ECONOMIC ANALYSIS OF POULTRY EGG PRODUCTION IN KWARA STATE, NIGERIA

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ABSTRACT
This study centred on the economic analysis of poultry egg production in Kwara State,Nigeria. The cost and returns to egg production, technical efficiency of egg producing farms and as well, the constraints to poultry egg production in the study area were analyzed. Data collected (using questionnaire), from 119 poultry farmers randomly selected from the lists obtained from Kwara State Ministry of Agriculture & Rural Development, was analyzed using descriptive statistics, gross margin, rate of returns, stochastic frontier production function and likert type scale. The findings indicated that 33.6% is the modal age for the respondents which ranges between 36-45years. Male farmers were found to dominate the eggs production business with a percentage of 66.4%. The Gross Margin was N33, 368.82 per month. The Rate of Return to eggs production was estimated at 25.94%. Maximum Likelihood Estimate of the stochastic frontier model shows that variables like farm size, veterinary services and labour were positively and statistically significant at 1% level.. The mean technical efficiency was estimated at 0.43. It is therefore recommended that Nigeria government should assist poultry farmers through policies that will enhance productivity growth and increase production efficiency. In addition, extension service should be given higher priority.

Keywords: Eggs, layers, poultry, production, efficiency, recession,

JEL Classification: Q12, Q13, Q18 and Q19

1. Introduction

Poultry is a sub-sector in the livestock industry constituting a major component of the agricultural economy. The sector provides animal protein-based food to the populace.. According to Sorensen (2010), poultry comes fourth among sources of animal proteins for human consumption in Nigeria and contributes about 27% of the national meat production. Poultry are farmed in great numbers with chicken being the most common; more than 50 billion chickens are raised annually as a source of food for both their meat and their eggs (Paula, 2015). Egg production essentially involves the use of good layer birds for the purpose of table eggs production (Ogunlade and Adebayo, 2009).

Nigeria's poultry industry has its root in the enterprise acumen of the then regional governments starting from the 1960s when the western regional government entered into joint pilot poultry production schemes with some foreign partners, notably the Israeli government (Adene & Oguntade, 2006). The entry of private investors into poultry production from the late 1960s to early 1970s marked the onset of indigenous commercial poultry industry. In time,it spreads from the west to the eastern region and parts of the Northern region. The first decade or so of this period witnessed a tremendous growth in the industry, especially in the now defunct Western Nigeria (Adene & Oguntade, 2006).

The size of the industry grew from less than one million in the mid-1960s to over 40 million by the early parts of the 1980s. All along, the growth of the industry had been propelled by various government initiatives and incentives, especially in the provision of training, technological support, input support services and others. Many of the poultry technical staff benefited from government subsidized capacity building training programme; inputs like vaccines and diagnostic services were also subsidized by government and even given out for free when the programme first started (Adene & Oguntade, 2006).

The importance of poultry to national economy cannot be over emphasized as it has become popular for the smallholder farmers that have contributed to the economy of the country. In Nigeria, poultry contributes about 15 percents of the total annual protein intake with approximately 1.3kg of poultry products consumed per head per year (Ologbon & Ambali, 2012). The poultry industry has assumed greater importance in improving employment opportunities and animal food production in Nigeria. Layers production represent an important sector especially in the developing countries to meet the household food demands and as an additional sources of income (FAO, 2014).In 2000, there were 50.4 million tons of eggs produced in the world (Executive guide to world poultry trends, 2001) and an estimated 53.4 million tons of table eggs were produced during 2002. In 2009, an estimated 62.1 million metric tons of eggs were produced worldwide from a total laying flock of approximately 6.4 billion hens (Memon *et al*., 2015). In 2013, the Nigerian poultry industry was estimated at ₦80 billion ($600 million) and is comprised of approximately 165 million birds, which produced 650,000 metric tons of eggs and 290,000 metric tons of poultry meat in 2013.

From a market size perspective, Nigeria's egg production is the largest in Africa (South Africa is the next largest at 540,000 metric tons of eggs) and Nigeria has the 2nd largest chicken population after South Africa's 200 million birds (Sahel, 2015) When compared with a country like Republic of Benin which was said to have experienced dramatic increase in egg production from five tons in 2009 to just fifteen tons in 2017 (FAOSTAT, 2019), Nigeria is not doing badly. However, the egg production in Nigeria appears unable to meet up with the increasing demand for the product in recent times, perhaps, occasioned by the rising population size.
In the past, most of the poultry raised in the country was from the indigenous breed but in the recent years, commercial poultry farms using modern techniques and inputs such as improved breeds, better feeding methods and innovative management practices have been emerged (Famoyin, 2000).

Achieving successes in the poultry enterprise (irrespective of the size) largely depends on the kind of care and attention the flock receives. The choice of where to source the birds, the choice of feed or feed material required and the operational disease control methods to be employed are very important in achieving these successes. According to Idachaba (2000), these factors play out in the determination of the total well-being of the poultry birds.

Previous research works have long established that profitability in the poultry industry depends majorly in the biological efficiency of the birds, efficiency of feed consumption and viability According to Kolacz and Bodak (2019), the assessment of the farm animal welfare can be attributed to production, economic, behavioral, and physiological parameters.

The economic efficiency of chicken meat and eggs production depend on the growth rate of the birds as well as the feeding cost and finishing time (Rahji *et al*., 2011). Production efficiency measurement has received considerable attention from both theoretical and applied economist (Bravo-Ureta and Rieger, 1991). Akanbi *et al* , *(*2011) and Adelodun et al, (2020) also inferred that efficiency studies helps in determining the under-utilization or over-utilization of factor inputs in any agricultural production process.

Kwara State is a growing state with a substantial number of poultry farms springing up in recent years. A number of research works had been carried out in the past in this area by (Ogunlade & Adebayo, 2009 and Atteh 2015). However, findings from these previous studies may not be sufficient in explaining the problems confronting the poultry enterprise, particularly, when viewed against the background of the recent recession experienced in the country which had led to an unprecedented rise in the cost of poultry feeds and some other poultry inputs.

Therefore, there is need to critically examine the current state of economic performance of these emerging poultry farms, with a view of proffering suggestions that may help in improving the lot of poultry farmers in the State. Specifically, the study::

- Identified the socioeconomic characteristics of eggs producing farmers in the study area.
- Estimated cost and returns of eggs production in the study area.

- Determined the technical efficiency of the eggs producing farms in the study area
- Identified the constraints to eggs production

2. Methodology

The study was carried out in Kwara State of Nigeria. The major occupation of people in the areas is farming and various crops are cultivated which they consume and also grown cash crops such as -cashew and oil palm. Rice, sorghum, cassava, maize, yam, beans and sweet potatoes are the major food crops grown in the areas. (Kwara ADP, 2018). Livestock commonly reared in the state include cows, sheep, goats, pigs, rabbits and poultrry birds. Poultry is however one major livestock being produced on commercial scale.

The primary data which was used for this study was obtained through structured questionnaires. A sampling framework was made based on the lists of poultry farmers obtained from the Kwara State Ministry of Agriculture and Natural Resources.

A hundred and nineteen (119) poultry farmers were randomly selected from the lists. Primary data obtained from these poultry farmers was collected through the use of well-structured questionnaire.

Analytical Technique

The analytical tools used in analyzing the collected data includes: Descriptive Statistics, Gross Margin, Rate of Returns, Stochastic Frontier Production Function and likert-type scale.

Gross margin was used to determine the cost and return of eggs production.

Gross Margin= Total Revenue – Total Variable Cost………….. (i)

Net-Income= Gross margin- Total Fixed Cost…………………. (ii)

Rate of Return Provides a measure of economic performance of the enterprise employed expressed in percentage (%)

Rate of Return (ROR) = $\frac{GM \times 100}{TVC}$ ………………………………………(iii)

The stochastic frontier production function model for the production technology of poultry-egg producers was assumed to be specified by the Cobb-Douglas Frontier production function (Tadesse and Krishnamoorthy, 1997), which was defined as:

$InY = \beta_o + \beta_I\, InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \beta_5 InX_5 + \beta_6 InX_6 + (Vi - Ui)$………………(iv)

Where:

In = Natural logarithms

Y = Value of poultry outputs (value for eggs and spent/culled layers) (naira)

X_1 = Farm size (number of birds)

X_2 = Veterinary service (naira)

X_3 = Feed (kg)

X_4 = Labour (naira)

X_5 =Utilities (made up of electricity, water supply, litter, transportation in Naira)

β_1 -β_2= coefficients of parameters estimated.
β_0 = intercept.
V_i and U_i are as defined in equation (iv). Based on equation (iv), equation (v) was specified as below to enable the identification of the factors which influence Technical Efficiency.

$$U_i = \alpha o + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + \alpha_7 Z_7 + \alpha_8 Z_8 + \alpha_9 Z_9 + \alpha_{10} Z_{10} + ei \quad \ldots\ldots (v)$$

Where:
U_i = Technical inefficiency as previously defined
Z_1 = experience (years)
Z_2 = Marital status (MS = 1 for single, MS = 2 for married and 3= divorce)
Z_3 = Gender of farmer (sex = 1 for male and sex = 0 for Female)
Z_4 = Family size (number)
Z_5 = Education Level (Number of years of schooling)
Z_6 = Years of experience (Years of poultry egg farming)
Z_7 = Number of extension contact in a production cycle.
Z_8 = Access to credit (access to credit = 1,otherwise= 0).
Z_9 = Membership of poultry association (member =1, Not member = 0)
Z_{10} = Availability of market outlets (yes=1,No=0)

These were included in the model to indicate their possible influence on the Technical Efficiency of the poultry egg farmers in the study area.The α_s are coefficients of parameters estimated together with the variance parameters of σ_2 and $_{ei.}$ The variance of the random errors ($_{ei}$) ,σ^2v and that of the technical inefficiency effects σ_2u and overall variance of the model are related as follows $\sigma^2 = \sigma u^2 + \sigma v^2$ and the ratio $\gamma = \sigma u^2 / \sigma^2$, measures the total variation of output of poultry-eggs from the frontier which can be attributed to technical inefficiency (Battese and Corra, 1997). The estimates for the parameters were obtained using the programme FRONTIER Model (Coelli, 1996).

Sampled poultry-egg producers were asked to rate the constraints to poultry-eggs production on a 4 point numerical rating scale of strongly severe problem = 4, moderately severe problem= 3, severe problem= 2 and not severe problem= 1
Compute Weighted Average

$$Xw = \frac{4(n4) + 3(n3) + 2(n2) + 1(n1)}{N} \quad \text{----------(vi)}$$

Where:
Xw = Weighted average
N= n4 + n3 + n2+ n1. Which is total number of respondents

3. Results and Discussion

Socioeconomic Characteristics of the Respondents

Table 1 shows the results of the study that majority of the respondents are within the age range of 36 - 45years old. This means that poultry egg production in the study area is embarked upon by men and women who are strong physically and mentally to face the rigorous activities that might occur in the poultry farming business in a developing country like Nigeria. The result in Table 1 shows that over 66.4% of the respondents are males.

Table 1 further indicates that majority of the respondents in the study area are literate and well-read as 89.1% of the respondents claimed to have tertiary education while the remaining 9.2% have secondary school education. For a literate farming population, respondents will find it easy to understand and adopt new innovations and modern farming techniques that will improve their productivity and profitability.

Table 1 also shows that 41% had been engaged in eggs production between 6 to 10 years. The mean years of experience was found to be 8 years. This indicates that majority of the poultry-egg farms owners in the study area are fairly new entrants into the business. It is generally expected that productivity increases with years of experience which will therefore enable farmers to make better decisions in the allocation of their resources and input combination in order to improve profitability. Over 50% of the respondents have household size range of 4-6 persons in the study area.

The result in Table 1 also indicates that 53.8% of the respondents said poultry farming was their primary occupation. This implies that poultry farming is their main source of income. Another 37% of the respondents are primarily civil servants. This means that poultry farming can be combined with some other occupations which is capable of fetching them more income that will be used to take care of their livelihood.

Furthermore, Table 1, reveals that more than half of the respondents (58.8%) do not have access to credit facility. The few of the respondents that have access to the credit facility from various sources, managed to survive with marginal productivity. About 70.6% of the respondents claimed to belong to one or more poultry associations, while 29.4% claimed not to belong to any association or group. Belonging to an association predisposes them to receiving beneficial information necessary for their farming operation. This was substantiated by Effiong & Onuekwusi, (2007) when they posited that membership of association is believed to enhance the sharing of information on improved technologies through interactions as well as easing inputs acquisition and utilization constraints faced by decision makers.

Table 1, also indicates the stages at which poultry farmers begin to rear their birds; most of the farmers (86.6%) obtained their birds as day-old-chicks while 13.4% of the respondents obtained theirs at the point-of-lay stage. As revealed in Table 1, most of the respondents (63.0%) claimed

to be using the battery cage system while 36.1% of the respondents confirmed using the deep litter housing system in the study area. Table 1 shows that 14.3% of the respondents have between 1001-5000 birds which forms the highest bulk; while only 1.7% kept below 100 birds in the study area.

The classification was premised on the study of Elysee *et al*., (2020) which stated small-scale farm contains less than 1,000 birds, medium scale farms had between 1,000 and less than 5,000 birds, and large scale poultry farm starts from 5,000 birds.

Table 1: Socioeconomic Characteristics of Poultry Farmers

Characteristics	Frequency (F)	Percentage (%)
Age in Years		
18-25	16	13.4
26-35	31	26.1
36-45	40	33.6
46-55	16	13.4
≥56	16	13.4
Gender		
Male	79	66.4
Female	40	33.6
Marital Status		
Single	30	25.2
Married	87	73.1
Divorced	2	1.7
Educational Level		
No formal education	1	0.8
Primary education	1	0.8
Secondary education	11	9.2
Tertiary Education	106	89.1
Farming experience		
≤5years	25	21.0
6-10years	49	41.2
11-15years	26	21.8
≥16years	19	16.0
Household size		
≤3persons	28	23.5
4-6persons	65	54.6
7-9persons	21	17.6
≥10persons	5	4.2
Primary occupation		
Poultry farming	64	53.8

Civil servant	44	37.0
Other	11	9.2
Access to credit facility		
Yes	49	41.2
No	70	58.8
Membership of poultry association		
Yes	84	70.6
No	35	29.4
Age at which birds were obtained		
Day old	103	86.6
Point of lay	16	13.4
Housing system		
battery cage	75	63.0
deep litter	43	36.1
semi-intensive	1	0.9
Number of birds kept		
≤100 birds	2	1.7
101-500 birds	9	7.6
501-1000 birds	21	17.6
1001-1500 birds	22	18.5
1501-2000 birds	9	7.6
2001-2500 birds	14	11.8
2501-3000 birds	11	9.2
3001- 3500 birds	6	5.0
3501-4000 birds	8	6.7
≥4000 birds	17	14.3

Source: Field Survey, 2018

Costs and Returns to Egg Production

The costs, return and profitability of poultry-egg production in the study area is shown in Table 2. The variable cost accounts for over 95% of the cost of production. Feeds constituted the highest percentage of the costs, accounting for 43.24% of the cost of production; this is followed by labour cost, cost for drugs and vaccines, in that order. Cost of water supply constitutes the least value of 63.03 naira, this might be due to the fact that most farms construct their private water supply source, and therefore, they do not include cost of water supply in their cost of production. Oluyemi and Roberts (1998), (Sekoni, 2002) in their study also found cost of feed to be the largest single variable cost in animal production (poultry production inclusive).

The Gross Margin was calculated to be 33,368.82 naira. The rate of returns to poultry egg production was estimated at 25.94%, while capital turnover per bird was 1.21 naira, this simply implies that for every 1 naira invested into production of egg, the farmer gets 1.21 naira as revenue. Also, the profitability index was calculated to be 0.21, this implies that for every 1 naira spent of production, the farmer gets 0.21 naira as income.

Table 2: Cost and Returns of egg Production

A. Variable Cost (VC)	**Amount (₦)**	**Percentage (%)**
Electricity	4221.85	3.19
Drugs and Vaccines	11979.41	8.16
Disinfectants	2968.49	2.24
Stocking	18590.60	14.06
Debeaking	1273.95	0.96
Water	63.03	0.05
Feeds	57188.18	43.24
Labour	24118.00	18.23
Litters	1277.31	1.00
Transportation	4368.07	3.30
Repair	2468.07	1.87
Miscellaneous	138.80	0.10
Total Variable Cost (TVC)	**128,655.76**	**96.43**

Calculation for Gross Margin

Item		**Percentage(%)**
B.Fixed Cost(FC)		
Storage	₦1344.50	1.02
Cost of Rent	₦2747.90	2.08
Tax	₦672.30	0.51
Total Fixed Cost(TFC)	**₦4,764.70**	3.57
Total Cost(TC)	**₦133,420.46**	100
C.Revenue		
Sales of Eggs	₦134,474.09	83.00
Sales of Spent Layers	₦27,550.49	17.00
Total Revenue(TR)	**₦162,024.58**	100
Calculation		
Gross Margin (TR-TVC)	₦162,024.58-₦128,655.76	**₦33,368.82**
Rate of Returns(GM/TVC x100)	33,368.82/128,655.76*100	**25.94 %**
Capital Turnover(TR/TC)	₦162,024.58/₦133,420.46	**1.21**
Profitability Index(GM/TR)	₦33,368.82/₦162,024.58	**0.21**

Source:field survey,2018

Determinants of Technical Inefficiency

The variance parameters for σ^2 and γ are 0.662 and 0.999. They are statistically significant at the 1% level as shown in table 3. The gamma (γ) indicates that, systematic influences that are unexplained by the production function are the dominant sources of random errors. While the sigma squared (σ^2) indicates the goodness of fit and correctness of the distributional form around for the composite error term. The likelihood ratio test showed that the model is statistically significant at 1% level. This was in tandem with work of (Elysee *et al*., 2020) which claimed that the production factors retained in the stochastic frontier model explained significant at 1% level of the poultry egg production in Republic of Benin. This indicates that the inefficiency effects make significant contribution to the economic efficiency of poultry farmers with utility costs of 1% level of significant with negative signs, this means that any additional increase with this variable would lead to a decrease in the poultry output while the other independent variables, (i.e. Farm size, veterinary services, feeds, and labour) were significant at 1% level with positive signs. This implies that one percent increase in the Farm size, veterinary services and labour will increase output by 0.879 percent, 0.160 percent and 0.038 percent respectively. This was in tandem with Binuomote *et al*., (2008) which stated that the more efficient these variables are given, the higher the production. The result of the inefficiency model shows that only the coefficients of extension visit, is significant at 1% level with positive sign of t-value (4.08). Probably, the extension contact claimed by the poultry farmers in the study area have significant impact in poultry farmers' efficiency.

Table 3: Maximum Likelihood Estimates and Inefficiency function

Variable	Coefficient	Standard error	t- value
Constant	6.900***	0.361	19.11
Farm size	0.879***	0.918	9.58
Veterinary service	0.160***	0.005	30.42
Feed	0.025	0.897	0.28
Labour	0.038***	0.001	59.80
Utilities and other expenses	-0.018***	0.002	-7.75
Inefficiency model			
Constant	-0.472	1.193	-0.40
Age	-0.113	0.128	-0.88
Marital status	0.280	0.270	1.04
Gender	-0.078	0.212	-0.37
Family size	0.040	0.140	0.28
Educational level	0.019	0.052	0.36
Years of experience	0.009	0.053	0.01
Extension contacts	0.432***	0.106	4.08
Access to credit	-0.269	0.242	-1.11

Membership of association	0.065	0.245	0.267
Market outlet	0.112	0.647	0.17
Variances			
Sigma-squared (σ^2)	0.662	0.137	4.823***
Gamma (γ)	0.999	0.0638	156.575***
Log likelihood function	-103.4404		
LR test	19.0506		

n=119, ***, Significant at 1%, Source: Data Analysis, 2018

Frequency Distribution of Technical Efficiency of Respondents

Table 4 shows that 37.8% of respondents operates with an efficiency level between the ranges of 0.21-0.40, while 11.76% of the respondents operate with an efficiency level between the range of 0.61- 0.80 and 12.60% of the respondent have an efficiency level between the ranges of 0.81-1.00. However the mean technical efficiency of the farmers in the study area is 0.431, this result implies that technical efficiency of poultry farmers in the study area could still be increased by 57% given the current level of technology and available resources are efficiently utilized.

Table 4: Frequency Distribution of Technical Efficiency of Respondent

Class interval of efficiency indices	Frequency(F)	Percentage(%)
0.01-0.20	24	20.17
0.21-0.40	45	37.82
0.41-0.60	21	17.65
0.61-0.80	14	11.76
0.81-1.00	15	12.60
Total	119	100.00
Maximum	0.999	99. 90
Minimum	0.0836	8.360
Mean	0.431	43.00

Source: Data Analysis, 2018

Ranking of Perceived Constraints to Poultry Egg Production

The result in Table 5 shows the major constraints claimed by poultry farmers to egg production in the study area, fluctuation of prices of feeds and other management equipment was ranked first. While, high initial start-up capital was ranked second and inadequate capital to manage and run day to day activities was ranked third . It can be seen from the Table 5 that the first three most pressing constraints to poultry egg production are finance related, which the result agrees with Liu (2006), which stated in his work that Technical Efficiency was highly influenced by financial

constraints. This also shows that constraints to egg production is dependent more on input factor than management factor. Disease outbreak is also a pressing issue which was ranked fourth.

Table 5: Perceived Constraints to Layers Production

Constraints	NS	S	MS	SS	Rank
Pilfering or insecurity	41	34	36	8	7th
Disease outbreak	34	34	39	12	4th
Presence of predator	32	46	37	4	6th
Excessive productivity leading to Egg glut	40	31	45	3	8th
Fluctuation of prices of feeds and other management equipment	4	22	55	38	1st
High initial start-up capital	11	13	60	35	2nd
Inadequate capital to manage and run day to day activities	15	34	48	22	3rd
Consumer preference for other close substitutes such as fish, meat, soybean cake	29	45	42	3	5th

Source: Field survey, 2018

4. **Conclusion**

The research work was set out to assess the "Economic Analysis of Poultry Egg Production in Kwara State Nigeria" particularly after the economic recession occasioned in the year 2015. Considering the socioeconomic characteristics of layer's birds farming households in the study area, a less average percent of 33.6% fell between 36 - 45years of age. Male dominated the eggs production business with 66.4%, most of the respondents 89.1% had tertiary education with average of about 14years of formal education in the study area. Forty-one percent (41.2%) of the respondents was found to have farming experience of 6-10years with mean farming experience of 8years.

Over 80% of the farmers obtained their birds at day old stage and 46.2% of the respondents used their personal savings as source of capital. Gross margin analysis revealed that variable inputs constituted over 90% of cost of production. Feed was identified as the highest among variable inputs with 43% of total cost of production.

The Gross Margin was calculated to be N33, 368.82 per month of production. The rate of returns to poultry egg production was estimated at 25.94%. However the mean technical efficiency of the farmers in the study area is 0.43.

The result also showed that fluctuation of prices of feeds and other management equipment, initial start-up capital, inadequate capital to manage and run day to day activities and disease outbreak are major noted constraints by respondents in the study area.

Based on this findings from the study the results revealed that poultry eggs producing farms are technically inefficient. Extension contact can be seen to have a positive effect on technical efficiency. The implication of the study therefore, is that the level of efficiency among poultry-

eggs producers in the study area could still be increased by 57% given the current level of technology and if the available resources are efficiently utilized.

Recommendations

The findings obtained from this study provide a very important information to guide efforts to better the productivity of poultry farms in Kwara state and Nigeria in order to contribute to food security and poverty alleviation. Therefore, the following policy implications were made based on the results obtained from the study. Because technical progress has a negative influence on this variable "utilities and other expenses", it is important to generate and make available to poultry farmers better and improved technologies on production inputs (day-old chicks, vaccines, water, drugs) and other expenses incurred for daily running of the farms. And to invest in poultry industry research and development, especially in commercial and large scale production and government should make credits (inform of loan and grant) available for poultry farmers in order to meet up with their financial obligations.

Finally, Nigeria government should assist poultry farmers in implementing vibrant economy and policies that will bring about productivity growth and increase production efficiency and technology innovation. In addition, extension service should take high priority by giving training to extension agents for them to disseminate useful information to poultry farmers and other stakeholders in the industry.

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