FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 4 No. 2, June, 2020, pp 392 - 400
DOI: https://doi.org/10.33003/fjs-2020-0402-234

IMPACT ASSESSMENT OF AGRICULTURAL TRANSFORMATION PROJECT ON PRODUCTIVITY AND POVERTY AMONG RICE FARMERS IN KANO STATE, NIGERIA.

[*1]Balogun, O. S., [2]Damisa, M. A., [2]Yusuf, O. and [3]Balogun, O. L.

[1]Department of Agricultural Extension and Management,
Federal College of Forestry Mechanisation Forestry Research Institute of Nigeria, Afaka, Mando Kaduna
[2]Department of Agricultural Economics, Ahmadu Bello University ABU Zaria.
[3]Department of Agricultural Economics & Extension Babcock University Ilishan Remo.

[*]Corresponding Author's Email: baaseg2006@yahoo.com

ABSTRACT
The study was carried out to examine the effect of agricultural transformation on the beneficiary's productivity and poverty of rice farmers in Kano State Nigeria. A multi-stage sampling method was employed to select 571 respondents for the study. Data were collected through structured questionnaires on respondent's income, input and output quantities as well as their expenditures. Data were analysis using descriptive statistics, Foster-Greer-Thorbecke (FGT), Propensity score matching and LATE model. Results from the study shows that respondents productivity revealed a significant difference of about 127 kg/ha in rice productivity between participants and non-participants. Also, the LATE estimates revealed an average treatment effect ATE0 of about 222.98kg/ha. Furthermore, the project had a significant effect ₦11, 321.4 on the participant's consumption expenditure than the non-participants ₦9980.60. Moreover, participants were, able to increase their household total expenditures by ₦34780 per annum. Fluctuations of input/output prices insect pests and inadequate extension visits were all the major constraints faced by the farmers. It was recommended that farmers' information and sensitization system should be overhauled and improved. Also, attention should be given to well organize extension visits for the farmers from stake holders.

Keywords: Impact, Agricultural Transformation, Poverty, Productivity and Rice farmers.

INTRODUCTION

Nigeria economic growth and political stability is highly hinged on agricultural growth, improvement and development. This is because agriculture is still the largest employer of labour, employing about 70% of the Nigerian labour force, particularly the rural dwellers (Izuchukwu, 2011). The high rate of poverty in Nigeria is worrisome and the deplorable standard of living in the rural areas is of great concern. Worthy of note is the fact that poverty is prevalent among the rural dwellers majority of who are farmers. This high rate of poverty has been attributed to low output, lack of access to market and low income Awotide *et, al*, (2015). However, Omonona, (2009) noted that the poverty situation in Nigeria has been deteriorating since the 1980s although the country is rich in human and material resources that should translate into better living standards. The National Bureau of Statistics (2007) showed that Nigerian poverty is predominantly a rural phenomenon; therefore farmers are likely to be affected than any sub group of the society.

Incomes and productivity in rural areas are low Ayanwale and Alimi (2004); hence the rural population has continued to remain poor. Smallholder agriculture, the dominant occupation in rural Nigeria, is mainly characterized by inadequate capital and low productivity. United State Agency for International Development (2011), International Fund for Agricultural Development (2009) and Cadoni and Angelucci, (2013) reported that most rice farmers (90%) in Nigeria are smallholders, applying low input strategy to agriculture, resulting in low output hence Nigeria rice productivity is among the lowest within neighbouring countries, with average yields of 1.51 tonne/ha. Haggblade, (2004) noted that a significant reduction in poverty will not be possible without rapid development and growth in the agricultural sector. People in agricultural sector earns relatively lower incomes hence they are generally poor. Given this scenario, agriculture is a robust alternative for stimulating economic growth, overcoming rural poverty and enhancing food security as well as achieving sustainable development (World Bank, 2008; Sunday *et., al*, 2009; Sunday *et., al*, 2010; CBN statistical bulletin 2010). Wanyama *et., al*, (2009) observed that agricultural productivity in the Sub Saharan Africa and Nigeria declined over the last decades and poverty levels have increased. Currently, agricultural productivity growth and development in the country are far behind that of other regions in the world, and is well below that which is required to achieve food security and poverty reduction goals in the country (Balogun 2016). Many farmers in the Sub-Sahara African countries Nigeria inclusive are facing declining crop yields, which have adverse effect on the region's economic growth and development. The external sector is dominated by petroleum, which generates about 95% of Nigeria's foreign exchange earnings while agriculture contributes the remaining 5% (NBS, 2004).

Although several development initiatives have been initiated, different policies and structural adjustment programmes have been implemented by government in a bid to overcome poverty in Nigeria. Between 1977 till date, among these programmes are: Directorate of Food, Roads and Rural Infrastructure (DFFRI), Better Life Programme (BLP), National Directorate of Employment (NDE); People' Bank of Nigeria (PBN); Community Bank (CB); Family Support Programme (FSP); Family Economic Advancement Programme (FEAP); Poverty Eradication Programme (PEP); National Poverty Eradication Programme (NAPEP); and National Economic Empowerment Development Strategy (NEEDS), Their aims are to ameliorate the suffering of the people by providing them employment opportunities, improve their standard of living and subsequently reduce their poverty.

In 2005, the presidential initiative on increased rice production, was implemented. In recent times, there has been demand by government, aid donors and the development community at large for hard evidence on the impacts of these public programmmes claiming to reduce poverty. Among questions often asked and for which answers are begging sought are: If the various initiatives really work? And how much impact do they have? In spite of the fact that some past studies have tried to addressee these questions, their "evaluations" only provide qualitative insights and do not assess outcomes against explicit and policy relevant counterfactuals which are now widely seen as unsatisfactory (Ravallion, 2005). Other studies carried out after the introduction of new varieties of rice such as NERICA, focus more generally on the rice sub-sector as a whole Akande, 2001, Bello, 2004, Daramola, 2005, Okoruwa *et al* ., 2007 while Spencer *et al*., (2006) was NERICA varieties specific. However, there is still a dearth of impact assessment studies in the rice sector in general and specifically on the Rice development programmes in the study area. Whether the latter are contributing to increase income and reduce poverty are the empirical questions this study addressed. In view of these, this research is poised to answer the following research questions; what are the socio-economic characteristics of the respondents, what is the income level of rice farmers participants and non-participants in the study area, does agricultural transformation have any effect on the rice farmers' productivity? Does agricultural transformation have any effect on the rice farmers' poverty status? The broad objective of the study is to assess the impact of Agricultural Transformation Project on the productivity and poverty of rice farmers in the study area. The specific objectives are to: estimate the income level of participants' rice farmers and non-participants in the study area determine the effect of agricultural transformation on the beneficiaries' productivity and determine the impact of agricultural transformation on the beneficiaries' poverty.

Theoretical Framework. **Theory of Impact Evaluation**

Impact evaluation is an assessment of how the intervention being evaluated affects outcomes, whether these effects are intended or unintended. The proper analysis of impact requires a counterfactual of what those outcomes would have been in the absence of the intervention. In most agricultural projects impact analysis, potential participants are assumed to make decision in their own best interest. Considering adoption from the view point of constrains optimisation, rational households are expected to participate if actually a choice can be made that is, if supply exists and credit constraints do not prevent purchasing the technology. The programme is also expected to be profitable or otherwise advantageous. In adoption and agricultural programme models and its resulting outcomes where selection into "treatment'' (participation is made by farmers on the basis of expected profitability of participation by farmers at time t). If the observable variable by the researcher known is denoted as (Z_{it}) and that which is not by (U_{it}), then, the following rule characterizes participation;

$T_{it}\,(Z_{it}U_{it}\varepsilon_{it}) = \{1\ if\ \ E_{\pi}{}^{*}\,(Z_{it}U_{it}T_{it}=1) - E_{\pi}{}^{*}(Z_{it}U_{it}T_{it}=0) + \varepsilon_0 > 0$ ……. (1)

Where T is a binary indicator of participation, $E_{\pi}{}^{*}$ is the maximized value of restricted general expected function and ε_{it} is an iid error term when ε_{it} is 0, participation takes place if and only if maximized expected profit with the new technology exceeds maximized expected profit from non-participants. Unless ε_{it} is very important the farmers that are observed adopting are in large part those who expected the technology to be profitable.

The outcome variable (for example, household consumption, poverty status, or productivity) Y_{it} is a function of observed variables X_{it}, unobserved variables V_{it}, adoption status T_{it}, and an $i\ i\ d$ error term μ_{it}.

$Y^{T}{}_{it} = Y^{*}{}_{it}\,[\,X_{it}, V_{it}, T_{it}(Z_{it}, U_{it}, \varepsilon_{it})\mu_{it}]$ ……(2)

If technology was randomly assigned, as it would be with a random experiment, then the causal effect of technology/programme on households' wellbeing can be represented as the difference in average wellbeing between participants and non-participants of the technology. A reduced form of the model can be represented as follows:

$Y^{T}{}_{i} = F^{T}\,(X_i) + \varepsilon^{T}{}_{i}\ \ T = 0{,}1$ ……..…… (3)

$T_i = G(W_i) + \varepsilon_i$ ……..(4)

where Y^{T} denotes income of household i that participates in the new technology T. Thus, $Y^{1}{}_{i}\ and\ Y^{0}{}_{i}$ would denote income in household i in case the later participates or does not participate in the new technology respectively. Income depends on a vector of some observed variables X_i and on a vector of unobserved variable $\varepsilon^{T}{}_{i}$. T_i is a binary variable equal to 1, if household i participates in the programme (and 0, otherwise); W_i is a subset of X_i and includes observed variables influencing the choice to employ a new technology; other unobserved household specific factors are summarized by the random variable ε_i.

In a counterfactual form, the quantity of interest is the average treatment effect, defined by Rosembaum and Rubin (1983) as

$\alpha = E(Y^{1}{}_{i} - Y^{0}{}_{i})$ ……(5)

A fundamental problem in estimating the causal effect in (12) is that only $Y^1{}_i \; or \; Y^0{}_i$ is observed and not both for each household; therefore what we observe can be expressed as:

$T_i = \; T_i Y^1{}_i + \; (1 - T_i)\, Y^0{}_i \;\; T = 0{,}1$ ……(6)

The expression for α can then be written as,

$\alpha = P.[E\,(Y^1|T = 1) – E\,(E\,(Y^0|T = 1) + (1\text{-}P).\,E\,(Y^1|T = 0) - E\,(Y^0|T = 1)]$ .....(7)

Where P is the probability of observing a household with T=1 in the sample. Eq (7) implies that the effect of participating in the programme for the whole sample is the weighted average of the effect of programme in the two groups of households.

If technology was randomly assigned to households, we could simply replace the unobserved counterfactuals, $E\,(Y^1|T = 0)$, with the actual income $E\,(Y^0|T = 1)$, as the two would be (close to) equal.

MATERIALS AND METHODS

Study Area. The study was carried out in Kano State. Kano State is located in North Western Nigeria. It occupies an area approximately 20,131km^2. It is located on latitude $11^0\ 30^1$N and longitude $8^0\ 30^1$E with an average altitude of 484m above sea level, the State has a population of totalling 9,383,628 (NPC, 2006). Kano State borders Katsina State to the north-west and Jigawa State to the north-east, (figure 3.1). Farming is the main occupation of the people and it is characterized predominantly by mixed cropping. Kano State features savanna vegetation with a semi-arid climate. It witnesses an average precipitation of about 690mm per year, the bulk of which falls from June to September. The State is typically hot throughout the year, though noticeably cool from December - February. The annual temperature ranges between 19.06^{0}c to 33.19^{0}c. It has a well-drained ferruginous soil.

Subsistence and commercial agriculture is mostly practiced in the State. Among the food crops cultivated are millet, cowpeas, sorghum, maize and rice for local consumption while groundnuts and cotton are produced for export and industrial purposes. Presently, rice is particularly important to the economic activities in the study area, both upland and low land rice is cropped in the study area because of the availability of tube wells and the Hedejia - Jama'a irrigation scheme lying on both sides of Zaria Kano-Rano roads. The scheme was originally started by Kano State government, it is one of the largest irrigation scheme in West Africa (Sangari, 2006). Kano State is a major producer of hides and skins, it is also a major producer of sesame, soybean, cotton, garlic, gum Arabic and chili pepper.

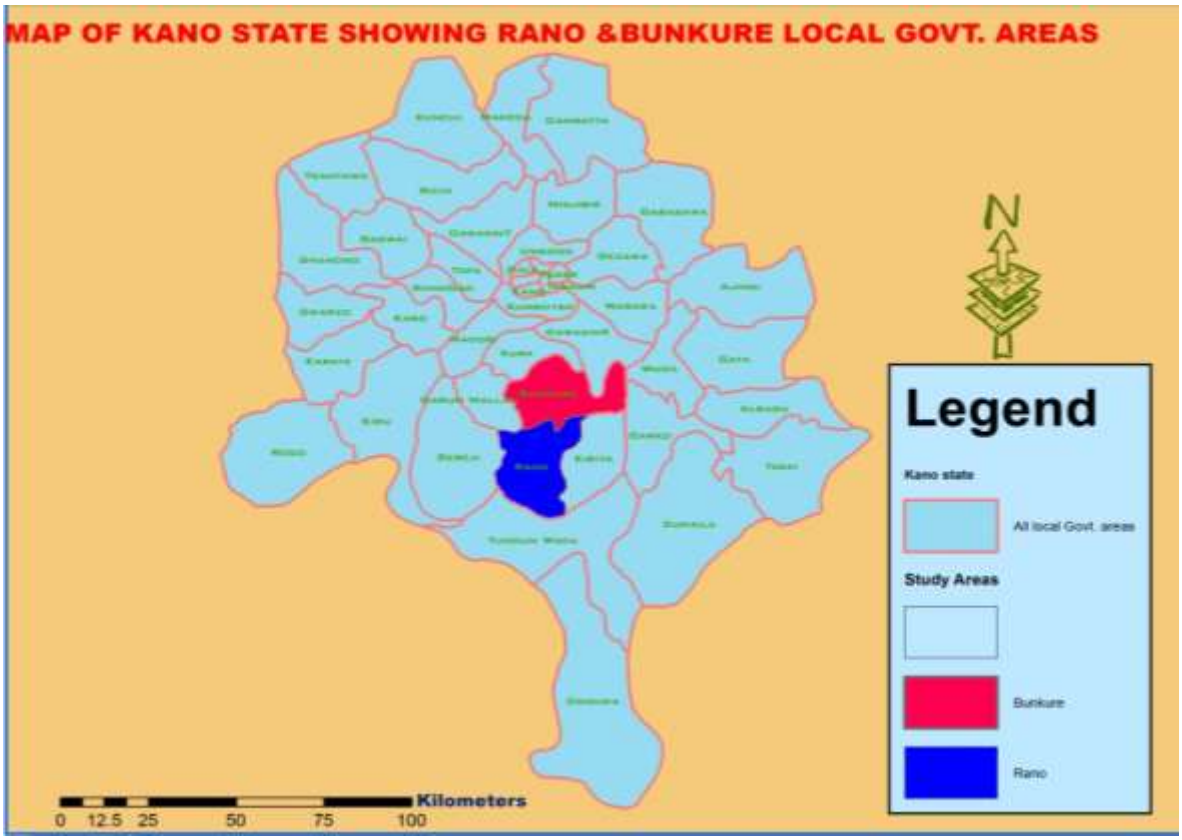

Figure 1: Map of Kano State showing Bunkure and Rano Local Government Areas
Source: Produced by researcher.

Sampling Technique.

Multi-stage sampling technique was employed to select the respondents for this study. The first stage involved random selection of two local governments from the three local governments that participated in agricultural transformation programme in the State. This was followed by purposive selection of seven villages from the local government areas. The selection of the villages was due to the implementation of agricultural transformation programmes and intensity of rice farming activities in the areas. Next, was the random selection of the respondents through the assistance of trained extension officers as presented in Table 1.

Table1: Description of sampled farmers according to villages

LGA	Village	Participants	Non-Participants	All Sample
Rano	Rano	32	57	89
	Rarun	30	43	73
	Kaurara	25	45	70
	Kazaurarawa	23	56	79
Bunkure	Bunkure	35	61	96
	Kuruma	35	48	83
	Shiye	21	60	81
Total		**201**	**370**	571

Source: Field survey, 2015.

Method of Data Collection and Analytical Technique

Data collection: Primary data was used for the study. This was obtained by administering structured questionnaire to participants and non-participants rice farming households in the study area by trained enumerators. A total of 571 farmers were used for the study consisting of 201 and 370 participants and non-participants. Data were collected on socio-economic variables (age, educational level, farm size, farming experience, and non-farming activities of the respondents). Information's was also collected on the input-output level, income and expenditure of the respondents.

Analytical Technique: Analytical technique used include

(i) Descriptive statistics (including frequencies and percentages), inferential statistics (Z-test, t-stat).

(ii) Poverty Measure

Foster-Greer-Thorbecke (1984) class of poverty measures, Key and Mcbride (2003) approach to the determination of total factor productivity,

The FGT (Foster-Greer-Thorbecke 1984) class of poverty measures was be used since it is decomposable across subgroups such as participants and non-participants. The FGT class of poverty measure is given generally as:

$P_{\propto} = \frac{1}{n}\sum_{1=1}^{n}\left[\frac{Z-y_i}{Z}\right]^{\propto}$ …….. (8)

where n is the total number of individuals in the population, z is the poverty line y_i is he value of per capita income of the ith person, and α is the poverty aversion parameter. When $\alpha = 0$, P_α is simply the head count ratio, the proportion of people at and below the poverty line. When $\alpha = 1$, P_1 is the poverty gap index (or depth of the poverty), defined by the mean distance to the poverty line, where the mean is formed over the entire population with the non-poor counted as having a zero poverty gap. When $\alpha = 2$, P_3 (the squared poverty gap) is called the severity of poverty index because it is sensitive to inequality among the poor.

Determination of productivity index model

Key and Mcbride (2003) approach to the determination of total factor productivity was adopted to evaluate the impact of the programme on the farmers. This is expressed as:

$TFP_i = Y_i / \sum P_i X_i$ ……..(9)

Where,

TFP_i = Index of total factor productivity for ith farmer).

Y_i = Quantity of rice produced (Kg) by ith farmer. P_i = Unit price of ith variable input (₦)

X_i = Quantity of ith variable input used. Where X_i includes the following, X_1 = Quantity of Rice seeds used (Kg), X_2 = Quantity of fertilizer (Kg),X_3 = Quantity of herbicides (liters)

X_4 = Quantity of Labour input (man-days).

(iii) The Local Average Treatment Effect Estimation (LATE)

Propensity score matching and the LATE model were used to determine the project impact on the farmers' productivity and welfare.

The LATE model is a combination of methods, it addressed the problem of overt, hidden and non-compliance bias. According to Imbens, (2004) and Lee (2005), the conditional independence based estimators of ATE, ATE1 and ATE0 called Inverse Propensity Score Weighing Estimators (IPSW), can be expressed by the following formulas.

$$A\hat{T}E = \frac{1}{n}\sum_{i=1}^{n} \frac{d_1 - \hat{p}(x_1))y_1}{\hat{P}(X_1)\,(1-\hat{P}(X_1))} \quad (10)$$

$$A\hat{T}E1 = \frac{1}{n_1}\sum_{i=1}^{n} \frac{d_1 - \hat{p}\,(x_1))y_1}{(1-\hat{p}(x_1))} \quad (11)$$

$$A\hat{T}E0 = \frac{1}{1-n_1}\sum_{i=1}^{n} \frac{d_1 - \hat{p}\,(x_1))y_1}{\hat{p}(x_1))} \quad (12a)$$

Where n is the sample size, $n_1 = \sum_{i=1}^{n} d_1$ is the number of treated (i.e. the number of project participants) and $p\hat{}\,(x)$ is a consistent estimate of the propensity score evaluated at $\boldsymbol{x}$. probit specification can be used to estimate the propensity score.

The *instrumental variable* (IV) based methods (Heckman and Vytlacil, 2005; Imbens 2004; Abadie, 2003; Imbens and Angrist, 1994) are designed to remove both overt and hidden biases and deal with the problem of endogenous treatment. The mean impact of the project on the average productivity, expenditure and income of the subpopulation of project potential participants (i.e. the LATE) is given by: (Imbens and Angrist, 1994; Imbens and Rubin 1997; Lee, 2005)

$$E\{y_1 - y_0 | d_1 = 1\} = \frac{E\,(y|z) - E(y|z=0)}{E(d|z=1) - E(d|z=0)} \quad (12b)$$

The RTS of equation (11) can be estimated by its sample analogue given by

$$\left[\frac{\sum_{i=1}^{n} y_1 z_1}{\sum_{i=1}^{n} Z_1} - \frac{\sum_{i=1}^{n} Z_i\,(1-Z_1)}{\sum_{i=1}^{n}(1-Z_1)}\right] X \left[\frac{\sum_{i=1}^{n} d_1 Z_1}{\sum_{i=1}^{n} Z_1} - \frac{\sum_{i=1}^{n} d_1(1-Z_1)}{\sum_{i=1}^{n}(1-Z_1)}\right]^{-1} \quad (13)$$

The implicit form of the model is represented as shown below;

$Y_{iLATE} = f(participation\ status, S_i, V_i, Z_i)$ ……(14)

Where Y_{iLATE} is the ith outcome component, (Productivity and Poverty status) participation status of respondents.

S_i = vector of covariates for propensity score model,V_i = vector of covariates for Instrumental model, Z_i = vector of covariates for impacted outcome model (LARF)

Covariates for the propensity score model.

X_5 = Years of formal education (Years), X_6 = Vocational training (Yes = 1, 0 otherwise)

X_7 = Years of experience of household head (Years), X_8 = Household size (Number)

Covariates for impacted outcome (Poverty status and income)

X_9 = Age of household head (Years), X_{10} = Gender of Household head (Male 1, 0 otherwise)

X_{11} = Level of Education (Years), X_{12} = Experience in rice farming (Years)

X_{13} = Household size (Number),

Covariates for poverty impact assessment

X_{14} = Farm size (ha), X_{15} = Family size (Number), X_{16} = Gender of household head (Male =1, Female = 0)

X_{17} = Consumption expenditure (₦), X_{18} = Off-farm income (₦), X_{19} = Livestock income(₦)

X_{20} = Total rent from land (₦), X_{21} = Distance to nearest agricultural office (Km)

X_{22} = distance to the main market (km), X_{23} = Membership of cooperative or community group X_{24} = Access to credit ((D=1 if yes, 0 if otherwise), X_{25} = Access to seed ((D=1 if yes, 0 if otherwise), X_{26} = Access to media ((D=1 if yes, 0 if otherwise

Covariates for the Instrument model

X_{27} = Years of formal Education (Years), X_{28} = Number of years in cultivating traditional variety of rice, X_{29} = Household location (1 if urban, 0 otherwise)

X_{30} = Number of years resident in the village/town (Years), X_{31} = Household size

X_{32} = Farmers nativity (Dummy 1 if yes, 0 otherwise), X_{33} = Primary occupation (dummy 1 if farming, 0 otherwise), X_{34} = Age of household head (Years), X_{35} = Number of local varieties known.

RESULTS AND DISCUSSION

Poverty status of rice farmers in the study area.

The respondent's distribution according to poverty status is presented in Table 3. The World Bank standard of daily income of $1.90/day (World Bank, 2009) was adopted for the study. Empirical findings from the study show that about 48.62% constituting about 274 sampled farmers spends less than (₦378.14/day). This imply that a sizable number of the farmers were not able to meet up with the daily minimum standard requirements for living. Furthermore, the poverty gap index (PGI) which define the average short fall in income measure that is the severity of the poverty (P_1) among the poor sub-population was found to be 0.27878 (27.8%). This implies that it will require about 100/day per farmer to move to poverty line. Also, the depth of poverty (0.2347) obtained revealed that an average of about ₦143.7 will be needed to take an average poor farmer out of poverty.

Table 2: Respondents' distribution according to poverty status

Class	Frequency	Percentage (%)
1-50	58	10.15
51-100	52	9.10
101-150	71	12.43
151-200	40	7.00
201-250	61	10.68
251-300	54	9.45
301-350	74	12.95
351-400	43	7.53
451-500	48	8.41
501-550	44	7.71
551-600	26	4.55
Total		
Poverty index based on 378.14/day		
Number of poor	278	48.64%
Total number of respondents	571	
Poverty incidence (Po)	0.4864	
Poverty by Severity (P1)	0.2788	₦100
Poverty Depth (P2)	0.2347	₦143.67

Source: Field survey 2015

Effect of the Programme on Participation of Rice Participants' Impacted Outcomes.

Table 4 presents the impact of agricultural transformation project on income from rice (production, other crops), total agricultural expenditure, per capita consumption expenditure, and the incidence of poverty among the farmers. The average participant was better-off in terms of household income. For instance, the participants had a significantly higher income from both the production of rice and other crops than the non-participants; consequently the participants were also able to spend more (₦98324.60) on agricultural production than the non-participants (₦ 85800.90).

The per capita expenditure was used to examine the impact of the project on the respondent's welfare because it reflects the effective consumption of households and therefore provides information on the food security status of households. Therefore, a comparison was made between the consumption expenditure of participants and non-participants. The result revealed that the consumption expenditure of the participants (₦11321.40) was higher than that of the non-participants (₦9980.60). This implies that the participants had a better welfare package than the non-participants.

Analysis of the incidence of poverty showed that about 48% of the farmers were poor. The incidence of analysis of the incidence of poverty showed that about 48% of the farmers were poor. The incidence of poverty was however higher among the non-participants (52%) than the participants (46%). These results are consistent with other related studies on the impact of agricultural technologies on poverty (Mendola, 2007; Diagne *et.al*. 2009; Javier, *et.al*. 2010). With this revelations it appears the participants were better-off than the non- participants. However, theses comparisons did not account for the effects of other characteristics of the farmers that could influence these outcomes. Hence, these observed differences cannot be attributed entirely to the project due to the problem of selection bias and non-compliance and thus have a causal interpretation (Heckman and Vytlacil, 2005; Imbens and Angrist, 1994). Therefore, other statistical methods were employed to assess the impact of agricultural transformation on rice productivity and welfare.

Table 4: Impact of agricultural transformation project on income from rice (production, other crops), total agricultural expenditure, per capita consumption expenditure, and the incidence of poverty among the farmers.

Variable	Pooled	Participants	Non participants	Mean Difference
Income from rice production	18246.30	103475.43	97404	6071.43***
Income from other crops	94359.55	102443.67	98732.78	3710.89
Non- Agricultural Income	96123.30		85560.32	3127.92
		82432.40		
Total agricultural expenditure	85800.90	98324.60	86413.20	11911.4***
Per Capita Consumption expenditure	10554.20	11321.40	9980.60	1340.8
Average farm size	0.96	1.18	1.05	0.13^{NS}
% of Poor households	48.00	47.00	52.00	5.00

Source: Field Survey, 2015

NS = Not significant *** = Significant at 1% level of probability

Effect of Project on rice farmers' productivity

The result of the impact of participation on participant's productivity and welfare is presented in Table 5. The result of the mean difference showed that there was a significant difference of 127.17kg/ha in rice productivity between the participants and non-participants. The Average Treatment Effect (ATE) in the entire population was 259.53kg/ha, the ATT on the sub-population of participants was 287.22kg/ha. This implies that the participants had an increase of 222.98kg/ha in rice productivity. Precisely, the LATE estimates suggested that participation in agricultural transformation project significantly increase rice productivity by 347.60kg/ha. This could be interpreted as the change in rice productivity that is attributed to the project. Furthermore, the impact was also higher among the poor farming households (660.82kg/ha) than the non-poor farming households (470.66kg/ha). This implies that participation in agricultural transformation impacted more on the life of the poor.

Table 5. Impact of participation on Participants productivity and welfare

Estimation	Parameter	Robust standard error	Z-Value
Estimation by mean Difference			
Observed Difference	127.69**	29.19	2.76
Participants	286.45***	72.76	10.94
Non-participants	158.76***	56.50	5.81
Inverse Propensity Score Weighting Estimation			
ATE	259.53**	120.00	3.89
ATE1	289.22**	125.30	5.69
ATE0	222.98**	102,40	4.18
Local Average Treatment Effect Estimation			
LATE by WALD estimators	206.78**	115.02	2.80
LATE by LARF	347.60***	134.43	6.58
Impact by Poverty Status			
Poor	660.82***	191.00	5.84
Non-poor	470.78***	213.68	3.89

Legend: Significant level **p<0.05, * p<0.10, *** p<0.01. Source: Field survey, 2015

Effect of the Project on Total Household Expenditure

The effect of the project on total household expenditure is presented in Table 6. The agricultural transformation revealed that agricultural transformation participation exerted a positive and significant impact on household expenditure in the study area. Precisely, the LATE estimate showed that participation in agricultural transformation significantly increased the total household expenditure by ₦34780.40. This represents the average change in total household expenditure brought about by the project. Also, comparison by poverty status further revealed that the impact was pro-poor in nature as it had a significant higher impact on the poor farming households (₦13498.52) than the non-poor (₦21460.50). The ATE estimates also showed a positive impact just like the LATE estimates. However, the ATE estimates of the impact of improved rice varieties adoption on rice productivity and welfare do not have a causal interpretation due to the problem of non-compliance.

Agricultural transformation was also pro-poor in nature as it had a higher positive impact on the poor households than the non-poor households in all the outcomes of interest considered in this study. It can be concluded that, the project can lead to the much desired increase in productivity, ensure national and households' food security. It can also be a way out of the menace of rural poverty in Nigeria with proper and consistent implementation.

Table 6. Effect of the Project on Total Household Expenditure

Estimation	Parameter	Robust standard error	Z-Value
Observed Difference	18909***	3840.26	6.40
Participants	105123***	3521.39	5.23
Non-participants	86214***	2848.62	9.87
Inverse Propensity Score Weighting Estimation			
ATE	36523**	233.46	2.67
ATE1	9123***	168.76	3.45
ATE0	6732.60**	145.87	2.58
LATE by WALD estimator	28320.56**	1123.14	2.74
LATE by LARF	34780.40***	3945.20	9.78
Impact by Poverty Status			
Poor	13498.52***	1372.14	4.8
Non-poor	21460.50***	6754.26	3.98

Source: Field survey 2015. Legend: * significant at 10%; *

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The study assessed the impact of agricultural transformation programme on the productivity and poverty of rice farmers in Kano State Nigeria and primary data were obtained through the use of well-structured questionnaire administered to 571 rice based farming households. The study revealed that about 48.64 percent respondents were poor. The severity and depth of poverty were found to be (0.27878) and (0.2347) respectively. The effect of agricultural transformation program on impacted outcomes shows that although there was no statistical significant difference between the area cultivated by the participant and non-participants, the participants were better off in terms of income. The estimated income of participants (₦98324.60) was statistically different from that of the non-participants (₦85800.90). The program also impacted positively on the respondent's welfare (Table 4) revealed a consumption expenditure of (₦11321.4) and (₦9,980.60) for the participants and non-participants respectively.

On the productivity, a significant mean difference of about (127kg/ha) was recorded between the participants and non-participants. Moreover, an average treatment effect of about 287.22 and 222.98kg/ha was obtained. Also, this implies that an increase of 222.98kg/ha in rice productivity. This impact was also higher among the poor (660kg/ha) than the non-poor (470.66kg/ha). The program exerted a significant positive effect on the participant's total household expenditure. The Local Average Treatment Effect estimate shows that participants in the program were able to increase their household total expenditure by ₦34780. The study concludes that the project also led to increase in productivity with an observed mean difference of about (127kg/ha) and an estimated Local Average Treatment Effect of about (222.98kg/ha) increase by participants. The poverty status (48 percent) of total respondents had also been positively impacted by the program. The study recommends that Prompt information and farmers' sensitization on developmental projects is very crucial to their participation and use of the package of practices.

The study also suggests that incentives to the participants at the point of sales by buying up their products during gluts when prices are low as a measure to stabilize market prices so as to keep farmers in production.

REFERENCES

Abadie A (2003). Semi-parametric Instrumental Variable Estimation of Treatment Response Models. *Journals of econometrics*. 113: pp 231-263

Ayanwale, A.B, and Alimi T (2004): The Impact of the National Fadama Facility in Alleviating Rural Poverty and Enhancing Agricultural Development in South-Western Nigeria. *Journal of Social Science.* Vol.9 (3): pp 157 – 161.

Akande T. (2001). An overview of the Nigerian Rice Economy, *the National Institute for Social and Economic Research (NISER), Ibadan.* https://www.google.com/overviewoftheNigerianRiceEconomy.

Awotide, B.A. Fashogbon, A and Awoyemi, T.T (2015) Impact of Agro-Industrial Development Strategies on small holder Rice Farmers Productivity, Income and Poverty: the case of contract Farming in Nigeria. *A Paper Presented at the International Conference of the Center for the Studies of African Economies (CSAE) 22-24th, March 2015*

Bello A. (2004)."Nigeria Imported 700 Million Rice in 2003 Federal Minister of Agriculture and Rural Development" in Nigerian Tribune Newspaper, Monday 7th June.

Balogun O.S. (2016) Effect of Agricultural Transformation on the Productivity and Poverty Status of Rice Farmers in Kano Nigeria. A PhD dissertation submitted to the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University Zaria, Nigeria.

Cadoni P and Angelucci F., (2013). Analysis of Incentives and Disincentives for Rice in Nigeria. *Technical Notes Series*, MAFAP, FAO, Rome.

Caliendo, M., and Kopeinig, S. (2008) Some Practical Guidance for the Implementation of Propensity Score Matching. IZA *Discussion Paper No. 1588*, University of Cologne. Central Bank of Nigeria (CBN), 2010, Statistical Bulletin

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' Africa rice (WARDA), Cotonou, Republic of Benin, November 0709, 2005.

Diagne, A., S. A. Adekambi, F. P. Simtowe and G. Biaou, (2009) The Impact of Agricultural Technology Adoption on Poverty: The Case of Nerica Rice Varieties in Benin. A shorter version of the paper being presented as contributed paper at the 27th Conference of the international Association of Agricultural Economists,August16-22, 2009 Beijing, China.

Foster, E., (2003). Propensity Score Matching. An Illustrative Analysis of Dose Response. Lippincott Williams & Wilkins, Inc. *Journal of Medical Care*, 41(10): pp 1183-1192

Foster, J., Greer, J. & Thorbecke, E. (1984). A Class of Decomposable Poverty measures. *Econometrica* 52 (3): pp 761–65.

Haggablade, D. (2004). Africa Agricultural Pest Performance, Future Imperatives in Building on Success

in Africa Agriculture. International Food Policy Research Institute, Vision 2020 Focus p.12

Izuchukwu, O., (2011). Analysis of the Contribution of Agricultural Sector on the Nigerian Economic Development. World Review of Business Research, 1(1). Pp 191-200.

Lee M J. (2005). Micro-Econometrics for Policy, Program and Treatment Effects. Advanced Texts in Econometrics. Oxford University Press, Oxford.

Mendola M. (2007). Agricultural Technology Adoption and Poverty Reduction: A Propensity–Score Matching analysis for Rural Bangladesh. *Food policy* 32(1): pp 372-393.

National Bureau of Statistics (NBS) 2004 issues

National Bureau of Statistics (NBS) 2007 issues.
Okoruwa V. O.; M. A. Y, Rahji and Ajani O, (2007).Rice and Maize Stratification Project in Nigeria.*Draft Report*

Omonona B.T (2009): Quantitative Analysis of Rural Poverty in Nigeria International Food Policy Research Institute (IFPRI); *NSSP Background Paper* 9

Ravallion, M.(2005) Evaluating Anti-poverty programs. World Bank Policy Research *Working Paper* 3625. The World Bank, Washington, D.C. Research on Livelihoods. Good practices from CIMMYT. Impacts Targeting and Assessment (ITA) Unit. Mexico

Sangari D.U (2006). An Evaluation of Water and Land Uses in Kano River Project Phase 1 Kano State. *Journal of J. Appl. Sci. Environ. Manage*.11 (2). pp 105 - 111

Spencer, D. A. Dorward, G. Abalu, Dayo P. and Ogungbile D (2006). Evaluation of Adoption of Nerica and Other Improved Upland Rice Varieties Following Varietal Promotion Activities in Nigeria. A Study for the Gatsby and Rockefeller Foundations, Final Report

Sunday B.A and Aya E.A (2009) Determinants of fertilizer use among small-holder farmers in Wetland Region of Cross River State Global *Journal of Agricultural Sciences* 8 (2):195-201.

Sunday B.A.,Edet. J.U and Aya. E.A.,(2010), Fertilizer–manure Substitution Among Arable Crop Farmers in Akwa Ibom State: Empirical Evidence. *Global Journal of Agricultural Sciences* 9(1): pp 37-40

Wanyama J.M., Mose L.O., Rono S.C and Masinde A.A.O (2009), Determinants of Fertilizer Use and Soil Conservation Practices in Maize Based Cropping System in Trans Nzoia District, Kenya. A Publication of Kenya Agricultural Research Institute, Kitale.

World Bank (2008) World Development Report. Agriculture for Development.wwwworldbank.org/wdr.(2008).