



Research Article

Profitability and Allocative Efficiency of Exotic Chicken Enterprises in Delta State, Nigeria

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Abstract | The purpose of this research was to estimate the resource allocation efficiency and profitability of exotic chicken enterprises in Delta State, Nigeria. A multistage sampling procedure was adopted to pick a sample of 120 farmers from whom data were elicited using structured questionnaire. Data were analyzed using descriptive and inferential statistics. The findings indicate that the average age of respondents was 43 years; majority (85%) of respondents were males with 16 years' experience in exotic chicken production; 75% were married and 48% had secondary education. The mean household size was 5 persons. Budgetary analysis showed a net return of ₦930,700.00 per annum and return on investment was 1.73 per naira. This means that exotic chicken production is profitable. The double log regression model result shows that cost of day old chicks, feed, drugs and vaccines, labour, shelter and equipment significantly influenced exotic chicken production. The resource use efficiency result infers that DOCs and drugs and vaccine were under-utilized while feeds, labour and housing and equipment were over-utilized by the farmers. The elasticity of production was 1.08. This is increasing returns to scale. This paper concludes that poultry farmers were inefficient in the application of productive resources and recommends capacity building on resource use for farmers. We recommend that credit facilities and specific training opportunities on resource use be extended to farmers to enhance their exotic chicken production efficiency.

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Introduction

Exotic chicken production is outstanding in that it gives the highest turnover rate in the livestock enterprises. Finances invested in poultry production are realized sooner than from other categories of the livestock industry. Exotic chicken is well-thought-out as healthy diet, since it contains adequate amounts of protein, energy, amino acid, vitamins and minerals to

satisfy the body needs given its high quality eggs and meat (Chrystal *et al.*, 2020; Moss *et al.*, 2018). Ayanwale *et al.* (2019) opined that WHO recommended daily intake of 65g of protein out of which 35g (38.8%) should be from animal sources. They further stressed that Nigeria's consumption of protein is 15g per head per day which is below the WHO recommendation. Inadequacy of protein intake, especially of meat and egg, lead to protein energy malnutrition (P.E.M.).

Viewed against this background, poultry production becomes of considerable importance to both the government and the private sector.

Ferdushy *et al.* (2016) have long recognized the value of poultry in terms of minimizing poverty. Poultry farming is widely practiced throughout Africa. Almost every household keeps certain breeds of poultry largely for domestic consumption, cash from sales and socio-cultural use (Nduthu, 2015). Chickens are of great use in many economic, cultural and religious activities including entertainment, gifts, funeral rites and spiritual purification throughout Kenya (Ipara, 2019). Ethiopians, likewise, keep birds for domestic consumption, sale, and reproduction, as well as other social and cultural functions (Assefa, 2019).

In his research in Rwandan rural areas, Jaques (2012), endorsed the works that poultry has a significant nutritional and economic benefit in the village and also plays a vital role in society through its contribution to rural cultural and social life. The production systems include intensive, semi-intensive and extensive methods. Poultry enterprises in the Nigeria are characterized more by failures rather than success largely because farmers attempt to transfer inappropriate technology, requiring expensive and often imported inputs, instead of exploiting locally available resources (Nkukwana, 2018; Swinnen and Kuijpers, 2017). Observations show that the poultry business is inundated by risks and uncertainties such as natural risks, poultry ailments and pests and high mortality rates. This scenario would lead to economic losses on investment (Wu, 2018; Suit and Choudhary, 2015).

Several attempts have been made to introduce exotic poultry breeds into Nigeria to boost production. But the intended purpose of solving the problem of poor quality of indigenous chicken was not achieved. However, Akintunde *et al.* (2015), Padhi (2016) asserted that improved management and feeding practices will increase the productivity of eggs and meat of chickens in Nigeria. Unfortunately, in Delta State today, the cost of building materials necessary for intensive management of poultry is beyond the reach of the poor.

The absence of feed mills and the supply dependency in large cities and its environs on certain ingredients add to the overall feeding cost in many parts of

the country. The lack of bulk supplies and storage lead to higher feed costs. Mixed feed prices remain unreasonably high even when prices of the largest component of mixed rations (for example maize) decrease by more than 50% (Dessie *et al.*, 2013).

Enhanced productivity is a logical procedure aimed at increasing the level of farm resources and making productive use of capital (Gbigbi, 2019). In order to achieve efficiency in exotic chicken production, resources must be optimally utilized. Performance and efficiency are global competitiveness metrics (Cechura *et al.*, 2014). Farmers productivity in using available resources and technology is crucial to farm growth (Dessale, 2019; Sujan *et al.*, 2017). The effective use of agricultural resources is an important element of the sustainability of agriculture (Tian *et al.*, 2018). This is a precondition for optimal production as inefficiency in resources use can impair food access and food security (Gbigbi, 2017).

A number of researches have been conducted on efficiency generally in Nigeria (Ojo, 2003; Etim *et al.*, 2005; Goni *et al.*, 2013; Adenuga *et al.*, 2013; Ayinde *et al.*, 2011) but none of these studies addressed the profitability and allocative efficiency of exotic chicken production in Delta State. In addition, related research results are dated far back such that they bear little or no relevance to present day circumstance hence they are of hardly any meaningful value in effective policy formulation. The need to have updated information on the subsector which could serve as veritable input for policy formulation and as a reference source provide the pedestal for this study.

This study therefore seeks to fill this knowledge gap by identifying major factors retarding the productivity of the existing poultry enterprises and how farm resources use can be improved for optimum productivity. It also identified ways of increasing the level of exotic chicken production so as to reduce the supply-demand deficit in the State. The thrust of the study was to examine the profitability and allocative efficiency of exotic chicken farms in Delta State. The precise objectives are:

- To identify the socioeconomic attributes of exotic chicken farmers.
- To evaluate costs and return associated with exotic chicken production.
- To examine the production factors that affect production.

- To determine the elasticity of production and return to scale.
- To estimate the resource allocative efficiency of exotic chicken producers.

Materials and Methods

This study was conducted in Delta State of Nigeria. A multistage sampling procedure was used to pick local government areas, communities and respondents for the study. In stage 1, two of the three agricultural zones were selected at random. Delta North and Delta Central were the designated agricultural areas. Furthermore, in stage 2, due to the high level of involvement in poultry farming, three local government areas were chosen deliberately. Ndokwa South, Ukwuani, Aniocha North, Ughelli North, Okpe and Udu. In stage 3, two (2) communities were randomly selected from each LGA, with a total of 12 participating communities. Ten (10) poultry farmers from each community were selected on a random basis and structured questionnaires were distributed to a total of 120 respondents from the list of poultry farmers generated by the Delta agricultural and rural development authority (DARDA). Nevertheless, 20 copies of the questionnaire were discarded due to non-response and incorrect information. Thus, data for 100 respondents were used for the study.

The data collected were price of day-old chicks, cost of feeding, medication and some socio-economic variables of the poultry farmers such as gender, age, marital status, educational level, and family size.

Model specification

Costs and returns analysis: Costs and returns analysis was carried out using the budgetary technique. Indicators such as net income, profit margin percentage and return per naira invested were analyzed:

$$Net\ farm\ income = TR - TC$$

$$Profit\ margin\ \% = net\ income / total\ income * 100$$

$$Returns\ per\ naira\ invested = Total\ income / total\ cost$$

$$TC = TFC + TVC$$

TR= Total revenue; TC= Total cost; TFC= Total fixed cost; TVC= Total variable cost.

Regression model

The regression model was employed to estimate the resource use and productivity of exotic chicken

production.

The explicit form of the model as follow:

$$TVOP = b_0 + b_1 DOC + b_2 COF + b_3 CODV + b_4 LBR + b_5 COHE + e$$

Where;

TVOP (Y)= output (₦)per year; DOC= cost of day-old chick (₦); COF = cost of feed (₦/kg); CODV= cost of drugs and vaccines (₦/litres); LBR= labour (man days); COHE = cost of housing and equipment (₦); $b_1 - b_n$ = coefficient of independent variables; $X_1 - X_n$ = vector of input quantities; e = stochastic error term.

Resource use efficiency

The marginal value product (MVP) of day-old chicks, feeds, medications and vaccines, labor, housing and equipment were calculated and then equated with their input prices to determine level of resources use efficiency.

Since the evaluated function expresses such variable in physical quantities, the MVP of such variable shall be matched to the price of its unit to determine its performance.

$$r = \frac{\text{Marginal value product}}{\text{Marginal factor cost}} = \frac{MVP}{MFC}$$

Where;

MVP= Product of marginal physical product and unit price of output; MFC= Cost of one unit of a particular resource; r = efficiency ratio

If there is no difference between its MVP and its MFC, a given resource is optimally allocated.

According to Gbigbi (2019), three scenarios can be observed;

(a) $MVP_{x1} / MFC_{x1} < 1$, indicates that resource X_1 is optimally utilized.

(b) $MVP_{x1} / MFC_{x1} > 1$, indicates that resource X_1 is over-utilized

(c) $MVP_{x1} / MFC_{x1} < 1$, indicates that resources X_1 is under-utilized.

Results and Discussion

Socio-economic characteristics of respondents

Table 1 which shows the socioeconomic characteristics of the respondents reveals that the modal age group

is 40 to 50 years with 39% of the respondents. This is followed by age group 29–39 years with 32% of the respondents in this category. The mean age was 44 years. The result suggests that most of the respondents (75%) are still vibrant and this could play a major role in helping the household business to grow. The finding also concurs with Gbigbi (2017) that majority of poultry producers were 42 years old.

Table 1: Socio-economic characteristics of respondents (N=100).

Variables	Frequency	Percentage	Mean/Mode
Age category (years)			
18–28	4	4	
29–39	32	32	44 years
40–50	39	39	
51–61	18	18	
62 - 72	7	7	
Sex			
Male	85	85	Male
Female	15	15	
Marital Status			
Single	9	9	
Married	75	75	Married
Divorced	6	6	
Widowed	10	10	
Educational level			
No formal education	29	29	
Primary education	17	17	Secondary
Secondary education	48	48	
Tertiary education	6	6	
Family size			
1 – 3	17	17	
4 – 6	56	56	5 persons
7 – 9	24	24	
10 -12	3	3	
Farming Experience			
0 - 4 years	2	2	
5 – 9	8	8	16 years
10 – 14	18	18	
15 – 19	47	47	
20 – 24	25	25	
Monthly Income (₦000)			
N5,000–N10,000	42	42	₦ 10,950.29
N10,001–N15,000	49	49	
N15,001–N20,000	7	7	
N20,001–N25,000	2	2	

Source: Survey data, 2019.

On sex, 85% of the respondents were males and 15% were females. This implies that males are predominant in poultry farming. This may be due to the tedious nature of activities involved in poultry production. This is in conformity with Moussa *et al.* (2019) and Tsado *et al.* (2018) findings that majority of people involved in poultry farming were males. The majority of respondents (75%) were married, 9% were single, 10% were widowed and the remaining 6% were divorced. Thus, majority of the respondents were married. The reason for high proportion of married people in small-scale poultry production was for economic empowerment. Mbah (2018) made a similar finding, stating that married farmers were more involved in poultry farming than unmarried farmers.

Forty eight percent (48%) of the respondents had secondary education, 29% had no formal education and 17% and 6%, respectively, had primary and tertiary education. This infers that high proportion of the respondents were literate. High literacy level facilitates understanding of issues and enhances the ability to implement modern poultry handling practices, thus increasing efficiency and profitability. It is predicted that a farmer’s level of education would have a direct impact on his or her decision-making. This supports Gbigbi (2021) findings that majority of the producers were educated in the study area.

The results further show that 56% of respondents had 4–6 people in their homes. Twenty four percent (24%) had household size of 7–9 persons and 17% had 1–3 people in their household. The remaining 3% of respondents have a family size of more than nine. The average family size was 5 persons. This means that the small number of people in the household may reduce the rate of consumption and make the income from the poultry industry more productive. This is congruent with finding of Mbah (2018).

Experience in poultry farming could enhance the efficiency in the management of farm resources, which has direct positive effects on poultry production. The result shows that 26% of the farmers have spent between 5 and 14 years in poultry farming: Forty seven percent (47%) of the respondents were found to have spent between 15 and 19 years in poultry farming and 25% spent above 19 years in poultry farming. The mean years of poultry farming experience was 16 years. This shows that respondents

have a longstanding experience in poultry production and that respondents can make better decisions to improve productivity and income, since experience in poultry farming is expected to usually determine the efficiency of farmers' decision on input combinations or allocation of resources. This agrees with the findings of [Suleiman et al. \(2017\)](#) that poultry farmers had spent many years in the business. He had a mean of 12 years experience. Most of those interviewed (91%) earned ₦5000–₦15000 monthly income. Those who earned more than ₦20 000 per month was 2% of all respondents. The monthly average revenue was ₦10,950.29 which was far lower than the national minimum monthly wage of ₦30,000. This indicates that the respondents had low income which could affect their level of poultry production.

Table 2: *Estimated costs and returns of exotic chicken production.*

Items	Total Quantity	Unit Cost (₦)	Total Value (₦)	Percentage of cost
Variable Cost				
- Day old chicks	505	150	75,750	14.11
- Feeds			184,000	34.28
- Labour	83.3 mandays	1500	125,000	23.29
-Drugs and vaccines			23,650	4.41
Total			408,400	
Fixed Cost depreciated				
- Housing	2	22,000	44,000	8.20
-Poultry equipment	32	450	14,400	2.68
Generator			5,000	0.93
- Value of land			65,000	12.13
Total			128,400	
Total Cost			536,800	
Revenue				
- Broilers	385	3500	1,347,500	
- Eggs	160 crates	750	120,000	
Total revenue			1,467,500	
Net farm income			930,700	
Profit margin %			63.42	
Return per naira invested			1.73	
Gross margin			1,059,100	

Source: Survey data, 2019.

Gross margin and net return analysis

The costs and returns analysis as shown in [Table 2](#)

revealed that the total cost incurred in exotic chicken production was ₦536, 800.00 while the total revenue realized was ₦1, 467,500.00. This gives a net return of ₦930,700.00 for the poultry farmers. Cost of feed (34.28%) constituted the highest percentage of cost followed by labour (23.29%) and cost of day old chicks (14.11%), respectively. The least cost element in exotic chicken production was rent on generator (0.93%). The profit margin was 63.42% of exotic chicken production and the return on per naira invested was ₦1.73. This means that the farmers made a profit of 73k for every ₦1.00 spent on the enterprise. In other words, exotic chicken production is a profitable business. This finding corroborates those of several researchers ([Suleiman et al., 2017](#); [Gbigbi, 2021](#)) who concluded that poultry business was highly profitable.

Regression result on production efficiency of exotic chicken

The result of double-log function indicates that the coefficient of multiple determinations (R^2) is 0.790. This implies that 79% of the total variation in the output of poultry enterprise as practiced by the farmers is explained by variation in the independent variables included in the model ([Table 3](#)). The variable day-old chicks (DOCs) had a positive and significant relationship with the output. The positive DOC coefficient which indicates that a 10% increase in the quantity of poultry production will result in 3.25% increase in DOC. The cost of feed was positive and significant at 1%, which means that an increase in feed supplies to birds would significantly increase their output. The result confirms [Olorunwa \(2018\)](#) finding that feeds is a major determinant of broiler production in Nigeria. The cost-effectiveness of drugs and vaccines administered to birds is positive and significant at 5%. This indicates that an improvement in the quantity of prescribed medications and vaccines would lead to 2.56% increase in production. The result is consistent with [Etuah et al. \(2020\)](#) and [Osuji \(2019\)](#) who in their respective studies on poultry efficiency studies there found a positive and significant relationship between medication and output. The coefficient of labour had positive and significant relationship with output at 5%. This means that an increase in workforce will lead to 2.37% increase in output. This conforms to the *a priori* expectation. The more people work on a farm, all things being equal, the more care the birds receive, resulting in higher incomes. This is in tandem with the result of [Kadiriri \(2019\)](#) findings that labour constitutes a key issue influencing output in poultry production. The regression coefficients of housing

and equipment as independent variables were positive and significant at 5% probability level. This indicates that the provision of better infrastructure for the poultry farms will result to higher output. This is in consonance with [Naseem and King \(2018\)](#), that the better the provision of housing and logistics, the quicker the return for the poultry farmer.

Table 3: Regression analysis result on production efficiency of exotic chicken.

Variable	Unstandardized Coefficients	T value	Significance
Cost of day old chick (X_1)	0.325	3.652	0.002***
Cost of feeds (X_2)	0.130	4.072	0.002***
Cost of drugs and vaccines (X_3)	0.256	3.041	0.007**
Labour (X_4)	0.237	2.972	0.006**
Cost of housing and equipment (X_5)	0.130	2.345	0.021**
Constant	14.460	17.602	0.000***
R-Square	0.790		
F-value	19.256		

Source: Survey data, 2019*** Significant at 1% level, ** significant at 5% level.

Table 4: Elasticity of production and return to scale.

Variable	Elasticities
Cost of day old chick (X_1)	0.325
Cost of feeds (X_2)	0.130
Cost of drugs and vaccines (X_3)	0.256
Labour (X_4)	0.237
Cost of housing and equipment (X_5)	0.130
RTS	1.08

Source: Survey data, 2019.

Return to scale (RTS)

The result as indicated by the regression coefficients or b-values which measure the elasticity of response of

each independent variable to output showed that one percent increase in cost of day old chick, cost of feed, cost of drugs and vaccine, labour and cost of housing and equipment would bring about 33%, 13%, 26%, 24% and 13% increase in output respectively. The sum of these elasticities of production is 1.08. This is more than unity thus indicating increasing return to scale ([Table 4](#)).

Allocative efficiency estimates

The results of the estimates of allocative efficiency in exotic chicken production are shown in [Table 5](#). The allocative efficiency estimates of poultry resources for day old chicks, feed, drugs and vaccines, labour, housing and equipment were 5.76, 0.01, 1.54, 0.02 and 0.08, respectively. The result shows that DOC, drugs and vaccines were underutilized and other resources have been over used which means that the allocation of poultry resources is under optimal. The underutilization of the DOC and of drugs and vaccines in the production process was caused by a lack of funding and the lack of access to loan facilities by many farmers. Feed was also over-utilized. The use of home-mixed food with a relatively low nutritional value by most farmers surveyed exacerbates this problem. The results showed that labour and housing and equipment in poultry production were overused. Excess family labour supply results in a propensity to overexploit farm labour. This condition is attributed to the gross inefficiency and over-use of labour found in the study. Therefore, inputs such as feed, labour, housing and equipment, may have to be reduced, while more land should be used, so as to achieve the optimal allocation of productive resources for poultry farmers. This is in agreement with the finding of [Sanusi et al. \(2019\)](#). This will increase productivity and ultimately net returns for poultry farmers in addition to the improved management skills and the acquisition of economically viable exotic breeds.

Table 5: Allocative efficiency of resources utilized in exotic chicken production.

Variable	Marginal physical product (MPP)	Marginal Value Product (MVP)	Marginal Factors Cost (MFC)	Allocative Efficiency	Remark
Day old chicks (X_1)	7.57	3,420.80	593.54	5.76	Under-utilization
Feeds (X_2)	0.5504	0.1801	33.5	0.01	Over utilization
Drugs and vaccines (X_3)	0.0823	2.14	1.39	1.54	Under utilization
Labour (X_4)	0.1067	5.46	2.40	0.02	Over utilization
Housing and equipment (X_5)	0.0638	0.6	7.84	0.08	Over utilization

Source: Survey data, 2019.

Conclusions and Recommendations

Exotic chicken production attracts a relatively higher cost compared to the traditional chicken which is maintained by almost every household in Delta State, however the attendant benefits far outweigh the costs. This is the bottom line measure of any economic activity. The positive bottom line result is predicated on the increased resource use efficiency it bestows on the subsector, a key objective of every economic activity. Exotic chicken production and resource allocation and resource use efficiency are global objectives the realization of which exotic chicken production facilitates in the subsector. The teething challenges encountered presently should therefore be viewed as indicators of greater success which will accompany the full development of the subsector when the challenges have been overcome, hence we recommend that every necessary support by way of policy support especially such as facilitates the production and supply of exotic poultry inputs and credit needs of farmers, should be given to the farmers to enable the subsector reach its full potential. Similarly, necessary training on input utilization for the farmers will also be required both to stimulate their participation in exotic chicken production and efficiency in resource use.

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Novelty Statement

The current study is one of the few studies which empirically investigated the profitability and allocative efficiency of exotic chicken in Delta State.

Author's Contribution

Theophilus Miebi Gbigbi: Designed the research plan and data analysis for this study and prepared the first draft of the manuscript.

Rodney Akpoviri Isiorhovoja: Assisted in reviewing the manuscript and helped in overall improvement of the final draft of the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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