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Determinants of farm productivity among smallholder rice farmers in Anambra State, Nigeria

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1 SUMMARY

The determinants of farm productivity among small-holder rice farmers in Ayamelum local government area of Anambra State were examined. A structured questionnaire was used to collect data from 120 randomly selected rice farmers. Results showed that the majority of the respondents had productivity level of between 2.1Kg/₦ and 3.0Kg/₦ (NB: ₦1=0.0065 US Dollar*) with the respondents having a mean productivity level of 2.92Kg/₦. The log-linear functional form gave the best line of fit. R^2 value was 58% and statistically significant at 5% level. Farm size, cost of labour and frequency of extension visit were negatively related to farmers productivity levels. While years of education, fertilizer and use of improved variety were positively significant (p=0.05). Farmer education and the provision of credits in the form of improved rice varieties and fertilizer, especially through private sector participation were recommended.

2 INTRODUCTION

In Nigeria, rice crop has witnessed some remarkable developments particularly in the past ten years. Both rice production and consumption in Nigeria have drastically increased. However, the consumption (demand) is growing faster than for any other major staples because consumption is broadening across all socio-economic classes. The substitution of rice for coarse grains, traditional roots and tubers has fuelled growth in demand at an annual rate of 5.6% between 1961 and 1992 (Osiname, 2002). F.A.O. (2003) also projected growth in rice consumption for Nigeria beyond year 2000 to be as high as 4.5% per annum. According to USAID (2008), the annual consumption of rice per capita stands at 29kg and has continued to rise at 11% per annum, induced by income growth. The limited capacity of the Nigerian rice sector to meet the domestic demand has been attributed to several factors; notable among them is declining productivity. According to Olayide and Heady (1982), farm productivity is the index of the ratio of the value of total farm output to the value of the total inputs used in farm production i.e. farm productivity, TFP = $\Sigma TP_i/\Sigma X_i$. Rice farmers in Nigeria are not getting maximum return from the resources committed to their enterprises (Okoruwa, *et al*, 2006), leading to a decline in per capita food production (Nwatulu, 1988).

Increasing agricultural productivity is a vital pre-requisite for rapid economic growth and development of a country, especially developing countries like Nigeria. The achievement of this objective by Nigerian farmers has been relatively low. In Ayamelum local government area of Anambra State, Southeast Nigeria, rice farming is a major activity among the farmers but its production is mainly in the hands of small-scale resource poor farmers who depend heavily on the use of traditional technologies, which Adebayo and

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Onu (2008) noted result in low productivity. Also, Bamidele *et al* (2008) noted that low productivity is characteristic of small-scale crop farms. However, Hussain and Perera (2004) observed that agricultural productivity change is explained by such factors as land and water related factors, climatic, agronomic, socio-economic, and farm management factors. Therefore, productivity increase among farmers requires a policy focus on these factors. It centers on how various factors that affect productivity could be examined in order to improve rice production in the area and Nigeria in general. There have been attempts to document the issues of factor productivity and resource use efficiency in rice and other arable crops in Nigeria (Okoye, *et al* 2008; Bamidele *et al,* 2008; Okoruwa *et al* 2006; Hussain and Perera, 2004). However, Nwakpu (2008) opined that technologies, systems, ecologies and cost factors are diverse and dynamic and these make it difficult to attain a comprehensive up-to-date analysis both in terms of time and location. Bamidele, *et al* (2008) also noted that productivity differences over time and farming types can result from variety of factors including variation in scale or level of production, farmer's rationality in resource use, and management practices at the plot levels.

This study therefore aims at examining the levels of productivity of rice farmers in Ayamelum local government area and explaining those factors that determine the farmers' level of productivity.

3 MATERIALS AND METHOD

3.1 Study Area: The study was carried out in Ayamelum L.G.A. of Anambra State, Southeast Nigeria. It is made up of eight (8) communities, namely; Omor, Umumbo, Umerum, Ifite-Ogwari, Omasi, Umueji, Igbakwu and Anaku, with a population of 158,410 (NPC, 2006). The area is located within longitude 6.36°E and 7.05°E, and latitude 5.43°N and 6.20°N and lies within the tropical rainforest belt with two peaks of annual rainfall. The most important geographical feature is Ezu River and the natural spring water (Owusi) in Omor community. Agriculture is the major occupation of the people. Rice, yam, maize and, pigeon pea are major crops grown while poultry, sheep, goat and pig are major animals reared.

3.2 Sampling Technique: A multistage random sampling technique was used to select the respondents. First, five (5) out of the eight (8) communities were randomly selected. The second stage involved a random selection of twenty four (24) farmers from each of the communities. This gave a total of 120 farmers, which served as the sample size for the study. Data were collected through the use of a structured questionnaire and analysed with both descriptive and inferential statistics.

3.3 Analytical Technique: Traditional productivity measurement, motivated within the cost-based or cost-benefit paradigm represented by TC (Y, P, t), involves characterizing input costs (using measured prices and quantities of inputs) and usually one aggregate output (Paul, 2000). He further noted that the resulting productivity measures are based on representing reductions in unit costs for a given output level or output expansion for a given input vector. Productivity measure may be based on single input or multiple inputs in which case the former is termed Single Factor Productivity (SFP) and the later termed the Multi-Factor or Total Factor Productivity (MFP or TFP) analysis. Okoye *et al* (2008) using only labour input employed the single factor productivity measure in determining the productivity levels of small-holder cocoyam farmers in Anambra State. However, production more often requires the combination of several inputs and measures need to reflect total factor productivity. This is the productivity measure employed in this study.

Key and Mcbride (2003) approach to the determination of total factor productivity was adopted. This is given as:

$$TFP_i = Y_i / \Sigma P_i X_i$$

Where,

TFP_i = Total factor productivity for ith farmer (Kg/₦).

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.

Σ = Summation

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This was used to compute the productivity level for each of the respondents. According to Key and Mcbride (2003), this methodology ignores the role of total fixed cost (TFC) as this does not affect both the profit maximization and the resource-use efficiency conditions. Besides, it is fixed and as such, a constant.

3.4 Determinants of Rice Farmer's Productivity (TFP): The determinants of rice farmer's productivity (TFP) were modelled in terms of socio-economic variables of the farmers and other factors. The model is specified as follows:

$TFP_i = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7 + e_i$

Where,

TFP_i = Total factor productivity for ith farmer (Kg/₦).
X_1 = Farm size (ha)
X_2 = Cost of labour used (Naira)
X_3 = Years of education
X_4 = Fertilizer used (Kg)
X_5 = Improved varieties used (Yes = 1, No =0)
X_6 = Frequency of extension visit
e_i = Error term
a_{0-7} = parameters to be estimated.

4 RESULTS AND DISCUSSION

The result of the analysis of the productivity levels of the farmers measured in quantity of rice produced (Kg) per naira cost of all variable inputs used i.e. Kg/₦, is summarized in Table 1.

Majority (59.17%) of the respondents had productivity levels of between 2.1 Kg/₦ and 3.0 Kg/₦ while about 3% had productivity levels of between 6.1 Kg/₦ and 7.0 Kg/₦. However, about 13% of the respondents had productivity levels between 1.1 Kg/₦ and 2.0 Kg/₦. Analysis shows that a mean productivity level of 2.92 Kg/₦ was achieved by the rice farmers. Generally, the result shows that the rice farmers were productive in their rice farming activities. This is shown by the productivity level of the farmers, which is greater than 1. This implies that the rice farmers got higher returns from their investments in rice farming.

Table 1: Distribution of Respondents According to their Productivity Levels

Productivity Level (Kg/₦)	Frequency	Percentage
– 2.0	16	13.33
2.1 – 3.0	71	59.17
3.1 – 4.0	19	15.83
4.1 – 5.0	4	3.34
5.1 – 6.0	7	5.63
6.1 – 7.0	3	2.50
Total	**120**	**100.00**

Source: Calculated from field data, 2010.
*-Exchange rate as at September, 2010: ₦ 1 = 0.0065 US Dollar

From the result of the regression analysis shown in Table 2, the coefficient of multiple determinations (R^2) was about 58% indicating that changes in the included independent variables explained about 58% variation in the productivity level of rice farmers in the study area. The F- statistic was significant at 5% level showing that the specified model provides a good fit. Also, the result shows that farm size, cost of labour used and frequency of extension visits were significant at 5% level but negatively signed. Thus an increase in these variables will cause the farmers' productivity levels to decrease. Inverse relationship between farm productivity and farm size has been reported by several researchers (Carter, 1984; Byiringiro and Reardon, 1996; Masterson, 2007 and Okoye *et al*, 2008). They conclude that the inverse relationship is a result of differential factor use intensity, which causes small farms to have greater average and marginal productivity of land. Thus, if farm size is small, the farmers are able to combine their resources better.

Table 2: Double-Log Multiple Regression results of Determinants of Productivity Levels of Rice farmers.

Variable	Coefficient	T - Value

Farm size	-1.758	- 5.234
Cost of Labour Used	-0.721	- 7.559
Years of Education	5.339	7.665
Quantity of Fertilizer Used	2.208	9.202
Use of Improved Rice Varieties	0.434	4.825
Frequency of Extension Visit	-5.485	9.050
Constant	-7.926	11.432

$R = 0.760$, $R^2 = 0.578$, $R^2 = 0.555$. S.E. of Estimate = 0.722, F – Statistic = 25.744

Cost of labour used inversely relates with farm productivity. This implies that a unit increase in labour use causes productivity to decrease by about 0.72 units. The increase in labour use means incurring higher cost of production, especially without an appreciable increase in output. Surprisingly, frequency of extension visits though significant at 5% level is negatively related to productivity levels of farmers. This deviates from the *apriori* expectation of positive relationship. This may be that these farmers do not receive adequate extension services as required.

Other variables that were significant and showed positive effect on productivity level of farmers were years of education, fertilizer, and improved variety. This shows that an increase in these variables will lead to a significant improvement in the productivity levels of the farmers. Better education promotes the adoption and use of yield-increasing technologies/inputs and encourages more efficient farm management practices. These are a *sine-qua-none* to increased farmer productivity. In the same vein, the use of improved rice varieties that are high-yielding, disease resistant and early maturing, and the use of appropriate fertilizer have been encouraged among farmers. This is because of their relative high returns to investment when compared with the local varieties.

5 CONCLUSION AND RECOMMENDATIONS

Farmer productivity is a critical issue in the pursuit of sustainable agricultural production in Nigeria. Over the years, farmers have been considered unproductive basically because of their small-scale level of production. This assertion is erroneous considering the fact that farm productivity depends greatly on resource combination and not basically on the size of farms. This study has identified education, fertilizer use and use of improved varieties of rice as having direct significant influence on rice farmer's productivity level. Thus, efforts should be directed towards encouraging farmers to embrace the various forms of formal education available in the area. Also, credit in the form of fertilizer and improved rice varieties should be made available to farmers at the appropriate time. The provision of these inputs is an area where private sector participation is highly recommended.

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