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ORIGINAL ARTICLE

PROFIT EFFICIENCY OF SMALL SCALE LAYER PRODUCERS IN SOME SELECTED LOCAL GOVERNMENT AREAS IN SOKOTO STATE, NIGERIA

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ABSTRACT

The study investigated the profit efficiency of small scale layer producers in some selected Local Government Areas (LGAs) in Sokoto State, Nigeria. The LGAs were purposively chosen based on high concentration of poultry farmers in these areas. A total of 120 respondents were selected randomly for this study. Data collection lasted from July to September, 2012. Data were analyzed using descriptive statistics, net farm income and stochastic frontier profit function models. Although layer enterprise was found to be a profitable venture, producers were found to be operating below the economic frontier given a mean profit efficiency value of 0.74 (i.e 74%) suggesting a scope for improvement by allocating existing resources more efficiently. Age, experience, credit, household size, gender and membership of association were found to be significant determinants of profit efficiency. The study recommends the stimulation of the domestic production of maize to curtail rising feed costs. There is also the need for extension education in the area of efficient resource management and cost saving strategies in layer production to raise farm incomes and profit.

Key words: Profit efficiency, Data collection, Sokoto State, Nigeria

1.INTRODUCTION

The production of food in Nigeria has not increased at the rate that can meet the increasing population. While food production increased at the rate of more than 2.5%, food demand increased at a rate of more than 3.5% due to high rate of population growth of 2.83% (Central Bank of Nigeria (CBN, 2004)). The apparent disparity between the rate of food production and demand for food in Nigeria has led to increasing food importation and high rates of increase in food prices. According to Wethli (2005), poultry production is one of the most profitable agricultural enterprises and the accruing returns from the enterprise can be used to improve the life of rural dwellers. Agromisa (2006) reported that the level of consumption of meat and other animal protein in Nigeria is estimated at about 8 grams per caput per day, which is about 27grams less than the 35 grams per caput minimum requirements recommended by the Food Agriculture Organization (FAO, 2003).

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Olerede (2005) observed that birds constitute over 90% of the current national livestock population and are of appreciable economic and social value to the investors and consumers. Poultry products which are sold contribute about 15% to the annual financial income of the household (Olukosi and Abraham, 2008). Poultry provide meat, egg, feather, manure (convertible to fertilizer and natural gas) to play an important role in the rural economy (Monsi, 2005). He affirmed that small scale layer production is an important element in diversifying income generation of the producers and increasing household food security. Evboumwan (2006) reported that the commercialization of poultry keeping is a recent development in a humid tropical country like Nigeria.

The measurement of efficiency remains an important area of research both in developing and developed countries. Profit efficiency depends on market forces, which in turn are influenced by the sectoral and marketing policies of the country. Battese and Coelli (1995) measured profit efficiency in which certain restrictions were imposed. Efficiency could be measured from a production function or a profit function approach. Determining the efficiency status of farmers is very important for policy purposes in an economy where

technologies are lacking (Jirong *et al*., 1996). Adegeye (2003) emphasized that subsistence oriented production especially among small scale farmers, poorly developed inputs and product markets, policy reversals, low investment in livestock enterprises, weakened extension services, poor utilization of superior varieties of poultry birds are some of the constraints to efficiency. The neglect of agriculture in Nigeria can be classified into severe, mild, chronic and transient. Nigerian agriculture continue to be neglected because of persistent dumping of cheap subsidized food imports from developed agriculture, weak agricultural stake-holders capacity prolonged political instability as a result of the discovery of petroleum and gas. The consequences of this neglect include food insecurity, food import tendency, rural unemployment, endemic poverty and stunted agro-industrialization.

The relationships between efficiency, market indicators and household characteristics have not been well studied in Nigeria. An understanding of these relationships could provide policy makers with information to design programmes that can contribute to measures needed to expand the food production potential of the country and better measures that can enhance agricultural efficiency can be implemented. This study was designed to ascertain the profitability and economic performance of small scale layer production in the study area and identify the determinants of profit efficiency of layer producers in the study area.

Conceptual framework

The popular approach to measure technical efficiency component is the use of frontier production function. However, it has been argued that a production function approach to measure efficiency may not be appropriate when farmers face different prices and have different factor endowments. This led to application of stochastic profit function models to estimate farm specific efficiency directly. Battese and Coelli (1995) extended the stochastic production frontier model by suggesting that the inefficiency effects can be expressed as a linear function of explanatory variables, reflecting farm-specific characteristics. The advantage of this model is that it allows the estimation of farm specific scores and the factors explaining the efficiency differentials among farmers in a single stage estimation procedure. The stochastic profit function is defined as:

$$\pi_j = f(P_{ij}, Z_{kj}).\ Exp\ (V_i - U_i) \quad \text{----------(1)}$$

π_j = normalized profit of the j^{th} farm and it is computed as gross revenue less valuable cost divided by the farm specific output price P, f represents an appropriate function (eg Cobb-Douglas, Trans-log etc), P_i is the price of the j^{th} variable input faced by the j^{th} farm divided by the price of unit of output, kj is level of k^{th} fixed factors for the j^{th} farm, V_i is a random variable which is assumed to be $N(O, \delta v^2)$ and independent of U_i which are non-negative random variables which are assumed to be $N(O, \delta v^2)$ i.e half normal distribution or have exponential distribution. If $U_j = 0$, the firm is operating on the frontier, obtaining maximum profit given the prices it faces and levels of fixed factors. If $U_j > 0$, the firm is inefficient. Profit efficiency is defined as:

Profit efficiency $= \pi / \pi^* f(P_{ij}, Z_{kj}) \exp(V_i - U_i) / f(P_{ij}, Z_{kj}) \exp Vj = \exp(-uj)$ ----------(2)

π is the observed profit and π^* is the frontier profit defined in terms of ratio of the observed profit to the corresponding frontier profit given the prices and the levels of fixed factors of production of the farmer.

The Empirical Model: the Cobb-Douglas stochastic frontier profit functional form is specified as:

$$\ln \pi j = \ln \alpha o + \sum_{i=1}^{4} \alpha i \ln Pij + \sum_{k=1}^{2} \alpha k \ln zkj + Vj - Uj \quad \text{----------(3)}$$

Where i refer to variable inputs, k refers to fixed inputs and j refers to farms respectively. πj is the normalized profit in naira per layer enterprises defined as gross revenue less total variable cost divided by the price of layer. V is the normal random errors which are assumed to be independent and identical distributed having zero mean and constant variance. U is the non-negative random variable associated with the profit efficiency of the enterprises.

Factors believed to affect the profit efficiency of the broiler farmer were incorporated into the model and estimated jointly. The efficiency component model is specified as:

$$-U = b_0 + b_1 X_{1j} + b_2 X_{2j} + b_3 X_{3j} + b_4 X_{4j} + b_5 X_{5j} + b_6 X_{6j} + b_7 X_{7j} + b_8 X_{8j} \quad \text{------ (4)}$$

Where U is the profit efficiency,

$X_{1\ j}$-X_{2j} are factors believed to affect the level of profit efficiency of the farmer and $b_{0,}$ b_1-b_8 are maximum likelihood estimates to be to be measured.

2.METHODOLOGY

Study area

The study was conducted in in Sokoto state, Nigeria. The state was created in January 1976 with the headquarters in Sokoto . It is made up of 23 Local Government Areas (LGAS) covering a total land area of 26,648,480 square kilometers, Metrological Stations in Nigeria State (M.S.N.S, 2009). It shares common borders with Niger republic to the north, Kebbi state to the west and Zamfara state to the east. The state is located within latitudes $11^0\ 30' - 13^0\ 50'$ N and longitudes $4^0 07' - 6^0 56'$E. The state has a population of 4,244,399 people based on 2006 population census (National Population Commission (NPC, 2006). The estimated population by 2012 was 11,844,317 inhabitants. The rainfall starts late (May) and ends early (September/October) with mean annual falls ranging between 130mm to 500mm (M.S.N.S, 2009). The mean minimum and maximum temperature are 23^0C – 43^0C (M.S.N.S, 2009).

Livestock farming and arable crop production are the major occupations of the people in the state. The people of the state are involved in the production, harvesting and marketing of farm products and the main livestock reared included: poultry, cattle, sheep and goats.

Sampling technique and sample size

The study was conducted in three selected local government areas (LGAs) of Sokoto state, namely, Sokoto North, Sokoto South and Wamakko. The LGAs were purposively chosen based on the high concentration of the population of poultry farmers in these areas which also was related to its cosmopolitan nature and high human population which drives the demand for poultry products. A total of fourty (40) respondents were randomly selected from each of these local government areas, to make up a sample size of 120

respondents. A sample frame which denoted the list of layer producers in the selected local government areas was obtained from the State Ministry of Agriculture. Agricultural Development Programme (ADP) agents, resident in each of these locations were adequately trained on the type of data required to be elicited from the respondents and co-opted in the data collection process for this study. They assisted the researcher in eliciting relevant information using the questionnaire as data collection instrument. Primary data were elicited from the respondents with the aid of a structured questionnaire. Secondary information were also obtained from journals, previous research works and textbooks.

The information elicited from the respondents include, socio-economic characteristics of respondents such as age, marital status, level of education, years of experience in the business, participation in cooperative society, extension visit, access to credit, source of funds, number of birds, feeds, access to credit, labour used and management system as well as information on other quantitative variables of interest such as, production inputs, outputs and their respective prices. The economic variables considered for estimating efficiency of layer production are: price of day old chicks (in Naira), price of feeds (Naira), price of drugs/medication (Naira), price of family labour (Naira), transportation cost (Naira), price of hired labour (Naira), Annual depreciation on durable capital items (Naira), and number of birds raised (Number),etc. Data collection lasted from July to September, 2012.

Methods of data analysis

The analytical techniques used in this study include, descriptive statistics such as means, frequency distributions and percentages to achieve objectives 1 and 4 respectively. The second objective was achieved by using the farm budget model. Objective three was achieved using the Cobb Douglas transcendental stochastic frontier profit function model. The farm budget model is a tool used to determine the level of resources used and output realized in farm enterprises (Olukosi *et al*., 2005). The farm budget model was used to ascertain the profitability of small scale layer producers in the study area. The farm budget model is defined as:

NFI=GI-TC ……..(5)

Where; **NFI**= Income or profit (refers to the difference between gross income and total of costs of layer production in the study area), **GI** = Gross income represents the sum of total value of layer production (sales of egg, birds and poultry droppings), **TC** = Total cost refers to all the expenses incurred in the layer production by the farmer. These include fixed costs and variable costs, **TVC** = Total variable costs. These are costs that vary according to expenditure, incurred on variable inputs employed in production and **TFC =** Total fixed costs. These are the depreciation cost incurred on fixed inputs used during the production period.

NFI=GI-+TFC)……(6)

NFI=GI-TVC-TFC..... (7)

$$NFI=\sum_{j=1}^{m} PjQj - \sum_{k=1} Pk\,Qk - TFC \quad \text{……..(8)}$$

Where, Pj = price of unit of Jth output, Qj = quantity of Jth output, Pk = price of Kth input, Qk = quantity of Kth input, ∑ = summation sign, TVC = total variable cost, TFC = total fixed cost, other variables are as previously defined.

Specification of the stochastic frontier profit function

The Cobb-Douglas transcendental logarithmic profit function was used to identify the determinants of profit efficiency of small-scale layer producers in the study area. The model estimated by jointly combining the production as well as inefficiency factors in a single stage maximum likelihood estimation procedure using computer software frontier version 4.1 (Battese and Coelli, 1995) to identify the determinants of profit efficiency. The model is explicitly specified as:

$$\begin{aligned}\ln \pi = {} & \ln b_0 + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + b_6\ln X_6 + b_7\ln X_7 + b_8\ln X_8 + 0.5b_{11}\ln X_1^2 + 0.5b_{22}\ln X_2^2 + 0.5b_{33}\ln X_3^2 + 0.5b_{44}\ln X_4^2 + 0.5b_{55}\ln X_5^2 + 0.5b_{66}\ln X_6^2 + 0.5b_{77}\ln X_7^2 + 0.5b_{88}\ln X_8^2 + b_{12}\ln X_1\ln X_2 + b_{13}\ln X_1\ln X_3 + b_{14}\ln X_1\ln X_4 + b_{15}\ln X_1\ln X_5 + b_{16}\ln X_1\ln X_6 + b_{17}\ln X_1\ln X_7 + b_{18}\ln X_1\ln X_8 + b_{23}\ln X_2\ln X_3 + b_{24}\ln X_2\ln X_4 + b_{25}\ln X_2\ln X_5 + b_{26}\ln X_2\ln X_6 + b_{27}\ln X_2\ln X_7 + b_{28}\ln X_2\ln X_8 + b_{34}\ln X_3\ln X_4 + b_{35}\ln X_3\ln X_5 + b_{36}\ln X_3\ln X_6 + b_{37}\ln X_3\ln X_7 + b_{38}\ln X_3\ln X_8 + b_{45}\ln X_4\ln X_5 + b_{46}\ln X_4\ln X_6 + b_{47}\ln X_4\ln X_7 + b_{48}\ln X_4\ln X_8 + b_{56}\ln X_5\ln X_6 + b_{57}\ln X_5\ln X_7 + b_{58}\ln X_5\ln X_8 + b_{67}\ln X_6\ln X_7 + b_{68}\ln X_6\ln X_8 + b_{78}\ln X_7\ln X_8 + V - U \quad \text{……..(13)}\end{aligned}$$

Where; π = Net profit, ln = Natural logarithm, X_1 = Price of day old chicks (Naira), X_2 = Price of Feeds/Feeds Supplements (Naira), X_3 = Price of Drugs/Veterinary services (Naira), X_4 = Price of family labour (Naira), X_5 = Price of Transportation (Naira), X_6 = Price of hired labour (Naira), X_7 = Annual depreciation on durable capital items (Naira), X_8 = Number of birds (Number), b_0 = Constant, b_1 - b_{78} = Maximum likelihood estimates, V = Statistical disturbance term and U = Farmer specific characteristics related to production efficiency, where;

$$U = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + \beta_8 Z_8 + \beta_9 Z_9 \quad \text{…….(14)}$$

and β_0 = Constant term, $\beta_1 - \beta_9$ = Maximum likelihood estimates to be measured, Z_1= Age of farmer (Years), Z_2= Educational level (Number of years spent in school), Z_3= Farming experience (Years), Z_4= Farm size (Measured by total number of birds), Z_5= Access to credit (Naira), Z_6= Number of extension visits, Z_7= Farm household size (Number of family members), Z_8= Gender (male = 1, female = 2), Z_9 = Membership of association (member = 1, non-member = 0).

3.RESULTS

The distribution of the respondents according to socioeconomic characteristics is presented in Table 1. The results of the study presented in Table 1 revealed that majority of the respondents (70%) were males, while the remaining 30% were females. Results in Table 1 further revealed that majority of the respondents were married and a typical respondent was married and 33 years of age with 5 family members.

The costs and returns of layer production in Naira per bird are presented in Table 2. Results in Table 2 indicated that an entrepreneur spent a total of ₦845.73 as total variable costs and ₦49.57 as total fixed costs to produce a bird and realized a total gross income of ₦2, 688.71 for every bird raised up to laying in the study area. The net profit realized per bird in the study area was ₦1,793.41/bird**.** The variable cost items indicated that feed accounted for the highest contribution to the total cost of

production which was 43.95% of the total costs. Financial analysis was done to assess the economic performance of layer enterprises in the study area. Results in Table 2 show the computed farm financial ratios of layer producers in the study area. The investment turnover and simple rate of return ratios were 54.12 and 2.00 respectively.

The Maximum Likelihood Estimates of the stochastic frontier profit function for layer enterprise are presented in the Table 3. The result shows that the sigma squared (δ^2) was 0.56 and significant at 0.01 probability level. This implies the correctness of the specified distributional assumptions about the error term. The gamma (γ) value was 0.99 and significant at 0.01 probability level, suggesting that the sources of error were stochastic. Individual profit efficiency indices ranged between 0.10 (10%) and 0.99 (99%) with a mean value of 0.74 (74%). This shows a wide gap between the most economically efficient farmer and the worst farmer in the sample given the average profit efficiency value of 0.74 (74%). This implies that there is 26% unattained efficiency for a typical layer producer.

The determinants of profit efficiency in layer production enterprise in the study area are presented in Table 4. The results indicates that age of farmer (-0.198), farming experience (0.0515), access to credit (-0.0711), farm household size (0.0448), gender (0.0423) and membership of association (0.0819). were the factors that significantly influenced the profit efficiency of layer producers in the study area. The negative and significant coefficient of age of farmer, farming experience and access to credit indicates that an increase in these variables resulted in a reduction in the levels of profit efficiency or increase in profit inefficiency of the respondents.

4.DISCUSSION

Socio-Economic characteristics of respondents

The distribution of the respondents according to socioeconomic characteristics is presented in Table 1. The results of the study presented in Table 1 revealed that majority of the respondents (70%) were males, while the remaining 30% were females. This indicates that layer production in the study area was dominated by male. The implication of male dominance may be that productivity will be higher, because, males have the tendency to be more labour efficient as compared to their female counterparts. However, this finding underscores the need for the design of policy to take into account this gender related peculiarity. Taking labour efficiencies into concern, this findings supported Reddy *et al.*,(2008) who found that the male folk were more profit efficient as compared to their female counterparts in the study area.

Results in Table 1 further revealed that majority of the respondents were married and a typical respondent was married and 33 years of age with 5 family members. Age affects decision and actions made in agriculture, because people's thoughts, behavior and needs are primarily related to their ages (Simsek and Karkacur, 1996). The results show that majority of the farmers are relatively young and are still in their agriculturally active age bracket. The implication is that younger farmers are likely to adopt innovation faster than older ones. The finding is in agreement with Sani *et al*., (2007). All the respondents had one form of education or the other. Studies have revealed that education influences the adoption of improved practices of modern agriculture (Obinne, 1991). An educated person is more likely to adopt modern farming practices more easily and hence could be a better producer.

The findings of this study also indicated that a typical poultry farmer had five years of experience in the business. This finding also agrees with Oluwatayo *et al.,* (2008) who found that farmers in Ekiti State also had up to seven years of experience in the business. Farmers with more years of experience in an enterprise would be more likely to be efficient, may possess realistic planning imperatives and may have better knowledge of climatic conditions and market situations.

Profitability of layer production enterprises

The costs and returns of layer production in Naira per bird are presented in Table 2. Results in Table 2 indicated that an entrepreneur spent a total of ₦845.73 as total variable costs and ₦49.57 as total fixed costs to produce a bird and realized a total gross income of ₦2, 688.71 for every bird raised up to laying in the study area. The net profit realized per bird in the study area was ₦1,793.41/bird**.** The variable cost items indicated that feed accounted for the highest contribution to the total cost of production which was 43.95% of the total costs. The results also revealed that acquisition of foundation stock ranked second highest representing 26.74% of the total costs of producing a layer bird. Vaccines and medication ranked third in decreasing magnitude of importance with 8.06%. The results further indicated that for the revenue items, proceeds from sale of egg generated more revenue as compared to sales from spent layer and droppings respectively. Proceeds from the sale of eggs accounted for 59.12% of the total gross income realized per layer, while sale of spent layer hen accounted for 25.52% and droppings 15.36% of the total gross income per layer produced. This implies that feed is an essential cost item in layer production. This agrees with Intisar (1995), Sharabeen (1996), Yusuf and Malamo (2007) and Adepoju (2008) who also found that feed cost comprised the highest share in the total cost of poultry production.

The results also showed that majority of the revenue is generated from the sale of eggs. This is similar to the findings of Narahari (2002), Rajendran and Samarendu (2003) and Emam and Hassan (2010) who found that sale of eggs contributed the highest share of the total revenue realized by egg producers. The result further showed that the average gross income per bird was N2,688.71 and net income was N1,793.41. This implies that layer production was profitable in the study area. The results also agree with the finding of Reddi (1986) and Rajendran and Samarendu (2003) who found that gross margins and net returns increases with increase in farm size and was profitable. It also lent credence to the findings of Yusuf and Malomo (2007), Sani *et al;* (2007) and Rajendran and Samarendu (2003) who opined that many factors affect the profitability which may include cost of birds, price of egg among others depending on the location of the farm.

Financial analysis

Financial analysis was done to assess the economic performance of layer enterprises in the study area. Results in Table 2 show the computed farm financial ratios of layer producers in the study area. The investment turnover and simple rate of return ratios were 54.12 and 2.00 respectively.

This indicates that for a typical respondent, the business made returns of 54.12% or ₦54.12 kobo on every Naira invested on the farm. Olukosi and Erhabor (1988) posited that the higher the rate of returns on capital, the better it is for the success of the farm business. A simple rate of returns ratio greater than 1 is acceptable for a farm business. The operating ratio was 0.31. It shows the proportion of the gross income used to off-set the operating costs. The operating cost is directly related to the farm variable input usage. Generally, the lower the value of the operating ratio, the better is the financial position of the farm. An operating ratio of 1 means that the gross income barely covers the expenses on the variable inputs used on the farm or the enterprise is at the break-even point. Results further show an income/expenses ratio of the enterprise of 3.00. The ratio was used to measure the value of the output exceeding the total cost of production. The ratio of 3.00 so obtained shows that the revenue exceeded the total costs of production. This indicates that the business is solvent. Income-expenses ratio of large magnitude suggests that the enterprise is in a better the financial position.

Table 1: **Distribution of the respondents according to socioeconomic characteristics**

Sex	**Frequency**	**Percentage**
Male	84	70.00
Female	36	30.00
Total	120	100.00
Marital Status		
Married	97	80.80
Single	23	19.20
Total	120	100.00
Education level		
Quranic	13	10.80
Primary	2	1.70
Secondary	12	10.00
Tertiary	93	77.00
Total	120	100.00
Extension access		
Yes	67	55.80
No	53	44.20
Total	120	100.00
Credit access		
Yes	63	52.50
No	57	47.50
Total	120	100.00
Source		
Self financing	48	40.10
Cooperative society	69	57.50
Commercial bank	1	0.80
Friends/relatives	1	0.80
Money lenders	1	0.80
Total	120	100.00
Management system		
Intensive	114	95.00
Semi-intensive	2	1.70
Extensive	4	1.30
Total	120	100.00
Labour		
Family	52	43.30
Hired	68	56.70
Total	120	100.00

	Minimum	**Maximum**	**Mean**	**Std. error**	**Std. dev.**
Age	20.00	60.00	33.00	0.73	8.00
Experience	1.00	21.00	5.00	0.31	3.42
Household size	1.00	15.00	5.00	0.34	3.75

Source: Field survey, 2012

Estimated Profit function

The Maximum Likelihood Estimates of the stochastic frontier profit function for layer enterprise are presented in the Table 3. The result shows that the sigma squared (δ^2) was 0.56 and significant at 0.01 probability level. This implies the correctness of the specified distributional assumptions about the error term. The gamma (γ) value was 0.99 and significant at

0.01 probability level, suggesting that the sources of error were stochastic. Individual profit efficiency indices ranged between 0.10 (10%) and 0.99 (99%) with a mean value of 0.74 (74%). This shows a wide gap between the most economically efficient

Table 3: Maximum likelihood Estimates of production factors

Variables	Parameter	Coefficient	Standard error (SE)	t-ratio
Constant	b_0	2.45	1.04	2.36**
Price of day old chicks	b_1	1.55	0.26	5.88***
Price of feed/supplement	b_2	-0.64	0.21	-3.05***
Price of drugs/veterinary services	b_3	-0.91	0.27	-3.34***
Price of family labour	b_4	-0.12	0.09	-1.31
Price of transportation	b_5	1.16	0.24	4.87***
Price of hired labour	b_6	0.43	0.14	3.11***
Annual depreciation	b_7	-0.70	0.19	-3.37***
Number of birds	b_8	-0.04	0.08	-5.89***
Interaction terms				
Price of day old chicks x price of day old chicks	b_{11}	-1.54	0.33	-4.65***
Price of feed/supplement x Price of feed/supplement	b_{22}	-0.40	0.12	-3.35***
Price of drugs/vet.Service x Price of drugs/vet.Service	b_{33}	0.13	0.21	0.66
Price of family labour x Price of family labour	b_{44}	-0.09	0.03	-0.31
Price of transportation x Price of transportation	b_{55}	-7.62	0.11	0.67
Price of hired labour x Price of hired labour	b_{66}	0.04	0.04	0.90
Annual depreciation x Annual depreciation	b_{77}	-0.80	0.12	-6.41***
Number of birds x Number of birds	b_{88}	-0.26	0.27	-0.97
Price of day old chicks x Price of feed/supplement	b_{12}	-0.51	0.30	-1.77*
Price of day old chicks x Price of drugs/vet. Services	b_{13}	2.24	0.17	3.06***
Price of day old chicks x Price of family labour	b_{14}	-0.21	0.14	-1.44
Price of day old chicks x Price of transportation	b_{15}	0.19	0.27	0.71
Price of day old chicks x Price of hired labour	b_{16}	-0.14	0.24	-0.59
Price of day old chicks x Annual depreciation	b_{17}	0.54	0.38	1.42
Price of day old chicks x Number of birds	b_{18}	0.61	0.34	1.82*
Price of feed/supplement x Price of drugs/vet.Services	b_{23}	-0.20	0.18	-1.16
Price of feed/supplement x Price of family labour	b_{24}	0.32	0.14	2.46**
Price of feed/supplement x Price of transportation	b_{25}	-7.00	0.27	-0.38
Price of feed/supplement x Price of hired labour	b_{26}	0.28	0.24	1.60
Price of feed/supplement x Annual depreciation	b_{27}	0.92	0.38	2.94***
Price of feed/supplement x Number of birds	b_{28}	0.76	0.34	1.58
Price of drugs/vet. services x Price of family labour	b_{34}	0.20	0.18	2.07**
Price of drugs/vet. services x Price of transportation	b_{35}	0.40	0.13	4.58***
Price of drugs/vet. services x Price of hired labour	b_{36}	0.19	0.19	1.39
Price of drugs/vet. services x Annual depreciation	b_{37}	-0.96	0.18	-7.78***
Price of drugs/vet. services x Number of birds	b_{38}	-1.83	0.31	-3.76***
Price of family labour x Price of transportation	b_{45}	0.12	0.48	1.20
Price of family labour x Price of hired labour	b_{46}	-0.33	0.10	-2.60**
Price of family labour x Annual depreciation	b_{47}	-0.49	0.09	-6.81***
Price of family labour x Number of birds	b_{48}	0.55	0.14	3.83***
Price of transportation x Price of hired labour	b_{56}	7.08	0.12	0.68
Price of transportation x Annual depreciation	b_{57}	-0.13	0.49	-0.45
Price of transportation x Number of birds	b_{58}	-0.24	0.10	-0.58
Price of hired labour x Annual depreciation	b_{67}	-0.55	0.13	-0.52
Price of hired labour x Number of birds	b_{77}	0.53	0.14	2.24**
Annual depreciation x Number of birds	b_{78}	1.14	0.15	3.05***
Diagnostic Statistics				
Sigma-squared (δ^2)		0.56		6.04***
Gamma (γ)		0.99		5.94***
Log-likelihood function				6.04***
LR-Test				5.94***
Maximum value		0.99		
Minimum value		0.10		
Mean profit efficiency		0.74		

Number of observation = 120; * = significant at 10%, ** = significant at 5%, *** = significant at 1%.
Source: computer printout of frontier version 4.1/field survey, 2012.

Table 2: Costs and returns of layer production (in Naira per bird)

Cost items	Amount (N)/bird	Percentage of total
Variable costs		
i) Foundation stock	239.36	26.74
ii) Feeds and supplements	393.49	43.95
iii) Vaccines and medication	72.19	8.06
iv) Electricity	27.91	3.12
v) Water	28.47	3.18
vi) Salaries	35.06	3.92
vii) Repairs and maintenance	18.69	2.09
viii) Transport	13.28	1.48
ix) Litter material	9.45	1.06
x) Commission/tax	7.84	0.88
Total variable costs(TVC)	845.73	94.46
Fixed cost (Depreciation on fixed assets such as feeders, drinkers, interest payments, etc)	49.57	5.54
C. Total cost(TC)	895.30	100.00
D. Revenue		
i) Egg	1,589.54	59.12
ii) Culled layer	686.16	25.52
iii) Droppings	413.00	15.36
Total gross income(TGI)	2,688.71	100.00
E. Net Profit(TGI – TC)	1, 793.41	
F. Farm financial ratios		
i) Investment turn over	54.24	
ii) Simple rate of return	2.00	
iii) Operating ratio	0.31	
iv) Income/expenses ratio	3.00	

Source: Field survey, 2012

Table 4: Determinants of inefficiency in layer production

Variables	parameter	Coefficient	Standard error (SE)	t-ratio
Constant	β_0	1.42	0.95	1.50
Age of farmer	β_1	-0.09	0.02	-4.13***
Educational level	β_2	-0.01	0.02	-0.71
Farming experience	β_3	0.05	0.02	2.79***
Farm size	β_4	0.01	0.01	1.49
Access to credit	β_5	0.07	0.02	4.25***
Number of extension visits	β_6	-0.02	0.01	-1.67
Farm household size	β_7	0.04	0.01	4.21***
Gender	β_8	0.04	0.01	3.98***
Membership of association	β_9	0.08	0.04	2.27**

Source: Field survey data 2012.

farmer and the worst farmer in the sample given the average profit efficiency value of 0.74 (74%). This implies that there is 26% unattained efficiency for a typical layer producer. There is therefore need for improvement in efficiency by optimally allocating existing resources given input-output prices to move production to the frontier.

The elasticity estimates of price of day old chicks, feed supplements, drugs and veterinary services, price of transportation, price of hired labour and the number of birds raised were statistically significant at 1% levels respectively. The price of day old chicks had a coefficient of 1.5472. This implies that an increase in the price of day old chicks by 1%, holding other variables constant, would lead to an increase in the profit obtained from egg production by 1.5472%. The estimated coefficients with respect to price of feeds/supplement, price of drugs/veterinary services, transportation , hired labour, annual depreciation and number of birds were -0.6380, -0.9058, 1.1601, 0.4286, -0.6990 and -0.0449 respectively. This also implies that a 1% increase in each of these variable inputs had led to an increase (if the coefficient was positive) or a decrease (if the coefficient was negative) in the amount of profit realized respectively. The magnitudes of estimated coefficients are of economic relevance. The estimated coefficient of feed variable was -0.6380 and statistically significant at 0.01 probability level. Adepoju (2008) stressed that feed cost is the most important single cost item associated with layer production due to

increase in the cost of maize, groundnut cake, soya bean meal, fish meat and scarcity of wheat and corn offal. Sonaiya and Sivan (2004) earlier noted that availability of feeds at economic prices is by far the most important condition for profitable layer production, because, it constitutes more than 75percent of the total expenditure. Further lending credence to this assertion, Adeyinka and Mamman (2004) observed that the cost of feed as a percentage of total variable cost was 67.8% in layer enterprise and concluded that upward increase in feed cost led to reduced profit margin. The estimated coefficient for price of drugs and veterinary service was negative and significant at 0.01 probability level. They also found out that the cost of drugs/veterinary services accounted for 5-10 percent of the total variable cost. Increase in the cost of drugs makes it difficult to check the increase in mortality rate as it depresses farm profits.

The parameter estimate of hired labour was positive and significant at the 0.01 probability level. Dillion *et al.,* (1998) reported that the cost of labour constituted the second largest after feed. It is therefore pertinent that the efficiency of labour should be as high as possible if profit is to be maximized in the enterprise. The estimated coefficient of capital inputs was -0.9058 and statistically significant at 0.01 probability level. Obinne (1991) stressed that fixed costs affect the profit of most crops and livestock enterprises especially in the short-run planning period. Expenditure on fixed cost items depends on the size of the farm and not on the output level in which the enterprise is operating. The estimated coefficient of day old chicks is 0.4286 and statistically significant at the 0.01 probability level. This implies that increasing the number of day old chicks will lead to increase in profit. The results agrees with the findings of Gueye (1999) that day old chicks require less feeds, drugs, medication and labour.

Determinants of profit inefficiency

The determinants of profit efficiency in layer production enterprise in the study area are presented in Table 4. The results indicates that age of farmer (-0.198), farming experience (0.0515), access to credit (-0.0711), farm household size (0.0448), gender (0.0423) and membership of association (0.0819). were the factors that significantly influenced the profit efficiency of layer producers in the study area. The negative and significant coefficient of age of farmer, farming experience and access to credit indicates that an increase in these variables resulted in a reduction in the levels of profit efficiency or increase in profit inefficiency of the respondents. This finding is consistent with the findings of Rahman (2001) and Oluwatayo *et al*.,(2008). However, with respect to years of formal education, this finding is not consistent with *a priori* expectation of the sign of the estimated coefficient. This is because, education is expected to exert a positive influence on the profit efficiency of the farmer. Farmers having more years of formal schooling are expected to be more profit efficient. Similarly, the negative sign of the coefficient for credit was also contrary to *a priori* expectation of a positive sign for this variable. This is because, access to credit provides the farmer with means of expanding and improving his farm. Hence, lack of aceess and utilization of credit facility will exert a negative effect on profit efficiency. Okoh *et al*; (2010) corroborates this fact by reporting that credit increases the net revenue obtained from fixed inputs, market conditions and individual characteristics, while credit constraints decreases the efficiency of farmer by limiting the adaptation of high yielding varieties and the acquisition of information needed to increase productivity. Another possible implication could be that farmers allocated part of the loan acquired to finance non-agricultural ventures which depressed their efficiency.

The result of participation in cooperative society with a coefficient of 0.0819 implies that membership of organized farmer groups boosted the level of profit efficiency of the respondents. A poultry egg farmer who participated more in farmers cooperative would be more likely to be profit efficient as compared to his/her counterpart who did not. Through non-formal interpersonal contacts, farmers tend to learn better production techniques as compared to when they operate in isolation. They are more likely to imbibe the success story and best practices of their counterparts to enhance efficiency. This finding agrees with Okoh *et al*; (2010) and also supports the findings of Wainaina *et al*; (2012) who found that participation in cooperative activities may give room to assessing credit facility to enhance their productivity. The group is likely to hedge the collateral requirement for the prospective borrower to finance production activities.

The result of age of farmers implies that age of farmers influences profit efficiency adversely. In other words, as the age of the farmer increases, his/her level of profit efficiency declines. This result does not agree with the findings of Simsek and Karkacur (1996) that age enhanced productivity as decisions and actions made is related to their ages. The result of household size suggests that large household size comprising of persons of active age bracket could constitute a work force with the propensity to increase efficiency (Oluwatayo *et al*; 2008). The result of the gender coefficient was positive. This suggests that male farmers are economically more efficient than female farmers in the study area and the enterprise is therefore stereotyped to sex. This agrees with the findings of Oluwatayo *et al*; (2008) who found that male farmers were more efficient than their female counterparts. Due to this fact, they were favoured in terms of access to extension services, credit access and training schemes, farm input supplies and services and new production technologies.

5.CONCLUSION AND POLICY RECOMMENDATIONS

The results of this study indicated that layer production is a profitable venture but producers are operating below the economic frontier even though the financial analysis indicated solvency. Marked mal-allocation of existing resources was responsible for sub-optimal efficiency by entrepreneurs. To provide a framework for the way forward, the following recommendations are suggested and the relevant actors identified for implementing these recommendations.There is need for cost-saving by the entrepreneurs to enable them operate on the frontier. It is recommended that lending rates to the agricultural sector should be below two digits in order to spur more and faster transformation of the poultry industry thereby contributing to realizing national development goals to overcome food insecurity, improve nutrition and overcome poverty. There is need to stimulate domestic production of maize and other feed crops in a bid to curtail rising feed costs.

The government can do this by providing incentives and a ready market for producers of corn for domestic and industrial purposes. Such incentives should include single digit lending rates and the provision of fertilizer, a critical input in maize production. This would require that farmers belong to organized groups to enable them access production inputs. The existing farmer cooperative societies should be further strengthened to necessitate improved access to credit and other facilities. There is also the need for extension education in the area of resource management and cost saving methodologies, feed formulation, purchasing quality breeds so as to improve farm income and profit. Poultry farmers should be encouraged to keep records for accountability and prudence. Veterinary services were found to be significant determinants of farm profit. A public information campaign aimed at ensuring public knowledge about poultry disease would greatly help to improve simple daily practices and reduce the risk of disease. Television would be the best way to inform people but the large majority of Nigerians particularly in rural areas have access only to radio. This should also be included in the extension education content for dissemination to poultry farmers.

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