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Full Length Research Paper

Productivity in agribusiness firms and its determinants in Abia State, Nigeria

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The study examined total factor productivity in agribusiness firms and its determinants in Abia state, Nigeria. The specific objectives includes, (1) to classify and examine firm specific characteristics that enhance productivity in agribusiness and (2) to identify factors that influence total factor productivity in agribusiness firms in Abia State. The first objective was realised with descriptive statistics while the second was determined with stochastic frontier production function. Data for the study was collected from 40 agribusiness firms. Analysis of the study was done using descriptive statistics and stochastic frontier production models. The result of the maximum likelihood estimates of the stochastic frontier production function indicates that the determinants of total-factor productivity (TFP) are skill labour, raw material, years of operation, scale of operation, access to credit and distance to nearby market. While the findings of the study reveals that skilled labour with coefficient of 0.823, years of operation, and access to credit exerted positive influence, variables like cost of raw material with coefficient of 0.097, distance to nearby market and scale of operation had negative influence on total factor productivity of agribusiness firm in the area. Based on this, it was recommended that agribusiness firms should build capacity of their workers through regular mounting of training programs and adopt strategies that would reduce cost of raw materials by purchasing in bulk among other things.

Key word: Total, productivity, firms, Abia, State.

INTRODUCTION

Growth in agribusiness productivity is considered essential in achieving sustainable economic growth and significant level of food security in an under developed country like Nigeria. Its importance in accelerating the pace of economic growth cannot be over emphasized given its usefulness in determining the efficiency and effective capacity of the nation's production system (Oyeranti, 2008; Nto and Mbanasor, 2008). NIPC (2008) observed that productivity in agribusiness sector is critically important if output is to increase at a sufficient level to meet escalating demand for food. This is true following empirical data which revealed that while food output increased at 2.5%, food demand increased at a rate more than 3.5% due to high rate of population growth of 3.18% (FOS, 1996; ABSEEDS, 2005; FRN 2009). Efforts by government to ensure that the deficit is augmented will turn to nought if a critical and fundamental review of the determinants of productivity in the subsector is not examined (Ojo, 2003; Prasada-Rao et al., 2004; NIPC, 2008). Improving the production system and capacity of agribusiness firm in emerging economy like Nigeria through increase productivity is an important policy goal especially now that agribusiness represents an important sector in agricultural commercialization of the economy. Block (1995) asserted that within the context of growth in food and poverty alleviation, emphasis should be placed on productivity increase arising from output maximization at constant or decreasing input. By extension, indices on productivity increase should be predicated upon maximization of output at minimum input (Nto and Mbanasor, 2008). This becomes necessary following the 29% productivity decline in individual agribusiness firms and 2.5% average annual decrease contrary to the targeted average annual productivity increase of 6%. Hence, Vallano et al. (2005), FARA (2006) and Prasada-Rao et al. (2004) further

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explain that to achieve this desired target, measures are required to enhance output by 6.2%, and thus productivity by 4.4%. In the light of this background, apprehension exists on the definition and type of productivity as to give direction and focus to this study. Hence, productivity implies ratio of some measure of output to some index of input used. Put differently, productivity is nothing more than the arithmetic ratio between the amount produced and the amount of any resources used in the course of production (Iyaniwura and Osoba, 1983; Eatwell and Newman, 1991; Oyeranti, 2008). Productivity as a concept assumes two dimensions of measurement namely partial and total factor approach.Partial measures are the amount of output per unit of a particular input. For instance, output per unit of land (land productivity). Also, is labour productivity which is output per economically active person EAP (Jayne et al., 1997; Prasada-Rao et al., 2004). Oyeranti (2008) added that labour productivity is the value of goods and services produced in a period of time divided by the hours of labour used to produce them. This implies output per hour worked. This method of measuring labour productivity seems faulty in the sense that increase in labour productivity may be driven by technological change, improvement in efficiency, improvements in the quality of labour through education and training as well as sound healthcare facilities. Symbolically, partial productivity can be denoted as Y/F_1 where Y is output and F_1 is any individual input. The shortcoming with partial measure of productivity is that, there is no clear indication of why there is change in productivity level across firms. For example, land or labour productivity may rise due to increase in the use of other agribusiness resources.

Oyeranti (2008) further maintained that overall productivity in the agribusiness sector could only be determined by a holistic evaluation of all resources (labour, capital, rent, raw material, managerial style etc) which he termed total factor productivity, TFP. TFP can be mathematically stated thus $Y/F_1+F_2+F_3....F_n$ where F_1 to F_n are the composite inputs used in the production of the output (Y). So, for the purpose of this study, productivity will be evaluated from this multi-factoral point of view. Despite the simplistic nature of this method of calculating output-inputs relations, the result obtained could be misleading hence the need to develop appropriate model that will take into effect the limiting factors associated with ratio of output to input. The intent is to come up with a quantified monitoring index that can be used to identify the determinants of total factor productivity in agribusiness production system. Though many studies have been conducted on TFP in other countries and sectors, so far there is dearth of empirical studies on the determinants of TFP that focused on agribusiness sector in Abia State and Nigeria in general. However, some empirical studies were consulted with a view to give direction to this study.

These include the following. Akinlo (2006) in his study; "Macro Economic Factors and Total Factor Productivity in Sub Sahara African Countries" indicated that external debt, inflation, and lending rate were negatively and statistically significant to TFP while human capital has positive and significant effect on TFP. The study adopted pooled regression approach to determine TFP at macro level of the economy of the study area. Msuya et al. (2008) in a "Study on Productivity Among Smallholder Maize Farmers in Tanzania", using a Stochastic Frontier Production Model, revealed that coefficient of land, intermediate materials, hired labour have expected positive signs and all, significant at 5% level. The findings further indicated land as the single most important factor of production with an elasticity of 0.6988, shows that increase in land will increase the output and thus productivity. Also, Prasada-Rao et al. (2004) in a study conducted on "Agricultural Productivity Growth, Employment and Poverty in Developing Countries, 1970 to 2000" observed that irrigation and government expenditure have significant positive influence on TFP levels. This means that increase in the percentage of arable irrigated land improves TFP levels. The positive influence of government expenditure could be attributed to the role of government in enhancing education, health services, and provision of infrastructure of the study area etc. Prasada-Rao et al. *(*2004) noted that all these have the potential to influence productivity. Therefore, policy formulation will stand hindered in agribusiness sector in general, without a study of this nature since none of the known empirical works explored the area of focus. Hence the objectives of the study include:

1. To classify and examine firm specific characteristics that adds to productivity in agribusiness firms in the area, and
2. To identify factors that influence TFP in the study area.

METHODOLOGY

The study was carried out in Abia State, Nigeria. The state which is divided into three agricultural zones consists of seventeen local government areas. Data for the study was collected from forty agribusiness firms. The firms were selected through purposive random sampling technique. Data were collected through the use of well structured questionnaire administered to staffs that are well informed on information concerning firm specific character, amounts spent on skill labour, unskilled labour, raw material inputs, capital expenditure, rent and other production resources.

Data were analysed using stochastic frontier production function (SFPF). Given the objective, the Cobb-Douglas production function was applied. The stochastic frontier production function is thus expressed as:

$$Yi = F(Z_i; \beta) \exp(v_i - u_i), = 1.\ 2,\ .n \quad (1)$$

where, Yi = TFP of the ith firm. TFP was obtained by dividing output (NGN) with composite inputs (#) used; Z_i = vector of input quantity used in the production of Y by the i-th firm; β = is a vector of

Table 1. Distribution of firms by location.

Location	Frequency	Percentage
Urban	30	75
Rural	10	25
Total	40	100

Source: Field survey data (2010).

parameter to be estimated, and $v_i - u_i$ = the composite error term where v_i and u_i are assumed to be independently and identifiable distributed. Hence Equation (1) is explicitly defined as

$$\ln Y_i = \beta o + \beta_1 \ln K_1 + \beta_2 \ln K_2 + \beta_3 \ln K_3 + \beta_4 \ln K_4 + \beta_5 \ln K_5 + \beta_6 \ln K_6 + \beta_7 \ln K_7 + \beta_8 \ln K_8 + V_i - U_i \quad (2)$$

Where, ln = natural log; *i* subscript represent i-th sample firm; Y_i = TFP of the i-th firm; β_0 = intercept; β_1- β_8 = coefficient to be estimated. K_1= skilled labour (NGN), defined in terms of all amount spent on skilled labor as wage for the production period under study; K_2 = unskilled labour (NGN), defined in terms of all amount spent on unskilled labour as wage; K_3 = raw material input (NGN). This is defined in terms of all cost of material input used in the production of the output;K_4 = capital input (NGN), defined as capital depreciation of asset for the production season under study. It also includes the amount paid as interest on borrowed fund; K_5 = years of operation; K_6 = firms scale of operation (dummy variable; I = small and medium scale, 0 = large scale); K_7 = access to credit (dummy variable; 1 = yes, 0 = no); K_8 = distance to market in km (Ojo, 2003; Oyeranti, 2008; Chirwa, 2007; Nwaru, 2004; Battese and Coelli, 1992; Ajibefun et al., 2002).

The agribusiness firms' specific characteristics were classified using descriptive statistics.

RESULTS AND DISCUSSION

The results of the statistical and econometric analyses of data as well as the discussion of findings were summarized and presented here.

Classification of agribusiness firms

Investors are always willing to invest in attractive agribusiness enterprises with high level of productivity. Several of these enterprises have been identified and classified in this study based on different criteria. The criteria used were those based on location of the agribusiness enterprise, operation practised, years of operation, and scale of operation.

Distribution of firms based on location.

Distribution of agribusiness firms based on location was summarized and presented in Table 1. As presented in the Table, 75% of the firms were located in the urban areas while 25% were located in the rural areas. This result is in consonance with the findings of FAO (2008), that majority of agribusiness enterprises in Nigeria are scattered all over the country but are concentrated more in the urban areas. However, this result ran contrary to the reports of Mbanasor and Ijere (1998) that agribusiness enterprises are found mostly in the rural areas where there is high availability of production land and raw material. The relative attractiveness of agribusiness enterprises to the urban areas is indicative of the comparative advantage conferred on these areas by their socio economic conditions. The urban-rural differentials in socio- economic condition is evidenced by high availability of skilled labour, regular and developed markets, developed physical infrastructure and production schemes. These opportunities if well harnessed may lead to high productivity of agribusiness sector in the area. So firms in the urban area have more tendencies for increased productivity.

Distribution of sampled firms based on years in agribusiness operation

Distribution of agribusiness firms based on years in agribusiness operation was summarized and presented in Table 2. The table shows the distribution of firms based on years of agribusiness operation. Results from the table indicate that 65% of the firms have been in agribusiness operation for more than 15 years while 35% have practiced agribusiness operation between 10 to 15 years. The number of years of agribusiness operation had some positive implication for increased productivity and sustainability in agribusiness operation. The more the number of years an investor may have been in business, the more he may have gained practical experience to handle the issues of productivity growth. Nwaru (2004) noted that improvement in productivity is based on the experience in business which is determined by the number of years of operation.

Distribution of sampled firms based on scale of operation

Distribution of agribusiness firms based on scale of operation was summarized and presented in Table 3. Table 3 reveals that small and medium scale enterprises were 70% of the sample while 30 percent were firms involved in large scale operations. The criteria used were

Table 2. Distribution of firms based on years in agribusiness operation.

Years of operation	Frequency	Percentage
10 – 15	14	35.00
16 – 21	10	25.00
22 – 27	6	15.00
28 – 33	4	10.00
34 – 39	6	15.00
Total	40	100.00

Source: Field survey data (2010).

Table 3. Distribution of sample firms based on scale of operation.

Scale of operation	Frequency	Percentage
Small and medium scale	28	70.00
Large scale	12	30.00
Total	40	100.00

Source: Field survey data (2010)

Table 4. Distribution of firms based on distance to nearby markets.

Distance(KM)	Frequency	Percentage
1 – 5	13	32.50
6 – 10	10	25.00
11 – 15	9	22.50
16 – 20	7	17.50
21 – 25	1	2.50
Total	40	100.00

Source: Field survey data (2010).

those of capital base and number of workers following (Akogun, 2003; Akinsulire, 2006). Small and medium enterprises operate under ₦200 million capital base and number of workers of less than 300 while large scale enterprises operate with capital base of ₦200 million and above and number of workers of 300 and above. The result is consistent with the finding of Mpagalile et al. (2008) who reported that majority of the firms (94%) were small and medium scale firms while the remaining 6% were large scale firms in a survey conducted on agribusiness firms in six African countries. Hence, the small and medium scale enterprises have the potentials of solving the low productivity level of under developed country like Nigeria because of employment generation and sustainability of food security as well as poverty alleviation. The result agrees with the findings of Nto and Mbanasor (2008) and Eboh (2005) that the economy of Nigeria is mostly dominated by small and medium scale enterprises accounting for over 70% of the investment in the economy. This may be attributed to various policies of government instituted to encourage small and medium enterprises in the area. The result conforms to a *priori* knowledge that small and medium scale enterprises dominate the investment environment of the country. Globally, SME agribusiness firms have the capacity to boast productivity of developing countries.

Distribution of firms based on distance to nearby markets

Distribution of agribusiness firms based on distance to nearby markets was summarized and presented in Table 4. The table indicates the distribution of the agribusiness firms based on nearness to markets. The table show that 57.5% of the entrepreneurs of the firms had to travel a distance of not more than 10 km to get to the nearby market. The table also reveals that 22.5, 17.5 and 2.5% of the firms' operators travelled the distance of 11 to 15 km, 16 to 20 km and above 21 km respectively to get to a nearby market. The proximity to market is an indication that the firms can easily acquire necessary inputs and also dispose output. It could be inferred that firms that are close to market have the advantage of increased product-

Table 5. Distribution of sample firms based on access to credit.

Accessibility	Frequency	Percentage
Yes	22	55.00
No	18	45.00
Total	40	100.00

Source: Field survey data (2010).

Table 6. Estimated Cobb-Douglas stochastic frontier production function for firms in Abia State, Nigeria.

Variable	Coefficient	Standard error	t-Values
Constant (k_0)	10.1497	1.2323	8.2357***
Skilled labour (k_1)	0.8230	0.2107	3.9650***
Unskilled labour (k_2)	0.1239	0.1778	0.6971
Cost raw material (k_3)	-0.0975	0.0188	-5.1953***
	0.0712	0.0512	1-3911
Capital input (k_4)	.9535	1.2775	0.7464
Years of operation (K_5)	0.24412	0.1352	1.8045*
Scale of operation (K_6)	-3.2819	1.06342	3.0869***
Access to credit (K_7)	2.9486	0.6342	4.6491***
Distance to market (K_8)	-0.2236	0.0978	-2.2861**
Diagnostic statistics			
Total variance (Sigma square) (δ^2)	0.6202	0.1591	3.8974***
Variance ratio (Gamma) (γ)	0.9690	0.0148	65.175***
LR test	30.6967		
Log-likelihood function	-11.1807		

Source: Computed from frontier 4.1 MLE results data 2010; **, **,* are significant levels at 1, 5 and 10%, respectively.

ivity given the low cost of inputs as a result of reduced transport cost. Hence, firms near the markets have potential tendency for high productivity (Nto and Mbanasor, 2011).

Distribution of firms based on access to credit

Distribution of agribusiness firms based on access to credit was summarized and presented in Table 5. The table shows the distribution of the firms based on access to credit. It shows that 55% of the agribusiness firms had access to credit. The result is in line with Nto and Mbanasor (2008) which reported that most agribusiness firms do have access to credit to adequately support all the agribusiness operations. However, the result is contrary to a *priori* expectation given the encouragement agribusiness firms (especially the SMEs) receive from government and other lending institutions. Low access to credit may constitute obstacle to TFP growth because of lack of capital to acquire necessary resources required to enhance output. Ijere and Mbanasor (1998) supported that credit can be considered from its ability to energise or motivate other factors of production. It acts as a catalyst that activates the engine of productivity growth and thus higher incomes (Nto and Mbanasor, 2011).

Determinants of total factor productivity

The estimated stochastic frontier production by the maximum likelihood estimates (MLE) for the total factor productivity of agribusiness firms were summarized and presented in Table 6, using the specification of Cobb-Douglas frontier production functions (Equations 1 and 2). According to the table, the sigma ($\delta^2 = 0.62$) and the gamma ($\gamma = 0.96$) are quite high and highly significant at 1.0% level of probability. The high and significant value of the sigma square (δ^2) indicates goodness of fit and correctness of the specified assumption of the composite error terms (Jahan et al., 2003; Msuya, 2008).

The explanatory variables showed that the coefficient for skilled labour was positive and significantly related to total factor productivity at 1% level of probability. This is in agreement with *a priori* expectation. This implies that when amount spent on skilled labour increases by 1%, total factor productivity will also increase by 0.8%. This finding is in line with Baten et al. (2009) who reported that if wage rate is enough for skilled labour, productivity will increase.

Skilled labour is more amenable to taking risk and changing business environment due to high level of education. Skilled labour can adequately make use of new technology and also adapt to new and challenging investment climate. Hence increase in amount spent on skilled labour is an indication that the trained workforce will be motivated to discharge their duty, thus increasing productivity and efficiency. Sukul and Mishra (2005) reported that when labour is not motivated through their wages and better conditions of service, productivity is likely to drop. However this result contradicts the findings of Amaefula et al. (2009) and Chirwa (2007) which reported that labour input is inversely related to output and hence productivity. Reason for this deviation is because Amaefula et al. *(*2009) empirical survey was on traditional agriculture which does not require skilled labour force.

The coefficient of amount of money spent on raw material inputs was negative and significantly related to total factor productivity at 1% level of probability. The coefficient of -0.09 is an indication of 0.09% decrease in total factor productivity. This result is also in agreement with *a priori* expectation since total factor productivity is a ratio of output to total variable cost of production. A continuous increase in raw materials and other production factors held constant may add nothing to total factor productivity. This implies that law of diminishing returns in agribusiness firm may have set in. By extension, increase in raw materials will increase productivity up to a point, and then it will start to have negative effect on it. For example if plant, machinery and factory size are held constant, continuous purchase of raw materials will not positively change productivity level. This means that raw material inventory is overstocked in the firm. Hence there is more purchase of raw materials than the recommended level or at a marginal productivity level. This may result to decay and spoilage for perishable raw materials. This finding is consistent with Msuya (2008) and Chirwa (2007) who reported negative relationship between expenditure on raw materials and productivity. However, the result ran contrary to Jahan et al. (2003) and Baten et al. (2009) who reported positive relationship between expenses on raw material and output hence productivity of agro-based firm. This implies that total factor productivity growth is mainly associated with increase in raw material inputs.

The study also identified some factors influencing TFP of the agribusiness firms in the study area. The signs of the estimated coefficients in the model have important implication on the TFP of the agribusiness firms. The coefficient for years of operations (0.24412) was positive and significantly related to TFP at 10% level of probability. In other words, firm with long operational years is expected to have higher level of technical efficiency than firms with reduced years of operations. Increase in this variable leads to increase in TFP. The number of years of operation in agribusiness practice may give an indication that the operators of the firm may have acquired enough experience on how to handle certain issues that will improve TFP. The finding is in agreement with Belhassen and Womack (2000) who reported similar positive relationship between years of operation and TFP of hog production agribusiness firms in Nigeria. The coefficient for scale of operation was negative (-.2819) and significant at 1% level of probability. This implies that large scale firms were more efficient than small and medium scale enterprises. Large firms are supposed to achieve higher t TFP considering their higher capital base and enjoyment of economies of scales. The coefficient for access to credit was positive (2.9486) and significant at 1% level of probability. This implies a direct relationship with TFP. Also, because of high asset base, firms can easily obtain loan from financial institutions given the availability of collateral. The result is in line with Obwona (2006) who reported that credit availability improves agribusiness firms' efficiency. The coefficient for distance to nearest market was negative and significant at 5% level of probability. This is expected because increase in distance to the nearest market would lead to a decrease in production efficiency since more money is required to acquire and evacuate input and output, respectively, as a result of transportation costs.

Conclusion

The study shows that determinants of TFP are skilled labour, cost of raw material, years of operation, scale of operation, access to credit and distance to nearby market. The findings on skilled labour indicate on the need for government to increase investment on human educational development. The firms should also build capacity of workers through mounting of training programmes. In the case of cost of raw material which has negative influence on TFP, it was recommended that agribusiness firms should embark on backward integration with their major sources of raw material inputs. The firms should further purchase in bulk while government should also restore subsidies on agribusiness raw material inputs. In addition, the Central Bank of Nigeria ought to strengthen credit policies on agribusiness sector.

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