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DETERMINANTS OF TECHNICAL EFFICIENCY IN POULTRY PRODUCTION: A CASE OF IJEBU NORTH LGA, OGUN STATE, NIGERIA

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DETERMINANTY TECHNICKEJ ÚČINNOSTI PRI PRODUKCII HYDINY: PRÍPADOVÁ ŠTÚDIA ZAMERANÁ NA VYBRANÝ REGIÓN V NIGÉRII

ABSTRACT
This paper investigates the factors that determine productivity and technical efficiency levels among smallholder poultry producers. The analytical tools used for this research were the Regression Analysis and Stochastic Production Frontier approach respectively. The analyses were performed with data obtained from 120 well-structured questionnaires drafted by me and administered among the farmers in the study areathrough the use of the multi-stage sampling technique. The questionnaires comprised of two main components: Socio-Economic Characteristics of the farmers and Production Data (variable/fixed production inputs/cost and output or yield), they were administered in two phases in August 2010. The results showed that the quantity of feeds used, level of education, the total number of birds, expenses on drugs and the sex of the farmer were major determinants of the output level and showed significant values. The stochastic production function showed that poultry farmers in the study area are efficient in the use of their resources with a minimum, maximum and mean technical efficiency of 42%, 95%, and 75.1% respectively. Therefore, an increase in the technical efficiencies of farmers and the efficient utilization of their productive resources, will boost the rural economy as the majority of these farmers are found there, thereby serving as a veritable means of improving their standard of living.

KEY WORDS: *Technical efficiency, Productivity, Agriculture, Poultry production.*

JEL Classification: *C21, Q13, Q18, R30*

Introduction

The role of the poultry industry in Nigeria has assumed a significant status over the years in terms of social, economic and dietary importance to both country and citizenry. The FAO (2010) reports that Nigeria produces above 550,000MT of poultry meat per annum and 700,000MT of eggs. This attracts some form of interest because apart from bridging the protein deficiency gap in our diets, it also empowers the people especially the rural poor economically. Interestingly, poultry meat and eggs are consumed animal protein without (or little if any at all) religious or cultural prohibitions in Nigeria. It was recorded that the poultry industry contributed about 25% of the country's Agricultural GDP (FAO, 2010) and meets the needs of man in meat and egg supply, organic fertilizers, research, medicine and aesthetic value (Atteh,2004).

However, inadequate capital, illiteracy and lack of technical experience are some of the most important socio-economic factors inhibiting poultry production in Nigeria. The technical aspect is of serious concern because the combination of these limited resources and inputs have important implications on the output level and to a large extent the trading of meat and poultry products globally (Landes et al. 2004). Hence the capacity to develop technical production practices that are consistent with environmental and economic conditions, is important to boost poultry production in Nigeria. Therefore, the question of how technically efficient the producers are arises.

Theoretical background

Technical efficiency entails the use of a minimum level of input under necessary technology to produce a given desired level of output. Hence, Efficiency is defined as how effectively a production unit uses variable resources for the purpose of profit maximization given the best production technology combination available (Kebede 2001). Technical efficiency in agriculture depends on a variety of factors or their combinations. These may include; technology adopted, input and output market environment, farm specialization, size of the farm and scale economies, organization and management, institutional policy framework among other factors (Gorton-Davidova 2004; Swinnen 2009). Coelli et al. (2005)posited that the influence of technology use and relative factor abundance on performance are crucial necessities in understanding and explaining the concepts of production theory, efficiency and induced technological progress. This is particularly interesting in that the small-scale poultry producers; classified by Ojo (2003) as farms having up to 1000 birds and who are the focus of this research, practically employ subsistence means for production in the study area.

To this end, Swinnen (2009) in his study on various agricultural structures, argued that there can be a mix between farm technical efficiency and labour/land ratio depending on differences in farm and labour adjustment processes in either labour intensive or capital and land intensive countries. He further affirms that there is a positive association between the size of land used by small farms and the size of labour used in agricultural production. Furthermore, agricultural inputs can be varied, as the more efficient farmers are with the utilization of available resources, the more productivity growth can be achieved. Various studies have observed that one of the most serious constraints of agricultural growth in Nigeria is the inefficient use of productive resources and that considerable growth can be achieved by simply improving the level of efficiency in resource use (Kareem et al. 2008). Furthermore, the major problem of the poultry production in Nigeria is that of low productivity and inefficiency in resource allocation and utilization (Onyenweaku and Effiong, 2006).

Poultry production in Nigeria is of great significance not only because it is a major source of protein in the country, but it also contributes to the Gross Domestic Product (GDP) and provides employment opportunities in Nigeria (Ajibefun and Daramola, 1999). However, according to the CBN (2004), food production increases at the rate of 2.5% while food demand increases at a rate of more than 3.5% due to high rate of population growth of 2.83 %. Also, when we consider the fact that despite various efforts by government over the years to increase poultry production in the country through several initiatives and policies, Nigeria is still lagging in poultry output projections as the output of poultry products still falls short of other livestock products (Afolabi,2007). Hence, there is every reason to be concerned because the National Planning Commission (2009) estimates that the country's population would have reached 193 million by 2020 and 289 million by 2050.

Therefore, this paper tends to look at the various factors that influence the production and to a large extent the efficiency of productive resource utilization in poultry production.

Research methodology

Method of data collection

For this study, primary and secondary data were used. Primary data were collected through a set of structured questionnaires that were administered to 120 poultry farmers and secondary data, were obtained from journals, previous researches, reports, textbooks, science magazines, and relevant publications.

Sampling Technique

Multi-stage random sampling was used to divide Ijebu North Local Government Area based on the 11 political wards which it consists of. Then of these, 5 wards were purposely selected for which the questionnaires were then administered in each of them.

Method of data analysis

To examine the determinants of output level, the analytical technique used was the regression technique which took into consideration various functional forms for the analysis. The general form for the model is given as:

$$Y = \beta o + \beta Xi + E \quad (1)$$

Where Y = Gross value of production (₦)
βo = Intercept
X_i = Independent or explanatory Variable
E = Error Term

The linear functional form will be:

$$Y = \beta o + \beta_1 X_1 + \beta X_2 + \beta_8 X_8 + E \quad (2)$$

X_1 = Age (Years)
X_2 = Experience of Farmer (Years)
X_3 = Sex (Male 1, Female 0)
X_4 = Level of education (Years)
X_5 = Quantity of feed used (Kg)
X_6 = Number of birds raised
X_7 = Expenses on drugs (₦)
X_8 = Total labour used (Man days)
$\beta_1 - \beta_8$ = regression coefficient.

The other functional forms that were used are:

Exponential: $\ln Y = \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_8 X_8 + E$ (3)

Semi-Log: $Y = \ln\beta o + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_8 \ln X_8 + E$ (4)

Double Log: $\ln Y = \ln\beta o + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_8 \ln X_8 + E$ (5)

The Stochastic production frontier approach was used to analyse the poultry production efficiency level(Coelli, 1996).

The estimated production function is the form:

$$\ln Yi = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + (Vi - Ui) \quad (6)$$

Where,

Y= Gross value of production (₦)
X_1=Number of birds
X_2=Quantity of feeds used (Kg)
X_3=Total labour used (Manday)
X_4=Expenses on medicines /vaccines (₦)
β_0=Intercept
Vi= random error assumed to be independent Ui, identical and normally distributed with zero mean and constant variance N (0,δ2v).
Ui=technically inefficiency effects which are assumed to be independent of Vi, they are non-negative truncation at zero or half normal distribution with N (μ, δ2u). If Ui =0, no allocative inefficiency occurs, the production lies on the stochastic frontier. If Ui>0, production lies below the frontier and it is inefficient.

Research results and findings

Determinants of output level in small scale poultry production

For poultry farming to make any headway in a nation, it is expedient to ensure that the major players, of which the farmer is a focal point, identify the necessary conditions and factors that will not only improve output but also sustain an improved level of revenue and income. This will also ensure the efficient allocation of these resources for the ultimate goal which is profit making for the farmer and food security for the nation. This was the basis for this objective.

To estimate the determinants of output level, the four functional forms were used for the regression to show the effect of the independent variables on the dependent variable (Gross value), and the lead equation chosen was based on econometric and statistical considerations. From the table 1 below, the adjusted R^2 values for the Linear, Exponential, Double Log and Semi Log functions are 0.875, 0.752, 0.707 and 0.687 respectively. The F values for the functions in the same order are 76.480, 33.825, 26.855, and 24.556 respectively. Therefore, the linear functional form was chosen as the lead equation as it had the highest adjusted R^2 value and F value among the four functions.

The level of education, quantity of feed used, number of birds and expenses on drugs were all significant at 1% with coefficient values of 0.13, 0.76, 0.14, and 0.17 respectively. This means that an increase in each of these four variables by 1% will cause the value of output to increase by 0.13%, 0.76%, 0.14% and 0.17% respectively. This result is supported by the findings of Oji and Chikuwa (2007) that the quantity of feeds

significantly determines production output levels. Sex was also significant but at 5% with a coefficient of 0.09. This indicates that the gross value of production of poultry farms operated by males was more likely to increase than what was obtained in poultry farms operated by females. This could however not be far from the fact that the majority of the respondents were male and that poultry farming requires some level of physical strength as it is basically labour intensive and still involves the use of crude implements on a small scale.

An adjusted R^2 value of 0.875 indicates that the independent variables will account for 87.5% variation in the output level of small scale poultry farming. Also, an F value of 76.48 which is significant at 1% is the goodness of fit which indicates that the model is best fitted for the objective.

Table 1. Estimates of Regression Analysis on the Determinants of poultry production.

F value	76.480	33.825	26.855	24.556
Adjusted R^2	0.875	0.752	0.707	0.687
R^2	0.886	0.775	0.734	0.716
Labour (X_8)	0.056 (1.206)	0.013 (0.196)	0.138** (1.96)	0.255*** (3.524)
Expenses on drugs (X_7)	0.171*** (3.426)	0.165** (2.352)	0.521*** (6.657)	0.432*** (5.341)
No of birds raised (X_6)	0.138** (3.056)	0.221*** (3.489)	0.067 (0.895)	-0.003 (-0.041)
Feeds used (X_5)	0.762*** (16.131)	0.706*** (10.620)	0.318*** (5.077)	0.323*** (4.999)
Level of education (X_4)	0.126)*** (3.406)	0.130** (2.502)	0.178*** (3.080)	0.204 (3.430)
Sex Male= 1 (X_3)	0.090** (2.584)	0.096)* (1.971)	0.050 (0.942)	0.036 (0.660)
Experience (X_2)	0.021 (0.424)	0.015 (0.209)	0.034 (0.434)	0.025 (0.315)
Age (X_1)	0.24 (0.44)	0.033 (0.421)	0.166* (1.929)	0.185** (2.079)
Constant	-549588 (-1.528)	12.902 (41.407)	3.809*** (3.916)	-0.01*** (-9.141)
Functional Form	Linear	Exponenti al	Double Log	Semi Log

Source: Field survey, 2010.
Figure in parenthesis represents the t-value.
*** *Significant at 1%*
** *Significant at 5%*
* *Significant at 10%*

Efficiency estimates of the poultry farmer

Given the specification of the Cobb-Douglas frontier production function, the technical efficiency of the poultry farmers in Ijebu North Local Government Area was calculated. The predicted levels of efficiency differ substantially among the farmers, ranging between 42% and 95% with a mean of 75.1%. The high level of technical efficiency is an indication of efficient resource use by the farmers. Also, there exist a reasonable gap between the efficiency of the best technically efficient farmer and that of the 'average' farmer. This type of gap variation in farmer-specific level suites poultry production business in the area. Furthermore, the varying socio-economic characteristics of the sampled farmers such as farming experience, level of education and age of the farmers, must have influenced the farmers' ability to use improved farming practices; a situation that must have contributed to the observed variation and high level of efficiency amongst them.

The positive and significant relationship of education on technical efficiency of the farmers is consistent with the findings of Onyenweaku et al(2004),Amaza and Olayemi (2000),Onyenweaku and Nwaru (2005), Onu et al (2000). Interestingly too, the years of experience showed no significant relationship with the output and negates the findings of Nwaogu (2006) who posited that the longer the years of farming experience, the more exposed the farmer becomes and the more efficient the farmer is expected to be.

Table 2. Technical Efficiency Analysis.

Decile Range of Technical Efficiency	Frequency	Percentage (%)
0.40-0.49	4	3.3
0.50-0.59	7	5.8
0.60-0.69	21	17.5
0.70-0.79	39	32.5
0.80-0.89	46	38.3
0.90-0.99	3	2.5
Total	120	100

Source: Field survey, 2010.

Mean = 75.1%
Minimum = 42%
Maximum = 95%

To this end, the level of efficiency as presented in Table 2, shows that about 38.3% of the sampled poultry farms had the level of technical efficiency exceeding 80% and operating close to the frontier. About 2.5% of the farmers had level efficiency ranging between 90%-99%, while about 50% of the farmers had technical efficiency ranging between 60%-79%. About 3.3% and 5.8% had technical efficiency ranging between 40%-49% and 50%-59% respectively.

Conclusion

The regression analysis revealed that the level of education, quantity of feed used, number of birds, expenses on drugs and sex had significant effect on the level of output, therefore they are important factors which should be considered by the farmers in their production process for increased revenue and value of output. The poultry farmers were technically efficient as the level of technical efficiency among them, ranged between 42% and 95% with a mean technical efficiency of 75.1%. Interestingly, 38.3% of the sampled poultry farms had technical efficiency exceeding 80% and thus operating close to the frontier. About 9.1% had level technical efficiency ranging between 40%-59%. Also, about 2.5% of the farmers had efficiency level ranging between 90%-99%, while about 50% of the farmers had technical efficiency ranging between 60%-79%.

This study revealed that the number of birds raised, expenses on drugs, sex, feed consumed and the level of education all have significant effect on the output of the poultry farms. This means that the output of poultry farms increased with an increase in stock of birds, expenses on drugs, feed consumed and level of education. Interestingly, output was higher in farms operated by male farmers compared to those operated by their female counterparts.

Recommendations

Based on the results obtained from this study, the following recommendations are made:

(i) The efficiencies of the farmers can be increased by constant and regular introduction of new techniques and innovation in poultry farming. This can only be made possible however, by an efficient and effective government driven extension system which will propel regular training and retraining.

(ii) Government and policy makers should encourage farmers to embrace more of mechanization by providing them with subsidies, leasing at affordable prices and creating a framework which will enable them have easy access to them.

(iii) To achieve a higher level of productivity in poultry production, there is need for the farmers to have easy access to credit for expansion.

All these will not only boost production levels of food but also improve the quality consumed by the populace.

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