PROFIT EFFICIENCY OF POULTRY EGG FARMERS IN ONDO STATE, NIGERIA; A STOCHASTIC PROFIT FUNCTION APPROACH

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Abstract
Profits in poultry egg farming have been very challenging over time, due to low capital base, inefficient management, technical and economic inefficiencies. Poultry egg production has moved into an underperformed situation, characterized by meager profit margin. Previous studies focus mainly on broiler production and efficiency of its production, however, paucity of information exist in the areas of profit efficiency in the study area. Hence, determinants of profit efficiency among poultry egg farmers in Ondo State, Nigeria were investigated.
A Purposive sampling technique was used for the study in Owo and Akure local government areas of Ondo State. Data were collected on socio-economic characteristics, eggs production inputs and output variables.
Descriptive statistics and stochastic profit function/inefficiency models were used in data analysis. Results show that 52 % of the poultry farmers were between 31-40 years, 62 % were male, 90 % had tertiary education, 66 % were primarily poultry farmers, 78 % were original poultry farm owners and 55 % had more than 5 years' work experience. Descriptive statistics on cost and returns indicated that 64 % of the return were from sales of egg, while the remaining 36 % was from sales of spent layers. The coefficient of included variable costs in the model are; Equipment (22.757), feeding (18.3437), labour (136.698), flock size (16.209), drug and medication (4.509). These were factors that affecting profit efficiency in the study area. While education (-2.3143), household size (-18.4291), access to credit (-16.027) and experience (-7.277) were determinants of profit efficiency. Education, household size, access to credit and experience in poultry production were the main determinants of profit efficiency of poultry egg production in Ondo State. Therefore, the concerned stakeholders in poultry sector should consider necessary policies that would stimulate the farmers to employ modern productive resources that would result in enhancement of poultry egg production efficiency.

Keywords: *Profit Margin, Technical Inefficiency, Economic Inefficiency, Cost and Return.*

Introduction

Poultry production is one of the major subsectors in Nigerian agricultural industry. It is the most commercialized sub-sector in the livestock sector of Nigeria's agricultural sector, Nwandu, *et al*., (2016) and Ojogho and Edon (2019). According to FAO (2010) and Nmadu, *et al*., (2014), poultry meat and eggs are the most consumed animal protein; unrestricted by any religion or culture in Nigeria. It was recorded that the poultry industry accounted for about 25% of the country's Agricultural GDP, Nmadu, *et al*., (2014) and Ohajianya, *et al.,* (2013). Poultry refers to all birds of economic value to man as source of meat, egg and fiber. Egg production involves the use of good layer birds for the purpose of table egg production, Adedeji, *et al.,* (2013), Akintunde, *et al.,* (2015) and Ogunlade and Adebayo, (2009). Eggs are major sources of animal protein in human diet. In Nigeria, the contribution of poultry production (meat and eggs) to total livestock output increased from 26% in 1995 to 27% in 1999 with an increase in egg production alone accounting for about 13% during the period, Rahji*et al*., (2015).The significant of consciousness of resource use efficiency in poultry egg production management cannot therefore not be overemphasized. Analysis of efficiency dates back to Farrell, M. J. (1957), provided a definition of frontier production functions, which embodied the idea of maximality. In his pioneering study he defined efficiency as the ability to produce a given level of output at lowest cost or how effectively a production unit uses variable resources for the purpose of profit maximization given the best production technology available. Three levels of efficiencies are distinguished, namely: Technical efficiency, Price or allocative efficiency and economic efficiency.

Technical efficiency refers to the input-output relationship. Firms are said to be efficient if they operate on the production frontier Adedeji, *et al.,* (2013), Akintunde, *et al.,* (2015) and Afolami, *et al.,* (2013). Going by this definition, however, it appears that egg poultry farmers in Nigeria are not getting maximum returns from the resources committed to the investment. According to Ojogho and Edon (2019) and Daniel, *et al.,* (2010), resources committed to agriculture should generate high productivity and the productivity should be transformed into an improvement in the quality of life of targeted Nigerians. It is therefore necessary to examine those factors that are basic to the effective management of poultry production and specifically those factors that have significant influence on profit from egg production. Identification of considerable factors for sustaining the efficiency of poultry farmers operating at or closer to the frontier would serve as standard measurement and comparison of good management practices in the study. In view of this, profit efficiency of poultry egg farmers has important implications for development strategies adopted in most developing countries where the primary sector is still dominant.

Production inefficiency is usually analyzed by its two components – technical and allocative efficiency. From production perspective, technical efficiency relates to the degree to which a farmer produces the maximum feasible output from a given bundle of inputs (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level output (an input oriented measure) (Aboki, *et al*., 2013) Allocative efficiency, relates to the degree to which a farmer utilizes inputs in optimal proportions, given the observed input prices, Adedeji, *et al.,* (2013), Akintunde, *et al.,* (2015) and Afolami, *et al.,* (2013). Recent studies in literature use both measures in one system, which allows additional efficient estimates to be obtained by simultaneous estimation of the system (Aboki, *et al*., 2013 and Ali *et. Al.,* 1994). To measure efficiency, the technical efficiency component involves the use of frontier production. The profit function approach combines the concepts of technical and allocative efficiency in the profit relationship and any inaccuracies in the production judgement are expected to be interpreted into lesser profits or revenue for the producer (Ali

et. al, 1994). Functional forms exist in literature for calculating profit function. They are Cobb-Douglas and flexible functional forms, such as normalized quadratic, normalized translog and generalized Leontif. The Cobb- Douglas functional procedure is commonly and often used to estimate farm efficiency (Ogundari, 2006; Sunday *et al.,* 2012; Oladeebo and Oluwaranti, 2012). Batteseand Coelli (1995) studies also used model by postulating a profit function, which is presumed to act in a way consistence with the stochastic frontier concept. Profit efficiency shows success of a given farm enterprise, as it points toward the capability of a farm to attain a maximum profit given a level of input and output prices as well as the level of fixed factors of production in the farm. From Farrel examination, a farm is profit efficient in resource use when it functions on the profit efficiency frontier. But there is profit inefficient farm when it works under the efficiency frontier. To understand better the levels of profit efficiency and its relationship with a host of farm level factors that can seriously help policy makers in generating efficiency improving policies as well as in judging the worth of current and poultry farmers' reforms. The current attempt is to fill the apparent gap in the literature in profit efficiency studies in poultry egg production with the resultant aim of increasing the well-being of poultry farmers in Ondo state, Nigeria.

The research questions that call for empirical validation are; what are the socioeconomic characteristics of the poultry egg farmers in the study area? What are the factors leading to profit inefficiency among poultry egg farmers? What are the factors limiting poultry egg farmers in the study area?It is on this note that the study seeks to analyze profit inefficiency of egg poultry farmers in the study area. Specifically, it describes the socio-economic characteristics of egg farmers, estimate the profit efficiency/inefficiency in the study area and identify the determinants of profit efficiency in the study area.

METHODOLOGY

Study Area: The study was carried out in Owo and Akure South local government areas of Ondo State.

Sampling Technique: A purposive sampling technique was used in the selection of poultry egg farmers in Owo and Akure South Local Government Areas (LGAs). The selection was due to the large number of poultry egg farmers in the local government areas. From the entire local governments, fifty (50) poultry egg farming households were randomly selected from each Local Governments each to make a total of 100 respondents for the study.

Data Collection: Data were collected using well-structured questionnaire on the socio-economic characteristics of egg poultry farmers such as age, gender, educational level, marital status, household size, access to credit, extension contact and input-output data on poultry egg production farmers in the study area.

Analytical tool: Analytical tools used were descriptive statistics, and stochastic profit function model.

The descriptive statistic tools used include frequency, percentage and table to analyse the socio economic characteristics of the poultry egg farmers in the study area. The Stochastic profit function model, which made use of the Cobb-Douglas profit function, consist of two equations, simultaneously ran together. The first aspect shows the efficiency of the explanatory variables (cost of poultry egg production) and the second equation measures the determinants of profit efficiency in the study area. The equation is specified as:

$$\pi = \beta_0 + \sum_{j=i}^{3} \beta_1 \ln X_{ji} \frac{1}{2} \sum_{i=1}^{n} \beta \; lin \; X2 \sum_{k=i}^{2} yij \ln S_{ki} + V_i - \mu_i \dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

Where;

π = gross profit, it is defined as gross revenue less total costs of production normalized by price of poultry egg output per farmer. X_2

X_1 = Cost of Equipment's (feeder and drinker (₦),

X_2 = Cost of feed (₦/Kg),

X_3 = Cost of labour input in (₦/Man day),

X_4 = Flock Size (number of laying birds)

X_5 = Total cost of drugs and medications (Naira);

X_6 = Total cost of energy (Naira);

$V_í$ = Statistical Noise

$U_í$ = Composite Error Term ($\varepsilon_í$).

The socio-economic determinants of profit inefficiency were modeled in terms of the socio-economic characteristics as institutional variables believed to affect the profit inefficiency of the farmer and the model is specified as follows:

$$\mu = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \ldots + V_í \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where: μ = profit inefficiency of the 1_{th} farm,

Z_1 = Age farmer (in years),

Z_2 = Level of education (number of years spent in school),

Z_3 = Gender (male = 1, female =0),

Z_4 = Farming experience (in years),

Z_5 = Credit status (Access =1, no access =0),

Z_6 = Household size (number),

ε_1 = Error Term.

The coefficient of the unknown parameters are to be estimated by the method of maximum likelihood using computer program FRONTIER Version 4.1, Coelli, T. J (1995).

Results and discussion

Table 1 shows that greater proportion (52 %) of the farmers ranged between the ages of 31-40 years and the average age among the poultry egg farmers was found to be 42 years with standard deviation of 4 years. This indicated that poultry egg farmers are young, able-bodied, and energetic men and women. This finding was corroborated by the submission of Yusuf, S. A. and Malomo, O. (2007) that reported an average age of 40 years for poultry (egg) farmers. From the table 1, the gender of the poultry eggs producers indicated that 31 respondents (62%) were male, while 19 respondents (38%) were female. This shows that more young and energetic men engaged in poultry farming.

Majority (90 %) of the farmers have tertiary education. The implication of this is that most of the farmers were literates and will easily adopt innovations and the technical know-how of application of improved technologies. Only 4 % have no formal education and primary education knowledge while 6% of the farmers have secondary school. Poultry farming is one of the primary occupations of the inhabitants of the study area and it constitutes 36% of the entire study area. 32% were civil servant, while 4 %, 10% and 18% of the respondents were artisan, traders and people with other professions, respectively.

It was discovered also that majority (52%) of the farmers have between 4-6 years of poultry farming experience while 48% have less than 1- 3 years working experience in poultry farming. The years of farm establishment according to the findings of this research work revealed that 44 % are below 5years, indicating that most poultry farms are still relatively new and functional which will enhance productivity of the farm and hence profit efficiency.

Table 1; Socioeconomic Characteristics of Poultry Egg Farmers

Variable	Range	Frequency	Percentage
Age	21-30	18	18.0
	31-40	52	52.0
	41-50	26	26.0
	51-60	04	04.0
	Total	**100**	**100.0**
Gender	male	62	62.0
	Female	38	38.0
	Total	**100**	**100.0**
Educational level	no formal	2	2.0
	Primary	2	2.0
	Sec.	6	6.0
	Tertiary	90	90.0
	Total	**100**	**100.0**
Primary occup.	Farming	36	36.0
	Civil serv.	32	32.0
	Trading	18	18.0
	Artisan	04	4.0
	Others	10	10.0
	Total	**100**	**100.0**
Experience	1-3 years	48	48.0
	4-6	52	52.0
	Total	**100**	**100.0**
Farm establishment	< 5 years	44	44.0
	5-15 years	38	38.0
	> 15 years	18	18.0
	Total	**100**	**100.0**

Source: Field Survey 2021.

The Determinants of Profit Efficiency. The Stochastic Profit Function Model

Findings from table 2 indicated that from the stochastic profit function model, the coefficients of variable cost used i.e. cost of equipment (22.757), cost of feeding(18.3457), cost of labour (136.698), cost of flock size(16.209) and cost of drugs and medication(4.509) in poultry egg production, all of these variables are positively related and were significant at 5%. This implies that a direct relationship exists between production costs and revenue generated from egg vis-à-vis profit, the implication is that, ceteris paribus, as production cost increases, revenue also increases and this cause corresponding marginal effects on the profits accrued to poultry farmers in the study area. The result also revealed the presence of technical efficiency effects in the poultry egg production in Owo and Akure South local Government Areas. This is confirmed by the large and significant value of the gamma coefficient (γ). The gamma value of 0.522 indicates that about 52% variation in the profits of the poultry egg production would be attributable to technical efficiency effects alone while only 48% would be due to random effects. The stochastic frontier, production function has important implications on the technical efficiency of the poultry farms.

On the other way round, the inefficiency model showing the determinants of profit inefficiency indicated from the table that variables that are negatively signed are profit inefficiency reducing variables. Education (-2.3143) is negatively related to profit inefficiency from the finding. This simply means the more educated the farmers become, the

more knowledgeable they are which translate to higher productivity and hence profitability. Household size (-18.4291), has a significant negative effect on profit inefficiency. This implies the more the family source of labour, the less the use of hired labour. Hence a positive effect on profits efficiency. Access to credit (-16.027) has an inverse relations to profit inefficiency, this implies the more credit available to the poultry egg farmers, the less profit inefficient they becomes. Experience (-7.277) also has a negative coefficient, this implies the more experience the farmer is, the more the knowledge, the productivity and profit efficiency.

Age (10.883) is positively correlated with profit inefficiency. This simply implies that increase in age would be linked with less physical capability to accomplish manual work efficiently.

Table 2:

Variables	Parameters	Coefficients	Stan Err	T-ratio	Prob;
Intercept	β_0	73.1555	8.096	9.036	.000
Cost of Equipment's (X_1)	β_1	22.757	6.502	3.500**	.019
Cost of Feed (X_2)	β_2	18.3457	6.221	2.949**	.048
Cost of Labour (X_3)	β_3	136.698	31.274	4.371**	.012
Cost of Flock Size (X_4)	β_4	16.209	3.440	4.712**	.001
Cost of Drugs and Medication (X_5)	β_5	4.509	1.720	2.622**	.037
Cost of Energy (X_6)	β_6	0.51353	0.445	1.154	.069
Inefficiency					
Constant/Intercept	δ_0	0.31129	4.096	.076	.442
Age (Z_1)	δ_1	10.883	3.972	2.740	.049
Education (Z_2)	δ_2	-2.3143	0.649	-3.566**	.574
Status of farmers (Z_3)	δ_3	2.04114	8.798	0.232	.818
Household Size (Z_4)	δ_4	-18.4291	5.681	-3.244**	.220
Access to Credit (Z_5)	δ_5	-16.027	7.822	-2.049**	.961
Experience in Egg Production (Z_6)	δ_6	-7.277	2.527	-2.880**	.384
Variance (R^2)	δ^2	0.522	-	-	0.011
Parameters	γ	5.823	-	-	0.059

Significant at 5% (0.05) level** of Significance (P<0.05).

Conclusion

On average, farmers were found to be young with more energetic men engaged in poultry farming. Most of the farmers were literates and will easily adopt innovations and the technical know-how of application of improved technologies. Larger proportion of poultry farms are still relatively new and functional which will enhance productivity of the farm and hence profit efficiency. The nature and status of equipment, feeds, labour, flock size, drug and vaccines determine the level of efficiency attained by the egg producing poultry farmers in the study area. While education, household size, access to credit and experience in poultry production were the main determinants of profit efficiency level of poultry egg production in Ondo State. Therefore, the concerned stakeholders in poultry sector should stimulate the farmers to employ modern productive resources (equipment, standardized feeds, skilled labour and timely administration of drugs and vaccines) that are necessary for enhancement of poultry egg production efficiency.

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