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Technical Efficiency of Agribusiness Firms in Southwestern Nigeria

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Abstract
This study evaluates the technical efficiency level of Agribusiness firms. Specifically, the objectives where to; identify socio-economic characteristics that influence technical efficiency, determine levels of technical efficiency, identify and analyse determinant of efficiency. Primary data used for this study were obtained from a representative sample of 120 Agribusiness firms which were selected using purposive random sampling.Frequency table and Stochastic frontier production function was used to analyse the data, Technical efficiency levels of Agribusiness firms showed that majority of the firms were operating above 70%. Age of decision maker (manager) was a major determinant that influence technical efficiency at 5%, educational level of decision maker and level of investment were significant at 1% and 10% respectively but level of investment was negatively significant. The study revealed that the Agribusiness firms were technically inefficient and there is room for efficiency growth.
Keywords: Agribusiness, efficiency, technical efficiency, firms, stochastic frontier, Maximum Likelihood Estimate

1. Introduction

The word Agribusiness as been defined to include not only those that farm the land but also the people and firms that provide the inputs, process the output, manufacture the food products, and transport and sell the food products to consumers Baruah, (2011). Agribusiness was also defined as the total output arising from farm production and product processing at both pre- and post farm gate levels (Acharya, 2007). The food and fiber system is increasingly being referred to as "Agribusiness". The term Agribusiness was first introduced by Davis and Goldberg in 1957. According to them it represents three part system made up of (1) the agricultural input sector (2) the production sector and (3) the processing-manufacturing sector. Agribusiness is emerging as a specialized branch of knowledge in the field of management sciences. In this context, agribusiness can be defined as science and practice of activities, with backward and forward linkages, related to production, processing, marketing, trade, and distribution of raw and processed food, feed and fibre, including supply of inputs and services for these activities (Acharya, 2007).

In Nigeria, Agribusiness firms are scattered all over the country but are concentrated in three main industrial clusters in Nigeria; Kano, Kaduna, Jos in the North; Lagos, Otta, Ibadan in the South West and Port Harcourt, Aba, Nnewi, Onitsha in the South East. In general, the Lagos-Otta-Ibadan axis accounts for 44 percent of the registered firms and roughly 52 percent of the employment. Based on the average number of employees per firm, the largest firms are also located in the Lagos area. While most of the sector is made up of small-scale enterprises (about 60 percent of the firms have between 20 and 49 employees), these account for 12 percent of employment. With a few exceptions, firms with more than 500 employees provide the bulk of sectoral employment. As a whole they account for 53 percent of total employment in the manufacturing sector (Marchet et al, 2001).

Agribusiness enterprises in Nigeria can be classified into four major groups, farming input supply companies, producing farm firms, food processing agribusiness firms, and food marketing and distribution agribusiness organizations. These four groups can be found in the formal and informal sector of the economy. The formal agribusiness sector is defined as any manufacturing firm registered with the National Directory of Establishments published by the Federal Office of Statistics and includes those that are registered with the Manufacturers Association of Nigeria (MAN) or the National Association of Small and Medium Scale Enterprises (NASME).

The informal sector is not registered with these umbrella bodies but may or may not be organized into localised associations. Examples include food processors, private food stores, supermarkets, farmer cooperatives, and wholesalers scattered all over the country. This group differs from micro-enterprises by the share volume of output or sophistication of machinery used in the production process.

Agribusiness system has undergone a rapid transformation especially in the processing and manufacturing sector as new industries have evolved and traditional farming operations have grown larger and more specialized. In Nigeria, Agribusiness firms have developed over the years from small scale to large scale but their efficiency and productivity in the daily running of the agribusiness firms still has much to be desired.

As a developing country, Nigeria has immense potential for better economic growth in both short and

long runs than it is currently recording. The need for the efficient allocation of productive resources cannot be overemphasized. Every factor of production should be efficiently and effectively mobilized to close the gap between actual and potential national outputs (Ajibefun et al, 2003). Therefore, any attempt to identify determinants of efficiency of productive resources would help in achieving growth at macro level. Besides, economic difficulties in most developing countries today, including Nigeria, make the financing of inputs/capital accumulation infeasible. Hence, the focus on industrial growth is shifting to issues of efficiency in the use of the available quantum of productive inputs.

The term "efficient" is very much confused and misused with the term "effective". In general, efficiency is a measurable concept, quantitatively determined by the ratio of output to input. "Effectiveness", is a relatively vague, non-quantitative concept, mainly concerned with achieving objectives (Wikipedia, 2012). A simple way of distinguishing between Efficiency and Effectiveness is the saying, "Efficiency is doing things right, while Effectiveness is doing the right things."

Efficiency in general describes the extent to which time or effort is well used for the intended task or purpose. It is often used with the specific purpose of relaying the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or unnecessary effort. "Efficiency" has widely varying meanings in different disciplines. To economists, efficiency is a relationship between ends and means. (Paul Heyne). Economists argue that the achievement of (greater) efficiency from scarce resources should be a major criterion for priority setting (Stephen and David 2012).

Ajibefun et al, 2003, the efficient allocation of resources at individual firm levels has implications for investment and employment at the national level. It also has implications for technical and technological progress resulting in supply shifts. Needless to add that gross national product (GNP) and per capita income will also be expected to rise, which will help to serve import substitution purposes by supporting domestic demand. Ajibefun et al, 2003, the measurement of efficiency is important for the following reasons. First, it is a success indicator and performance measure by which production units are evaluated. Second, it is only by measuring efficiency and separating its effects from the effects of the production environment that one can explore hypotheses concerning the sources of efficiency differentials. Identification of sources of inefficiency is essential to the institution of public and private policies designed to improve performance. Third, the ability to quantify efficiency provides decision makers with a control mechanism with which to monitor the performance of the production system or units under control.

The concept of efficiency is divided into three namely; Technical, Allocative and Productive Efficiency. These three are vital in the growth and development of any Agribusiness firms. Technical efficiency means that natural resources are transformed into goods and services without waste, that producers are doing the best job possible of combining resources to make goods and services. There is no waste of material inputs. There are no workers standing idly around waiting for spare parts. The maximum amount of physical production is obtained from the given resource inputs. In essence, production is achieved at the lowest possible opportunity cost.

Koopmans (1951) provided a definition of Technical Efficiency: A producer is technically efficient if, and only if, it is impossible to produce more of any output without producing less of some other output or using more of some input. A firm is said to be technically efficient if a firm is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. For example. a firm would be technically inefficient if a firm employed too many workers than was necessary or used outdated capital. Technical efficiency is a prerequisite for Allocative or Economic Efficiency.

The purpose of this study is to evaluate the Technical Efficiency of Agribusiness firms, it specifically to, (1) identify socio-economic characteristics that influence technical efficiency; (2) determine levels of technical efficiency; (3) analyse determinant of efficiency; (4) estimate technical efficiencies of Agribusiness firms;

Hypothesis of the study states that the selected Agribusiness firms are efficient and have no room for efficiency growth

2. Theoretical Framework

Technical efficiency means that natural resources are transformed into goods and services without waste, that producers are doing the best job possible of combining resources to make goods and services. There is no waste of material inputs. There are no workers standing idly around waiting for spare parts. The maximum amount of physical production is obtained from the given resource inputs. In essence, production is achieved at the lowest possible opportunity cost. Technical efficiency refers to the ability of a firm to produce maximum output given its inputs (Oleg, Michael and Andreas, 2012).

Technical efficiency has also been defined as the effectiveness with which a given set of inputs is used to produce an output. Koopmans (1951) provided a definition of Technical Efficiency: A producer is technically efficient if, and only if, it is impossible to produce more of any output without producing less of some other output or using more of some input. A firm is said to be technically efficient if a firm is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. For example. a firm would be

technically inefficient if a firm employed too many workers than was necessary or used outdated capital.

The level of technical efficiency of a particular firm is characterised by the relationship between observed production and some ideal or potential production (Greene 1993). However, while technical efficiency is necessary for economic efficiency, it does not guarantee economic efficiency. Technical efficiency is just one component of overall economic efficiency. Inos an Sean (2012), however, in order to be economically efficient, a firm must first be technically efficient. Profit maximisation requires a firm to produce the maximum output given the level of inputs employed (i.e. be technically efficient), use the right mix of inputs in light of the relative price of each input (i.e. be input allocative efficient) and produce the right mix of outputs given the set of prices (i.e. be output allocative efficient) (Kumbhaker and Lovell 2000).

3. Methodology

The research was carried out in Lagos State the 2nd fastest growing city in Africa and 7th in the world and Ogun State both situated at the South-Western Zone of Nigeria due to their prominence in Agriculture and Agribusiness.

3.1 Sampling Technique

Purposive and Random Sampling techniques was used to select the respondents, Lagos and Ogun state were purposively selected because of the prevalence in Agribusiness. Simple Random Sampling was used to select 60 Agribusiness firms from the list of Agribusiness firms provided making a total sample size of One hundred and twenty (120) firms.

3.2 Analytical Technique

Descriptive statistics such as frequency distribution and percentages, Maximum Likelihood Estimates (MLE) and stochastic frontier production function analyses techniques were used to analyse the data collected.

3.2.1. Model Specification

3.2.1.1 Technical efficiency estimation

The Cobb–Douglas (1928) stochastic frontier production function specifies the technology of the enterprises. The model was defined by:

$$ln\ Yi = f(xi,\beta)\exp(Vi - Ui)\ i = 1,2,\ldots\ldots,n \quad (1)$$

where *l*n represents the natural logarithm; the subscript *i* represents the ith enterprise; and *Y* represents the value of output, which is measured in monetary unit (naira). *X* represents the quantity of inputs used in production by ith enterprise, and varies between *i* and *n* inputs.

The Vi 's are assumed to be independent and identically distributed random errors (iid), having N(0,σv 2) distribution, independent of the *Ui*s. The *Ui*s are technical inefficiency effects, which were assumed to be non-negative random variables.

This stochastic frontier model was independently proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). The model is such that the possible production, Yi' is bounded above by the stochastic quantity, f(xi;~)exp(Vi); hence the term *stochastic frontier.*

The technical efficiency of the individual firm was defined in terms of the ratio of observed output to the corresponding frontier output, conditional on the levels of input used by the firm. Hence the technical efficiency of firm *i was* expressed as:

$$Tei = \frac{ln\ Yi}{ln\ Y^*} = \frac{f(Xi;\beta)\exp(vi-ui)}{f(Xi;\beta)\exp(vi)} = \exp(-ui) \quad (2)$$

Given the assumptions of the stochastic frontier model, inference about the parameters of the model can be based on the maximum-likelihood estimators because the standard regularity conditions hold. Aigner, Lovell and Schmidt (1977) suggested that the maximum-likelihood estimates of the parameters of the model be obtained in terms of the parameterization, $\sigma \equiv \sigma^2_V + \sigma^2$ and $\lambda \equiv \sigma/\sigma$ V'

3.2.1.2. Determinants of Technical Efficiency

Some of the factors that influence the technical efficiency was determined quantitatively the Ordinary Least Square multiple regression analysis (OLS) under the assumption that data collected fulfilled the assumptions of multiple regression model. These assumptions include absence of multicollinearity among the explanatory variables, normally distributed error term with zero mean and constant variance and non auto regression disturbance (Koutsoyiannis 1981).

Technical Efficiencies were assumed to be determined by firm specific variables, and may be expressed as:

$$\mu i = \delta\ 0 + \Sigma\delta\ iz \quad (3)$$

where δ*s* are unknown parameters to be estimated and the *zs* represent the factors that could influence efficiency of the enterprises.

Variable to be estimated are Output (Y) measured in Naira; X1 = Quantity of Agric raw materials in

(Kg); X2 = Quantity of other materials used (Kg); X3 = Quantity of water (in litres); X4 = Working hours (in person-days); X5 = Total material cost (in naira); X6 = Depreciation on equipment (in naira); X7 = Age of business operator/decision maker (in years); X8 = Level of education of business operator/ decision maker (in years); X9 = Number of employees; X10 = Level of investment (in naira);

4.0 Result and Discussion

4.1 Socio Economic Characteristics

Table 1 shows that 37 companies out of the 120 companies interviewed have been in existence between 11-15years which amount to 30.83%, others are between 6-10 years, 16-20years, 21-25years, over 25years which represents 17.50%, 16.67%, 15.83%, 19.17% respectively. Table 2 shows that 72.50% of decision makers have master's degree while 27.50% have first degree. Table 3 shows that 47.50% of the decision makers are between the ages of 41-45years while 10% are between 35-40years, 19.17 are between 46-50years while 51-60years and over 60years are 12.50% and 10.83% respectively. Table 4 shows the gender of the decision makers 70% were Male while 30% were Female.

4.2 Technical Efficiency Estimate

The Maximum Likelihood Estimate for the variables was obtained after transforming the variables into log form and then running a Stochastic Frontier Production Function. Table 5 shows the MLE result which indicates that Age of Decision makers was significant at 5%, while Level of investment was negatively significant at 10%.

4.3 Determinant of Efficiency

In table 7, the Educational level and Age of decision maker was significant at 1% and 5% respectively. This result indicates that with access to more business knowledge and decision making skills firms will me more technically efficient. The significance of Age of decision makers (manager) simply implies that younger people are better equipped and make better use of technology in their production process.

4.4 Technical Efficiency Level

Table 7 indicate that technical efficiency (*TE*) indices range from 30 to 100 per cent for the firms in the sample, with an average of 71 per cent. This shows that the firms still have room for efficiency growth.

4.5 Hypothesis test

The hypothesis stating that the firms are Technically Efficient and have no room for efficiency growth is rejected (table 7), this is ascertained by the result of average Technical efficiency level of the firms at 71% (table 8), Agribusiness firms still have 29% room for efficiency.

5.0 Conclusion

This study as establish the fact that the Agribusiness firms in the sample data are not technically efficient and therefore have room for efficiency growth which was supported by the average Technical efficiency level of 71%. However, Level of investment, Age and Educational level of decision makers (managers) were significant at 10%, 5% and 1% respectively.

Age of decision makers (managers) was found to be a vital and sensitive factor that influence Technical efficiency coupled with their level of education which gives them more exposure to business information that helps them to make better economic decision that favours production and increase Technical efficiency (*TE*) of firms.

Investment level showed a significant influence on Technical efficiency but with its negative influence one can only conclude that the interest rate offered by commercial banks in the country is on the high side. Federal Government and Central Bank of Nigeria should therefore make effort to reduce the interest rate charged by commercial banks for loans as this will increase the efficiency and hence productivity of firms.

Firms should encourage young and brilliant minds to manage the enterprise as they are better in embracing and managing technology for better performance. Business managers should also pursue more knowledge in their line of business as this will ensure they get the right business information and knowledge to make them better decision makers to increase their efficiency and production.

References

Acharya S. S. (2007) Agribusiness in India: Some Facts and Emerging Issues, *Agricultural Economics Research Review* Vol 20 Conference issue 2007 pp 409-424. Presidential Address at the 15th Annual Conference of Agricultural Economics Research Association (India) (AERA), organized by University of Agricultural Sciences, Dharwad, October 25-26, 2007

Ajibefun Igbekele A. and Adebiye G. Daramola (2003) Efficiency of microenterprises in the Nigerian economy

AERC Research Paper 134 African Economic Research Consortium, Nairobi

Aigner, D. J., Lovell, C., and Schmidt, P. (1977). Formulation and Estimation of Stochastic Frontier Production Models. Journal of Econometrics, 6, 21{37.

Cobb, C.W and Douglas P.H. (1928), "A Theory of Production". *American Econometric Review*, 18, 139-165.

Davis and Goldberg (1974). Agribusiness management for development countries

Dr B.K Baruah (2011). Agribusiness Management, its meaning, nature and scope, types of management tasks and responsibilities Department of Agril. Economics Farm Management Assam Agricultural University Jorhat – 785 013.

Greene, W.H. (1993). *The measurements of Productive Efficiency: Techniques and Applications*, Oxford University Press, Oxford,

Koutsoyiannis A (1981), *Theory of Econometrics.* London: The Macmillan Press Ltd.

Koopmans, T. C. (1951). An Analysis of Production as an E_cient Combination of Activities. In T. C. Koopmans, ed., Activities Analysis of Production and Allocation, New York: Wiley.

Kumbhakar, S., and Lovell, C. (2000). Stochastic Frontier Analysis. Cambridge: Cambridge University Press.

Meeusen, W., and van den Broeck, J. (1977). Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error. International Economics Review, 18:2, 435{44}

Oleg Badunenko Michael Fritsch Andreas Stephan (2011) What determines technical efficiency of firms? evidence from a representative panel of German manufacturing firms

Stephen Palmer and David J Torgerson (1999) Education and Debate Economics notes, Definitions of efficiency BMJ 318:1136

Sean Pascoe (2012) Estimation of technical efficiency: a review of some of the stochastic frontier and DEA software.

Wikipedia (2012). Food Processing, www.wikipedia.com/foodprocessing.htm

Table 1: Age of business (Year of operation)

Age of business (years of operation	Freq	Percent
6-10	21	17.5
11-15	37	30.83
16-20	20	16.67
21-25	19	15.83
Over 25 years	23	19.17
Total	120	100

Table 2: Educational status of business operator

Educational status of business operator	Freq	Percent
First degree	38	27.50
Masters degree	87	72.50
Total	120	100

Table 3: Age of business operator

Age of business operator (years)	Freq	Percent
35-40	12	10
41-45	57	47.5
46-50	23	19.17
51-55	15	12.50
Over 55	13	10.83
Total	120	100

Table 4: Gender of Decision maker

Gender of decision maker	Freq	Percent
Female	36	30
Male	84	40
Total	120	100

Table 5: Maximum Likelihood Estimates (MLE)

Variables	**Coefficient**	**Standard deviation**	**Z values**
Constant	22.47548	5.121062	4.39
Quantity of Agric raw materials in (X1)	-0.0454966	0.0507083	-0.90
Quantity of other materials used (X2)	0.1170173	0.1173479	1.0
Quantity of water (X3)	-0.0505026	0.1306363	-0.39
Working hours (X4)	-0.2314634	0.5170721	-0.45
Total material cost (X5)	0.0070501	0.0606769	0.12
Depreciation on equipment (X6)	-0.3959299	0.5157606	-0.77
Age of decision maker (X7)	3.632024	1.326622	2.74**
Level of education of decision maker (X8)	-0.0102758	1.355653	-0.01
Number of employees (X9)	-0.022263	0.4413401	-0.05
Level of investment (X10)	-0.579602	0.4315977	-1.34***
$\ln sig\sigma_v^2$	-9.576431	2.48685	-3.85
$\ln sig\sigma_u^2$	1.108864	0.1927963	5.75
Sigmaσ_v	0.0083273	0.0103544	
Sigmaσ_u	1.740952	0.1678246	
Sigmaσ^2	3.030984	0.5843547	
Lamda λ	209.0655	0.1678015	
Log likelihood	-110.72675		

Source Field Survey 2013 **5%, ***10% significance level

Table 6: Hypothesis testing

Null Hypothesis	Calculated value	Df	Pvalue	Decision
H0;u=0	69.80	13	0.0000	Rejected

Table 7: Determinant of Technical Efficiency

Variable	**Coefficient**	**Standard error**	**T values**
Constant	-0.303	0.0929	-3.26
Age of decision maker (M1)	0.126	0.0610	2.07**
Educational level of decision maker (M2)	0.112	0.0186	6.02*
Number of employees (M3)	0.333	2.97	0.11
Level of investment (M4)	-380.6517	10236.3	-0.04
Age of business (M5)	-0.990	0.823	-1.20
R^2	0.2467		
R^{-2}	0.2137		
F value	7.47		

Source Field Survey 2013 *1%, **5% significance level

Table 8 Technical Efficiency Level

Technical Efficiency Level	**Percent**
90-100	4
80-89	29
70-79	58
60-69	0
50-59	5
40-49	17
30-39	7
Below 30	0
Mean	**71**