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TECHNICAL EFFICIENCY OF SMALLHOLDER POULTRY FARMERS IN AKURE SOUTH LOCAL GOVERNMENT AREA, ONDO STATE, NIGERIA

Oluwakemi ODUNTAN

The Federal University of Technology, Department of Agricultural and Resource Economics, PMB 704, Akure, Nigeria, Email: ooduntan@futa.edu.ng

Corresponding author: ooduntan@futa.edu.ng

Abstract

The study examined the technical efficiency of smallholder poultry farmers in Akure South Local Government Area, Ondo State, Nigeria. The study used a multi-stage sampling procedure to select eighty respondents with the aid of structured questionnaire. The primary data collected were analysed using descriptive statistics, budgeting analysis and the stochastic frontier production function model. Findings revealed that majority (65%) of the respondents were male. The mean age of the respondents was 40 years. About 66.3% of the respondents were married and majority (85.0%) of the respondents were literate with at least primary school education. The mean of farming experience was 7years, indicating that most of the farmers were new entrants into the poultry business. The findings indicated that poultry production by smallholder farmers was a profitable enterprise in the study area. The results of the stochastic frontier analysis revealed that farming experience, access to credit facilities, membership of cooperative association and extension contact influenced the technical efficiency of smallholder poultry farmers in the study area. It was therefore, recommended that government should work on providing credit access to farmers while also stimulating agricultural extension programs through educational and research institutions. Also, farmers should come together often so that they can pool resources together and easily get the government's attention.

Key words**:** *efficiency, farmers, Ondo State, poultry, smallholder*

INTRODUCTION

Agriculture remains an important economic sector in many developing countries. It is a source of growth and a potential source of investment opportunities for the growing industries. However, the primary place agriculture occupies in Nigerian economy in providing food and fibre for the populace, has made it the most important sector influencing the livelihood of over 70% of Nigerians and a larger employer of labour in Nigeria (Aina and Omonona, 2012) [3]. However, the Nigerian poultry industry in particular has been rapidly expanding in recent years and is therefore one of the most commercialized subsectors of Nigerian Agriculture (USDA, 2013; Adene and Oguntade 2006) [1, 12]. The popularity of poultry production can be explained by the fact that poultry has many advantages over other livestock. Poultry birds are good converters of feed into useable protein in meat and eggs. The production costs per unit remain relatively low, and the return on investment is high (Heinke *et al*; 2015) [7]. Poultry refers to all birds of economic value to man. They are domesticated birds kept for eggs, meat, feathers and sometimes manure. These include: domestic fowl, turkey, pigeon, duck, geese, quail, guinea fowl, peacock and recently ostrich. They all belong to the zoological class Aves (Atteh, 2015) [5].

Smallholder poultry constitutes the most important sector, which accounts for the major poultry products supply in the developing world (Jato *et al.,* 2012) [8]. However, an attempt to utilize the full potentials of this sector has frequently failed due to the technical inefficiency which has consistently put the poultry farmers on the verge of economic redundancy and incapacitation. In the past 10 years, poultry products consumption in developing countries has increased by 5.8 percent per year, faster than the growth in population which also gave rise to increase in demand. For the supply to meet or exceed the demand for poultry

products, there should be a significant improvement in the efficiency so as to maximize the use of existing input.

MATERIALS AND METHODS

Study Area

The study was conducted in Akure South Local Government Area, Ondo State, Nigeria. It is located in the Southern part of Ondo State sharing boundaries with Akure North and Ifedore Local Government Areas in the North, Idanre Local Government in the South and Ondo East and Ile Oluji Local Government Areas in the West. Most of the land available to communities in the local government area is arable which is why they practise farming as the major occupation for family consumption and to meet commercial needs. The area consists largely of Yoruba-speaking people. The local government occupies a geographical area of 1,591 square kilometers with population of about 420,594 inhabitants (NPC, 2006) [9]. Its climatic condition also favours the rearing of poultry birds which are basically everywhere in the state. Research reports have however shown that poultry is more of major economic activities for people living in the rural communities that are abound in the Akure South Local Government area of Ondo State.

Data Source and Sampling Technique

Primary data were used for this study. The data were collected from the respondents with the aid of a structured questionnaire. Multi-stage Sampling Procedure was used for selecting the respondents used in this study. The first stage involved purposive selection of Akure South Local Government Area because of its high population. The second stage involved random selection of four (4) villages from the Local Government Area. In the final stage, 20 respondents from each village were selected to make a total of 80 respondents used for the study.

Analytical Technique and Model Specification

Data collected were analysed with the use of descriptive statistics, budgeting analysis and econometric analysis involving the use of stochastic frontier production function model. Descriptive statistics was used to present the socio-economic characteristics of the respondents. Budgeting analysis was used for the estimation of profitability of poultry production in the study area while the stochastic frontier production function model was used to estimate poultry farmer's technical efficiency.

Budgeting Analysis

The Gross Margin (GM) of an enterprise is the difference between the Total Value of Production (Total Revenue) and the Total Variable Cost (TVC) of production that is (eqn. 1):

$$GM = TR - TVC$$

$$= \Sigma P_i Q_i - \Sigma C_j X_j \quad (1)$$

where:
subscripts I refers to the i-th respondents while j represents observation of the j-th variable costs
GM = Gross margin
TR = Total revenue of different poultry products in naira for i-th poultry farmers
TVC = Total variable costs involved in rearing the different poultry birds in naira for i-th poultry farmers
P_i = Price per kg of each poultry bird
Q_i = Quantity of the different poultry birds reared by the i-th poultry farmers
C_j = Unit cost of j-th input used by the i-th poultry farmers
X_j = Quantity of j-th variable input used by the i-th poultry farmers.
If GM >0, then the farm enterprise is profitable
If GM < 0, then the farm enterprise is not profitable
The variables cost items are cost of wages paid to crew members, expenses on fuel (petrol), kerosene, oil, feed, water and maintenance/services.
The Net Revenue (NR) represents the difference between total revenue and total cost. The Net Revenue is given by (eqn. 2):

$$NR = TR - (TVC + TFC) \quad (2)$$

where:

TFC = Total Fixed Cost
TVC = Total Variable Cost

The Stochastic Frontier Production Function Analysis (SFPFA)

The SFPF inefficiency studies were employed in this study. In the SFPF, the error term is assumed to have two components parts, Vi and Ui. The Vi covers the random effects (random errors) on the production and they are outside the control of the decision unit while the U measures the technical inefficiency effects, which are behavioural factors that come under the control of the decision unit.

They are controllable errors if efficient management is used. The stochastic frontier approach is generally preferred for research because of the inherent variability of entrepreneurial productions due to interplay of raw materials, sophisticated equipment and environmental failures of many firms who are small enterprises, where keeping of accurate records is not always a priority; hence, available data on production are subject to measurement errors (Ojo and Ajibefun, 2002) [10]. Also, the specification of the stochastic frontier production model is stated thus:

$$Yi = f(Xa; \beta) \exp (Vi - Ui), i = 1, 2, ..., n,$$

where:
Y is output in a specified unit,
X denotes the actual input vector,
β is the vector of production function parameters and
εi is the error term that is decomposed into two identically distributed with mean zero and constant variance (σ2).

Vi captures the white noise in the production, which are due to factors that are not within the influence of the producers. It is independent of Ui. The Ui is a non-negative one-sided, truncation at zero with the normal distribution (Battese and Coelli, 1996) [6]. It measures the technical inefficiency relative to the frontier production function, which is attributed to controllable factors (technical inefficiency), it is half normal, identically and independently distributed with zero mean and constant variance.

The variances of the random errors ($\sigma^2 v$) and that of the technical inefficiency effects ($\sigma^2 u$) and overall model variance (σ^2) is related thus:

$\sigma^2 = \sigma u^2 + \sigma v^2$ and
the ratio, $\Upsilon = \sigma u^2/\sigma^2$ is called gamma.

It measures the total variation of output from the frontier, which can be attributed to technical inefficiency (Aigner, Lovell, & Schmidt, 1992) [2].

The TE of an individual firm is defined in terms of the observed output (Yi) to the corresponding frontier output (Yi*). The Y* is maximum output achievable given the existing technology and assuming 100 per cent efficiency.
It is denoted as:

$$Yi^* = f(Xib) + Vi$$
$$TE = Yi/Yi^*$$

Also, TE can be estimated by using the expectation of Ui conditioned on the random variable (V–U) as shown by Battese and Coelli (1996), that is:

$$TE = \frac{f(Xib) + Vi - Ui}{f(Xib) + Vi}, \text{ and that } 0 \leq TE \leq 1$$

The production technology of those in poultry production was developed through Cobb–Douglas frontier production function and which was further adopted and specified by Tadesse and Krishnamurthy (1997) [11] as follows:

$$LnYi = Ln\beta o + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \beta_6 LnX_6 + V_i + U_i$$

Y = Output (value of eggs, spent layers, market weight broilers and cockerels sold in naira)
X_1 = Farm size (number of birds)
X_2 = Cost of veterinary services (₦)
X_3 = Quantity of feed (kg)
X_4 = Labour input (man days)
X_5 = Capital input (₦)
X_6 = Cost of utilities and other expenses (₦)

βo = Constant terms
ln = Natural logarithm;
V_i = Random error assumed to be independent of U_i. Identical and normally distributed with zero mean and constant variable N (0, σv^2). U_i = Technical inefficiency effect which is assumed to be independent of Vi, they are non-negative truncation at zero or half normal distribution with N (0, σu^2). βj = $\sigma^2 v$, $\sigma^2 u$, σ^2 are unknown scalar parameters to be estimated.
The inefficiency model (U_i) is defined by:

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9$$

where: U_i, Z_1, Z_2, Z_3, Z_4, Z_5, Z_6, Z_7, Z_8, Z_9 represent: technical inefficiency effects, marital status, gender, family size, level of education, years of experience, extension contact, credits, membership of cooperative association and distance of farm to major road.

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Respondents

The results of the summary of socio-economic characteristics showed that the average age of respondents in the study area was 40 years. This implies that respondents were still within the active age which is required for farming activities. Most (65.0%) of the respondents were male while 35% of the respondents were female. This was expected given the drudgery nature, physical and energy demand as well as capital intensive nature of investment required to establish smallholder poultry farm enterprise. Most (66.3%) of the respondents were married.
Table 1 further shows that about 28.8% had secondary school education; about 15.0% had no formal education while 7.5% and 48.8% had primary education and tertiary education respectively. A huge proportion (85.0%) of the respondents had one form of western education or the other. Educational level of farms owners is very important in the management of poultry and it is known to affect their farming activities. The high literacy level of the respondents would afford them the opportunity to understand and adopt modern farm practices thereby enhancing productivity and profitability.
Furthermore, Table 1 shows that only 5% of the respondents had between 11-20 years of farming experience in smallholder poultry enterprise and a total of 78.2% had between 6-10 years. The mean years of farming experience was found to be 7 years. This suggests that majority of the smallholder poultry farms owners in the area were fairly new entrants into the business. It is generally expected that productivity increases with years of farming experience. Experienced smallholder poultry farms owners are likely to make better decisions to enhance productivity and income.

Table 1. Socio-Economic Characteristics of the Respondents

Variable	Frequency	Percentage
Sex		
Male	52	65.0
Female	28	35.0
Total	80	100.0
Marital status		
Single	23	28.8
Married	53	66.3
Widowed	4	5.0
Total	80	100.0
Age		
20-29 years	10	12.5
30-39 years	23	28.8
40-49 years	36	45.0
50-59 years	9	11.3
60 and above	2	2.5
Total	80	100.0
Level of Education		
No formal education	12	15.0
Primary School education	6	7.5
Secondary school education	23	28.8
Tertiary education	39	48.8
Total	80	100.0
Farming Experience		
1-5 years	13	16.3
6-10 years	63	78.2
11 and above	4	5.0
Total	80	100.0

Source: Computed from field Survey, 2018.

Costs and Returns of Smallholder Poultry Farmers

The Table shows the costs incurred and the profit realized by the smallholder poultry farmers in the study area. The mean of the total revenue, total variable cost and gross margin obtained in the study area were ₦5,250.85, ₦3,802.15 and ₦1,448.70 respectively. The findings indicated that poultry production by smallholder farmers was a profitable enterprise in the study area.

Table 2. Cost and Returns of Smallholder Poultry Farmers

Cost Item	Mean	Percentage
Variable Cost		
Stocking	222.19	5.71
Feeding	3,082.27	79.21
Labour	205.07	5.26
Vet. Service	192.23	4.94
Utility and other costs	100.39	2.58
Total Variable Cost	3,802.15	97.71
Total Fixed Cost	89.11	2.29
Total Cost	3,891.26	100
Revenue		
Eggs	4,528.89	86.25
Spent layer	593.06	11.2
Manure	110.35	2.10
Empty bags	18.55	0.36
Total Revenue	5,250.85	100
Net Farm Income	1,359.59	
Gross Margin = TR – TVC	1,448.70	

Source: Computed from field Survey, 2018.

Estimates of the Stochastic Production Function

The estimates of the Cobb-Douglass stochastic production function are as presented in Table 3. The value of gamma (γ) = 0.99 is statistically significant at the 5% level, which implies that 99% of the residual variation egg output was due to the inefficiency effect. Thus, the Cobb-Douglas functional form is an adequate representation of the data. Table revealed that the mean technical efficiency of 56.0% was recorded in the study area. This suggests that an average of about 56% of potential maximum output is gained due to production efficiency while the short fall (discrepancy between observed output and the frontier output) can be attributed to inefficiencies.

The major factors affecting the output of poultry eggs were in flock size, veterinary services, feed intake and labour. The coefficient of in flock size had a positive and significant relationship with output at 1% level. This implies that poultry egg production increased with increase in number of birds kept. Similarly, the coefficient of veterinary services was positive and significant at 1% level which implies that proper management involving the provision of adequate, qualitative and timely veterinary services to the birds will improve the technical efficiency of the farmers. The coefficient of feed cost was also positive and significant at 5% level. This indicates that the higher the feed intake by the birds, the greater the technical efficiency of the farmers. Furthermore, coefficient of labour variable was positive and significant at 1% level. On the other hand, the results of the inefficiency model showed that the coefficients of years of experience, extension contact, credits and membership of cooperative association were negative and statistically significant indicating that these factors led to increase in technical efficiency of poultry farmers in the study area.

The year of experience is negatively significant at 1% level of probability which implies that farmers with more years of experience tend to be more technically efficient in poultry egg production. Continuous practice of an occupation for a long period presumably makes a person more experienced and more productive in practice. The estimated coefficient of access to credit is significant at 1% level. This suggests that smallholder poultry producers who have greater access to credit tend to be more efficient in poultry egg production. Also, the availability of credit helps to finance the purchase of feed and some expensive fixed inputs which have a positive effect on smallholder poultry production.

Furthermore, the coefficient of membership of cooperative association is negative and statistically significant at 1% level. According to Amos (2013) [4], membership of association is of immense benefits to

members, it gives opportunity for bulk purchase of inputs at discounted rates and helps members secure credit facilities as at when due. Poultry farmers that belong to one or more cooperative societies tend to be more technically efficient in their production. This is because membership of organization affords the operators the opportunity of sharing information on modern poultry egg production practices by interacting with other farmers.

Table 3. Estimates of the stochastic production function and inefficiency parameters of smallholder poultry farms

Variables	Coefficients	Std error	t-ratios
General model			
Constant	1.513*	0.522	2.900
In flock size	0.195*	0.077	2.536
In veterinary services	0.240*	0.069	3.499
In feed intake	0.107**	0.054	1.997
In labour	0.288*	0.035	8.197
In capital inputs	0.039	0.058	0.666
In utilities & other expenses	0.023	0.042	0.562
Inefficiency model			
Constant	0.623	0.823	0.769
Marital status	2.583	3.096	0.834
Gender	0.146	0.505	0.288
Family size	-0.005	0.003	-1.484
Educational level	-0.001	0.008	-0.075
Years of experience	-0.018*	0.006	-2.985
Extension contact	-0.011**	0.005	-2.240
Credits	-0.363*	0.103	-3.536
Membership of cooperative	-0.341*	0.119	-2.871
Distance of farm to major road	-0.023	0.042	-0.562
Variance parameters			
Sigma	0.213*	0.004	6.043
Gamma	0.999**	0.466	2.145
Log likelihood	15.731		
Mean Technical Efficiency	0.56		
Number of Observations (N)	80		

Note: * = significant at 1%, ** = significant at 5%, ln= natural logarithm
Source: Computed from field Survey, 2018.

The coefficient associated with extension contact in the inefficiency function was negative and statistically significant at 5% level, implying that the variable reduced farm's technical inefficiency. Poultry farmers who had been regularly trained and visited by extension agent, and participated in some demonstration trials tend to be more technically efficient.

Constraints to Smallholder Poultry Production

The results of the analysis presented in Table 4 revealed the constraints to smallholder poultry production in declining order of importance in terms of severity of the challenges.

Respondents rated limited finance as the most important problem. This could be the reason why farmers could not acquire the necessary inputs especially fixed inputs for large scale production which attracts higher profit and efficiency. This is because in addition to the quantity of inputs used, the timing of input usage also affects farm output. High cost of inputs was the next most important constraints identified by the respondents. High cost of inputs makes it very difficult for existing firms to expand their scale of operation making a large number of them to stagnate in the small scale class, while new ones are reluctant to go into the business.

Stocking of poor breeds of poultry is tantamount to waste of effort because such breeds are positioned to get infected with diseases than good breeds. Poor quality day old chicks make the farms' investment less profitable if not a complete loss. Scarcity of raw materials for plants, fixtures, buildings and equipment coupled with their high cost were identified by the respondents as the 4th most pressing constraint. It can be inferred that many small-scale poultry farms probably have been compelled to close down and those still managing to survive are producing at very high cost and contending with serious inputs limitations.

The respondents in the study area pointed inadequate storage facilities as 5th most important problem to their business. The decision makers found it very difficult to purchase enough inputs especially feed which at harvest periods usually considerably cheap and available. The eggs can only be stored for

few days in which case must be disposed even when the price is not favourable in order to avoid complete loss. Marketing of products and inadequate extension services were of minor problems to the poultry industry in the study area.

Table 4. Ranking of Constraints to Smallholder Poultry Production

Constraints	Frequency	Percentage	Rank
Limited finance	72	19.3	1st
High cost of inputs	66	17.7	2nd
Disease outbreak	60	16.1	3rd
Scarcity of raw materials	54	14.5	4th
Lack of storage facilities	43	11.5	5th
Marketing of products	39	10.4	6th
Inadequate extension services	39	10.4	6th

*Multiple responses allowed
Source: Computed from field Survey, 2018

CONCLUSIONS

The conclusion drawn from the study area shows that most of the smallholder poultry farmers were males and their age was within the economically active age which favoured the adoption of poultry farming. Most of the smallholder poultry farmers were married and highly experienced in farming because of families' inheritance. Majority engaged in poultry farming because it was a family business and to augment income from other sources. Limited finance, high costs of poultry farming inputs, disease outbreak, scarcity of raw materials, lack of storage facilities, marketing of products and inadequate extension services were the hindrances in the poultry business. Also, factors like years of farming experience, access to credit facilities, membership of cooperative associations and extension contact were seen to be very important to the technical efficiency of smallholder poultry farmers in the study area.

REFERENCES

[1]Adene, D.F., Oguntade, A.E., 2006, The Structure and Importance of the Commercial and Village-Based Poultry Systems in Nigeria. Food and Agriculture Organization Bulletin.
[2]Aigner, D.J., Lovell, C.A.K., Schmidt, P., 1992, Formulation and Estimation of Stochastic Frontier Production Function Model. Journal of Econometrics. 6(2):21–37.
[3]Aina, S.O., Omonona, B.T., 2012, Nigerian Agricultural Insurance Scheme prospect, Achievement and Problem. Global Advance Research Journal of Agricultural Science, Vol. 1(5):090 - 095.
[4]Amos, A. P., 2013, Allocative Efficiency of Resource-Use by Cassava Farmers in Wamba Local Government Area, Nasarawa State, Nigeria; International Journal of Economic Development Research and Investment. 4(3):12.
[5]Atteh, J.O., 2015, Theory and Practice of Poultry Production. Graphcom Publishers. Pp. 1-12.
[6]Battese, G., Coelli, J.J., 1996, Identification of Factors which Influence the Technical Inefficiency of Indian Farmers. Australian Journal of Agricultural Economics. 6(1):48–55.
[7]Heinke, H., Alexandra, C., Ludwig, T., 2015, The Poultry Market in Nigeria: Market Structures and Potential for Investment in the Market. International Food and Agribusiness Management Association (IFAMA). Pp 197 International Food and Agribusiness Management Review Volume 18 Special Issue A., www.ifama.org, Accessed on 7th December 2018.
[8]Jato, N.A, Maikasuwa, M.A., Jabo, M.S., Gunu, U.I., 2012, Assessing the Technical Efficiency Level of Poultry Egg Producers in Ilorin, Kwara State: A Data Envelopment Analysis Approach. European Scientific Journal 8(27): 111.
[9]National Population Commission, 2006, Estimated population figures. National Population commission of Nigeria, Abuja.
[10]Ojo, S.O., Ajibefun, I.A., 2002, Effect of Training on Labor Productivity in Ondo State, Nigeria. Journal of Sustainable Agriculture and the Environment. 2(2):275–279.
[11]Tadesse, B., Krishnamurthy, S., 1977, Technical Efficiency in Paddy Farms of Tamil Nadu. An Analysis Based on Farm Size and Ecology Zone. Agricultural Economics. 16:185–192.
[12]USDA, 2013, Agricultural Marketing Service: Livestock, Poultry and Grain Market News. International Egg and Poultry Review, Vol.16, No.08.