

Analysis of the factors influencing productivity of rice farms in Ebonyi State, Nigeria

Cordelia N.O*¹ and O. Edwin²

¹Department of Agricultural Economics, Ahmadu Bello University, Zaria, Nigeria

²Department of Agricultural Economics, Ebonyi State University, Nigeria

Abstract

Great impediment to achieving food security in Nigeria, is the low productivity of most staple food crops which translated to limited food availability for the populace. These have efforts made by the Nigerian government towards food security. Greater emphasis/attention is usually channel towards improving the inputs use by the farmers, and development of improved seed varieties while the root causes of the staple food low productivity is left unattended to. Therefore, this research centered on the analysis of the factors that determines rice farms productivity in Ebonyi state, Nigeria. About 476 Rice farms were selected through a multi-stage sampling procedure. Data were collected from primary source using structured questionnaire. Data were analyzed using mean, standard deviation, percentage, Total Factor Productivity (TFP), and regression method. The result that emanated from the analysis shows that extension visit, household size, and rice farm size positively and significantly influenced productivity of Ebonyi rice farms while age of the farmer and herbicide usage negatively influenced productivity of Ebonyi rice farms. The result further reveal that 1% increase in herbicide quantity significantly decreased the productivity of rice farm by 4%. Therefore, Agricultural Development Programme (ADP), and other agency that have the mandate of training farmers should intensify effort in the areas of herbicides usage. In-depth soil analysis should be conducted in Ebonyi soil to ascertain the compatibility of herbicide with their soil.

Key Words: Analysis; Factors influencing; Rice Productivity; Rice Farmers; Ebonyi state.

Introduction

Productivity is the ratio of output to inputs used to generate the output (Ramailaet *al.*, 2011). It is the production value (or quantity) divided by the amount of factors utilized in the production (Pepitone, 2000). Therefore, productivity can be seen as the relationship between the output quantity, and the quantity of input utilized in generating the output

Productivity have many effects on economies, and growth of any sectors. Literatures have established that higher

productivity results in higher performances (increase in production), and higher returns (factors costs minimization, good selling prices, among others). High productivity of agricultural products is necessary for fostering economic development and achieving food security in most developing countries (O'Donnell, 2012). Adoption of improve agricultural technology by the farmers could lead to increase in agricultural productivity, and stimulate the movement from a low agricultural productivity to a high agricultural productivity (World Bank, 2008). Improvement in the productivity of agricultural products is necessary for poverty

*Corresponding author: Cordelia

Email: godstime_ogefine@yahoo.com

Received: September 25, 2020;

Accepted: November 15, 2020;

Published: November 16, 2020.

reduction, and achievement of other development objectives (Van Beveren, 2012; O'Donnell, 2012; IFPRI, 2016b). The existing literatures establishes that increase in total factor productivity, reduces poverty, and high agricultural productivity is necessary for poverty reduction (Van Beveren, 2012; O'Donnell, 2012; Rebaty and Lewell, 2013). Recently, productivity studies in agriculture have attracted attention of researchers in economic, and policy makers in both less developed, and developed countries (Van Beveren, 2012; O'Donnell, 2012). Studies have proved that it is not easy for a country to move forward towards economic stability without achieving a considerable growth in agricultural productivity (O'Donnell, 2012). According to IFPRI (2016b), the stagnation in Nigerian agricultural productivity is as a result of loss of efficiency in Agricultural production. Low rice productivity was attributed to the dominance of rain-fed rice growing systems, low input used, and use of local varieties. About seventy seven percent of rice production in Nigeria is rain-fed while twenty three percent is irrigated (Onyekwena, 2016). The average yield in rain-fed is between 1 to 3 tonnes/ha in Nigeria (IFPRI, 2016b). Rice is a very important staple in Nigeria. Thus, the demand for rice will continue to grow, due to rapid population growth (IFPRI, 2016a). Nigeria is the second largest importer of rice in the world, and the highest importer of rice in countries in West Africa (Cadoni and Angelucci, 2013; Onyekwena, 2016). Despite many policies, and strategies adopted by the Nigerian government in the rice sector, rice production is far below the domestic demand. Rice demand in 2014 was estimated at 5.9 million metric tonnes (MT) while 2.7 million MT was produced locally, leaving a gap of 3.2 Million MT in supply (Sahel, 2015). The demand increased to 6.3 million MT in 2016 with a

local production of 3.2 million metric tonnes (Osanyinlusi and Adenegan, 2016; Grow Africa, 2017). The need to level the gap between rice supply and demand has led to importation of rice. It was reported that Nigeria is spending ₦1 billion daily on rice importation (Onyekwena, 2016). While significant progress was made in increasing the land size under rice cultivation, declines in rice productivity has offset the gains in the cultivated area (Onyekwena, 2016; IFPRI, 2016b). United states Department of Agriculture estimated that Nigeria imported 3 million metric tonnes of rice in 2018. The local rice production, and productivity dropped in 2016, and 2018 compared with 2015 production and productivity (USDA, 2018). It is clear from the existing literature that Nigerian rice productivity is among the lowest when compared with countries like Ghana, Chad, Niger, and Benin, with an average yields of 1.51t/ha (Cadoni, and Angelucci, 2013; Ilu, 2015). Despite the problem of low rice productivity in Nigeria, past research works on rice production centered on economic contribution of rice production (Ekpe and Alimba, 2013; Nwaobiala and Ume, 2013), thereby creating a research gap which this research work tends to fill. The research work aims at determining the factors that have influence on productivity of Ebonyi State rice farms.

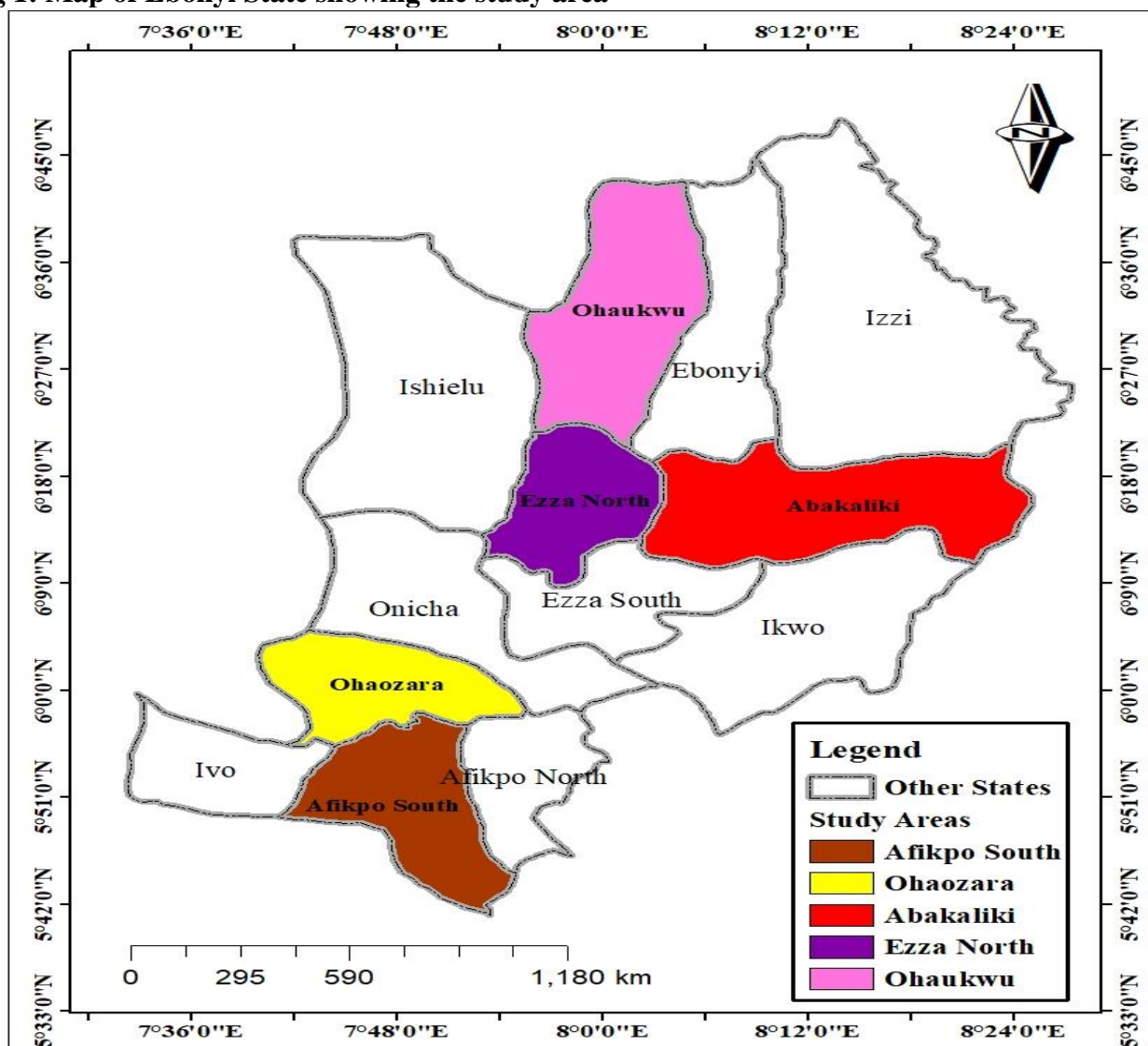
Methodology

The study area is Ebonyi State. Agriculture is considered as a major occupation in this State, about eighty five percent of the population are earning their living from one form of agriculture or another. Ebonyi State has a total land area of 5,935 km² (Obasi *et al.*, 2015). Among Ebonyi state agricultural potentials is Abakaliki rice production cultivated in an estimated land area of

311,208 hectares by over 140 thousand farmers (Ebonyi State ADP, 2018). Visitors to Ebonyi state usually testifies to the high quality of the rice compared with other locally produced rice, and Abakaliki rice is known for its nutritional values, (Nwolieji, 2015; Ebonyi State ADP, 2018).

total population projected to be 3.1 million people in 2020.

Fig 1: Map of Ebonyi State showing the study area



**Source: Administrative map of Nigeria
MAP OF EBONYI STATE SHOWING STUDY AREAS**

Data collection and sampling technique

Multi-stage sampling procedures were used for this study. In the first stage, 5 Local Government Areas (LGA) out of 13 LGAs in the state were randomly selected. In the

second stage, 3 villages each were randomly selected from the 5 LGAs making a total of 15 villages. In the third stage, 476 rice farmers (whose farms were used) were randomly selected from the lists of rice

farmers in 15 sampled villages. Data used in this study were collected from primary source with the aid of structured questionnaire and field observations. The cost route survey approach was used in collecting the required data in three stages – after planting, weeding and after harvesting of rice for 2018 season. Data collected were analyzed using descriptive statistics, Total Factor Productivity Model and Multiple Regression model.

Total factor productivity model

Productivity measures the performance of a sector (Conradie, Piesse and Thirtle, 2009). The productivity of rice farming households was estimated using the Total Factor productivity (TFP) model as was used by Coelli, (1996) and adopted by Osanyinlusi and Adenegan, (2016).

$$TFP = \frac{\text{Gross value of output}}{\text{gross value of inputs used}} \dots\dots\dots (1)$$

The higher the ratio, the more productive the rice farm is.

Multiple regression model

In order to examine the determinants or factors that may likely influence productivity, a multiple regression analysis was used.

The empirical analysis is stated thus:

$$P = \theta_0 + \theta_1 X_1 + \theta_2 X_2 + \theta_3 X_3 + \theta_4 X_4 + \theta_5 X_5 + \theta_6 X_6 + \theta_7 X_7 + \theta_8 X_8 + \theta_9 X_9 + \theta_{10} X_{10} + \theta_{11} X_{11} + \theta_{12} X_{12} + \theta_{13} X_{13} + e_i \dots\dots\dots (2)$$

Where; P = Productivity of rice farm (estimated with Total Factor Productivity)

θ_0 = constant

$\theta_1 - \theta_{13}$ = parameters to be estimated

X_1 = Extension visit (number of visit in a month)

X_2 = Education (years spent in formal education by the rice farmer)

X_3 = household size of the rice farmer (number)

X_4 = rice farm size (ha)

X_5 = age of the rice farmer (years)

X_6 = Health of the rice farmer (amount spent on health)

X_7 = rice variety used (a dummy variable: 1 for improved variety and 0 for local variety)

X_8 = Amount of credit obtained for rice production (Naira)

X_9 = sex of the rice farmer (Male 1 and female 0)

X_{10} = quantity of rice seed used by the rice farmer (kg)

X_{11} = quantity of agrochemical used by the rice farmer (kg)

X_{12} = quantity of fertilizer used by the rice farmer (kg)

X_{13} = labour used by the rice farmer in rice production (mandays)

e_i = error term.

Results and discussion

A number of socio-economic characteristics of rice farming households which includes age, years in formal education, sex, extension visit, years of rice farming experience, household and farm sizes were examined and presented in Table 1.

From the result in Table 1 shows that majority (70.59%) of the rice farmers were male while minority (29.41%) of them were female. This shows that rice farmers in Ebonyi state are dominated by male gender. Age of the farmers affect the ability of the farmer to perform farming operation. The older the

farmer, the more experienced he/she is expected to be, age aid in decision making and high productivity. The result in Table 1 reveals that the average age of the rice farmers was 47 years. This implies that many rice farmers were still within their productive, and economic viable stage, and can make positive contribution to agricultural

production. This is in line with the work of Osanyinlusi and Adenegan, (2016). Large household size can be an asset to the farmers in terms of available labour force. However, the study in Table 1 reveals that the average households size of the rice farmers was 7 members.

Table 1: Socio-economic Characteristics of the Respondents

Variables	Frequency	Percentage
Sex		
Female	140	29.41
Male	336	70.59
Age		
21 – 30	24	5.04
31 – 40	131	7.52
41 – 50	160	33.61
51 – 60	122	25.63
61 – 70	36	7.56
71 – 80	3	0.63
		mean = 47
Education		
0	65	13.66
1 – 6	168	35.29
7 – 12	193	40.55
13 – 18	50	10.50
		mean = 9
Household size		
1 – 5	133	27.94
6 – 10	299	62.82
11 – 15	37	7.77
16 – 20	7	1.47
		mean = 7
Rice variety		
Local	121	25.42
Improved	355	74.58
Farm size		
0.2 – 1.1	304	63.87
1.2 – 2.1	134	28.15
2.2 – 3.1	32	6.72
3.2 – 4.1	5	1.05
4.2 – 5.1	1	0.21
		mean = 1.2
Farming experience		
5 – 14	98	20.59
15 – 24	211	44.33
25 – 34	96	20.17
35 – 44	60	12.61
45 – 54	11	2.31
		mean = 22
Extension visit		
0	218	45.80
1 – 3	248	52.10
4 – 6	10	2.10
		mean = 1

Source: Field Survey, 2018.

This means that majority of the rice farmers have relatively high household sizes. This is a positive indication of availability of family labour for rice farm work. It is believed that educational level of a farmer affects his/her level of productivity. Likewise, the result presented in Table 1 reveals that the average years spent by the rice farmers in formal education was 9 years. This shows that rice farmers had some level of formal education, and can therefore understand productive information. This finding agrees with Ilu (2015)

The result as presented in Table 1 Table 1 reveals that majority (74.58%) of the rice farmers planted improved rice varieties identified as FARO 44, and FARO 52 while minority (25.42%) of them planted local variety identified as MARS, R16, R8, and 306. The average farm size of the rice farmers was 1.2 hectares. This shows that they are mainly small holder farmers based on Federal Ministry of Agriculture and Rural Development, which classified farmers with land holdings less than five (5) hectares as small scale (FMARD (2010). This is in conformity with the work of Ilu (2015). It is believed that through extension visits, farmers are better informed about new technologies which could increase their productivity. The result in Table 1 reveals that the average extension visit to the rice farmers was once per farming period, implying that adoption of new innovation may be quiet difficult for them. Also, the average years of rice farming experience was 22 which is long enough for the rice farmers to master the act of rice farming, and improve their rice production performance. This finding is in line with Girei, Saingbe, Bitrus and Bassey (2017).

Factors influencing productivity of the rice farms.

The results of the factors influencing productivity of rice farms in Ebonyi State are presented in Table 2. The result in Table 2 reveals that $F(18,462)$ of 5.6 (Significant at 1% level), the R^2 of 0.4362, and the adjusted R^2 of 0.4119 shows that the overall model is fitted in the data, and the explanatory variables in the model, collectively explain the determinant of productivity of rice farms in Ebonyi State. The adjusted R^2 value shows that 41% of the variations in productivity of

the rice farms in Ebonyi State can be explained by the included variables.

From the result in Table 2, extension visit (0.5119), household size (0.01445), rice farm size (0.15137), age (-0.00375), and herbicide (-0.00426) significantly influenced productivity of Ebonyi rice farms while years of formal education (-0.00365), amount spent on sickness (-1.29e-06), credit amount (-1.73e-07), sex (-0.00823), seed (3.82e-06), fertilizer (-0.00012), and labour (0.00028) did not influence productivity of Ebonyi rice farms. The result shows that keeping other factors constant, 1% increase in the extension visit to the rice farmers will increase their rice farms productivity by 0.5119%. This could be due to proper utilization of the knowledge/information gotten from the extension agent. This is in line with Aymen *et al* (2015).

The result in Table 2 shows that households' size had significant ($P < 0.1$), and positive influence on productivity of rice farms. Thus, keeping other factors constant, 1% increase in households' size of the rice farmer will increase their rice farm productivity by 0.01445%. In line with the *a priori* expectation, rice farm size had a significant ($P < 0.01$), and a positive relationship with the productivity of rice farms the productivity of rice farms in Ebonyi state. The result shows

that keeping other factors constant, 1% increase in farm size allocated for rice production will increase the productivity of rice farms by 0.15137%. This is in line with the work of Osanyinlusi and Adenegan (2016).

The result of the analysis in Table 2 reveals that age, and herbicide were significant, and negatively influenced productivity of rice farms in Ebonyi state. This implies that as these factors increases, productivity of Ebonyi rice farms decreases, and vice versa. Thus, keeping other factors constant, Additional increase in rice farmers' age, will decrease their productivity by 0.0037%. This implies that a rice farm own by a younger rice farmer

in Ebonyi state is more productive than the older rice farmer counterpart. This is in line with other past research works like Osanyinlusi and Adenegan (2016). Against the theory, and *a priori* expectation was that keeping other factors constant, 1% increase in the quantity of herbicide used by the rice farmers in rice production will decrease the productivity of the rice farm by 0.00426%. This could be that their soil is not compatible with the chemicals, thereby causing harm to the rice crop. Also, it could be due to the negative effect of fake chemicals being sold in the open-market as reported by the unfortunate rice farmers who bought, and used such chemicals during this field work.

Table 2: Determinants of Productivity of Ebonyi rice farming households

Variables	Coefficient	Standard error	t	P>(t)
Extension visit	0.5119143	0.180208	2.84	0.004***
Education	-0.0036508	0.0039202	-0.93	0.352
Household size	0.0144481	0.0074317	1.94	0.052*
Rice farm size	0.1513651	0.0344268	4.40	0.0000***
Age	-0.0037462	0.0020097	-1.86	0.063*
Sick amount	-1.29e-06	2.20e-06	-0.59	0.557
Rice variety	-0.0153703	0.0400417	-0.38	0.701
Credit amount	-1.73e-07	3.37e-07	-0.51	0.608
Sex	-0.0082288	0.0339879	-0.24	0.809
Seed	3.82e-06	4.01e-06	0.95	0.341
herbicide	-0.0042588	0.0019132	-2.23	0.026**
Fertilizers	-0.0001174	0.0000833	-1.41	0.159
Labour	0.0002816	0.0002061	1.37	0.173
Constants	0.374910	0.1036116	3.62	0.000
No of obs	476			
F(18,462) =5.60				
prob>F = 0.0000				
R ² =0.4362				
Adj R ² = 0.4119				
Root MSE = 0.30933				

Source: Field Survey, 2018. Note: ***,**, * is significant at 1%, 5% and 10% respectively.

Conclusion

This research work which centered on the analysis of the factors influencing productivity of rice farms in Ebonyi state, Nigeria establishes that extension visit, household size, rice farm size, age, and herbicide were the significant factors that influenced the productivity of Ebonyi rice farms. Therefore, Agricultural Development Programme (ADP) of Ebonyi States, and other agricultural based capacity development organizations that have the mandate of training the farmers should intensify effort in the areas of how herbicides should be used against abused or waste as herbicide negatively affect their rice farms productivity. Also, in-depth soil analysis should be conducted in Ebonyi soil to ascertain the compatibility of herbicide with their soil.

Reference

- Akintayo, O. I. (2011) 'Output Differentials, Total Factor Productivity, and Factor Use Intensity in Rain-Fed Rice Production Systems in Ekiti and Niger States', *Unpublished* Doctorate thesis, Department of Agricultural Economics University of Ibadan.
- Aymen, F., Boubaker, D., Aw-Hassan, A., Samia, A., and Ali, I. (2015) 'Approaches to Total Factor Productivity Measurements in the Agriculture Economy', A CGIAR Research Program on Dryland Systems.
- Cadoni, P., and Angelucci, F. (2013) 'Analysis of Incentives and disincentives for Rice in Nigeria', Technical notes series, MAFAP, FAO, Rome.
- Coelli, T. J. (1996) 'A guide to FRONTIER Version 4.1: A computer program for stochastic frontier production and cost function estimation', A CEPA Working Paper, University of New England, Armidale, Australia.
- Conradie, B., Piesse, J., and Thirtle, C. (2009) 'What is the appropriate level of aggregation for productivity indices? Comparing district, regional, and national measures', *Agrekon*, 48(1) pp. 09 - 021.
- Ebonyi State ADP. (2018) 'Farmers inventory file' 2018.
- Ekpe, I., and Alimba, J. O. (2013) 'Economics of Rice Production in Ebonyi State South East Nigeria', *International Journal of Foods, Agriculture and Veterinary Sciences*, 3 (2) pp. 77 - 81.
- Federal Ministry of Agriculture and Rural Development (FMARD). (2010) 'National Agriculture and Food Security Strategy', 2010-2020. Abuja, Nigeria.
- Girei, A. A., Saingbe, N. D., Bitrus, M. A., and Bassey .I. H. (2017) 'Revealing the Impact of Fadama III Project on the Income Level of Beneficiary Farmers in Plateau State, Nigeria'. *European Journal of Academic Essay*, 4(2) pp. 26 - 38.

- Grow Africa. (2017) 'Ecowas Rice Fact Book'.
<https://www.growafrica.com/resources/ecowas-rice-factbook>
- Ilu, I.Y. (2015) 'Value Chain Analysis of Rice (*Oryza Sativa*) in Kano River Irrigation Project (Krip) Kano State, Nigeria', An unpublished Ph.D Thesis, Department of Agricultural Economics, Ahmadu Bello University, Zaria, Nigeria.
- International Food Policy Research Institute (IFPRI). (2016a) 'The Nigerian Rice Economy: Policy Options for Transforming Production, Marketing, and Trade', University of Pennsylvania Press, Philadelphia.
- International Food Policy Research Institute (IFPRI). (2016b) 'Agricultural Productivity in Africa, Trends, Patterns, and Determinants', University of Pennsylvania Press, Philadelphia.
- Nwaobiala, C. U., and Ume S. I. (2013) 'Economic Analysis of Upland Rice Production in Ebonyi, Southern Agricultural Zone of Ebonyi State, Nigeria', *International Journal of Agriculture and Rural Development*. 16(2) pp. 1503 - 1508.
- Nwalieji, H. U. (2015) 'Comparative Profit Analysis of Rice Production Enterprise among Farmers in Anambra and Ebonyi States, Nigeria', *Asian Journal of Agricultural Extension, Economics & Sociology*, 8(3) pp. 1 - 10.
- Obasi, F. A., Agbo, F. U. and Onyenekwe, S. C. (2015). Environmental and socio-economic effects of timber harvesting in Ebonyi State, Nigeria. *African Journal of Agricultural Research*, 10(11):1233-1238.
- O'Donnell, C. J. (2012) 'Non parametric Estimates of the Components of Productivity and Profitability Change in U.S Agriculture', *American Journal of Agricultural Economics*, 94(4) pp. 873-890.
- Ogundipe, A. A., Oduntan, E. A., Ogunniyi, I. A. and Olagunju, O. K. (2017). Agricultural Productivity, Poverty Reduction and Inclusive Growth in Africa: Linkages and Pathways. *Asian Journal of Agricultural Extension, Economics and Sociology*. 8(1):1 – 15.
- Okpe, I. J., Uji, T. and Okpachu, S. A. (2014). The Impact of Rice Milling on Poverty Reduction in the Three Geo-Political Zones of Benue State, Nigeria. *IOSR Journal of Economics and Finance* 3(2): 1 – 8.
- Onyekwena, C. (2016) 'Towards Rice Self-Sufficiency in Nigeria: Contemporary Issues and Challenges. A Power Point Presentation to Centre for the Study of the Economies of Africa (CSEA).
http://ipar.sn/IMG/pdf/towards_rice_self-sufficiency_in_nigeria_jan13.pdf
- Osanyinlusi, O. I. and Adenegan, K. O. (2016). The Determinants of Rice Farmers Productivity in Ekiti State, Nigeria. *Greener Journal of Agricultural Science*. 6 (2): 049 – 058.

- Pepitone, J. (2000) 'Human Resource's new role: creating value, Humn Resources Focus, January 2000.
- Ramalia, M., Mahlangu, S. and Dean D.T. (2011) 'Agricultural Productivity in South Africa: Literature Review, Directorate Economic Services Production Economics Unit. Agriculture, Forestry and Fisheries Republic of South Africa. <https://www.daff.gov.za/docs/genreports/agricproductivity.pdf>
- Rebati, M. and Lewell, F. G. (2013) 'Impact of Agricultural Productivity Changes on Poverty Reduction in Developing Countires. Selected Paper for Presentation at the Southern Agricultural Economics Association (SAEA) Annual Meeting, Orlando, Florida 3 – 5 Feb. 2013.
- Sahel Capital Partners and Advisory Limited. (2015) 'Rice in Nigeria: Industry Dynamics, Sahel Capital Limited Vol 12.
- United States Department of Agriculture (USDA). (2018) 'Grain: World Markets and Trade. Foreign Agricultural Services' www.tralac.org/images/docs/12936/grain-world-markets-and-trade-usda-april-2018.pdf. Accessed on 15th September, 2019.
- Van Beveren, I. (2012) 'Total Factor Productivity Estimation: A Practical Review' *Journal of Economic Surveys*, 26(1):98–128.
- World Bank. (2008) 'World Development Report: Agriculture for Development' The World Bank Group. <https://openknowledge.worldbank.org/handle/10986/5990>
- Yemen Taro. (1967) 'Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row Zeigler, R.S (2006) Rice Research for Poverty Alleviation and Environmental Sustainability in Asia. www.niaes.affre.go.jp/sinfo/sympo/hi8/20061212pdf/s3_zeigler.pdf accessed on 27th March, 2018.