



PROFITABILITY AND TECHNICAL EFFICIENCY OF BATTERY CAGE EGG PRODUCTION IN OBAFEMI OWODE LOCAL GOVERNMENT AREA OF OGUN STATE, NIGERIA

OSUNMAKINDE, M.A.^{1*}, OGUNNAIKE, M.G.¹, OSINOWO, O.H.¹,
MUFUTAU, R.A.² AND SHONOWO, O.S.¹

¹Department of Agricultural Economics and Farm Management,

²Department of Agricultural Extension and Rural Sociology, College of Agricultural Sciences,
Olabisi Onabanjo University, Ayetoro, Nigeria

ABSTRACT

There is a shortfall in the supply of poultry egg which has resulted in the low consumption of eggs even though it is considered the most affordable source of animal protein to many households. Although there are numerous poultry farms producing eggs in Nigeria, many of them are not technically efficient in their production. This study examined the economic analysis of egg production under battery cage system in Obafemi Owode Local Government Area (LGA) of Ogun State, Nigeria. A two-stage sampling procedure was used to select two hundred and forty (240) poultry egg farmers randomly from the study area. Primary data collected was analysed using descriptive statistics, budgetary analysis and stochastic frontier production function analysis. The result revealed male dominance (62.5%) in poultry egg production and the average age of the farmers was 44.7 years. Most (85.8%) of the poultry egg farmers had formal education and the average household size was 7 persons. A total revenue of ₦4,246,149.91 and net income of ₦3,004,219.06 was earned by an average battery cage poultry farmer. The total cost of production was ₦1,241,930.85. The Benefit-cost ratio was calculated to be 3.42 and the gross ratio was 41%. The stochastic production function showed that quantity of feed, flock size and labour were significant. The inefficiency model revealed that level of education and years of farming experience were significant. The mean efficiency of poultry egg producing farms was 71.86%. The study recommended that poultry egg farmers in the study area should be encouraged to increase the quantity of feed given to their birds and their flock size for increased output.

Keywords: Poultry Egg Production, Profitability, Stochastic Frontier, Technical Efficiency

***Correspondence:** bolajimag2002@yahoo.com, + 2348034660806

INTRODUCTION

The production of livestock forms an essential part of the agricultural economy in Nigeria with poultry playing a major role as sources of meat and eggs to the large population of the country [1, 2, 3]. Eggs and meat have high nutritional value especially protein and they are therefore important components of balanced diets in households. Apart from providing food directly, it also serves as a major source of livelihoods for many households. The poultry industry accounts for about 58.2% of total livestock production in the nation [4]. According to FAO [5] the sustainable development of the poultry industry is crucial to global food security.

Poultry production is characterized by short generation intervals, high feed conversion ratio and high turnover rate. Thus, poultry production stands out as the most resourceful and profitable way of increasing accessibility to top quality food protein because eggs contain virtually all essential amino acids, minerals and vitamins [6]. According to Busari and Okhai [7], Nigeria has the highest number of poultry farms in Africa with the poultry population estimated at 104.3 million and comprising of 72.4 million chickens, 11.8 million ducks, 4.7 million guinea fowls, 15.2 million pigeons and 0.2 million turkeys. It is on record that the

poultry industry contributes between 10 and 25 percent of the country's agricultural GDP and employs approximately 20 million people [7, 18].

Poultry production is faced with many constraints which usually force farmers out of the enterprise. The major constraints of poultry enterprise include: high cost of feed, disease management, poor or erratic power supply, poor management practices, lack of storage or processing facilities, lack of technological know-how, unavailability of day-old chicks, poor quality feeds, and occasionally insufficient feed ingredients (especially grains) and poor veterinary services, unavailability of drugs and vaccines and lack of capital for enlargement and many more [1, 8, 2, 9].

In recent times, the rearing of layers for egg production has increased, all in a bid to bridge the gap between its demand and supply. However, output level still remains low due to the ever-increasing population of the country. According to Ajiboye *et al.* [10, 14], the low consumption of eggs even though it is considered the most affordable source of animal protein to many households can be attributed to a shortfall in poultry egg supply basically due to the ever-increasing population growth. A major problem faced by poultry egg farmers is the rising cost of feed [3]. The major component of feeds for poultry are grains which are also largely

consumed by the human population. This explains why grain supply is always less than demand in the country and why feeds for poultry is very expensive. According to Hamzat *et al.* [3], a change in output of maize and its price produces a corresponding change in poultry feed price and prices of poultry products and consequently its profitability. With the abovementioned challenges to poultry egg production, it is important to examine the profitability and efficiency of production of poultry egg farmers in Obafemi Owole Local Government Area of Ogun State using battery cage system.

MATERIALS AND METHODS

Study area

Obafemi Owole is one of the 20 Local Government Areas in Ogun State, Nigeria. It lies between longitude 3°30'E and latitude 6°57'N and has a land area of 1,410 km² with a population of 228,851 [11]. The LGA is endowed with vast fertile land suitable for cultivating food and cash crops. The people are predominantly farmers. The major food crops grown in the area include cassava, rice, cocoyam, plantain, maize and vegetable, while palm produce and cocoa form the major cash crops.

Ethical clearance

Ethical clearance was obtained from the poultry egg farmers in the study area.

Sample collection

A two-stage sampling technique was used to select the sample size. The first stage involved the purposive selection of ten (10) communities in the Local Government Area known for poultry farming. The second stage involved a random selection of an average of twenty-four (24) poultry egg farmers making a total of one hundred and twenty (240) sampled poultry egg farmers. Primary data obtained through the administering of well-structured questionnaires was used for this study.

Analytical techniques

a. Socio-economic characteristics of poultry egg farmers

Descriptive statistical tools were used. This includes frequencies, means and standard deviations.

b. Profitability of poultry egg production

Budgetary analysis was used. This measures the difference between the gross output or revenue and the total cost in the farming system. It is given as:

$$NI = TR - TC$$

$$TC = TVC + TFC$$

$$GM = TR - TVC$$

Where:

NI = Net income

TR = Total Revenue (₦)

TC = Total Cost (₦)

GM = Gross Margin

TVC = Total Variable Cost

TFC = Total Fixed Cost, (which was depreciated using the straight-line method).

Other profitability ratios were also measured and they include benefit-cost ratio, return on investment and the gross ratio.

c. Technical efficiency of egg production

Stochastic frontier model was used as the inferential statistics for the analysis of technical efficiency. Cobb-Douglas stochastic production frontier function was used with inefficiency variables to determine the technical efficiency effects of most important variables to the returns of poultry egg farms. The production stochastic frontier is specified thus;

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 (V_i - U_i)$$

Where:

Y = Poultry egg produced (in crates)

X₁ = Quantity of feeds and feed supplements (Kg)

X₂ = Expenses on medicines/vaccines (₦)

X₃ = Labour (man days)

X₄ = Flock size

V_i = random error assumed to be independent of U_i, identical and normally distributed with zero mean and constant variance σ^2_v (0, σ^2_v).

U_i = technical inefficiency effects which are assumed to be independent of V_i

V_i, they are non-negative truncation at zero or half normal distribution with μ , σ^2_u

If U_i = 0 no allocative inefficiency occurs, the production lies on the stochastic frontier. If U_i > 0, production lies below the frontier and it is inefficient.

Technical Inefficiency Model in addition to the general model was defined to estimate the influence of some farmer's socio-economic variables on the technical efficiencies of the farmers. The model is specified as:

$$L = \alpha_1 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + e$$

Where;

L = Technical inefficiency

Z₁ = Age (years)

Z₂ = Household size (number)

Z₃ = Level of education (years)

Z₄ = Years of Experience (years)

Z₅ = Sex of the farmer (Male = 1, Female = 0)

While $\alpha_0, \alpha_1, \alpha_2, \dots, \alpha_5$ are the parameters to be determined together with the variance parameters.

RESULTS AND DISCUSSION

The socio-economic characteristics of the poultry-egg farmers is as presented in Table 1. The result revealed that majority (64.2%) of the poultry egg farmers were

between 31 and 50 years old with an average age of 44.7 years. Male dominance (62.5%) was observed among the poultry farmers with most of them (85.8%) having one form of formal education or the other. Majority (85.8%) of the poultry egg farmers were married and most of the households had between 5 and 8 persons. The average household size was 7 persons. The average years of experience and flock stock were found to be 9.6 years and 1263 birds respectively.

Profitability of poultry egg production

The result of the budgetary analysis is presented in Table 2. The total revenue of ₦4,246,149.91 was earned by an average battery cage poultry farmer. These are revenue generated from the sales of egg, spent layers, empty feed bags and poultry droppings. The analysis further shows that the net income received by an average battery cage poultry farmer was about ₦3,004,219.06 and the total cost of production was ₦1,241,930.85. The cost of feeds constituted the highest proportion (42.0%) of the total cost of poultry egg production and this is in tandem with the findings by Yusuf *et al.* and Olorunwa [12, 13]. The Benefit-cost ratio was 3.42 implying that for every ₦1 naira invested in the poultry egg production in the study area a return of about ₦3.42 and a profit of ₦2.42 was realized, thus the business is very profitable. This is in line with the findings of these authors [7, 13, 14, 15] who indicated that poultry egg production is a profitable business in Nigeria. The gross ratio of 0.41 measures the overall financial success of the production process and this shows that the total production cost was about 41% of the gross income.

Technical efficiency of egg production

a) Maximum likelihood estimates of parameters of the Stochastic Frontier Production

The Maximum Likelihood Estimates (MLE) of the stochastic frontier production parameters for poultry egg production is presented in Table 3. As shown in the table, the estimated sigma squared (δ^2) which is the total variance parameter in the stochastic frontier function is 5.180 and is significantly different from zero at 5%, implying a good fit of the model and the correctness of the specified distributional assumptions. Also, the estimated gamma (γ) which is the variance ratio parameter is 0.952 and is significant at 1% which implied that about 99.01% variations in the outputs of the poultry egg farmers were due to the inefficiency factor. The log likelihood function value was -21.46 at 1% level of significance. The mean technical efficiency is 71.86%. The variation in the level of technical efficiency indicates that more opportunities exist for broiler farmers to increase their broiler productivity and income by 28.14% through improvements in their technical efficiency of production.

The quantity of feed and flock size were positive and significant at 5%, implying that poultry egg farmers can increase their output levels by increasing the quantity of feed fed to layers and the flock size. This indicates that the more the feed intake by the birds and the greater the flock size, the greater the technical efficiency of the farmers. The result is in line with the findings of Otunaya *et al.* [16] and Olorunwa [13]. Labour was significant at 10% and this is in line with *a priori* expectations. Rearing layers poultry birds require more hands than raising broilers. This finding corroborates those of Ajiboye [14, 10].

b) Inefficiency

Inefficiency effects were present and make significant contribution to the efficiency or otherwise of the poultry egg farmers. Educational level of the respondents was negatively significant at 5%. This is in line with *a priori* expectation and to the findings of authors [17, 13, 14, 10]. The implication of this is that poultry farmers that are very educated have lower technical inefficiencies. Use of battery cage system of egg production entails a lot of technicalities that only the educated farmers may be able to adopt. Years of experience also had a negative effect on inefficiency at 10% level of significance. Poultry egg farmers with many years of experience are less technically inefficient compared to the inexperienced ones. Farmers with more years of experience tend to be more technically efficient in egg production. This agrees with the findings of authors [19, 13, 10] who reported that years of experience reduce farmers inefficiency.

CONCLUSION AND RECOMMENDATION

Based on the empirical findings, it can be concluded that poultry egg production is very profitable with an average gross margin of ₦3,193,187.40 kobo and an average net income of ₦3,004,219.06 kobo in a production cycle. Educational level and farming experience of the farmers were the major determinants of technical inefficiency. The quantity of feed, flock size and labour significantly determined the output of poultry egg farmers in the study area. The study therefore recommends that poultry egg farmers should be encouraged to formulate feed for their birds to reduce the cost of feed and thereby be able to feed them adequately to increase their output. They should also increase their scale of production to be able to accommodate more birds for increased output.

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Table 1: Socio-economic Characteristics of Respondents

Variables	Frequency	Percentage
Age (Years)		
≤ 30	14	5.8
31 – 40	82	34.2
41 – 50	72	30.0
51 – 60	52	21.7
> 60	20	8.3
Mean	44.7	
Sex		
Male	150	62.5
Female	90	37.5
Marital Status		
Single	8	3.3
Married	206	85.8
Divorced/Widow(er)	26	10.8
Household Size		
1 - 4	80	33.3
5 – 8	130	54.2
> 8	30	2.5
Mean	7	
Educational Level		
No Formal	34	14.2
Primary	124	51.6
Secondary	78	32.5
Tertiary	4	1.7
Production Experience		
≤ 10	114	37.5
11 – 20	68	28.3
21 – 30	42	22.5
> 30	16	11.7
Mean	9.6	
Flock Size		

≤ 500	68	11.8
501 – 1000	72	1.4
1001 – 2000	56	61.1
> 2000	44	25.7
Mean	1263	

Source: Field survey, 2022

Table 2: Profitability of poultry egg production

Variables	Average value (₦)	% of total cost
Revenue		
Crates of eggs	2,345,208.33	
Spent layers sold	1,862,295.83	
Empty feed bags	19,124.92	
Poultry droppings	19,520.83	
Total Revenue (TR)	4,246,149.91	
Variable cost		
Feed	521,056.67	42.0
Hired labour	19,578.33	1.6
Transportation	2,355.42	0.2
Vet service	1,275.00	0.1
Vaccines	4,255.00	0.3
Medications	5,860.00	0.5
Day old chicks	317,666.67	25.6
Point of lay	180,689.17	14.5
Fuel	22,456.25	1.8
Total Variable Cost (TVC)	1,052,962.51	84.8
Total Fixed Cost (TFC)	188,968.34	15.2
Total Cost (TC= TVC+TFC)	1,241,930.85	100.0
Gross margin (GM = TR-TVC)	3,193,187.40	
Net income (NI = TR-TC)	3,004,219.06	
Benefit-cost ratio (BCR = TR/TC)	3.42	

Gross Ratio (GR = TC/NI)	0.41
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Source: Field survey, 2022

Table 3: Maximum Likelihood Estimates for poultry egg farmers

Variables	Coefficient	t-ratio
Constant	-2.6705	-12.382***
Quantity of feeds	0.0410	3.411**
Expenses on medicines/vaccines	-0.0468	-0.538
Labour	0.0343	2.088*
Flock size	0.8383	7.287**
<i>Inefficiency</i>		
Constant	-27.3859	-1.842*
Farmer's age	-0.3002	-2.328
Household size	2.2135	1.454
Level of education	-0.1696	-1.642*
Years of Experience	-0.7991	-1.996*
Sex of the farmer	-5.4933	-1.954
<i>Diagnostics Statistics</i>		
Total Variance (σ^2)	5.180	4.583**
Variance Ratio (γ)	0.952	0.364***
Log Likelihood function	-21.46	
Mean Technical Efficiency	71.86	
Number of Observation	240	

Note *** T- value significant at 1% and ** T- value significant at 5%

Source: Field survey, 2022