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Rice Farmers' Technical Efficiency and Level of Poverty: Evidence from the Anchor Borrower Program (ABP)

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Abstract

To avoids the moribund path of most of the earlier implemented agricultural-based interventions in Nigeria. Anchor Borrowers' program was introduced to contribute meaningfully to the economy. The study investigated on rice farmers' technical efficiency and level of poverty in Nigeria with evidence from the Anchor borrower program. Primary data were analyzed using Descriptive analysis, Gini coefficient, Stochastic production Frontier model, Regression analysis, and Vulnerability Index. Evidence from the result revealed that the average yield per hectare of paddy rice for the beneficiaries (70%) majorly was 4500 kg while non-beneficiaries (52%) was 3500kg. The production function showed that the coefficient of regression for herbicides, seed and fertilizer was positively significant at 5% and %, respectively. The factors that influencing technical inefficiency (farm organization, farm size, farm experience and ABP loan) were found to be negatively significant. The logistic regression model estimate revealed that factors influence loan acquisitions of respondents include: (farm organization, extension agent visit, age of household, and farm size) which were positively statistically significant and this is important in explaining ABP credit acquisition access among households. The results of the Gini coefficient also indicated that income inequality was higher in ABP beneficiaries than non-beneficiaries. Vulnerability index results showed that ABP non-beneficiaries were more vulnerable to poverty than beneficiaries. Additionally, the non-beneficiaries have a poorer population than beneficiaries. However, these results indicate that the Anchor borrower program has a positive impact on beneficiaries' welfare.

Keywords:
ABP; Gini-Coefficient; Rice Farmer; Vulnerability-Index

1. Introduction

In Africa, agriculture is probably the mainstay because it accounts for 40% of export revenue, 33% of natural income, and 70% of all livelihoods, whether directly or indirectly. Many African countries' economy has been transformed and have experienced significant poverty reduction thanks to growth driven by agriculture. Due to its connections to other economic sectors, which support job creation and promote economic development, agriculture has an impact on world trade. (Obazi et al., 2022; Beegle & Christiaensen, 2019; Diao et al., 2017). It has proven to be a viable and effective means by which poverty could be eradicated and enhance economic growth (Edoumiekumo & Audu, 2009). At the end of 2017 in Nigeria, Agriculture contributed 29.15% to overall Gross Domestic Product (GDP) in real terms which was higher than the contributions in the third quarter of 2016 and second quarter of 2017 which stood at 28.68% and 22.93% respectively (World Bank, 2021). However, the sector is still characterized by poor yields, low resource-use efficiency, and limited areas under cultivation etc (Olubunmi-Ajayi et al., 2023). These, coupled with the poor farming systems resulting in lower productivity (Kolawole & Ojo, 2007). Agriculture is divided into two main sectors which are livestock and crop production. Crop production is subdivided into commercialized farming and subsistence farming. The major crops growing in Nigeria include cereal, tuber, legumes, vegetables and fruits and rice is one of cereal crops.

Rice (*Oryza-Sativa*) is one of the leading food crops of the world (Amaza & Maurice, 2005). Rice is the second most important cereal in the world after wheat in terms of production. It is an ancient staple food crop consumed by more than half of the world population with 4.8 billion people in 176 countries. It is the most important food crop for over 2.89 billion people in Asia, over 40 million in Africa and over 150.3 million people in America. (Biyi, 2005). Rice is the most strategic food crop in West Africa considering its contribution to food security, (FAO, 2016).

The Nigerian rice sub-sector witnessed a remarkable increased in output averagely 1.77 million metric tons within the period of 1990 to 2016, (FAO, 2018). This observed increase was ascribed to increment in hectarage cultivated as there was no increase in the yield, within this time period, Adesina (2012) observed a yield fall 315 kg per hectare. This decrease in yield of rice led to supply deficit situation in the country and increase in importation. The Nigerian government in its plight to reduce importation of this product and increase in its local production, came up with strategies under different interventions in which anchor borrowers' programme is one of them.

Anchor Borrowers' Programme (ABP) is Central Bank of Nigeria (CBN) policy initiative with a view to collaborate with anchor companies involved in the production and processing of key agricultural commodities. (Salisu et al., 2022) ABP was launched by President Muhammad Buhari on November 17th, 2015 with the intention of creating a linkage between anchor companies involved in the processing and small holder farmers (SHFs) of the required key agricultural commodities. The policy thrust of the ABP is provision of farm inputs in kind and cash (for farm labour) to small holders' farmers to boost production of rice, stabilize input supply to agro-processor (Anchor). At harvest, the SHF supplies his/her produce to the Agro-processor who pays the cash equivalent to the farmer's account, (Ayinde et al., 2018).

The current ban on rice importation placed by the Federal Government of Nigeria has led to surge in rice prices because local rice production is yet to match the growing domestic demand for rice. Rice farmers in Nigeria are generally poor primarily because the production resources are expensive and inadequately available to support rice production in commercial quantity. In addition, most commercial banks charged two digits' interest rates and emphasized provision of collateral security before the farmers could access agricultural loan. The productivity of rice would always be a success in the presence of perfect credit market system. Due to the unstable credit market, Nigeria experiences falling in rice yield from 1754.40kg per hectare in 2008 to 1275.2 kg per hectare in 2014 (FAO, 2016). The dependencies on rice importation continue to grow to the extent that over 350 billion naira was invested on importation of rice to cover the domestic demand short- falls (IITA, 2011).

Credit has a significant role to play in increasing farm productivity because the cultivation of most agricultural products for example paddy rice involves a high cash outlay for meeting operating costs during the cultivation season (Iqbal et al., 2003).

Therefore, credit appears as a solution to the low rice production, because it enhanced timely purchases and efficient allocation of factors of input to produce the maximum output. (Bolarinwa & Fakoya, 2011).

In an attempt to address the national rice demand-supply gap, Nigeria government initiate a loan intervention program named Anchor Borrowers Program (ABP) financed by Central Bank of Nigeria (CBN). This study looked at the influence of loan on rice production without picking interest on the affordability of loan security by poor farmers. Since ABP has been created, several studies have looked at its impact on the production of rice among farmers (Gona et al., 2020). However, the effect on poverty status of farmers and their technical efficiency have not been fully explored in the literature, particularly in the north-central states of Nigeria. Therefore the objectives of this study include the following: describe the socio-economic characteristics of rice farmers, evaluate the technical efficiency and its determinants of rice production among the beneficiaries of ABP and non- beneficiaries of ABP, determine the factors affecting acquisition of ABP loan among rice farmers, estimate the level of income inequality among rice farmers among the ABP beneficiaries and non-beneficiaries and determine the level of vulnerability to poverty of respondents.

2. Materials and Methods

2.1 Area of study

Niger State as the case study is chosen base on her ecological advantage of rice farming system (rain-fed upland and rain-fed lowland and irrigation) and natural water availability and as one of the leading rice producing states in Nigeria. Niger State which located in the Guinea savanna vegetative belt of Nigeria. It lies between latitude 5.3904^0 east and longitude 10.2155^0 north. The state capital is Minna and there are twenty-five local government areas which are divided into three Agricultural Development Project (ADP) zones. Niger State which is located in the Guinea Savanna belt of Nigeria with a population of 5,556, 200 (World bank, 2021). The state experiences distinct dry and wet seasons with annual rainfall varying from 1,100mm in the northern part of the State to 1,600 mm in the southern parts with a duration of 7 to 8 and 5 to 6 months in the south and northern zones respectively and temperature range of 26ºC to 36ºC. Generally, the climate, soil and hydrology of the State permit the cultivation of most of Nigeria's staple crops and still allows sufficient opportunities for grazing, fresh water fishing and forestry development. The Agricultural Performance Survey (APS) for 2017 has rated Niger State as the leading producer of paddy rice in the country. Niger state is not only divided into three agricultural zones under climatic features containing nearly all classes of soils of the savannah regions of West Africa (Ayinde, 2013). But the soil types range from the shallow soils around the rocky landscapes to deep soils of the valleys. The deeper soils, representing the alluvial type even though complex in appearance has exceptional potential for rain fed and irrigated farming. One of the major ecological problems hindering the rice sub-sector in the state is flooding during the rainy season, drought and bush burning during the dry season. Niger state rice yield estimate is about 2.3 metric ton per hectare although varies largely between farmers. With such a favorable climate, the major crops grown in the state consists of rice, sorghum, maize, millet, groundnuts, cowpeas, soybeans, cotton, yam, cassava, vegetables and others

2.2 Method of Data Collection

The set of data for this study were cross sectional data from primary sources with the aid of a structured questionnaire.

2.3 Sampling Technique

One out of three (3) Agricultural zones which is Bida zone was purposively selected being the most prominent rice producing area in the state. Three local government areas out of seven LGAs in the zone were randomly selected. The systematic random selection of one-fifth of the rice producing communities from each of the selected LGAs (four communities per LGA) based on the list of registered rice farmers was adopted and the final stage involved a random selection of twenty of ABP beneficiaries and non-beneficiaries from each selected community. However, 200 respondents were able to be received out of 240 questionnaires shared in the state due to missing data.

2.4 Data Analysis

The study employed both descriptive (mean, median, frequent and percentage) and inferential statistics in analyzing the data.

2.5 The Logistic Regression Model

The binomial logistic regression model was used given that the dependent variable is dichotomous: 0 when farmers do not have access to credit and 1 farmer have access to credit. Predictor variables are a set of socioeconomic and demographic status indicators and dwelling endowment of the farmers. This regression model has a binary response variable and it's a linear regression tool. According to Agresti (1996), it is the appropriate tool to use, when one wants to predicts the presence or absence of a dichotomous characteristics, or outcome based on, values of a set of predictor variables. It's a linear regression but useful when the dependent variable is dichotomous (Borooah, 2002). The coefficients from the regression can be used to appraise odds ratio, for each of the independent variables, in the model. Adopting Olawuyi & Raufu (2012), the model is specified as:

$$\text{Prob}\ (Y_i = 1) = \frac{\exp(X'i\ \beta)}{1+\exp(X'i\beta)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

The dependent variable is a dichotomous variable depicting the farmer's status and took the value of (one) 1 if the farmer has access to credit and (zero) 0 if otherwise. The independent variables are the socioeconomics characteristics.

The explicit logit model is expressed as:

$$\ln[p/(1\text{-}p)] = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + \text{u}\ \ (logistic)$$

The hypothesized independent variables are:

Y_i = Respondents' decision to credit acquisition of the schemes (1 = access credit, 0 = Otherwise)

i = 1,…,9

The variables included in the model are:

X_1 = Market accessibility (yes=1, 0 = Otherwise)

X_2 = Income (naira)

X_3 = Educational level (years)

X_4 = Gender (1 = male, and 0 = female)

X_5 = Farm size (ha)

X_6= Farm experience (years)

X_7 = Dependency ratio (number of dependants)
X_8= Farm org (Yes=1, 0 = Otherwise)
X_9 = Extension access (number of visit).
U = error term
β_1- β_9 = The coefficients for the respective variables in the logit function

2.6 The Stochastic Frontier Production Function

To estimate the technical efficiency of rice farmers, in the study area, the Cobb Douglas functional form of stochastic production frontier was employed. The stochastic production frontier model has the advantage of allowing instantaneous estimation of individual technical efficiency, of the farmer as well as the determinant of technical efficiency (Battese & Coelli, 2004).

It is expressed as:

$Yi = f(X_i \beta) + (vi-ui)$ ……………………..… (2)

Where: Yi is the output of the i^{th} farm
X_i is a K x 1 vector of physical input quantities of the i^{th} farm
β is a vector of unknown parameters estimated
v_i are random variables which are assumed to be normally distributed N (0, σv2). and independent of the farmer.
u_i are non- negative random variables, called technical inefficiency effects
The explicit form of the model in linearized form is expressed as

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + v_i - u_i$ ……………..…(3)

Where: Y = Rice output (kg)
X_1= Farm size(ha)
X_2 = Rice seed (kg)
X_3 = Fertilizer (kg)
X_4 = Herbicides (litres)
X_5 = Labour (man-day)
$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$,= Parameters to be estimated. This is used to explain the elasticity of the Y variable with respect to the X variable. In other words, the coefficients are the estimated percent change in the dependent variable for a percent change in the independent variable.

The inefficiency model is represented by U_i which is defined as follows:

$u_i = d_0 + d_1z_1 + d_2z_2 + d_3z_3 + d_4z_4 + d_5z_5$ …………………………..(4)

u_i = Technical inefficiency
Z_I = Level of education (years)
Z_2 = Household size (adult equivalent)
Z_3 = Age (years)
Z_4 = Extension contact (number of visits)
Z_5 = ABP Loan (₦)
Z_6 = Credit accessibility (Yes=1, 0= Otherwise)
$d_0, d_1, d_2 \ldots d_6$ = Parameters to be estimated

Since the dependent variable of the inefficiency model represents the mode of inefficiency, a positive sign of the estimated parameter implies, that the associated variable, has a negative effect on efficiency, but, positive effect on inefficiency and vice versa (Rahji, 2005).

The p-values for this study are statistically significant and at a significance level (typically 0.01, 0.05, and 0.1).

2.7 Gini- coefficient model

Gini coefficient used was for the estimation and comparism of the degree of income inequality between ABP Beneficiaries and Non-Beneficiaries. By calculation, the Gini-coefficient is computed as follows:

$G_y = \frac{2}{n2\mu} \frac{\sum n+1}{2} Yi$ …………………………………(5)

Where: n = number of observations, μ = mean of the distribution, Yi = income of the ith household, G_y = Gini income.

The Gini-coefficient is a measure of statistical dispersion most prominently used as a measure to show the degree of income distribution or inequality of wealth distribution between different households in a population.

Gini-coefficient is defined as a ratio with values between zero and one (0-1). A low Gini-coefficient indicates more equal income or wealth distribution, while a high Gini-coefficient indicates more unequal distribution. Zero (0) corresponds to perfect equality while one (1) corresponds to perfect inequality.

The Gini-coefficient is a precise way of measuring the position of the Lorenz curve. It is determined by measuring the ratio of the area between the Lorenz curve and the 45-degree line to the whole area below the 45-degree line. If the Lorenz curve is at 45-degree line, then the value of the Gini-coefficient will be zero. In general, the closer the Lorenz curve is to the line of perfect equality, the less the inequality and the smaller the Gini-coefficient. Below is the graphical representation of the Gini coefficient.

2.8 Vulnerability index

Vulnerability in this context is defined as expected poverty, or as the probability that a household's consumption will lie below the predetermined poverty line.

The vulnerability is defined as the probability of its consumption being below the poverty line in the future.

$V_h = pr(lnc_h < lnz)$ ……………………(6)

Where V_h is the vulnerability of household h, c denotes per capital consumption of household h and z stand for poverty line of household consumption. The probability that a household will find itself poor depends not only on its expected (mean) consumption but also on the volatility of its consumption stream. Therefore, both estimates (household expected consumption and the variance of its consumption) are required to quantify the level of household's vulnerability to poverty. Assuming that for household h the data generation process for consumption was captured by the following equation.

$lnC_h = X_h\beta + \varepsilon_h$ ……………………..(7)

where Ch stand for per capita consumption for household h, Xh represents a vector of observable household characteristics such as household size, gender of household head, educational attainment of the head of household, etc, β is a vector of parameters, and εh is mean –zero disturbance term that captures household's idiosyncratic factors contributing to differential level of per capita consumption for households that share the same characteristics. The vulnerability to poverty of household h with characteristics Xh can now be calculated by:

$Vh = pr(lnCh<lnz| Xh) – \Phi[\frac{lnc - xh\beta}{\sigma}]$ ……………………(8)

Where Vh denotes predicted vulnerability to poverty, that is the probability that the capital consumption level (Ch) will lower than the poverty line (z) conditional on household characteristics Xh, xhβ, household's expected log consumption calculated from equation (2). Meanwhile, Φ (.) denotes the cumulative density of the standard normal distribution and σ is the standard error of error term in (2).

To investigate the determinants of vulnerability to poverty, the measure of y and vulnerability to poverty is, regressed on the set of household characteristics. The model of vulnerability to poverty is:

$V_h = X_h \gamma + \varepsilon_h$ ……………………………………………..(9)

Where V_h is vulnerability to poverty, γ is a Kx1 vector of unknown parameters, X_h is 1xK vector of explanatory variables, and ε_h are models' residuals.

3. Results and Discussion

3.1 Socio-economic and Demographic Characteristics of Farming Households

Descriptive statistics were used to assess information on the socioeconomic profile of rice farmers, and the results are shown in Table 1. The findings showed that married men predominately produce rice in the study area. Males are the family heads and hence in control of the main agricultural production activities, while women are mostly involved in processing and selling, as seen by the male dominance in rice production. The majority of respondents (57%) were relatively in middle aged group (41-50) year which reveals that they were still in their active productive age. Most of beneficiaries (52%) have household size greater than 10, while non-beneficiaries with households' size more than 10 were 39%. The amount of family labour available is usually closely related to the household size of the farming household. In the traditional agricultural production, the average farmer first exhausts all sources of labour in his family before hiring labour in order to reduce the cost of production (Muhammad-Lawal *et al.*, 2009). Most of the rice farmers (45%) have farming experience between 16 – 25 years. This indicates that farming is an age-long venture to both groups of farmers.

Membership of an agricultural organization has the tendency of enhancing the skills of farming households and improving food security (Olagunju & Adeyemo 2000). About 87% of the sampled farmers are members of farm organization with all (100%) the beneficiaries and about (30%) non- beneficiaries were belonging to farm organization. This is because farm organization is an important criterion for rice farmers to be eligible and to access the loan intervention.

Also in Table 1, most of beneficiaries (53%) have an average of 3-5 hectare of farmland and non-beneficiaries (43%) have the same farmland and the mean is 3 hectares. This revealed that rice farmers were still operating on small scale in the study area. This result is supporting the conventional wisdom that, between 0.1 - 5 ha fall into category of small-scale farmers which was in line with the findings of Amao et al., (2017). According to Fakayode et al., (2009) and Fadilah et al., (2023) that the size-distribution of these holdings were evidenced in literature as small – scale farms which ranges from 0.10 - 4.99 hectares, medium scale, ranging from 5.0 – 9.99 hectares and large scale ranging from 10 hectares and upward. The income distribution among rice farmers in the study area showed that 37% of non-beneficiaries had less than ₦300000 per season, and none of the beneficiaries had such. 39.82% of beneficiaries had between ₦400001 - ₦500000 per season level of income, while 11.63% of non- beneficiaries fall into this category. 17.7% and 1.16% of beneficiaries and non-beneficiaries respectively had above ₦600000 per season, this indicates that beneficiaries had more income than non – beneficiaries, the mean income is #462241 per season. This implies that rice production was lucrative agribusiness in the study area. The finding supported the work of Akinbile et al., (2023) who revealed that government intervention had positive impact increase their income and general well- being on the activities of the farmers.

The output per season of beneficiaries' farmers (79%) was majorly between 4000-5000 (kg) while that of non-beneficiaries' farmers (52%) was majorly between 3000-4000 (kg). This implies that beneficiaries got more output per season than non-beneficiaries. This also agreed with support the findings of Gona (2020) who revealed that government intervention has positive impact on the beneficiaries.

3.2 Determinants of the Technical Efficiency of Rice Farmers in the Study Area

Table 2, explains the result of the production function of the farmers. The results show that the coefficient of herbicides, seed and fertilizer were positively significant. The regression coefficient of herbicide application which was positively significant at 5%, explains that the rate of change in herbicide usage on rice production or yield per unit hectare is less than unity. Out of this estimate, it can be concluded that one unit increase in herbicide application result in 0.075 increases in output of rice. This supports the notion that the use of herbicide helps to control weed that compete favorably with crop plant for water, soil nutrient and air. The regression coefficient of seed was also positively and significantly correlated at 1%, which implies that an increase in improved seeds will lead to 0.093 increases in rice productivity. In the case of fertilizer usage, the regression coefficient of fertilizer is positively significant at 1%. This explains that the magnitude of fertilizer to improve rice production is also less than unity. This implies that one-unit increase in fertilizer application would end up in having 0.152 increases in yield of rice. The supported the reports of Rahji (2005), Ayinde et al., (2009) and Tolulope et al., (2023).

Table 1. Socio-economic Characteristics of Respondents

Variables	Beneficiaries N=113		Non- beneficiaries N=87		Pooled N=200	
	Freq	Percentage	Freq	Percentage	Freq	Percentage
Gender						
Male	73	64.60	72	83.72	145	72.86
Female	40	35.40	15	17.24	55	27.14
Total	113	100.00	87	100.00	200	100.00
Age						
>30	2	1.77	3	3.45	5	2.50
31-40	25	22.12	29	33.33	54	27.00
41-50	69	61.06	45	51.72	114	57.00
51-60	16	14.16	10	11.49	26	13.00
<60	1	0.88	-	-	1	0.50
Mean	45					
Household Size						
< 5	6	5.31	5	5.74	11	5.50
6-15	41	36.28	21	24.14	62	31.00
16-25	47	41.59	43	49.43	90	45.00
26-35	16	14.16	18	20.69	34	17.00
>35	3	2.65	2	2.00	5	2.50
Mean	20					
Farm Organization						
Member	113	100	61	70.11	174	87.00
Non-member	-	-	26	29.89	26	13.00
Income (₦)						
< 300000	-	-	32	36.78	32	16.00
300000-400000	9	7.69	38	43.68	47	23.50
400001-500000	45	39.82	11	12.64	56	28.00
500001-600000	39	34.5	6	6.90	45	22.50
Above 600000	20	17.70	-	-	21	10.50
Mean	462241					
Farm Size(ha)						
> 2	2	1.77	9	10.34	11	5.50
2.1-3.0	31	27.43	29	33.33	60	30.00
3.1-5.0	60	53.10	37	42.53	97	48.50
Above 5	20	17.70	12	13.79	32	16.00
Mean	3					
Output (kg)						
>2000	-	-	8	9.20	8	4.00
2000-3000	8	7.08	26	29.89	34	17.00
3001-4000	14	12.39	45	51.72	59	29.5
4001-5000	79	69.91	5	5.75	84	42.00
Above 5000	10	8.85	3	3.45	13	6.50
Mean	3986.94					

Source: Field Survey 2021

Table 2. Estimates of the Production Function

Output	Coefficient	z	P>|z|
Herbicides	0.075**	2.37	0.018
Seeds	0.093***	2.83	0.005
Labour	-0.033	-1.06	0.288
Fertilizer	0.152***	4.15	0.000
Inefficiency Model			
Farming Organisation	-1.722***	-3.71	0.000
Gender	0.091	0.15	0.878
Farm size	-0.781***	-2.83	0.005
Age of Household Head	-0.044	-0.83	0.406
Farm experience	-1.640***	-4.04	0.000
Extension	-0.003	-0.20	0.842
ABP Loan	-2.392**	-1.94	0.053
Constant	0.344***	8.77	0.000

Source: Data Analysis, 2021

The inefficiency model, presented in Table 2, revealed that the socio-economic characteristics (farm organization, farm size, farm experience and ABP loan) remained the major variables that negatively explain the technical inefficiency of the rice farmer. The regression coefficient of farm organization was negatively significant at 1%, indicating that rice farmers that are non-member of any farm organization are technically inefficient. This inclined with apriori expectation that farm organization has supportive effect to increase technical efficiency. The coefficient of farm size was negatively significant at 1%, the implication is that farmers with lesser farmland were technical inefficient to the farmers that has more productive land. Alene et al., (2005) in their study also obtained a negative result with the same kind of specification. This also negated the apriori expectation and theoretical submission that says inverse relationship paradox, smallholder farmers are more efficient in managing farmland than large holder farmers. The regression coefficient of farm experience is negatively significant at 1% to explain technical inefficiency. Out of this estimate, it can be inferred that farmer with less farm experience are technically inefficient than farmers with more farming experience. The coefficient of ABP loan was also negatively significant at 5%, indicating that beneficiaries' farmers were less technically inefficient to non- beneficiaries' farmers and corroborates the finding of Gona (2020).

3.3 Determinants of ABP Loan Acquisition

The result on Table 3 show the determinant of household's decision to acquire ABP loan. The logistic regression model was employed to access the determinants of loan acquisition among the respondents in the study area. The result of the logistic regression model estimate revealed that factors influence loan acquisitions of respondents include farm organization, extension visit, farm size and age of household head.

Farm organization was significant at ($p<0.01$) and has a positive influence on credit acquisition by households. This was also in accordance with a priory expectation. This could be expected because the important criteria for any farmer to be eligible for credit acquisition of ABP's scheme are group membership. The group will be recognized as collateral as well as guarantor for accessing credit. The result of the study, therefore, revealed that households belonging to a farm organization will have greater opportunity of securing loan from ABP's intervention, which supported the findings of Salisu et al., (2022). Also, the coefficient 3.37 implies that a one unit change in farm group membership results in a 3.37 unit change in the log of the odds.

Extension Agent Visitation has positive influence on credit acquisition of ABPs scheme by farming households. This is due to the fact that extension agents were the only personnel that had very close contact with rural farmers and obtain useful information relating to their farming practices. The variable has the expected sign and is significant at 5% probability level. This indicates that the higher the visitation rate of household by extension agent, the more they receive vital information and the greater the probability of households being directed to the route to secure loan with minimal risk that ABP's scheme connote. This result is consistent with Adefalu et al (2014) who revealed positive and significant relationship between extension agent visitation by households' head and credit acquisition scheme. Also, the coefficient 0.07 implies that a one unit change in extension agent visitation results in a 0.07 unit change in the log of the odds.

Age of Household was significant at ($p<0.05$) and had positive influence on credit acquisition of ABP's scheme by farming households. This is due to the fact that, the rate of change of the households' age to the choice of farmers to take loan or not is less than unity, it is therefore, inferred that one unity increase in households' age would lead to 0.9044 increase in loan acquisition decision of rice farmers. This also supported the finding of Odu et al., (2009). Also, the coefficient 0.09 implies that a one-unit change in age of household results in a 0.09 unit change in the log of the odds. The coefficient of farm size is positively significant at 10%. This indicates that respondents have the tendency of getting ABP credit from the size of their successful rice farming, and corroborates the finding of Olagunju & Adeyemo (2000). Also, the coefficient 0.06 implies that a one-unit change in farm size results in a 0.06-unit change in the log of the odds.

3.4 Level of Income Distributions of Respondents in the Study Area

The result in Table 4, the Gini Coefficient for overall income of household heads was computed as 0.19. This shows a low level of inequality in income distribution, which suggests that homogenous population, dominates the farm households. The result of the generalized Entropy measures as in Table 6 shows that when higher weight is given to distances between income distributions, it takes value of 0.019 and 0.464 with weight of 2 for both beneficiaries and non-beneficiaries respectively. These values were in line with the results of Gini - Coefficient of homogeneity in the farm households. The Table also revealed the Theils T value of 29% for the beneficiaries and 36% for the non-beneficiaries; indicated that 29% and 36% of the total inequality was contributed by the overall income of the respondents respectively, while Theils L which measure the mean log deviation showed that 32.7% and 41.1% of total inequality was contributed by the total income of the respondents respectively. This also supported the finding of Amao et al., (2017).

In general, from the above result, ABP beneficiaries have more equal income than non-beneficiaries, but the non-beneficiaries that also have income equality due to other sources of income, despite the fact that they are not benefitted (got assistance from cooperative, family and friends).

The Gini coefficient can be used to compare income distributions across different population sectors as well as countries, for example the Gini coefficient for ABP beneficiaries is differs from that of non-beneficiaries (though their Gini coefficients are nearly identical) (Ogunniyi et al., 2018).

3.5 Lorenz curve

The results presented in Figure 1, showed the Lorenz curves which graphically depict the nature income distribution that was quantitatively analyzed using gini coefficient. As shown on the graph, the cumulative income in naira was plotted on the y axis while the cumulative proportion of the total number of respondents was plotted on the x axis. A perfectly equalized degree of distribution is depicted by the straight diagonal line y=x called the line of perfect equality or the 45^0 line. The degrees of income inequalities among ABP rice farmers are shown by the curves which form an arc with the 45^0 lines (line of equality). The extent of deviation of these curves from the line reveals the level and nature of income inequality among the respondents in the study area. The value of gini coefficient (0.11) showed that there exists low level of income inequality among the respondents in the study area.

Table 3. Determinants of ABP Loan acquisition

Variables	Coefficient	Std. Err	P value
Constant(X0)	-7.89***	-5.20	0.00
Market Access (X1)	0.07	0.17	0.86
Age of household head (X2)	0.09**	2.64	0.01
Farm experience (X3)	-0.02	-0.65	0.52
Farm size (X4)	0.06*	1.78	0.08
Gender (X5)	0.53	1.18	0.24
Extension agents visit (X6)	0.07**	2.67	0.01
Farm organization (Membership)	3.37***	6.27	0.00

***significance at 1%, **significant at 5%, * significant at 10%,

Table 4. Inequality Measures

Variables	Beneficiaries		Non-Beneficiaries		Pooled	
	Values	Percent	Values	Percent	Values	Percent
Gini (Total Income)	0.11	11.00	0.23	23.00	0.19	19.00
Generalized Entropy (α=0)	0.02	2.00	0.14	14.00	0.07	7.00
(α = 1)	0.02	2.00	0.19	19.00	0.09	9.00
(α = 2)	0.02	2.00	0.46	46.00	0.15	15.00
GE Theils T	0.29	29.00	0.36	36.00	0.26	26.00
GE Theils L	0.33	33.00	0.41	41.00	0.31	31.00

Source: Field Survey, 2021

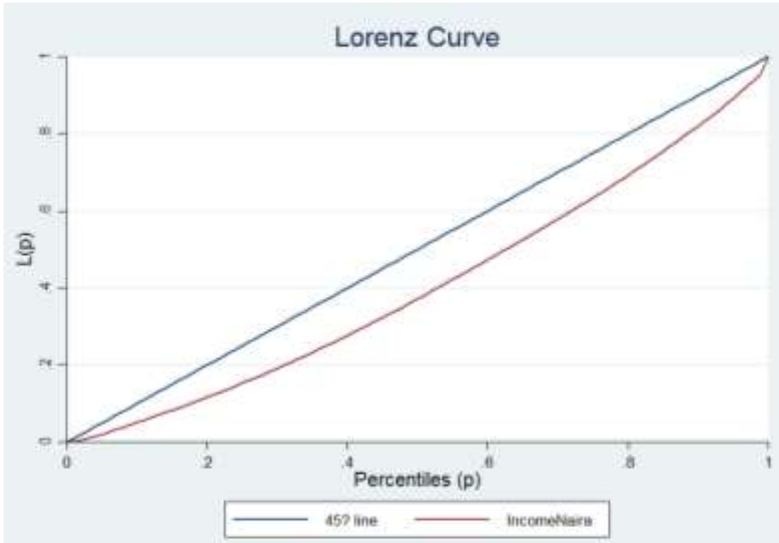

Figure 1. Lorenz Curve

3.6 Level of vulnerability to poverty

The result presented on Table 5 showed that 3 beneficiaries were poor and non-vulnerable to poverty, 29 were non-poor and at the same time non-vulnerable. 12 of the beneficiaries were poor and they are vulnerable to poverty while 69 of the respondents were non-poor and at the same time vulnerable to poverty. Additionally, 3 of the non-beneficiaries were poor and non-vulnerable to poverty, and only 8 were non-poor and at the same time non-vulnerable. 33 of the non-beneficiaries were poor and were vulnerable to poverty while 50 of the respondents were non-poor and at the same time vulnerable to poverty. The result showed a significant number of the respondents who are vulnerable to poverty irrespective of the present poverty status; non-beneficiaries were found to be more vulnerable than beneficiaries. So also, the non-beneficiaries have more poor population than beneficiaries. However, these results indicate that Anchor borrower program has positive impact on beneficiaries' welfare. This finding supported the work of Indranil & Foster (2010).

Table 6 and figure 1 also showed the vulnerability index and graphical presentation of respondents, (less than 0.5 is low vulnerable to poverty, 0.5-1.0 is moderately vulnerable to poverty and above 1 is highly vulnerable to poverty), it revealed that non-beneficiaries were highly vulnerable to poverty.

Table 5. Vulnerability to poverty Status of the respondents

Vulnerability	Poverty status					
	Beneficiaries			Non-beneficiaries		
	Poor	Non-poor	Total	Poor	Non-poor	Total
Non-vulnerable	3	29	32	3	8	11
Vulnerable	12	69	81	33	42	75
Total	15	98	113	36	50	86

Source: Field Survey, 2021

Table 6. Level of Vulnerability to poverty of the respondents

Vulnerability index	Beneficiaries		Non-Beneficiaries		Pooled	
	Freq	Percentage	Freq	Percentage	Freq	Percentage
<=0.50	98	86.73	8	9.20	106	53.00
0.51-1.0	7	6.19	20	22.98	27	13.50
Above 1.0	8	7.08	59	67.82	67	33.50
Total	113	100.00	87	100.00	200	100

Source: Field Survey, 2021

4. Conclusion and Recommendation

ABP credit acquisition has lower interest rate for disbursement of loan to the beneficiaries. Income, and extension agent visitation, farm age of household, farm group membership and farm experience of the household were the important factors determining the social credit acquisition. This study has also revealed that the scheme had some positive impact on the activities of the beneficiary farmers. Conclusively the programme improved paddy rice yield and also increased farmers' income and reduce the beneficiaries vulnerable to poverty. However, it also has its shortcomings such as late delay in approval/disbursement of funds.

By recommendation, implementers of ABP should develop strategies that will encourage much participation in the scheme. Such strategies should include a legal framework that will address the challenges being faced by the beneficiaries.

This study contributed to knowledge in the sense that it provides a more comprehensive source of information, as well as an input into the formulation of economic policies aimed at making farm input more accessible and inexpensive to farmers as a method of increasing productivity and ensuring food security in Nigeria.

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