Journal of Agriculture and Agricultural Technology
(JAAT)
Journal of Agriculture and Agricultural Technology 12(1), 2023

Original Research Paper

RESOURCE PRODUCTIVITY OF RICE FARMERS UNDER THE AGRICULTURAL TRANSFORMATION AGENDA (ATA) PROGRAMME IN NIGER STATE, NIGERIA

***Anyanwu, I. B., Ojo, M. A., Nmadu, J. N and Adebayo, C. O.**

Department of Agricultural Economics and Farm Management, Federal University of Technology, P.M.B. 65, Minna, Nigeria.

*Corresponding author: iyke.anyanwu12@gmail.com

ABSTRACT

The study evaluated the resource productivity of rice farmers under the Agricultural Transformation Agenda (ATA) programme in Niger State, Nigeria. Primary data were used for the study and collected from three Local Governments Areas of the State from a total of 194 rice farmers consisting of both beneficiary and non-beneficiary farmers of the ATA programme. Data collected were analyzed using Total Factor Productivity (TFP) and Propensity Score Matching (PSM) methods. The results of the PSM technique to determine the impact of the programme on the productivity of the rice farmers shows that from all matching procedures, the programme had a positive and significant effect on total productivity, fertilizer productivity, seed productivity, land productivity, labour productivity, agrochemical productivity of the farmers and these variables were higher for the beneficiary farmers than that of the non-beneficiaries by at least 0.81 %, 3.9 %, 11.03 %, 4.96 %, 1.22 %, 4.79 % respectively. The study recommends that since the programme showed significant increases in the productivity of the beneficiaries when compared with the non-beneficiaries, government policies, investments, and efforts aimed at the sustainability of the programme should be encouraged and made to be able to stimulate further increases in the growth and productivity of farmers, particularly in rice subsector.

Keywords: Agricultural productivity, Total Factor Productivity, Propensity Score Matching, Agricultural Transformation Agenda.

INTRODUCTION

The agricultural sector has been one of the effervescent sectors driving Nigeria's economy and contributing to the overall growth of developing economies. According to Nepal Rastra Bank (2014), in many developing nations, about three-fourths of the population depends on the agricultural sector as their source of livelihood while also contributing significantly to their economies. In Nigeria, the sector accounted for about 30 % of the Gross Domestic Product of Nigeria in third quarter of 2021 and 34.66 % of total employment in 2020 (National Bureau of Statistics, NBS 2021 in Federal Ministry of Agriculture and Rural Development, FMARD 2022); over 70 % of non-oil exports and provides over 80 % of the food needs of the country (NBS, 2013; Muhammad-Lawal and Omotesho, 2008; Kolawole and Ojo, 2007). However, despite this importance, agricultural production and food supply in Nigeria is still lagging, as a result of low utilization of modern inputs by farmers, unavailability and inaccessibility of farmlands well as the non-mechanized nature of the prevailing agricultural production system (Olawuyi *et al.,* 2010). The potentials that abound in Nigeria's agriculture have remained largely untapped which has led to dwindling performance of the agricultural sector both domestically and in international trade over the years. These challenges thus necessitated the need to initiate a sustainable programme that will drive improved productivity in agriculture and return Nigeria's agriculture to its dominant status in food production and major commodity export. The FMARD (2011) noted that as part of the Federal Government of Nigeria's effort to revamp the agricultural sector, ensure food security, diversify the economy, and enhance foreign exchange earnings, the FMARD embarked on a Transformation Agenda with a focus on the development of agricultural value chains, including the provision of and availability of improved inputs (seeds and fertilizer), increased productivity, as well the establishment of staple crops processing zones. It was designed to achieve a hunger-free Nigeria, through an agricultural sector that drives income growth, accelerates the achievement of food and nutrition security, generates employment, and transform Nigeria into a leading player in the global food market to grow wealth for millions of farmers.

Rice (*Oryza sativa*) is targeted as one of the major or key crops of focus under the ATA programme. Nigeria spends about ₦356b on rice importation annually making it the second largest importer of rice in the world (AfDB, 2013). The rice transformation sub-component aims to transform Nigeria from a nation that depends greatly on imported parboiled rice to a nation more dependent on locally produced parboiled rice. Nigeria's growing demand for rice can be attributed to the effect of shifts in consumer preferences driven by urbanization and changes in employment patterns. Nigeria consumes nearly 6 million metric tons of rice annually and more than half of it is imported parboiled rice (FAOSTAT, 2013) while the local production according to Daramola (2005) is put at 2.0 million MT. Rice consumption in Nigeria is forecast to reach 36 million tons by 2050 (FMARD, 2012). Hence, rice is an economically important food security crop in Nigeria. This therefore means that if Nigeria is to be food-secure, adequate attention should be given to rice production and the rice subsector.

This study, therefore, investigated the extent to which the ATA has been able to increase rice production in Nigeria to ensure that local production can meet this huge demand of the population. Despite the prospects, hopes, and promises of the ATA, there has not been adequate research at evaluating its achievements in improving the productivity of the farmers and increasing local rice production, especially in Niger State, Nigeria. This therefore makes it imperative to evaluate the impact of the ATA programme on rice production in the State especially as it relates to the farm-level resource productivity of the rice farmers.

METHODOLOGY

Area of Study

This study was conducted in Niger State, Nigeria. The State is located in the North-Central zone and Southern Guinea Savannah agro-ecological zone of Nigeria. The state is bordered on the North-East by Kaduna State and on the South-East by the Federal Capital Territory (FCT), Abuja. It is also bordered on the North, West, South-West, and South by Zamfara, Kebbi, Kogi and Kwara States respectively. It also shares a foreign border with the Republic of Benin in the Northwest. The State covers an estimated land mass of about 76,363 square kilometres, constituting about 10% of Nigeria's total land mass, of which 85 % is arable land. The population of the State as of the 2006 census is put at 3,954,772 persons consisting of 2,032,998 males and 1,917,778 females (National Population Commission, 2009) and this population is projected to reach an estimated 5,853,062 persons by 2022 at a 3 % growth rate. An estimated 85 % of the population are farmers

which makes farming the major occupation of the people. The state has three principal ethnic groups – the Nupe, the Gwari, and the Hausa people with several other minority ethnic groups. Generally, the fertile soils and hydrology of the State permit the cultivation of most of Nigeria's staple crops and still allow sufficient opportunities for grazing, freshwater fishing, and forest development.

Data Collection and Sampling Procedure

Primary data was used for the study and were collected using a structured questionnaire with the aid of well-trained enumerators. The study involved data collection from both beneficiary and non-beneficiary rice farmers of the ATA programme. A multistage sampling technique was used to select respondents for the study. The first stage involved the random selection of one LGA from each of the three agricultural zones in the State. The LGAs randomly selected were Gbako in Zone A, Bosso in Zone B, and Wushishi in Zone C. The second stage involved the random selection of 10% of the rice-producing communities/villages in each of the local governments selected where the ATA programme was implemented. In the final stage, a proportionate-to-size sampling technique was used to select the sample size (respondents), who are registered rice farmers that participated in the ATA programme in each of the villages. Using the proportionate-to-size sampling technique, a total of 97 rice farmers that benefited from the ATA programme were randomly selected from the farming communities in the LGAs and interviewed.

Similarly, another 97 non-beneficiary rice farmers from these areas were randomly sampled proportionately from the neighbouring communities to serve as a control. This is to avoid location bias and the spillover effect of the programme if the control were to be selected from the same communities as the beneficiaries. This brought the total number of respondents to 194.

Analytical Techniques

Total Factor Productivity and Propensity Score Matching technique were used to determine the impact of the ATA programme on the productivity of the rice farmers.

Total Factor Productivity

The Total and Partial Factor productivity was used to determine the productivity of the rice farmers in the study area. O'Donnell (2008), Sabasi and Kompaniyets (2015) showed that Total Factor Productivity (TFP) for a farmer *i* in period *t* can be expressed mathematically as in Eqn 1

:

$$TFP_{it} = \frac{Y_{it}}{X_{it}} \quad (1)$$

Where $Y_{it} \equiv Y$ ($\mathbf{y}_{it}$) is aggregate output, $\mathbf{y}_{it} \in i_+^M$ is a vector of output quantities, $X_{it} \equiv X$ ($\boldsymbol{x}_{it}$) is aggregate input, and $\boldsymbol{x}_{it} \in i_+^N$ is a vector of input quantities.

Ojo *et al.* (2018) and Emenyonu, *et al.* (2014) in the like manner expressed Total Factor Productivity as in Eqn 2:

$$\text{Total Factor Productivity (TFP)} = \frac{\text{VOP}}{\text{VIE}} \quad (2)$$

Where, TFP = Total Factor Productivity

VOP = Value of Output Produced (₦)

VIE = Value of Inputs Employed (₦).

The effect of ATA on the productivity of the farmers was determined using the following regression model as expressed in Eqn 3:

$$Y = f(X1, X2, X3, X4, X5, X6, X7, X8 + ei) \quad (3)$$

Where: Y = Total factor productivity index, X1 = Farm Size (Ha), X2 = Labour used (man-days), X3 = Fertilizer applied in (Kg), X4 = Seed used in (Kg), X5 = Agrochemical applied in (liters), X6 = NIRSAL Credit/Loan collected in (₦), X7 = Farmer registration in National farmer's Database (1 if registered, 0 if otherwise), X8 = ATA participation (1 if participated, 0 if otherwise).

Propensity Score Matching (PSM)

The Propensity Score Matching (PSM) technique was used to determine the impact of the ATA programme on the productivity of the rice farmers in the study area. In evaluating the impact of a project/programme, it is necessary to determine the difference between what occurred and what would have occurred if the agent had the opposite treatment participation. If a project's outcome indicator is household income, for instance, the average impact of the programme on the beneficiaries is referred to as the Average effect of the Treatment on the Treated (ATT) and is defined as the difference between the expected income earned by programme beneficiaries while participating in the programme and the expected income they would have received if they had not

participated in the programme/project (Nkonya *et. al*., 2007; Gebrehiwot and Van der Veen, 2015). The ATT is expressed in Eqn 4 as:

$$ATT = E(Y_1|p = 1) - E(Y_0|p = 1) \quad (4)$$

Where,

ATT = Average impact of Treatment on Treated;

p = participation in the programme (p = 1 if participated in the ATA project and p = 0 if did not participate in the programme);

Y_1 = outcome (household income) of the project beneficiary after participation in the programme;

Y_0 = outcome (household income) of the same beneficiary if he/she did not participate in the programme.

In implementing the PSM, an empirical model was specified to derive the propensity score. For the ATA programme, we estimated the propensity score for participation in the programme with a probit model using the observable variables that included both determinants of participation in the programme and factors that affected the outcome following Nkonya *et. al*. (2007); Wu *et. al.* (2010); and Gabrehiwot and Van der Veen (2015). The model is specified as in Eqns 5, 6 and 7:

$$y_i = \begin{cases} y_i^* \; if \; y_i^* > 0 \\ 0 \; if \; y_i^* \leq 0 \end{cases} \quad (5)$$

$$y_i^* = \beta_0 + X\beta_1 + \mu_i \;, \; \mu/x \sim N(0, \delta^2) \quad (6)$$

$$y_i^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots. + \beta_{13} X_{13} + \mu_i \quad (7)$$

where, yi* = dependent variable (Propensity scoring index), β = vector of unknown coefficients, X1 = Gender of the respondent (1 if male, 0 if otherwise), X2 = Age of respondent (in years), X3 = Farm size (in ha), X4 = Farming Experience (in years), X5 = Membership of cooperative society (1 if member, 0 if otherwise), X6 = Number of extension contact in a farming season (number), X7 = Number of labour force available for farming (number), X8 = Value of agricultural equipment owned (₦), X9 = Value of livestock owned (TLU), X10 = Distance to the all-weather road (Km),

X11 = Distance to the nearest town (Km), X12 = Access to potable water supply (Dummy, 1 if have access, 0 if otherwise), X13 = Means of transportation (Dummy, 1 if have access, 0 if otherwise).

The estimated propensity scores were used to construct the comparison groups. Several methods or matching algorithms were used for selecting the matching observations (Smith and Todd, 2005). These include nearest-neighbor matching, kernel matching, stratification matching, radius/caliper matching, etc. The algorithm will find for each agent in the treatment group a member or members of the control group who has (have) a similar-enough propensity score (PS), and these two are matched (Hudson *et al*., 2014). The average difference between the outcomes of the matches is an estimate of the ATT.

RESULTS AND DISCUSSION

Impact of Agricultural Transformation Agenda (ATA) on productivity of rice farmers in Niger State, Nigeria

The Total Factor Productivity (TFP) Index and the Propensity Score Matching (PSM) were used to estimate the impact of the ATA programme on the productivity of the rice farmers in the study area. Table 1 shows the results of the impact of the ATA programme on the total productivity of the rice farmers in the study area using the TFP. The results show that the model has an F-ratio of 32.52 and that the whole model is statistically significant at 1% level of probability. The coefficient of determination (R^2) indicated that 34.2 % variations in the productivity of the rice farmers in the study area were explained by the explanatory variables included in the model.

Table 1 further revealed that farm size, labour used, the quantity of fertilizer applied, amount of improved seed used, the number of agrochemicals used, amount of NIRSAL loans collected, and ATA participation were all directly related to productivity and are all significant 1 % level of probability. This indicates that a unit increase in these variables holding other factors constant led to an increase in the productivity of the rice farmers by 0.190, 0.166, 0.975, 0.299, 0.866, 0.206, and 0.457, respectively. This finding is corroborated by the findings of Ojo *et al.* (2018), Obasi *et al.* (2013), and Fakayode *et al.* (2007) who reported that farm size, labour used, fertilizer use and planting material are among the main factors that determine farm productivity. Also, findings by Anyanwu (2014) confirm that agricultural credits/loans in the form of microcredits are one of the major determinants of farm productivity.

Table 1: Impact of the Agricultural Transformation Agenda programme on the productivity of rice farmers in Niger State, Nigeria (double-log as the lead equation)

Variables (n=194)	Coefficients	t-value
Farm Size, X_1 (Ha)	0.190	5.66***
Labour used, X_2 (Man-days)	0.166	3.04***
Fertilizer applied, X_3 (Kg)	0.975	5.83***
Amount of Seed used, X_4 (Kg)	0.299	4.49***
Agrochemicals Applied, X_5 (liters)	0.866	3.70***
Amount of NIRSAL Loan collected, X_6 (₦)	0.206	5.24***
Farmers Registration in National Farmer's Database, X_7 (Dummy, Yes=1, No=0)	-0.003	-0.22
ATA Participation, X_8 (Dummy, Yes=1, No=0)	0.457	3.97***
Constant	-2.088	-6.09
R^2 Square	0.342	
Adjusted R^2 Square	0.331	
F-Ratio	32.52***	

*** = Significant at 1% level of probability, ** = Significant at 5% level of probability, * = Significant at 10% level of probability.

Source: Field Survey, 2019.

Using the PSM, Table 2 shows the propensity score for participation on Total Productivity of the rice farmers in Niger State. The result shows that, among the various farmer characteristics, membership in a cooperative society has the strongest influence on farmers' likelihood of participating in the ATA programme in the State. This indicates that farmers who are members of cooperative societies or farmers' unions are more likely to participate in the ATA programme in the state. Similarly, other farmer characteristics such as gender, age, farm size, number of labour force available, farming experience, number of extension contact within a year, the value of agricultural equipment owned, and value of livestock owned also have positive influences on the likelihood of farmers' participation in the ATA programme in the State.

However, distance to all-weather roads, distance to the nearest town, means of transport, and access to public water supply all had negative influences on the likelihood of farmers' participation in the ATA programme in the State. This means that the farther the farmer to the all-weather road, the

less likely it will influence their decision to participate in the ATA programme in Niger State. Also, distance to the nearest town was not equally considered by the rice farmers as an influence on their participation in the programme as the farther the distance to the nearest town, the less likely farmers would participate in the programme. For access to portable water supply, this means that the farmer's participation in the ATA programme was not influenced by the access to the potable water supply to farmers in Niger State and therefore not considered as a factor to influence farmers' participation.

Table 3 shows the impact of ATA on the productivity of rice farmers in Niger State. The result from all matching procedures (nearest neighbour, radius, kernel, and stratification matching) shows that the programme had a positive and significant effect on total productivity, fertilizer productivity, seed productivity, land productivity, labour productivity, and agrochemical productivity.

The result, in specific terms, shows that total productivity for the beneficiary farmers in Niger State was higher than that of the non-beneficiary farmers by at least 0.81 %, fertilizer productivity for the beneficiary farmers was higher than that of the non-beneficiary farmers by at least 3.9 %, seed productivity for the beneficiary farmers was higher than that of the non-beneficiary farmers by at least 10.35 %, land productivity was higher for the beneficiary farmers by at least 1.17 % than that of the non-beneficiary farmers, labour productivity was higher for the beneficiary farmers by at least 1.22 % than that of the non-beneficiary farmers while agrochemical productivity for the beneficiary farmers was higher than that of the non-beneficiary farmers by at least 4.79 %.

Table 2: Propensity score for Participation in ATA on Total Productivity of rice farmers in Niger State

Variable Category	Variable Definition	Coefficient	p-value
Farmer-specific variables	Gender	0.42	0.32
	Age	0.05	0.01
	Farm size	0.01	0.78
Farm-specific variables	No of labour force available	0.05	0.20
	Distance to all-weather road	-0.01	0.67
	Distance to the nearest town	-0.02	0.13
Farmer-capital endowment variables	Farming experience	0.02	0.17
	Membership of a cooperative society	0.49	0.06
	No of extension contact	0.17	0.00
Asset endowment variables	Value of Agric equipment owned	0.01	0.07
	Value of livestock owned	0.01	0.18
	Means of transport	-0.14	0.50
	Access to portable water supply	-0.22	0.33
Constant	Constant	-2.27	0.02
Model Characteristics	No of Observations: 194	Log Likelihood: -115.5598	
	Pseudo R^2: 0.1362	p-value: 0.0005	

Source: Computations from data from field survey 2019.

Table 3: Impact of ATA on the productivity of rice farmers in Niger State

Matching Algorithm	Outcome variables	Treated (N=97)	Control (N=97)	ATT	Standard Error	t-value (Significance)
Nearest Neighbour Matching (NNM)	Total productivity	3.58	2.71	0.87	0.18	4.89**
	Fertilizer Productivity	15.18	10.96	4.22	1.35	3.13**
	Seed Productivity	49.93	38.08	11.85	5.91	2.01**
	Land Productivity	4.61	3.43	1.18	0.87	2.68**
	Labour Productivity	6.22	5.00	1.22	0.40	3.03**
	Agrochem Productivity	9.79	5.00	4.79	7.29	2.75**
Radius Matching (RM)	Total productivity	3.56	2.71	0.85	0.13	5.14*
	Fertilizer Productivity	14.85	10.85	4.00	1.30	3.08**
	Seed Productivity	49.24	38.21	11.03	4.73	2.33**
	Land Productivity	4.69	3.46	1.23	0.92	2.92**
	Labour Productivity	6.20	4.94	1.26	0.35	3.57**
	Agrochem Productivity	9.91	4.94	4.97	7.47	2.60**
Kernel Based Matching (KBM)	Total productivity	3.52	2.71	0.81	0.13	4.71**
	Fertilizer Productivity	14.85	10.95	3.90	1.33	2.91**
	Seed Productivity	49.24	37.97	11.27	4.91	2.30**
	Land Productivity	4.69	3.37	1.32	0.93	2.71**
	Labour Productivity	6.20	4.93	1.28	0.37	3.48**
	Agrochem Productivity	9.91	4.93	4.97	7.47	2.60**
Stratification Matching (SM)	Total productivity	3.57	2.71	0.86	0.15	4.78**
	Fertilizer Productivity	15.18	10.41	4.77	1.47	3.25**
	Seed Productivity	49.93	39.58	10.35	7.17	1.44**
	Land Productivity	4.71	3.54	1.17	0.91	2.15**
	Labour Productivity	6.22	4.96	1.27	0.45	2.82**
	Agrochem Productivity	9.79	4.96	4.83	7.29	2.76**

Note: Significance level at ***1%, **5%, and *10%

Source: Data computations, 2019.

Balancing test for conditional independence assumption (CIA)

Propensity score estimation balances the distribution of independent variables in the groups of beneficiaries and non-beneficiaries of the ATA programme. Figure 1 shows the distribution and common support for the propensity estimation for the State. From the graph, the treated (matched) and the untreated (unmatched) individuals were within the region of common support indicating that all treated individuals have corresponding untreated individuals.

The results in Table 4 further indicate that there was a substantial reduction in bias as a result of matching. The estimates showed that reductions in the median absolute bias were all greater than 20 percent and hence considered 'large' (Rosenbaum and Rubin, 1983; Kirui *et al.,* 2012). Also, the results of the pseudo-R^2 after matching were all lower than before matching for each of the outcome variables. This implies that after matching, there were no systematic differences in the distribution of covariates between both the beneficiaries and non-beneficiaries of the ATA programme. The joint significance of the regressors was rejected after matching, whereas we failed to reject at any significance level before matching. This thus suggests that there was no systematic difference in the distribution of covariates between the beneficiaries and non-beneficiaries of the ATA programme

.

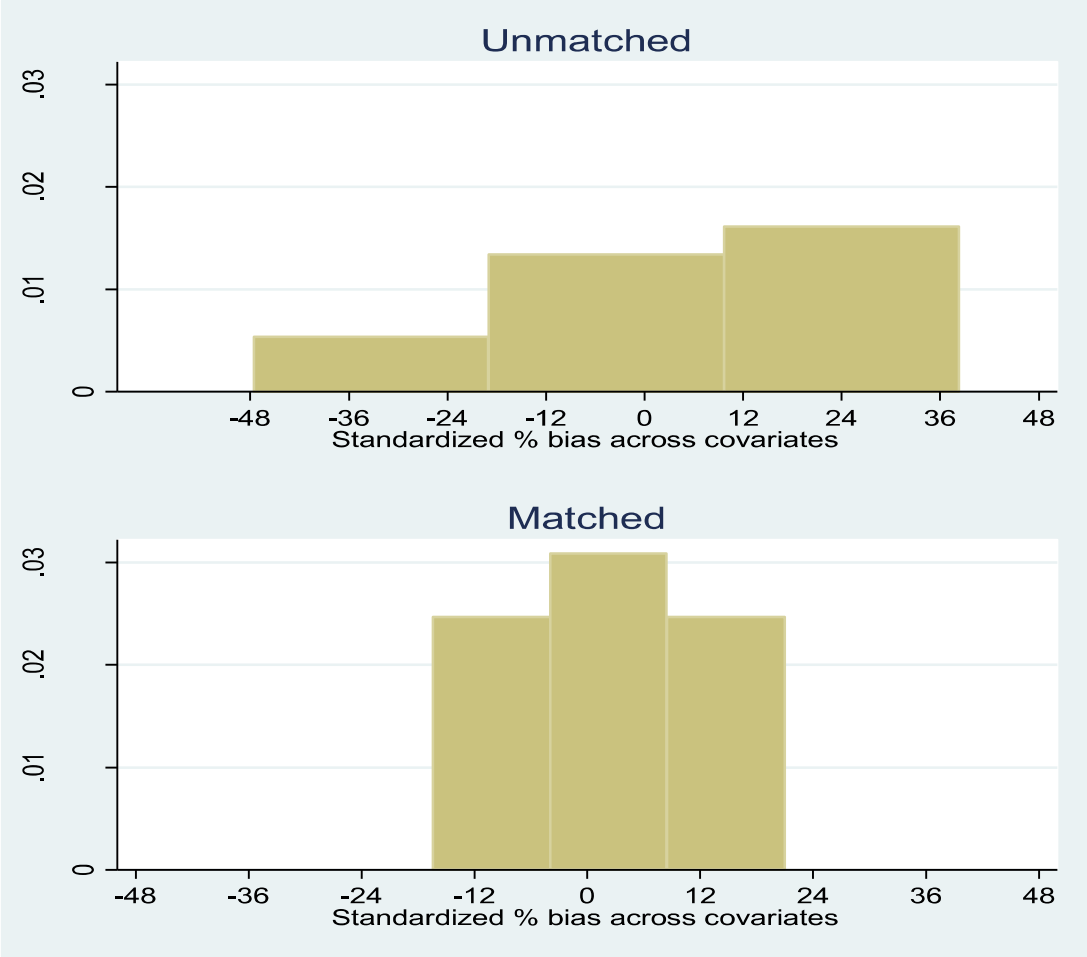

Figure 1: Propensity score distribution and common support for propensity score estimation for Niger State

Table 4: Indicators of covariate balancing before and after matching

Outcome variables	Mean bias before matching	Mean bias after matching	Median bias before matching	Median bias after matching	% bias reduction	Pseudo R^2 (Unmatched)	Pseudo R^2 (matched)	p-value of LR (Unmatched)	p-value of LR (matched)
Income	18.0	8.3	13.4	6.8	97.06	0.088	0.032	61.76	22.92
Total productivity	17.1	11.4	13.8	7.9	74.68	0.351	0.012	8.51	0.809
Fertilizer Productivity	32.3	11.9	23.3	12.4	87.90	0.351	0.066	78.81	14.91
Seed Productivity	23.1	12.2	14.1	7.6	85.53	0.187	0.146	39.92	31.16
Land Productivity	3.8	2.4	3.2	1.9	68.42	0.351	0.003	1.87	1.00
Labour Productivity	19.2	8.8	15.1	7.8	93.59	0.136	0.054	36.43	14.52
Agrochem Productivity	18.0	7.4	13.4	7.1	88.73	0.088	0.022	61.78	15.70

Source: Data computations, 2019

Test of Hypothesis

The null hypothesis states that there is no significant difference between the farm-level productivity of the beneficiary and non-beneficiary rice farmers under the Agricultural Transformation Agenda. A summary of the t-test computation is presented in Table 5. The results in Table 5 indicated that the computed t-statistic of 4.3027 is greater than the t-critical value of 2.326 at a 0.01 level of significance. This means that the null hypothesis is therefore rejected and we accept the alternative that there is a significant difference between the farm-level productivity of beneficiary and non-beneficiary rice farmers under the Agricultural Transformation Agenda. This result implies that the beneficiary farmers will be more productive and generate greater output per hectare than their non-beneficiary counterparts and would therefore be better off than them.

Table 5: Test of difference between the mean total productivity of beneficiary and non-beneficiary rice farmers in Niger State, Nigeria

Paired Differences	Mean	Std. Deviation	t_{cal}	Significance t_{crit} @ 0.01 level of sig.	Decision
Beneficiaries	4.7028	2.6003	4.3027***	2.326	Reject
Non-beneficiaries	3.8274	1.9438			

*** Implies statistically significant at 0.01 probability level.

Source: Data computations (2019)

CONCLUSION AND RECOMMENDATIONS

The study established that the ATA programme had a significant impact on the productivity of rice farmers in North-central Nigeria. The programme was found to have afforded more farmers more access to farm inputs that enabled them to increase their productivity. Among the determinants of access to the ATA programme in the study area are farm size, membership of a cooperative society, level of education, age, and the number of extension contacts in a cropping season. The PSM results show that the programme had positive and significant effects on total productivity, fertilizer productivity, seed productivity, land productivity, labour productivity, and agrochemical

productivity of the farmers and these variables were higher for the beneficiary rice farmers than that of the non-beneficiaries indicating that the beneficiaries of the programme fared better than their non-beneficiary counterparts in terms of their outputs in the study area.

The study, therefore, recommends that since the programme shows significant increases in the productivity of the beneficiary rice farmers in the study area when compared with the non-beneficiaries, policies, and efforts aimed at the sustainability of the programme be able to stimulate further increases in the growth and productivity of farmers, particularly in rice subsector should be encouraged. Government policies such as the follow-up programmes, the Agricultural Promotion Policy (APP), and the National Agricultural Technology and Innovation Policy (NATIP) should be made such that future investments in the agricultural sector would build on the successes of the ATA programme while improving on the identified pitfalls or weaknesses to make it better to be able to drive further growth in the sector. Successive governments should build on the gains achieved in programmes like this to improve agricultural productivity and not discard it for other policies which would lead to policy summersaults that have been the bane of policy sustainability in the agricultural sector in Nigeria.

REFERENCES

African Development Bank (AfDB, 2013). Strategic Environmental and Social Assessment of Agricultural Transformation Agenda Support Programme – Phase 1 in Nigeria (Executive Summary). Africa Development Bank Group. Pp 3-9.

Anyanwu, I. B. (2014) Evaluation of the effects of microfinance credit scheme on poverty alleviation among small-holder farmers in Niger State, Nigeria. An unpublished Thesis presented to the Postgraduate School, Federal University of Technology, Minna in partial fulfilment of the Requirements for the award of the Master of Technology (M.Tech) in Agricultural Economics. Pp 65 – 70.

Daramola, B. (2005). Government Policies and Competitiveness of Nigerian Rice Economy. A Paper presented at the 'Workshop on Rice Policy & Food Security in Sub-Saharan Africa' organized by CGIAR. Retrieved June 16, 2019 from http://www.foodnet.cgiar.org

Emenyonu, C. A., Nwosu, A. C., Lemchi, J. I. and Iheke, O. R. (2014). Analysis of Productivity, Profitability, Income and Returns on Investments in Youth SMEs in Niger Delta, Nigeria. *International Journal of Small Business and Entrepreneurship Research,* 2 (1): 20-34.

Fakayode, S. B., Babatunde, R. O. and Ajao, R. (2007). Productivity Analysis of Cassava-Based Production Systems in the Guinea Savannah: Case Study of Kwara State, Nigeria. *American-Eurasian Journal of Scientific Research*, 3(1):39.

FAOSTAT, (2013). Agricultural Production Database. Food and Agriculture Organization of the United Nations, FAO, Rome, Italy. Retrieved Jan 16, 2016 from http://faostat.fao.org/site/703/default/aspx

Federal Ministry of Agriculture and Rural Development, FMARD (2011) Agricultural Transformation Agenda: We will grow Nigeria's Agricultural Sector. Abuja, FMARD. Pp 12-70.

Federal Ministry of Agriculture and Rural Development, FMARD (2022). National Agricultural Technology and Innovation Policy (2022 – 2027). Abuja, FMARD. Pp 1– 84.

Gabrehiwot, T., and Van der Veen, A. (2015). Estimating the Impact of a Food Security Program by Propensity-Score Matching. *Journal of Development and Agricultural Economics*, 7(1): 38-47.

Hudson, P., Botzen, W. J. W., Kreibich, H., Bubeck, P., and Aerts, J. C. J. H. (2014). Evaluating the Effectiveness of Flood Damage Mitigation Measures by the Application of Propensity Score Matching. *Natural Hazards and Earths System Science*, 14(1): 1731–1747.

Kirrui, O. K., Okello, J. J., and Nyikal, R. A. (2012). Impact of mobile phone-based money transfer services in agriculture: evidence from Kenya. Selected paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguacu, Brazil, 18 – 24 August, 2012. Pp 1-22.

Kolawole, O., and Ojo, S. O. (2007). Economic Efficiency of Small-Scale Food production in Nigeria. *Journal of Social Sciences,* 14(2): 123–130.

Nkoya, E., Philip, D., Mogues, T., Yahaya, M. K., Adewale, G., Pender, J., Arokoyo, T., and Edward, K. (2007). Beneficiary Assessment/Impact Evaluation of the Second National Fadama Development Project. Abuja, National Fadama Development Office, Pp 29 – 38.

Muhammad-Lawal, A. and Omotesho, O. A. (2008). Cereals and Farming Households' Food Security in Kwara State, Nigeria. *Agricultural Journal,* 3(3): 235–240.

Napal Rastra Bank (2014). Agricultural Credit and its Impact on Farm Productivity: A Case Study of Kailali District. Nepal, Banking Development and Research Unit, Dhangadhi Office, Napal Rastra Bank. Pp 1 – 12.

National Bureau of Statistics (NBS, 2013). *National baseline youth survey*. Abuja: National Bureau of Statistics.

National Population Commission, NPC (2009). 2006 National Population Census Official Gazette (Extraordinary). 94 (4): 52.

Obasi, P. C., Henri-Ukoha, A., Ukewuihe, I. S., and Chidiebere-Mark, N. M. (2013). Factors affecting agricultural productivity among arable crop farmers in Imo State, Nigeria. *Nigerian American Journal of Experimental Agriculture*, 3(2):443-454.

Ojo, M. A., Usman M. A., Mohammed U. S., Ojo A. O. and Oseghale, A. I. (2018). Effect of Insurgency on Food Crop farmers' Productivity in Borno and Gombe States, Nigeria. *Ife Journal of Agriculture*, 3(30): 43-55.

Olawuyi, S. O., Olapade-Ogunwole, F., Fabiyi, Y. L., and Ganiyu, M. O. (2010). Effects of Microfinance State. In: Nmadu, J. N, M. A Ojo, U. S Mohammed, K. M Baba, F. D Ibrahim and E. S Yisa (eds) Commercial Agriculture, Banking Reforms and Economic Downturn: Setting a New Agenda for Agricultural Development in Nigeria. *Proceedings of the 11th Annual Conference of National Association of Agricultural Economists*, 30th Nov – 3rd Dec 2010 held at FUT, Minna, Niger State. Pp 12-16.

O'Donnell, C. J. (2008). An Aggregate Quantity Price Framework for Measuring and Decomposing Productivity and Profitability Change. Center for Efficiency and Productivity Analysis Working Paper No. WP07/2008, University of Queensland. Retrieved May 10, 2016 from http://www.uq.edu.au/economics/cepa/docs/WP/WP072008.pdf

Rosenbaum, P.R. and Rubin, D. B. (1983). The Central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41–55.

Sabasi, D. and Kompaniyets, L. (2015). Impact of Credit Constraints on Profitability and Productivity in U.S Agriculture. Selected Paper Prepared for presentation at the Agricultural & Applied Economics Association's 2015 AAEA Annual Meeting, San Francisco, Califonia, CA, July 26-28 2015. Pp 6-12.

Smith, J. and Todd, P. (2005). "Does matching overcome LaLonde's critique of non-experimental estimators?" *Journal of Econometrics*, 125(1-2): 305-353.

Wu, H., Ding, S., Pandy, S., and Tao, D. (2010). Assessing the Impact of Agricultural Technology Adoption on Farmer's Well-being using Propensity-Score Matching Analysis in Rural China. *Asian Economic Journal*, 24(2): 141-160.