

It has become more imperative for policy makers in Africa to focus more on policies targeted at ensuring increased use of modern inputs in Africa's Agriculture (1Megan and Barrett, 2016). Its use has been established to be fundamental to modern agriculture in developed countries, and also a catalyst to the green revolution that swept through Asia and Latin America during the '60s and '70s [2]. This of course has resulted in several declarations such as the Abuja Declaration, Malabo Declaration, under the Comprehensive Africa Agriculture Development Programme (CAADP) [1]

Following this, Governments are increasingly reinstating agricultural input subsidy to promote access to input, and arising from this, they are enjoying success relatively to what was obtainable in several decades past [3] In one of the several attempts to achieve this, like many sub Saharan African Governments, Nigeria's government in 2012 implemented Growth Enhancement Support Scheme (GES) which is targeted at massively providing input to make fertilizer and improved seed accessible to smallholders [4, 5]. What set this program aside from previous program is the involvement of private agro-dealers to procure and distribute subsidized fertilizer and improved seeds leveraging on technology-the e-voucher [6].

GES programme is effective in improving productivity and welfare outcomes of beneficiary smallholders [7]. In

order to further improve access and availability of inputs, Federal Government of Nigeria has established the Anchor Borrowers Programme (ABP). The programme established through Nigeria's apex Bank-the Central Bank of Nigeria (CBN), as part of a more encompassing economic reforms was to be implemented broadly to create a linkage between anchor companies involved in the processing and small holder farmers (SHFs) of the required key agricultural commodities[8]. The programme impetus is however also the provision of farm inputs in kind and cash (for farm labour) to small holder farmers. This is to stabilize inputs supply to agro industries, by boosting production of specific commodity of interest. This will also address the country's negative balance of payments on food [8]. With this broad objective of the programme, small holder farmers are expected through the programme to transit from being a subsistence farmer to commercial farmer. This, the CBN is not oblivious of, hence the need to thrust the Private sector into the implementation of the Programme [8]

In principle, the programme targeted smallholder farmers who are producers of various agricultural commodities across the country to include (Rice, Maize, Wheat, Cotton, Roots and Tubers, Sugarcane, Tree crops etc as its beneficiary of input-loan[8]. Nevertheless, Rice production appeared to have enjoyed the highest attention of this programme, with about 80% of the fund going into rice production, and have so far utilized 40 billion naira out of the 220 billion naira allocated for Micro Small and Medium Scale (MSMEs) Development fund[8]. The modus operandi is for these farmers to be in groups/cooperative(s) of between 5 and 20 for ease of administration, they are given inputs loan in kind for Seeds and Fertilizers, and Cash for Labour. For effectiveness, the program is not left only to the hands of the Government of Nigeria, it is largely driven and coordinated by Private Sector, mainly among Private financial institutions (Deposit Money Banks, Development Finance Institutions, Microfinance Banks), The Anchor, which are private large-scale integrated processors, who have been in agreement to off-take the produce at the agreed prices or as may be reviewed, and lastly the Input suppliers [8].

Rice as a crop has received widespread attention from International, regional bodies and national bodies due

to its importance [9]. It is a critical staple food in Nigeria. It's estimated per capita consumption of rice per month has been put at about 24.8 kg[11]. Very significant proportions of the Nigerian population depend on rice for their dietary needs. Rice is grown in all the States of the federation and Federal Capital Territory though production varies from State to State and the prevalent types of rice production systems in Nigeria also varies. The various production systems include rainfed upland, rainfed lowland, irrigated lowland, deep water floating and mangrove swamp [12]. Nigeria currently ranks highest as the largest producer and consumer of rice in West Africa [13,14]. Nigeria meets its demand deficit through importation of rice from other countries [16, 17, 18, 19]. With the innovation of thrusting the private sector in driving the Anchor Borrowers programme, it is expected that smallholder farmers will achieve their transition from peasantry to commercial levels. While this Anchor Borrower program is ongoing, given the so much potential and hopes it carries, it is however also important to see how well the targeted farmers have adopted it, as it is on this basis its stated objectives could be measured.

Several studies have been carried out on agricultural technology adoption in developing countries. [20, 21] carried out detailed survey of agricultural innovation adoption in developing countries and found that farm size, risk, human capital, availability of labour, access to credit and land tenure systems were most critical factors determining farmers' innovation adoption decisions. Introduction of new technology increases productivity. The decision of whether or not to adopt a new technology or innovation hinges upon a careful evaluation of a large number of technical, institutional and socio-economic factors. The adoption of ABP like any innovation is expected to grow slowly and gradually in the beginning, and then have a period of rapid growth that will taper off and become stable and eventually decline [22]. According to [23] individual innovativeness theory is based on who adopts the innovation and when, and therefore there would be various determinants of adoption of ABP at the individual level, while there would also be a variety of external or social conditions. These include; the form of the decision which could either be collectively, individually, or by a central authority, the communication channels through which information about an innovation is acquired whether

mass media or interpersonal, and the nature of the social system in which the potential adopters are embedded, its norms, and the degree of interconnectedness. It is against this backdrop; the importance, objectives and the hope the ABP carries that its awareness and the determinants be assessed among rice farmers in the study area.

## **2.METHODOLOGY**

### **2.1. study area**

This study was carried out in Kaduna State, Nigeria. The state is a Northern of Nigeria's state and bordered by the states of Zamfara, Katsina, and Kano to the north; Bauchi and Plateau to the east; Nassawara to the south; Niger to the west, and Abuja Federal Capital Territory also borders Kaduna state to the southwest .It has an area of 46,053 km, with a population of 6,113,503 and 23 Local Government areas [24]. The state lies between latitude 10°21' north of the equator and 7°45" East prime meridian. The vegetation of the state is tropical grassland in Southern Kaduna while much of the rest falls within the guinea savanna, characterized by scattered short trees, shrubs and grasses. The soil is mostly loamy and sandy, with substantial amount of clay also found. Its climate favors the cultivation of notable food crops like rice, maize, millet, wheat, soybean cowpea, tomatoes, pepper, etc, and thus an agrarian [25]. The state has averagely high temperature which ranges between 21 to 29°C and high relative humidity with two distinct seasons. The rainy season lasts from April/May to September/October and the dry season lasts from the rest of the year October/November till April/May [25]

### **2.2. Sampling Technique and Data Collection**

A multistage sampling procedure was employed in selecting the respondents used for this study. The first stage is the purposive selection of Five (5) Local Governments out of the twenty three Local Government Areas of the state. The choice of these local governments is based on its predominant and massive production of rice. In the second stage, three communities in the Local Government were randomly selected while the third stage random selection of rice farmers were carried out proportionate to size of the

Local Government. This was based on National Population Commission Population census [24]. In total, a sample of 240 respondents was used for the study.

### **2.3. Types and sources of data**

Primary data used in this study was obtained in a cross-sectional survey of rural households-rice farmers in the study area. Structured questionnaires was deployed to obtain information on socioeconomic and demographic characteristics such as household size, level of education, age of household heads, farm size, inputs received, average yield in tons/ hectare, distance to inputs dealers, input and output market prices etc.

### **2.4. Analytical Framework**

The study evaluated the awareness of Anchor Borrowers Program using descriptive statistics and determinants of its adoption using Probit regression model.

Probit regression model has been widely utilized to evaluate the functional association among the probability of adoption and its determining variables. This variables may include; education, farm size, land ownership and other socio-cultural factors. With a binary econometric model like probit model, a more specific analysis of farmers' adoption of new technology could be ascertained [26, 27, 28]. This type of analysis provides more detailed information on the characteristics of the farmers who tend to adopt a specific innovation. The probit regression model is preferred for its good properties assumption of normal distribution [29].

The probit model makes the assumption that while  $Y_i$  only takes the values of 0 and 1 for the dependent variable there is still a latent, unobserved continuous variable  $Y_i^*$  that determines the value of  $Y_i$  [30 ]. The probit model assumes variable  $Y_i$  as binary with only two possible outcomes (1 for adoption and 0 for non-adoption). It also Consider also a vector of explanatory variables  $x_i$  which explains  $Y_i$ . Then the probit model takes the form:

$$\Pr\left(Y_i = \frac{1}{x_i}\right) = F(\beta'X_i) \text{-----} \\ = \phi(\beta'X_i) \text{-----} \\ \text{--- (1)}$$

where Pr denotes probability,  $Y_i$  is the binary choice variable representing adoption and  $\Phi$  is the cumulative distribution function (CDF) of the standard normal distribution.  $\beta$  is a vector of unknown parameters. It is assumed that the latent variable  $Y^*$  can be specified as follows:

$$Y_i^* = \beta_0 + \sum_{n=1}^n \beta_n X_{ni} + \varepsilon_i \text{-----} \text{(2)}$$

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \text{-----} \text{(3)}$$

where  $x_i$  represents a vector of explanatory variables,  $\varepsilon_i$  is a random disturbance term,  $N$  is the total sample size, and  $\beta$  is a vector of unknown parameters to be estimated by the method of maximum likelihood. Due to the non-linearity of the probit model, the parameters are not necessarily the marginal effects of the various independent variables. The marginal effects of the coefficients are more informative and useful for policy decision-making. To estimate the marginal effect, we differentiate equation (1) with respect to  $x_i$  [31-34]:

$$\frac{\partial y_i}{\partial x_i} = \phi(\beta'x_i)\beta_i \text{-----} \\ \text{-----} \text{(4)}$$

where  $\phi$  represents the probability density function of the standard normal distribution. The empirical specification of the probit model for the study is given as follows:

$$y_i = \beta_0 + \sum_{n=1}^n \beta_n X_{ni} + \varepsilon_i \text{-----} \text{(5)}$$

Where  $Y_i$  = adoption of Anchor Borrowers Programme (ABP) (=1 if rice farmer adopted ABP, 0 otherwise);  $x_1$  = age;  $x_2$  = ABP awareness; (=1 if rice farmer is aware of ABP, 0 otherwise)  $x_3$  = Marital status; (=1 if rice farmer is married, 0 otherwise)  $x_4$  = Access to credit; (=1 if rice farmer had access to credit, 0 otherwise)  $x_5$  = engagement in off-farm work; (=1 if rice farmers engaged in off-farm work, 0 otherwise)  $x_6$  = own land (=1 if farmer own land, 0 otherwise);  $x_7$  = farm size; membership of cooperative society (=1 if rice farmer belong to a cooperative society, 0 otherwise);  $x_8$  = Numbers of years lived in the community;  $x_9$  = Expected market price of rice;  $x_{10}$  = membership of savings and credit group (1 if farmer belong to savings and credit group, 0 otherwise);  $x_{11}$  = Years of farm experience. The choice of variables in the model was based on intuition and literature [32, 33]. The definition and expected signs of the variables used in the probit model are given in Table 1.

**Table 1. Table of A-priori expectations**

Variable	Description	Expected Sign
Adoption of ABP		
Age	Age of rice farmer in years	+/-
ABP awareness	Dummy: 1 if rice farmer is aware; 0 otherwise	+
Marital Status	Dummy: 1 if rice farmer is married; 0 otherwise	+/-
Access to Credit	Dummy: 1 if rice farmer has access to credit; 0 otherwise	+/-
Eng in Off farm work	Dummy: 1 if rice farmer engaged in off farm work 0 otherwise	+/-
Own Land	Dummy: 1 if rice farmer own land; 0 otherwise	+/-

Farm Size	Farm size of Rice farmers	+
Membership of Cooperative	Dummy: 1 if rice farmers belong to a cooperative; 0 otherwise	+
Years lived in Community	Number of years lived in the community by rice farmers	+
Expected Market price	Expected Market price of rice	+
Membership of Savings and Credit group	Dummy: 1 if rice farmers belong to a cooperative; 0 otherwise	+
Years of farm experience	Years of farm experience of rice farmers	+/-

The decisions by many researchers with respect to the sign of many of the explanatory variables explaining adoption process still largely differ. Hence, there still remains no consensus as to the signs the variables should take. This variation could be as a result of methodological differences. Also, empirical results across different geographical regions are likely to show some variations.

Age is considered a very important variable which influences household and farm decisions and is widely used as a variable in adoption studies. Previous studies have shown that young people are more likely take risks when presented with any innovation, thus pose more chances of being adopters [34, 35]. Nonetheless, studies such as [36] found out that age had a positive association with technologies such as fertilizer by cocoa farmers in Ghana. Other studies such as corroborates... As a result of this, the sign of the variable in this study could be considered to be indeterminate.

Awareness of the programme itself i.e the Anchor Borrowers Program is expected to have a positive relationship with its adoption. Awareness of the program is prerequisite to its adoption, hence rice farmers who are first aware of this programme are more likely to adopt it. Having being aware of the program, with the benefits that are associated with it, such farmers may be motivated to adopt the programme to further enhance their production. On the other hand, other farmers may consider the benefits not enough to guarantee them a good yield. Hence the influence of the variable is indeterminate.

It has been shown that farm size has a positive influence on farmers' adoption of farm technologies [37-39 26-28]. [40 29] established that the positive relationship of farm size on adoption may be attributed to economies of scale effects.

Ownership of land is expected to have a positive relationship with adoption of ABP. Rice farmers who own their farm land is likely to make long term commitment and thus adopt ABP.

Engagement in off-farm work activities are sources of additional income which may encourage or discourage investment in new technologies

Membership of cooperative society facilitates exchange of information which may positively or negatively influence adoption of innovations. Bulk of the farmers being literate presents avenue to interact and generate new ideas to changing conditions in rice production. This is in line with the findings of [41]

Number of years lived in the community affects the probability of becoming aware of the ABP [7] . Farmers who have spent many years in the community are more likely to adopt ABP, and thus expected to have a positive relationship.

Farmers' expectant of a satisfactory market price of rice in the cropping season can aid adoption of agricultural technology. Farmers who predict a better market price for their farm produce may be more willing to invest in production technologies and hence are more likely to adopt it.

Membership of savings and credit group can also facilitate adoption through information share among members of the group.

Years of farm experience can influence how risk averse a farmer can be, and instead fails to adopt a technology.

### 3.SUMMARY DESCRIPTION OF VARIABLES

Table 2 showed the summary statistics of variables used in this study based on awareness of ABP. The distribution shows rice farmers who are aware of ABP are older in age. This set of rice farmers has a mean of 41.22 years, while those who were unaware are 41.16 years. Rice farmers who were aware of ABP and those who were unaware also have an average household size of 9.79 and 9.64 persons respectively approximating 10 persons per household. Both groups of rice farmers (i.e those that were aware and those unaware) spent an average of 9 years in school. In addition, rice farmers who were aware had a mean farm size of 1.86 ha while those who were unaware had 1.77ha. Further to this, mean years of farming experience of rice farmers who

were aware of ABP is 19.02 years, whereas those who were unaware is 17.18 years. Thus implying that rice farmers who were aware of ABP had more years of farming experience. Mean value of primary occupation of those who were aware of ABP is 0.99, and those who were unaware are 0.89. Rice farmers who is aware of ABP had a mean value of access to credit of 0.67, and at the other hand, those who were not aware is 0.46, which could indicate that rice farmers who were aware relatively had more access to credit. Membership of cooperative society and adoption of ABP had a mean value of 0.813 and 0.73 for those who are aware of ABP respectively, and those who were not aware had a mean value of 0.208 each respectively, which are suggestive that rice farmers who belong to a cooperative society were more aware of ABP and those who were aware of ABP, tend to adopt ABP.

**Table 2: Description of selected variables**

Variables	ABP aware (N=96)		NABP aware(N=144)	
	Mean	S.D	Mean	S.D
Age	41.22	12.49	41.16	13.26
Sex Male (=1; 0 otherwise)	0.99	0.12	0.98	0.17
Household size	9.79	7.08	9.64	6.96
Farm size	1.859	0.742	1.772	0.859
Years of education	9.08	4.229	9.00	5.503
Primary Occupation Farming (=1;0 otherwise)	0.99	0.12	0.89	0.32
Years of Farming exp	19.02	10.69	17.18	11.38
Access to credit Yes (=1; 0 otherwise)	0.67	0.199	0.46	0.17
Membership of cooperative Yes (=1; 0 otherwise)	0.813	0.392	0.208	0.408
ABP adoption Yes (=1; 0 otherwise)	0.73	0.447	.0208	0.143

Source: Field Survey, 2018

Table 3 below presents the results of the probit regression model used to investigate the determinants of adoption of Anchor Borrowers Program (ABP) among rice farmers in the study area. The decision of a rice farmer to either adopts ABP or not is the dependent variable. About 13 explanatory variables were considered to be explaining rice farmers' decision to adopt ABP, and from which a sizeable number were statistically significant at various levels. The marginal effect of the estimates was equally explained along with the coefficient in this section as seen on the same table. While the coefficients can be used to provide insight as to the direction of the explanatory variable, the marginal effects further showed to what extent these explanatory variables determines the adoption of ABP.

The Wald chi-square value of 133.18 with a p-value of 0.0000 reveals that the Probit model as a whole is statistically significant.

The table shows that awareness of the Anchor Borrowers Program (ABP) significantly influences the adoption of ABP among rice farmers in the study area and is statistically significant at 1%. The coefficient of ABP awareness is positive, and therefore implies that adoption of ABP among rice farmers in the study area increases with the awareness of the program. The indication of this is that, rice farmers who are aware of the program are more likely to adopt the ABP. Further to this, the marginal effect estimate of the model does show that the awareness of ABP increases the likelihood of adopting ABP by 66.7%. Based on the marginal effect estimates of the awareness of ABP and its consistency with the direction of causality, as well as having the highest estimate among the explanatory variable, it could be agreed that awareness of ABP holds the key to its adoption among rice farmers in the study area. [42] also found out that information is important to adoption of agricultural technologies. A farmer is likely to adopt agricultural Technology if he is aware of it.

Further to this, access to credit has positive and statistically significant relationship at 1% level of significance with adoption of ABP. Both its coefficient and the marginal effects estimates of the variable is not in contrary with a-priori expectation, implying that access to credit increases the likelihood of adoption of ABP. With marginal effect estimates of 0.243, access to credit increases the likelihood of adoption of ABP by 24.3%. This without any doubt implies that access to

credit contributes in a sizeable manner to the adoption of ABP. The reason for this may not be far-fetched, since despite the innovation ushered in to the program to ensure affordability and accessibility of inputs to small holder farmers, the program is also structured as a credit program, since farmers pay for these inputs at a future date with proceeds from their farm outputs. Similarly, [43] also reported that access to credit significantly influence adoption of Maize technologies.

Engagement in off farm work has a positive effect on adoption of ABP, and it is statistically significant at 5%. The significant level and the direction of Engagement are admissible, implying that the likelihood of adopting ABP significantly increases with rice farmers' engagement in other work apart from farming. However, their marginal effect of the estimate is only statistically at 10% level of significant, as against the coefficient which is statistically at 5% level. The marginal effect of the estimates shows that engagement in off-farm work increases the likelihood of ABP adoption by 13.7%.

Of the two membership of Association (i.e membership of cooperative society and membership of Savings and Credit group) considered in the model to explain adoption of ABP, only being a member of cooperative society statistically influences adoption of ABP. It has a positive relationship with adoption and statistically significant at 5% level. More specifically, the marginal effect estimates show that a rice farmers' decision to be a member of cooperative society increases the likelihood of ABP adoption by 20.7%. This could be adjudged to flow of information that is always associated with membership of associations that address mutual interest. This is consistent with findings of [44] who also found out that membership of a cooperative society influences an individual farmer's decision in farm technologies adoption. [45] also established that a farmer's decision to adopt a new technology hinges upon the adoption decision of other farmers in their social group, and in particular in the context of agricultural innovations, farmers share information and learn from each other. Individual farmers are expected to be more likely to adopt when they know many other adopters.

In terms of farm experience of rice farmers, it has a negative relationship with adoption of ABP, and

statistically significant at 10% level of significance. The implication of this is that as a rice farmer years of farm experience increases, he is less likely to adopt ABP. The marginal effect estimate of Years of farm experience is also negative. It is estimated at -0.007 and statistically

significant at 10% level. This thus implies that Years of farm experience decreases the likelihood of adoption of ABP by a paltry 0.7

**Table 3: Determinants of adoption of Anchor Borrowers Program**

Adoption of ABP	Robust		Marginal effect	Std. Err.
	Coefficient.	Std. Err.		
Age	-0.021	0.023	-0.006	0.007
ABP awareness	2.335***	0.316	0.667***	0.067
Marital Status	-0.846	0.543	-0.231	0.141
Access to credit	0.860**	0.378	0.243**	0.111
Eng in Off farm work	0.494**	0.229	0.137*	0.074
Own Land	-0.131	0.251	-0.036	0.070
Farm size	-0.138	0.126	-0.038	0.034
Membership of Cooperative	0.734**	0.380	0.207**	0.106
Years lived in Community	0.031	0.023	0.008	0.007
Expected market rice price	0.00008	0.0001	0.00002	0.00004
Membership of Savings &Credit	0.129	0.268	0.00002	0.00004
Years of farm experience	-0.024*	0.0129	-0.007*	0.003
Constant	-1.407	1.599		

Log pseudolikelihood = -45.917045 Pseudo R2 = 0.7045 Wald chi2(12) = 133.18 Prob > chi2 = 0.0000

#### 4. CONCLUSION AND POLICY RECOMMENDATIONS

The study employed a descriptive statistics and probit model to assess the awareness and determinants of ABP adoption by rice farmers respectively. The study revealed that about 96 rice farmers which accounts for only 40% of the respondents were aware of ABP, while the remaining 60% were unaware. The study revealed that access to credit, engagement in off-farm work, membership of cooperative society were critical to adoption of ABP. Particularly, the study revealed that rice farmers' awareness of ABP significantly determines ABP adoption. The implications of the findings are that access to credit and adoption of ABP had a positive association and thus efforts should be made to sustain

and improve on the access to credit features of the program.

Furthermore, rice farmers who engage in off-farm work were more likely of adopt ABP. Rice farmers who belong to cooperative society are also more likely to adopt ABP, which may be associated with exchange of information which always gain prominence among cooperative society. Years of farm experience also had a negative relationship with ABP adoption, and the reason could be that rice farmers with several years of farming experience are risk averse, and may instead settle for their conventional means of rice production. Efforts to Based on the findings, the study recommends that policy calculated efforts should be made to communicate Government programs to rural areas where majority of the farmers are domiciled, so as to



increase the awareness on the Program. This is so because, findings from the study revealed that majority of rice farmers in the study area were unaware of the Anchor Borrowers Program. In addition to this, adoption of these programs has been revealed to hinge on the level of Awareness on ABP by rice farmers.

Further, policy makers should gear efforts and continue to put measures to encourage farmers in cooperative society, since membership of a cooperative society was found to improve adoption. Membership of cooperative society may also be critical to access to credit, which was found to significantly influence ABP adoption.

### REFERENCES

- [1] Aparajaita Goyal, John Nash. Reaping richer returns: Public spending priorities for African agricultural productivity growth. World Bank publication 2016.
- [2] Crawford, E., Jayne, T.S., Kelly, V. "Alternative Approaches for Promoting Fertilizer Use in Africa." Agriculture and Rural Development Discussion Paper .2006:22. World Bank, Washington D.C
- [3] Jayne, T. S., & Rashid, S. Input subsidy programs in sub-Saharan Africa: A synthesis of recent evidence. *Agricultural Economics*.2013: 44(6),547–562.
- [4] Liverpool-Tasie LS. Targeted subsidies and private market participation: An assessment of fertilizer demand in Nigeria.2013: IFPRI discussion paper No. 1194.International Food Policy Research Institute (IFPRI), Washington DC.
- [5] Liverpool-Tasie, L. S., & Takeshima, H. Input promotion within a complex.2013
- [6] Federal Ministry of Agriculture and Rural Development (FMARD), Nigeria (2013). GES live data dashboard. Retrieved on 02/12/2014 from <http://www.fmar.gov.ng/ges-live-data-dashboard>
- [7] Tesfamichael et al.,.Productivity and Welfare Effects of Nigeria's e Voucher-Based Input Subsidy Program. *World Development* 2017:97( 251–265)
- [8] Central Bank of Nigeria: Anchor Borrowers guideline, Department of development finance department, 2016
- [9] Orefi, A. Fertilizer usage and technical efficiency of rice farms under tropical conditions: A Data Envelopment Analysis (DEA). *Journal of Agricultural Science*. 2011: 2(2):83-87.
- [10] Onyeneke, R. U. Determinants of Adoption of Improved Technologies in Rice Production in Imo State, Nigeria. *Determinants of Adoption of Improved Technologies in Rice Production in Imo State, Nigeria*.2015:12(11), 888- 896
- [11] Adeyeye JA, Navesero EP, Ariyo OJ, Adeyeye SA. Consumer preference for rice consumption in Nigeria. 2010: *J. Humanit. Soc. Sci. Creative Arts* 5:26-36.
- [12] Ezedinma CI .Impact of trade on domestic rice production and the challenge of self- sufficiency in Nigeria. *International Institute of Tropical Agriculture, Ibadan, Nigeria*. 2005
- [13] Cadoni P, Angelucci F. Analysis of incentives and disincentives for rice in Nigeria Technical notes series MAFAP, FAO, Rome. 2013
- [14] Daramola B. Government policies and competitiveness of Nigerian Rice economy. Paper presented at the workshop on rice policy and food security in Sub-Saharan Africa. Organised by WARDA, Cotonou, Republic of Benin.2005
- [15] Oyinbo O, Omolehin RA, Abdulsalam Z. Household consumption preferences for imported and domestic rice in Kaduna State, Nigeria: Implications for rice quality improvement.2013: *PAT* 9:29-37.
- [16] Ogundele OO, Okoruwa VO .Technical efficiency differentials in rice production technologies in Nigeria, 2006: *AERC Research Paper* 154.
- [17] Akinbile CO (2010). Behavioural pattern of upland rice agronomic parameters to variable water supply in Nigeria. *J. Plant Breed. Crop Sci*.2010: 2(4):073-080
- [18] Adenuga AH, Omotosho OA, Ojehomon VET, Diagne A, Olorunsanya EO, Adenuga OM Poverty Analysis of Rice farming Households. A multidimensional Approach. *Albanian J. Agric. Sci*. 2013:12(4):641-651
- [19] Obayelu AB, Adeoti JO, Donstop NPM. Technical efficiency and impact differentials between the adopters and nonadopters of

- Nerica in the six baseline states in Nigeria.2017: Rev. Agric. Appl. Econ.2006: 20(1):03
- [20] Feder G, Just RE, Zilberman D. Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change*. 1985;33:255-298.
- [21] Feder G, Umali D. The adoption of agricultural innovations: A review. *Technological Forecasting and Social Change*. 1993;43:215-239.
- [22] Rogers EM. *Diffusion of innovations*. Third edition. London: Macmillan.1983.
- [23] Nutley , S. Davies, H and Walter. *Conceptual synthesis 1: Learning from the diffusion and innovation*.2002:<http://www.st-andrews.ac.uk/cppm/Learning%20from%20Diffusion%20of%20innovations.pdf>
- [24] Population Commission (NPC). *Population Figure*. Federal Republic of Nigeria, Abuja. 2006:Retrieved from <http://www.npc.gov>
- [25] Udo, P. O. *Physical Geography of Nigeria*. Heinemann Education Publishers, Ibadan.1982.
- [26] Belay K. 2001. Factors influencing adoption of high yielding maize varieties in southwestern Ethiopia: An application of logit analysis. *Quant J Int Agric*.2001;40(2): 149–167.
- [27] Zhou S D, Herzfeld T, Glauben T, Zhang Y H, Hu B C. Factors affecting Chinese farmers' decisions to adopt a watersaving technology. *Can J Agr Econol*.2008;56(1): 51–61.
- [28] Mariano M J, Villano R, Fleming E. Factors influencing farmers' adoption of modern rice technologies and good management practices in the Philippines. *Agric Syst*.2012;110: 41–53.
- [29] Wooldridge, J. M. *Econometric Analysis of Cross Section and Panel Data*, 2nd Edition. Cambridge, MA: MIT Press.2010
- [30] Sebopetji TO, Belete A. An application of probit analysis to factors affecting smallscale farmers' decision to take credit: A case study of greater letabo local municipality in South Africa. *African Journal of Agricultural Research*.2009;4(8):718-723.
- [31] Ben-Houassa KE. Adoption and levels of demand of fertilizer in cocoa farming in Côte d'Ivoire: Does Risk Aversion Matter? Paper selected for presentation at the CSAE Conference – Economic Development in Africa - Held at St Catherine's College, Oxford. 2011;20-22.
- [32] Asamoah M, Aneani F, Ofori S, Branor PF. Analysis of farmers adoption behaviour of CRIG recommended technologies as a package: The case of some self help cocoa farmer associations in the eastern region of Ghana. *Agricultural Sciences*. 2015;6:601-608. Available:<http://dx.doi.org/10.4236/as.2015.66059>
- [33] Nmadu JN, Sallawu H, Omojeso BV. Socio-Economic factors affecting adoption of innovations by cocoa farmers in Ondo State, Nigeria. *European Journal of Business, Economics and Accountancy*. 2015;3(2):58-66.
- [34] T Gregory. P Sewando. Determinants of the probability of adopting quality protein maize, QPM technology in Tanzania: A logistic regression analysis. 2013;2(2):729-746
- [35] Alavalapati JRR, Luckert MK, Gill DS. Adoption of agro forestry practices: A case study from Andhra Pradesh, India. *Agro forestry Systems*. 1995;32:1–14.
- [36] Aneani F, Anchirinah VM, Owusu-Ansah F, Asamoah M. Adoption of some cocoa production technologies by cocoa farmers in Ghana. *Sustainable Agriculture Research*. 2012;1(1):103–117.
- [37] Norris PE, Batie SS. Virginia farmers' soil conservation decisions: An application of Tobit analysis. *Southern Journal of Agricultural Economics*. 1987;52:208–20. *Agricultural Economics*. 1987;52:208–20.
- [38] Kebede Y, Gunjal K, Coffin G. Adoption of new technologies in Ethiopian agriculture: The case of Tegulet-Bulga District, Shoa Province. *Agricultural Economics*. 1990;4: 27–43.
- [39] Polson R, Spencer DSC. The technology adoption process in subsistence agriculture: The case of cassava in South western Nigeria. *Agricultural Systems*.1991;36:65–78.
- [40] CIMMYT (International Maize and Wheat Improvement Centre). *The adoption of agricultural technology: A guide for survey design*. Economics program, CIMMYT, Mexico; 1993.
- [41] Nwankwo UM, Peters KJ, Bokelmann W. Can cooperative membership and participation

- affect adoption decisions? Issues for sustainable biotechnology dissemination. *Ag Bio Forum*. 2009; 12(3-4):437-451.
- [42] Awotide et al., Assessing the extent and determinants of adoption of improved cassava varieties in South- Western Nigeria. *Journal of Development and Agricultural Economics*. 2014;6(9):376-385
- [43] Feleke S, Zegeye T. Adoption of improved maize varieties in Southern Ethiopia: Factors and strategy option. *J. Food Policy*.2006: 31(5): 442-457
- [44] Onumadu FN, Osahon EE. Socio-Economic Determinants of Adoption of Improved Rice Technology by Farmers in Ayamelum Local Government Area of Anambra State, Nigeria. *Int. J. Sci. Technol. Res*. 2014: 3(1):308-314.
- [45] Oladele OI, Wakatsuki T. Socio-economic features, dynamics of farmers associations and adoption of sawah rice production technology in Nigeria and Ghana. *J. Food Agric. Environ*. 2012: 10(2):434- 437.
- [46] Alarima CI, Kolawole A, Fabusoro E, Ajulo AA, Masunaga T, Wakatsuki T (2011). Knowledge and training needs of farmers adopting Sawah rice production technology in Nigeria. *J. Food Agric. Environ*. 9 (3- 4):177-182.
- [47] Asante EG. Benefit-Cost analysis of CRIG recommended technologies in relation to farmer adoption patterns and implication for the cocoa industry in Ghana. A final report submitted to the research committee. Cocoa Research Institute of Ghana (CRIG), Akim Tafo; 1992.
- [48] Bamidele FS, Abayomi OO, Esther OA (2010). Economic analysis of Rice consumption patterns in Nigeria. *J. Agri. Sci. Tech*. 12(2):135-144.
- [49] Goni M, Mohammed S, Baba BA (2007). Analysis of Resource-use Efficiency in Rice Production in the Lake Chad Area of Borno State, Nigeria. *J. Sustain. Dev. Agric*.  
a. *Environ*. 3:31-37
- [50] Langer W. 2000. The Assessment of Fit in the Class of Logistic Regression Models: A Pathway Out of the Jungle of Pseudo-R<sup>2</sup>s. Halle: Institut für Soziologie. 15. Morris ML, Tripp R, Dankyi AA. Adoption and impacts of improved maize production technology: A case study of the Ghana grains development project. Economics Program Paper 99-01. Mexico, D.F.: CIMMYT; 1999. World Bank, 2009. *Awakening Africa's Sleeping Giant: Prospects for Commercial Agriculture in the Guinea Savannah Zone and Beyond*. World Bank, Washington, DC.
- [51] Zhou S D, Herzfeld T, Glauben T, Zhang Y H, Hu B C. 2008. Factors affecting Chinese farmers' decisions to adopt a watersaving technology. *Can J Agr Econol*, 56(1): 51–61. Muzari W, Gatsi W, Muvhunzi S. 2012. The impacts of technology adoption on smallholder agricultural productivity in sub-Saharan Africa: A review. *J Sust Dev*, 5(8): 69.
- [52] Feleke S, Zegeye T. Adoption of improved maize varieties in Southern Ethiopia: Factors and strategy option. *J. Food Policy*.2006: 31(5): 442-457
- [53] Awotide et al., Assessing the extent and determinants of adoption of improved cassava varieties in South- Western Nigeria. *Journal of Development and Agricultural Economics*. 2014;6(9):376-385
- [54] Feleke S, Zegeye T. Adoption of improved maize varieties in Southern Ethiopia: Factors and strategy option. *J. Food Policy*.2006: 31(5): 442-457