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Analysis of Profit Efficiency of Broiler Production In Delta State, Nigeria

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Abstract
The Study examined profit efficiency of broiler farmers in Delta State, Nigeria. The specific objectives of the study were to: describe socio-economic characteristics of broiler farmers in the study area, estimate the level of profit efficiency of broiler farmers, examine the determinants of profit efficiency of broiler farmers and identify the constraints faced by broiler farmers in the study area. Multistage sampling procedure was used in the selection of 240 broiler farmers. Data for this study was collected from primary source. The data collected were analysed using both descriptive and inferential statistics. The result of the study showed that computed average age of broiler farmers was 43 years. Male dominated broiler production in the study area with 54%. The computed average farming experience was 5 years. Majority of the broiler farmers (65.8%) used the deep litter system; 34.6% raised less than 200 broilers. The Maximum Likelihood (ML) estimates of the Cobb-Douglas Stochastic Frontier Production parameters for broiler production showed that the coefficient of flock size and feed have positive signs and are statistically significant at 1% level of profitability. Analysis of profit efficiency showed that educational level decreased farmer's profit inefficiency and invariably increased their profit efficiencies, while age and credit access increased their profit inefficiencies at 1% level of probability. The return-on-investment value of 1.29 indicated that broiler production was profitable in the study area. The business was profitable with about 29 kobo profit per N1.00 investment. The study recommends that government should design policies aimed at subsidizing cost of production inputs like feed, drugs/medicine, day old chicks and target such policies at experienced broiler farmers to help increase profit efficiency and profitability of the enterprise.

Keywords: Analysis, Profit, Efficiency, Broiler, Production

Introduction

Animal protein is an essential part of human nutrition because of its biological significance. Proteins are necessary for the growth of young ones, configuration of gametes in reproduction, formation of digestive juices, repair of worn-out tissues or cells, production of anti-bodies as well as enzymes and hormones in the body [1]. Animal proteins are more "biologically complete" than vegetable proteins with regards to their amino-acids composition [2]. The dearth in the quantity and quality of protein supply in Nigeria is a challenge that is beyond dependence on plant protein alone [2]. It suffices therefore, to explore quality protein of animal origin of which poultry meat is of prime importance. Poultry production serves as an auxiliary occupation to balance the income of small and trivial farm families. It occupies an essential position in the rural space because of its vast potential to bring about rapid economic growth, particularly benefitting the weaker section of the populace [3].

The primary motive of poultry farmer had been to produce good quality meat and eggs at minimal cost but this objective has been hampered by man's keen competition with his animals over grains [4]. The term poultry refers to local and foreign fowls which are raised and fattened for their products, which comprise eggs, meat and in some cases feathers. Birds that are raised for poultry comprise fowls, turkey, ducks and geese, among others. Poultry sub-sector today is unarguably one of the most striking investment options in the agricultural sector in Nigeria. The growth of the poultry industry in Nigeria has been described as the highest means of bridging the protein shortage gap existing in the country. Poultry enterprises may differ from basic backyard poultry care to commercial production. The significance of the poultry industry is that it concentrates in providing jobs not only to those involved in production directly, but also for the hatchery activities, feed dealers, building materials, manufacturers of incubators, processors of egg and poultry products and

all dealers engaged in the marketing of egg and poultry from the time they leave the producer until they are in hands of consumers [5]. Poultry production in the earlier period was not counted as an essential occupation; it has developed and occupies a place of satisfaction among the livestock enterprise due to rapid monetary turnover [6]. This remarkable reason, amongst others has made the enterprise eye-catching and popular among small, medium as well as large scale poultry farmers.

The poultry industry plays significant role in the growth of Nigerian economy. It is a key source of egg and meat which have high nutritional importance mostly in the supply of protein [7]. Nigerian poultry industry is dominated by small-holder farmers who on the total raise bulk of the birds for egg production and meat, but individually rear less than 1000 birds using different production methods in consonance with little resources available to them [8]. Poultry business has changed from subsistence to commercial poultry farming [9]. This agrees with the findings of [10], that poultry farming is now a huge business that is split into several operations including hatcheries, broiler farms for meat production and pullet farms for egg production. The poultry industry has emerged as the most dynamic and fastest expanding segment in the animal husbandry sector.

Broiler production is a means of livelihood and a way of achieving some level of economic independence. In Nigeria, broiler production involves the care of chickens of heavy meat breeds for the reason of obtaining good quality meat products usually sold live or processed [6]. Broiler production is carried out in all parts of the country with no known religious, social or cultural inhibitions linked with their production and consumption.

Investment in broiler enterprises is attractive because the production cost per unit is low relative to other types of livestock if properly managed [6]. Poultry meat is very tender, palatable and acceptable to consumers and broiler enterprises have short production cycles indicating that it has rapid monetary turnover [11]. It was reported that most commercial broilers reach slaughter weight at between 5-7 weeks of age, although some growing strains reach slaughter weight at approximately 14 weeks of age [11]. In addition, [9] opined that broilers are marketed at an average age of around 56 days, therefore a number of batches can be raised within a year. Large numbers of farmers who engage in this business do so for income generation purposes [11]. Poultry products account for about 15% of annual income of the family [12]. Due to these clear advantages of broiler production, huge number of farmers together with men and women venture into their production mainly to generate income besides meeting the protein requirements of the households.

Recently, the estimated per capita daily animal intake in Nigeria stood at 20gm [13]. According to [14] broiler meat is in short supply and demand on the other hand is growing by nearly 3.5% per annum [15]. With the growing population in Nigeria, the increased demand for poultry meat is inevitable, hence the need for an expanded production [16]

Given the beneficial features of the poultry enterprise over livestock, the sub sector can be dependable source of cheap animal protein to many people in the study area. To increase protein intake in Nigeria, it therefore calls for urgent need to increase broiler production at both household and commercial holdings. According to [17] who postulated that broiler was tactical in addressing animal protein intake deficiency in human nutrition because of its high productiveness, fast growth rate, short generation interval and unparallel competence in nutrient transformation to high quality animal protein.

Profitability is a major factor that determines the survival of broiler businesses and a necessary condition for farmers to go on to remain in the poultry industry. Scale of operation has the possibility of enhancing profitability of agricultural enterprise and to make farmers remain in business. The profit function approach combines the approach of technical and allocative efficiencies in the profit relationship. Any errors in the production choice are thought to be translated into lower profit or revenue for the producer. Profit efficiency, consequently is defined as the capability of a farm to achieve the highest feasible profit given the prices and levels of fixed factors of that farm and profit inefficiency, in this background, is defined as loss of profit for not operating in the frontier [19]. The main difficulty of the poultry production in Nigeria is that of little productivity and inefficiency in resource allocation and utilisation [9]. Farming in general, has to use accessible inputs as efficiently as possible to attain optimum production [20].

In broiler production as well as other agricultural sectors, the core of economic efficiency is the resource use efficiency. It means that given a particular level of inputs, broiler producers should be proficient to achieve maximum profit. It is clear for resources of a business purchase which shows that the less it spends to produce a given amount of output, the larger its profitability. This indicates that for producers to attain their goals in earning more profit the resources used in production should be efficiently utilized [14].

In realization of the importance of animal protein and quick returns, the government pursued various programmed at all levels to boost the mass production of livestock products, to ensure the attainment of FAO's recommendation of 35g per capita of animal protein per day [18]. It is against this background that this study was carried out to find the profit efficiency of broiler production in Delta State, Nigeria

Today, the growth of poultry industry has continued unabated. Despite the potentials of poultry production in Nigeria, many poultry enterprises are reported to operate at very low capacities [20]. This result in low returns compared to the given amount of input committed. This indicates that poultry producers are not operating at the maximum and this result in poultry products being inadequate relative to the increasing demand for such products [21]. The supply of poultry products is far less than their demands. The government through its policies over the years supported the poultry industry to boost production. Despite all this

intervention by the government and NGOs directed towards increasing returns to broiler production, the growth in the sector still remains low. The downward trend of broiler production has been attributed primarily to high cost of production due to high cost of feed, drugs, lack of credit facilities, weakness in management and low profit. Therefore, broiler production is yet to receive maximum returns from the resources committed to production even with government commitment. This therefore raises issues of efficiency in resource use in the light of increasing cost of production. Previous studies [22] were conducted on poultry production generally. Only few studies [23] examined broiler production in Nigeria. However, none of these studies looked at profit efficiency of broiler production in Delta State. There is paucity of information on profit efficiency of broiler production, hence, this study.

The broad objective of this study was to examine the profit efficiency of broiler production in Delta State, Nigeria. The specific objectives were to:

i. describe the socioeconomic characteristics of the broiler farmers in the study area.
ii. determine the profitability of the broiler production.
iii. estimate the level of profit efficiency of broiler farmers and
iv. identify the constraints faced by broiler farmers in the study area.

The hypotheses postulated that:

i. broiler farming is not profitable and
ii. there is no profit efficiency in broiler production in the study area

The measurement of production efficiency goes a long way to determine the profitability of an enterprise which links agricultural growth to profit. Knowing the level of efficiency of broiler production is very important from a policy perspective in an economy where improved technologies are not fully exploited. Knowing the efficiency level of broiler farmers will help develop a more sustainable productive system as well help broiler farmers to improve upon the use of their scarce Development Programmes (DADP) extension workers and trained field assistant in each community. Primary data were collected using structured questionnaire. Data were collected on the socioeconomic characteristics of the poultry farmers, prices and quantities of production inputs and outputs as well as constraints to broiler poultry production in the area.

Data analysis

The data for this study were analyzed using both descriptive and inferential statistics. Descriptive statistics, include percentages, frequencies and mean. Enterprise budget technique, stochastic frontier profit model and profit inefficiency effect model were also used to analyse data.

Model Specification

Stochastic Frontier Profit Function: The data in this study were fitted into Cobb-Douglas and Translog profit function regression models and output of the best form were selected through the use of generalized log-likelihood test after meeting the econometric requirements.

(i) Cobb-Douglas profit function form;

$$\ln\pi_I = \alpha_o + \sum\alpha_i \ln (X_I) + (V_I - U_I) \quad (1)$$

(ii) Transcendental logarithmic profit function:

$$\ln\pi_I = \alpha_o + \sum^{6}_{i=1} \alpha_i \ln x_i + 1/2 \sum^{6}_{i<j=1} \sum^{6} \alpha_i \ln x_i \ln x_j + V_i - U_I \quad (2)$$

Where pi = normalized profit of the jth broiler farmers (Dependent)

X_I = price of day old chicks; X_2 = price of feed; X_3 = cost of labour; X_4 = drug and medication price; X_5 = cost of other inputs (electricity, water, transportation and fuel); X_6 = depreciated value of poultry house/building, equipment. It was calculated using straight line method of calculating depreciation.

Profit inefficiency model

$$U_I = \delta_0 + \sum^{6}_{i=1} \delta_i Z_{ji} \quad (3)$$

resources which will in turn improve their income and standard of living.

Materials and Methods

Study Area: The study area was Delta State of Nigeria. There are three agricultural zones in the state, namely Delta North, Delta South and Delta Central. It has twenty-five local government areas. It is located between longitude 5°00` and 6°45` East and latitude 5°00` and 6°30` North. It is bounded in the North and East by Edo State and Anambra State; in the South East by Bayelsa State and in the Southern flank by the Night of Benin. It has a population of 14,095,391 [24]. The principal crops grown are cassava, yam, maize, cocoyams, sweet potatoes and plantains. The livestock reared include; cattle, pig, sheep, goat and poultry. The area was chosen for the study due to the fact that broiler production is prevalent. Hence, broiler production efficiency needs serious attention to encourage maximum investment among the broiler farmers.

Sampling

Multistage sampling procedure was used in the selection of respondents. Firstly, the three (3) agricultural zones were selected from the state mainly because of their involvement in broiler production activities. Secondly, two (2) local government areas were purposively selected from each agricultural zone giving a total of six (6) Local Government Areas (LGAs). The list of registered poultry farmers was obtained from the sampled LGAs which formed the sampling frame. A total of 40 boiler poultry farmers were randomly selected from each LGA giving a total of 240 broiler poultry farmer respondents which constitute the sample size.

Data collection

Data for this study were collected from primary source. Primary data were collected through survey with the help of the Delta State Agricultural

Where: δ is the parameter to be estimated, U is a non-negative error term that is profit inefficiency effect relative to the Stochastic Frontier Profit, Z is a vector of variables explaining inefficiency effect and &o = constant in equation.

Z_1 = gender (male = 1, otherwise = 0); Z_2 = age (years); Z_3 = farming experience (years); Z_4 = education (years) Z_5 = formal poultry farming training (yes = 1, otherwise = 0); Z_6 = cooperative membership (yes = 1, otherwise = 0); Z_7 = access to credit (access = 1, otherwise = 0); Z_8 = mortality (%).

To choose the functional form that best describes the inefficiency effect, the following hypothesis was tested;

(i) $H_o = \alpha_{ij} = 0$, for all i and j, which states that the Cobb-Douglas production function is an adequate representation of the data for broiler farmers. If this hypothesis is rejected, then Hi was accepted, meaning that the Translog profit function best describes the data.

(ii) Ho: $\gamma = \delta_o = \delta_i = \delta_8 = 0$, this hypothesis specifies that the profit inefficiency effect are not present in the model. If this hypothesis is accepted, then broiler farmers are fully efficient. Test of the above hypothesis was obtained by using the generalized likelihood-ratio statistic which is defined by;

$$\lambda = -2 \ln [L(H_o)/L(H_1)] = -2 \ln [L(H_o) - L(H_i)] \quad (4)$$

Where L (Ho) is the value of the likelihood function for the frontier model, in which the parameter restrictions specified by the null hypothesis, Ho are imposed; and L (Hi) is the value of the likelihood function for the general frontier model. If the null hypothesis is true, then h has approximately a chi-square (or a mixed square) distributed with degrees of freedom equal to the difference between the parameters under Hi and Ho respectively; that is the number of parameters excluded in the model.

Enterprise budget

*E*nterprise Budget is the listing of revenue from the sales of broiler birds and cost incurred in production. The gross margin is the difference between the gross farm income (GFI) and total variable cost (TVC). It is a useful planning tool in situation where fixed capital is negligible portion of the farming enterprise in the case of small scale subsistence agriculture [25]. They further stated that gross margin analysis enables the estimation of the total expenses (costs) as well as various receipts (revenue or returns) within a production period.

It is expressed as:

$$GM = GFI - TVC \quad (5)$$

$$NFI = TGM - TFC \quad (6)$$

Where:

GM = Gross Margin, GFI = Gross Farm Income, TVC = Total Variable Costs, TFC = Total Fixed Costs, NFI = Net Farm Income.

Results and Discussion

Socioeconomic characteristics of broiler farmers

***Age*:** The frequency distribution of respondents according to socioeconomic characteristics is shown in **Table 1**. The result showed that most of the broiler farmers 30% fell within the productive age range of 31-40 years. The average age of the broiler farmers was estimated to be 43 years. This means that broiler farmers are in their prime and active age of production.

Sex: **Table 1** also showed that both men and women were actively involved in broiler production but the percentage of men was higher. Men accounted for 54% while female were about 46%. The high number of males might be attributed to hard task (such as building of the poultry house, changing of poultry litters, processing of fish meal/blood meal among others) involved in broiler production process.

Marital status

Table 1 showed that about 60.8% of the respondents were married. About 21.3% were single while 5.4% were divorced and 12.5% were widowed. The high number of married people in the business was to reduce labour cost as most married persons have children that probably contribute to the labour force in broiler production.

Household size

Table 1 showed the distribution of respondents according to their household size. Majority of the respondents (58%) fell within the household size of 4-6 person's, (2%) fell within household size of 10 and above persons. The average family size of the respondents was about 6 person per household. This result agreed with the findings of [26] who found out that majority of the small scale broiler farmers in Delta State had an average family size of 6 people. It also agrees with the findings of [27] that broiler farmers in Umuahia Capital Territory of Abia State, Nigeria had the average household size of 6.

Farming experience

The distribution of respondents by farming experience indicated that there was influx of new entrants into broiler production in recent times, because about 78.3% who had 1-5 years of experience were in the majority. This could be due to the ban on importation of frozen broiler product by the Federal Government. This was followed by about 15.8% who had farming experience of 6-10 years, 3.3% had farming experience of 11-15 years and 2.5% had farming experience of 15 years and above. The average farming experience of the respondents was about 5 years which meant that they were relatively new in the business.

Educational level

The result in **Table 1** showed that about 90% of small scale broiler farmers had formal education at primary, secondary and tertiary level at 20%, 26.3% and 42.9% respectively. On the other hand, 10% had no formal education. With this level of education, there is tendency for the farmers being able to increase the level of technology adopted and skill acquired. This study agrees with the findings of [28] that greater percentage of small-scale poultry farmers in Ogun State had formal education.

Management practice

The management practices by the respondents showed that majority (65.8%) adopted deep litter system, about

16.7% adopted battery cage system while 17.5% adopted both deep litter and battery cage system.

Source of Labour: Majority of the farmers (59.2%) get their source of labour from both family members and hired, followed by family (29.6%) then 11.3% were hired.

Flock Size: Result revealed that 34.6% of broiler farmers raised less than 200 birds, followed by about 19.2% who raised between 401-600 birds. About 17.5% raised 201-400 birds, 10.4% raised between 601-800 birds while the least (8.8%) raised more than 1000 birds. The mean flick size was found to be 577 birds.

Table 1. Socio-economic characteristics of broiler farmers in Delta State

Characteristics	Category	Frequency	Percentage	Mean/Mode
Age	<20 years	1	0.4	43 years
	21-30 years	33	13.8	
	31-40 years	70	30	
	41-50 years	72	29.2	
	51-60 years	59	24.6	
	>60 years	5	2.1	
Gender	Female	110	45.8	
	Male	130	54.2	Male
Marital Status	Single	51	21.3	
	Married	146	60.8	Married
	Divorced	13	5.4	
	Widowed	30	12.5	
Household Size	1-3 persons	28	11.7	6 persons
	4-6 persons	138	57.5	
	7-9 persons	70	29.2	
	Above 10	4	1.7	
Farming Experience	1-5 years	188	78.3	5 years
	6-10 years	38	15.8	
	11-15 years	8	3.3	
	Above 16 years	6	2.5	
Education	No Formal	26	10.8	
	Primary	48	20	
	Secondary	63	26.3	
	Tertiary	103	42.9	Tertiary
Membership of Cooperative	No	106	44.2	
	Yes	134	55.8	Yes
Management Practices	Deep litter	158	65.8	Deep litter
	Battery cage	40	16.7	
	Both	42	17.5	
Source of labour	Family	71	29.6	
	Hired	27	11.3	
	Family and Hired	142	59.2	Family and Hired
Flock Size	<200 birds	83	34.6	
	201-400 birds	42	17.5	577 birds (small and medium scale farms)
	401-600 birds	46	19.2	
	601-800 birds	25	10.4	
	801-1000 birds	23	9.6	
	>1000 birds	21	8.8	

Source: Computed from field data, 2021.

Enterprise budget analysis and profitability of broiler farmers

The straight line method of depreciation was used to determine the annual cost of building and equipment. The average fixed cost incurred by the farmers in the study area amounted to the sum of N70,800.00 on 577-unit broiler production enterprise. Findings indicated that feeds cost accounted for about 85.94% which is the greatest variable cost. This is followed by purchase of day- old chicks and medication that accounted for 10.63% and 1.32% respectively. From the enterprise budget analysis for the broiler shown in the **Table 2** it could be observed that broiler production is a profitable venture. The average gross income for a 577 unit of broiler of sampled farms were N1,212,600.00 and average net returns was calculated to be N272,930.00. It could therefore be

summarized that the average total variable cost for producing a broiler to maturity in the study area is N1505,84, while average total fixed cost per bird is N112.70. Thus, the total cost of producing a mature broiler is N1618,54, while the gross revenue per bird is N2,331,92. Since return on investment (ROI) is greater than one, broiler production is considered profitable in

the study area. The business is profitable with about 29% profit on investment. The study revealed that for every N1.00 invested on broiler production yields an ROI of N1.29 and net return on investment (NROI) of N0.29. The result of this finding corroborates with that of [29] who stated that a N1.00 investment in broiler production all things being equal would yield N0.42 in return. Therefore the null hypothesis (H_{01}) which states that broiler farming is not profitable is rejected.

Table 2: Enterprise Budget per Annum for the Average Broiler Producers

Item	Quantity	Cost/unit (N)	Amount (N)	Percentage
Gross Income	520	2,300.00	1,196,000.00	98.63
Empty Bags (feed)	230	20.00	4,600.00	0.39
Poultry dropping (bags)	120	100.00	12,000.00	0.99
Total Revenue			1,212,600.00	100
Variable Costs				
Opening Stock	577	160.00	92,320.00	10.63
Feeds (Starter)	63	2,800.00	176,400.00	20.30
Feeds (Finisher)	187	3,050.00	570,350.00	65.64
Medication/Veterinary Services			11,500.00	1.32
Miscellaneous (water, wood			2,800.00	0.32
Labour			7,000.00	0.81
Transportation			8,500.00	0.98
Total Variable Costs			868,870.00	100
Gross Margin			343,730.00	
Fixed Cost				
Depreciation on shelter/housing			12,800.00	18.08
Depreciation on equipment			52,000.00	73.45
Depreciation on repairs and maintenance			6,000.00	8.47
Total Fixed Cost			70,800.00	100
Total Cost			939,670.00	
Net Farm Profit			272,930.00	
Return on Investment (ROI)			1.29	
Net return on investment (NROI) = NFI/TC			0.29	

Source: Computed from field data, 2021.

Estimated profit function

The maximum likelihood (ML) estimates of the Cobb-Douglas Stochastic Frontier production function for small scale broiler farmers are presented in **Table 3**.

Flock Size: The coefficient of flock size has the *a priori* expected positive sign and is statistically significant at 1% level. This implied that 1% increase in flock size will increase the quantity of broiler output by 0.3235. This result corroborated with findings of [30] which results showed a positive and significant relationship between broiler output and flock size.

Feed

Feed also had the *a priori* expected positive sign and also significant at 1% showing direct relationship with output. This implies that a 1% increase in amount of feed will increase the quantity of broiler output by 0.1780. The estimated variance ($\delta_2 S$ = 0.0014) is statistically significant at 1% level of profitability. This value indicated that profit inefficiency was highly significant in the broiler farmer's production activities. The r parameters showed the relative magnitude of the variance in output associated with technical efficiency. The coefficients of the variable derived from the maximum likelihood estimation (MLE) were very important for discussing results of the analysis of the data. This coefficient represented percentage change in the dependent variable as a result of percentage change in the independent (or explanatory) variable. Gamma γ is estimated at 0.5412 and is statistically significant at 1% indicating that 54% of the total variation in broiler profitability is due to technical inefficiency factors.

Determinants of profit efficiency of broiler production

This section presents the results of analysis of the factors that determine profit efficiency in broiler production in Delta State. These explanatory variables (or factors) were of interest in this study because they have important policy implication.

Table 3 showed the results of the inefficiency model for broiler farmers. Age, Educational level and credit access have significant effect on the level of profit inefficiency with a coefficient of 0.0553, -0.0511 and 0.0326 respectively. Therefore, the null hypothesis (H_{02}) which stated that there is no profit inefficiency for

broiler production in the study area was rejected. The positive coefficient of age and credit access implied that any increase in the value of any of the variable would lead to an increase in the profit inefficiency level of the farmer. Educational levels have negative relationship with profit inefficiency. The negative coefficient implied that any increase in the value of the variable would lead to a decrease in the profit inefficiency level of the farmer.

Age

The coefficient of age had a positive sign and was statistically significant at 1% level of probability. This implied that as the age of broiler farmer's increased their level of profit inefficiency increased (or technical inefficiency increase). This finding agreed with the findings of [31] who reported that the older the household head becomes, the more he or she is unable to combine the available technology. However, the finding tended to disagree with the findings of [32] that technical efficiency and profit efficiency, increase with age respectively.

Educational level

The coefficient of educational level had a negative sign and is statistically significant at 1%. This suggests that as the level of education of the farmers increase, their level of technical inefficiency reduces. This finding agreed with that of [13] whose result showed the coefficient of educational level to be negative and statistically significant at 1% level of profitability.

Credit access

From the estimated coefficient for broiler farmers, credit accessibility was positive and significant at 1% level of probability. The finding showed that the profit inefficiencies tend to increase for farmers that had access to credit. This maybe as a result of the fact that credit received by the farmers were not properly managed or diverted to other uses. The result disagreed with the finding of [33] which indicated that inefficiency decreased with credit accessibility. However, it agreed with the findings of [34] that access to credit had positive relationship with profit inefficiency.

Table 3. Estimated dual purpose Cobb-Douglas Stochastic Frontier Profit Function for Broiler Farmers in Delta State, Nigeria.

Variable	Parameters	Coefficient	Standard error	t-value
Profit factor				
Constant	β_0	3.6699	0.2258	14.0632***
Flock Size	β_1	0.3235	0.0359	4.0014***
Feed	β_2	0.1780	0.0458	2.5741***
Labour	β_3	0.0015	0.0254	0.5577
Drugs and Vaccine	β_4	0.0295	0.0358	1.0045
Cost of other inputs	β_5	0.0356	0.0214	0.5123
Depreciation of fixed assets	β_6	0.0562	0.0221	0.3366
Inefficiency factors				
Constants	Z_0	0.7874	0.0587	14.0221***
Gender	Z_1	0.4535	0.0335	0.6335
Age	Z_2	0.0553	0.0145	10.1240***
Farming Experience	Z_3	-0.0006	0.0014	-0.4887
Educational level	Z_4	-0.0511	0.0025	-5.0578***
Training attended	Z_5	0.0033	0.0034	0.0668
Cooperative society membership	Z_6	0.0021	0.0055	0.4454
Credit Access	Z_7	0.0326	0.0145	8.9665***
Mortality	Z_8	-0.0122	0.0021	-0.1542
Diagnostic statistics				
Total variance (sigma squared)	δ_2s	0.0014	0.0003	8.0365***
Variance ratio (gamma)	Υ	0.5412	0.0532	5.3587***
LR. Test		151.4350		
Log-likelihood function		321.0550		

***, ** and * are significant levels at 1%, 5% and 10% respectively.
Source: Computed from field data, 2021.

Profit efficiency estimates for broiler farmers in delta state Nigeria

The profit efficiency showed the ability of farmers to derive maximum output from the inputs used in broiler production. Given the results of the Cobb-Douglas Stochastic Frontier model, the technical estimates are presented and discussed in **Table 4**.

The profit efficiency of the sampled households was less than 1 (or 100%), indicating that all the households were producing below the maximum efficiency frontier. A range of technical efficiency is observed across the

sampled households where the spread was large. The best broiler household had a profit efficiency of 98.36%, while the worst household had a profit efficiency of 52%. The mean profit efficiency was 72%. This implied that on the average, the respondents were able to obtain just over 72% of optimal profit from a given set of inputs.
This showed that broiler farmers households profit efficiency can be improved by 28% in order to raise the level of broiler profitability in the study area. This result was in consonance with the findings [35] who reported mean profit efficiency level of 0.69 (range 13 to 95%). It also agreed with the findings of [36] who stated that profit efficiency ranged between 20% and 91% and the mean profit efficiency level of cassava farmers was 79% which suggested that an estimated 21% loss in profit was due to a combination of both technical and allocative inefficiencies in cassava production. The finding also tallies with the result obtained by [37] in their study on profit efficiency among catfish farmers in Benue state, Nigeria. Their findings showed that profit efficiency ranged from 23% to 99% with a mean efficiency of 84%.

Table 4. Frequency distribution of profit efficiency among broiler farmers in Delta State Nigeria

Profit Efficiency range (%)	Frequency	Percentage	Mean/Mode
<51	0	0.00	
51-60	8	3.33	
61-70	82	34.17	61-70 (65%)
71-80	59	24.58	
81-90	47	19.58	
91-100	44	18.33	
Total	240	100	
Mean profit efficiency	72%		
Minimum profit efficiency	52%		
Maximum profit efficiency	98.36%		

Source: Computed from field data, 2021

Constraints to broiler production as perceived by the farmers

Some constraints were identified as hindrances to increased broiler profitability amongst the farmers. **Table 5** presented the identified constraints on broiler production as perceived by the farmers. The major constraints encountered by small scale broiler farmers are high cost of feeds (83.8%). These findings agreed with the finding of [38] whose findings showed that feed cost was the major constraints in poultry production. High cost of day- old chicks was estimated to be 83.3%. Other problems included disease outbreak 69.2%, mortality 71.3%, theft 60.4% and high cost of veterinary services 65.4%. One could then say that the constraints to broiler production were mainly due to input factors than management factors.

Table 5: Constraints on broiler production as Perceived by the farmers

Constraints	Frequency	Percentage	Rank
High cost of feed	200	83.8	1st
High cost of day old chicks	201	83.3	2nd
Mortality	171	71.3	3rd
Disease outbreak	166	69.2	4th
High cost of veterinary services	157	65.4	5th
Difficulty to access veterinary services	145	60.4	6th
Theft	145	60.4	6th

Source: Computed from field data, 2021.) Note: Multiple Responses recorded

The challenges associated with poultry production in Nigeria were diseases and pests, poor weight gain or feed Conversion, low and poor performing breeds, feeding and Management problems and lack of capital [39]. According to [40] poultry industry in Nigeria is overwhelmed by host of risks and uncertainties and these comprise natural risks, pest, poultry diseases, all these results in high mortality rates in poultry production; social risks; economic risks (price fluctuation), loss or unexpected depreciation of investment: vague or unstable supply of feed as well as disparity in the quality of feed. The high demand for poultry products by humans, the accomplishment of exotic breeds and the ease of mastering the methods of poultry production amid other factors, make poultry business an incredibly attractive venture [41]

Conclusion

Broiler Farmers in Delta State are technically profit inefficient (28%). Age, level of education and credit accessibility influenced the profit efficiency of broiler

production. Individual levels of profit efficiency ranged between 52% and 98% with a mean of 72%, suggesting that opportunities still exists for increasing productivity and profit of broiler farmers in the study area. This can be achieved by increasing the efficiency of resources used at the farm level up to 28%.

Based on the findings of the study, the following recommendations were made: The government should design policies aimed at subsidizing cost of production inputs like feed, drugs/medicine, day old chicks should be implemented. They should be targeted at experienced broiler farmers to help increase production and efficiency. Farmers should make effort to keep their surroundings clean and ensure that litter materials are disposed of as at when due. This will help to reduce the incidence of diseases outbreak, mortality and improve conditions for poultry rearing which in turn will lead to increase in Production output.

Declaration of conflicting interests

The authors declared no potential conflicts of interest

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