Profitability and Resource Use Efficiency of Poultry Egg Production in Abuja, Nigeria

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ABSTRACT

The profitability, break-even point, elasticity of production, and resource use efficiency of poultry egg production by poultry egg farmers was determined in Abuja. Primary data were collected from 62 farmers drawn from the area of study by a simple random sampling technique. Analysis of data was carried out via the use of descriptive statistics, multiple regression, costs and returns analysis (budgeting), and break-even analysis. The costs and returns analysis indicated that an average farmer invested annually NGN (Nigerian naira currency) 3,504,352 (USD 1 is approximately NGN 160) in poultry egg production. The gross margin, net income, and gross return invested were NGN 10,875,663, NGN 9,798,772 and 1.72 respectively. These figures suggest that egg production in the study area was profitable. The study also showed that the break-even point for an average poultry egg farmer in Abuja was 3,978 crates of eggs per annum and the margin of safety ratio was 89 percent. In addition, the results of the study revealed that poultry egg farmers had positive, decreasing returns to scale (0.508) in egg production which indicated that poultry egg production was in the rational stage of production (Stage 2). Poultry production was profitable in Abuja but the farmers were not fully efficient in the use of their resources. To improve the profitability and resource use efficiency of poultry production, it was recommended that poultry egg farmers should implement better management practices to minimize the incidence of disease outbreaks, thereby reducing the cost of production.

Keywords: poultry egg production, break-even point, margin of safety, resource use efficiency, return to scale

บทคัดย่อ

งานวิจัยนี้ทำการศึกษาผลกำไรของการผลิตไข่ไก่ในเมืองอาบูจา ประเทศไนจีเรีย โดยทำการวิเคราะห์จุดคุ้มทุน ความยืดหยุ่นของการผลิตและการใช้ทรัพยากรการผลิต เก็บข้อมูลจากเกษตรกรผู้เลี้ยงไก่ไข่จำนวน 62 คน ที่ได้จากการสุ่มตัวอย่างในพื้นที่ศึกษา ทำการวิเคราะห์ข้อมูลโดยใช้สถิติพื้นฐาน การวิเคราะห์การถดถอยพหุ การวิเคราะห์ต้นทุนและผลตอบแทน และการวิเคราะห์จุดคุ้มทุน ผลการวิเคราะห์ต้นทุนและผลตอบแทนพบว่า โดยเฉลี่ยเกษตรกรลงทุนในการเลี้ยงไก่ไข่เป็นจำนวนเงิน 3,504,352 NGN ต่อปี (1 USD เท่ากับ 160 NGN) ผลกำไรรวม รายได้สุทธิ และผลตอบแทนรวมมีค่าเท่ากับ10,875,663 NGN, 9,798,772 NGN และ 1.72 ตามลำดับ บ่งชี้ว่าการผลิตไข่ไก่ในพื้นที่นี้ให้ผลกำไร

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นอกจากนี้ จุดคุ้มทุนในการผลิตโดยเฉลี่ยอยู่ที่ 3,978 ลังของผลผลิตไข่ไก่ต่อปี โดยอัตราต่ำสุดของระดับความปลอดภัยที่ร้อยละ 89 ทั้งนี้ ผลได้ต่อขนาดลดลงเชิงบวก (0.508) บ่งชี้ว่าการผลิตไข่ไก่เป็นระยะการผลิตที่เหมาะสม (ระยะที่ 2) แต่แม้ว่าการเลี้ยงไก่ไข่ที่เมืองอาบูจาให้ผลกำไรคุ้มทุน ยังพบว่าเกษตรกรไม่ได้ใช้ทรัพยากรการผลิตอย่างมีประสิทธิภาพสูงสุด ดังนั้นเพื่อเพิ่มผลกำไรและประสิทธิภาพของการใช้ทรัพยากรการผลิต จึงมีข้อเสนอแนะให้เกษตรกรจัดการฟาร์มไก่ไข่ให้ดีขึ้นเพื่อลดอัตราการเกิดโรคระบาดไก่ ซึ่งจะทำให้ต้นทุนการผลิตลดลงในที่สุด

คำสำคัญ: การผลิตไข่ไก่ จุดคุ้มทุน ระดับความปลอดภัย ประสิทธิภาพการใช้ทรัพยากร ผลได้ต่อขนาด

INTRODUCTION

The poultry industry is very important to the Nigerian economy because it provides a good source of animal protein in meat and eggs. Proteins play important roles in the formation of a balanced human diet which is essential for the good health, vigor, and productive capacity of the people (Abedullah, Maqbool, & Bukhsh, 2007). Protein is also important in the building and repair of body tissues; a low intake of protein hinders the development of the brain, reduces the skillfulness of the young, and retards the growth rate and resistance to infections (Ogidan, 2002). Animal protein sources include fish, eggs, poultry meat, beef, milk, bacon, pork and mutton. In Nigeria, the three most popular are frozen fish, beef, and poultry egg and meat (Apantaku, 2006). The usefulness of any food for body building depends on the amount of protein it contains. The poultry egg industry, apart from providing employment and a livelihood to thousands of people in Nigeria, also provides high quality, nutritious food. The egg is a complete protein with excellent quality; one egg will give 6g of protein and egg-white protein has a biological value of 100, the highest biological value of any single protein (Food and Agriculture Organization , 2005). Tijani, Alimi, and Adesiyan (2006) reported that eggs have a number of uses apart from domestic consumption in households; They are used in confectionery, bakery products, ice cream, and cosmetics. Egg shell is a good source of calcium. The nutritional status of many Nigerians is characterized by low calorie and protein intakes and Nigerians' greatest problem is that of inadequate animal protein in their diets (Iyangbe & Orewa, 2009). The Food and Agriculture Organization (1989) recommendation for daily protein consumption is 60 g per person out of which 35 g is expected to be from an animal source. However, Adepoju (2008) reported that the average per capita protein intake in Nigeria was 51.7 g of which only 6.8 g came from animal sources but in developed countries, the average per capita protein intake was over 90 g with more than 65 g of animal protein. Thus, widespread malnutrition will become more evident in the country if there is no substantial improvement in poultry production as a major source of protein.

Egg production in Nigeria has been troubled by unstable trends in the economy. The problems of the industry make it very difficult for expansion and new producers find it hard to start a business. Such problems include the high cost of feed, outbreaks of diseases, and marketing problems. This situation has forced many small scale poultry farms to close down and those still managing to survive are producing at very high cost with serious input limitations Adebiyi (2000). in Nigeria, despite growth in the egg production industry since 2000, local demand has not been matched by local supply with reported egg imports of 730 million in 2000, which was down slightly from 732 million eggs imported in 1999 (United States Department of Agriculture, 2001).

Efficiency and productivity, although referring to distinct concepts derived from the production function, are interrelated and are common performance measures by which

agricultural units are evaluated. The everyday meaning of the term 'efficiency' refers to a situation where resources are used to their capacity so that no resources are wasted. The origin of the operational concept of efficiency can be traced back to Farrell (1957) and has been widely used both in its original form and in various modifications, for example, Reinhard, Lovell, and Thijssen (1999), Amos, Chikwendu, and Nmadu, (2004), Lovell (2004), Oude Lansink, and Reinhard (2004), Coelli, Rao, O'Donnell, and Battese, (2005), Fraser and Graham (2005), Graham (2008), and Ogundari (2009), from which the following general discussion is derived. It is a measure of efficiency accounting for a single output and multiple inputs. The efficiency of an economic unit is a 'holistic measure', in that it takes account of all resources used and all outputs produced in determining 'how well' or 'how effectively' the decision making unit combines inputs to produce output. Traditionally, there are three types of efficiency. Technical efficiency (TE) involves a comparison between observed and optimal values of outputs and inputs. Using an input orientation to compare the actual or observed input level to the optimal input level with the corresponding output, the level of technical efficiency can be determined. A technically efficient farm will operate on the isoquant representing the efficient quantity. Adopting an output orientation, technical efficiency occurs when the maximum output is obtained from the given inputs. A technically efficient farm will be located on the production frontier. If information on relevant market prices is available and an economic objective, such as revenue or cost efficiency is assumed, allocative efficiency (AE) can be determined. AE reflects the ability of the farmer to use inputs, or produce output, in the most profitable manner, given their respective prices and the production technology. Combining AE with TE gives a measure of overall economic efficiency. Productive efficiency essentially measures the extent to which production at a particular time reflects the best possible practice. Economic efficiency provides a measure for whole farm comparisons independent of the level of inputs used, or output produced, and can be used as a benchmark to make comparisons across many producers. Relative efficiencies can be determined as well as the identification of the factors that are responsible for variations between units. On the other hand, productivity is a measure of the efficiency with which inputs are used to produce output; it is a ratio of output to input(s). It can be measured in relation to one single input, such as labor or capital, to yield a partial productivity measure, or to multiple inputs to provide a wider total factor productivity measure. Reasons why productivity may vary between productive units over time include differences in the technology used by the productive units, differences in the efficiency of the production processes in the use of inputs to produce output, or variations in the environment in which production takes place. Technical progress, efficiency and scale can all impact on performance.

It is against this background that the current study examined the profitability, elasticity of production, break-even point, margin of safety, and resource use efficiency of poultry enterprises in the Federal Capital Territory, Abuja, Nigeria. This work will be useful in formulating policies that will bring about an increased level of poultry production and thereby bridge the gap between the demand and supply of poultry products in the country. The results from this study will help to assess the impact of resources already committed to the poultry industry and the extent to which poultry output can be increased from such existing resources. The research results would also be valuable to researchers and policy-makers who could use the policy variables identified in this study to formulate more empirical policies that will improve the production environment. In addition, the results will assist farmers to manage their poultry egg production enterprise more efficiently and earn higher profits and may lead to a better organizational ability and productivity resulting in increased egg production over time.

METHODOLOGY

This study was carried out in the Federal Capital Territory, Abuja, Nigeria. A simple random sampling technique was employed to select 62 respondents from the list of 100 poultry eggs farmers registered with the Abuja Agricultural Development Programme. This list covered the poultry egg farmers in the six area councils of Abaji, Kwali, Kuje, Gwagwalada, Bwari, and Municipal. The data used for this study were both primary and secondary. Primary data were collected between April and September, 2010 through the use of a structured questionnaire and an interview schedule administered to the poultry producers selected in the study area.

Data were analyzed using descriptive statistics, costs and returns analysis, multiple regressions, and break-even analysis. Descriptive statistics such as tables, frequency distribution, means, standard deviation and percentages were used to describe the socio-economic characteristics of poultry egg farmers. Costs and returns analysis (a budgeting technique) was used to determine the profitability of poultry egg production in the study area. The analysis used the relationships GM = GR – TVC and NFI = GM – TFC, where GM is the gross margin, GR is the gross revenue/returns, TVC is the total variable cost, NFI is the net farm income/profit, and TFC is the total fixed cost.

Break-even analysis was used to estimate the break-even output for poultry egg farmers in the study area. The formula for estimating the required output to break even according to Reddy and Ram (2005) is given by Equation 1:

$$\text{Break-Even Point} = \frac{\text{Fixed Cost}}{\text{Selling price-Variable Cost per unit}} \quad (1)$$

The margin of safety indicates the difference between the total output and the output at the break-even point (Reddy and Ram, 1996). The formula for the margin of safety ratio is given by Equation 2:

$$\text{Margin of safety ratio} = \frac{\text{Total output-output at BEP}}{\text{Qunatity of output}} \quad (2)$$

In order to determine the elasticity of production (input elasticity) and returns to scale, ordinary least squares regression was used. The implicit form of the model is specified by Equation 3:

$$Q = f(X_1, X_2, X_3, X_4, X_5, X_6) \quad (3)$$

Where:

Q = Quantity of poultry eggs produced (kg)
X_1 = Total number of birds
X_2 = Hired labor (man days)
X_3 = Family labor (man days)
X_4 = Costs of medication and veterinary services (NGN)
X_5 = Quantity of feed consumed (kg)
X_6 = Transportation cost (NGN)

Various functional forms, that is, linear, double log, semi-log, and exponential, of Equation 3 were tried in order to get the best fit. The explicit forms are functions of the input shown by Equations 4–7, respectively:

$$Q = a_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + U \quad (4)$$

$$\text{LogQ} = a_0 + b_1\text{Logx}_1 + b_2\text{Logx}_2 + b_3\text{Logx}_3 + b_4\text{Logx}_4 + b_5\text{Logx}_5 + b_6\text{Logx}_6 + U \quad (5)$$

$$\text{LogQ} = a_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + U \quad (6)$$

$$Q = a_0 + b_1\text{Logx}_1 + b_2\text{Logx}_2 + b_3\text{Logx}_3 + b_4\text{Logx}_4 + b_5\text{Logx}_5 + b_6\text{Logx}_6 + U \quad (7)$$

The best fitting equation was chosen according to the following econometric and statistical criteria: the magnitude of the coefficient of multiple determination (R^2), the significance of

the individual explanatory variables as expressed by their *t*-values, the significance of the overall production function as judged by the *F*-value, and the appropriateness of the signs of the regression coefficients based on *a priori* expectations.

Input elasticity (E_p) of the various forms was determined as:

Double log: $E_p = b_i$ (8)

Linear: $E_p = \frac{\partial Q}{\partial X_i} \cdot \frac{X_i}{Q} = b_i \cdot \frac{X_i}{Q}$ (9)

Semi-log: $E_p = \frac{\partial Q}{\partial X_i} \cdot \frac{X_i}{Q} = b_i \cdot X_i$ (10)

Exponential: $E_p = \frac{\partial Q}{\partial X_i} \cdot \frac{X_i}{Q} = \frac{b_i}{Q}$ (11)

Where:

E_p = elasticity of production
b_i = regression coefficients
Q = geometric mean of output of eggs
X_i = input use of i^{th} resource
$\frac{\partial Q}{\partial X}$ = derivative of Q with respect to X_i
Px_i = price per unit of i^{th} resource
P_Q = Price of unit of output
MFC = marginal factor cost

In order to determine the resource use efficiency of poultry egg farmers, the study adopted the method used by Oladeebo and Ambe-Lamidi (2007), where the marginal value product (MVP_i), the additional income received from using an additional unit of financial input for each resource, was computed and compared with the respective acquisition cost (MFC). The MVP of a particular resource was computed using Equation 12:

$$MVP = MPPx_i \cdot P_Q \quad (12)$$

Where:

MPP_{Xi} = the marginal physical product of X_i resource that was used in the production process

Depending on the functional form chosen as the lead equation for regression, the MPP and the MVP can be obtained using Equations 13–16:

Linear: MPP = $\partial Q/\partial X = b_i$;
$MVP = b_i . P_Q$ (13)

Double log: MPP = $b_i.Q/X_i$;
$MVP = b_i.Q/X_i . P_Q$ (14)

Semi-log: MPP = $b_i.Q$;
$MVP = b_i.Q . P_Q$ (15)

Exponential: MPP = b_i/X_i ;
$MVP = b_i/X_i . P_Q$ (16)

The resource use efficiency (RUE) ratio (allocation index) is computed using Equation 17:

$$RUE\ ratio = MVP/Px_i = MVP/MFC \quad (17)$$

The value of RUE lies between 0 and 1. When the RUE ratio = 1, resources are optimally utilized. When the RUE ratio < 1, resources are overutilized. When the RUE ratio > 1, resources are underutilized. MVP is the additional income received from using an additional unit of financial input and is derived from Equation 18:

$$MVP = b . P_Q \quad (18)$$

RESULTS AND DISCUSSION

Table 1 sets out the socio-economic parameters of the respondents while Table 2 shows the result of the analysis of the costs and returns accruing to an average poultry egg farmer in Abuja. Table 3 shows the break-even analysis for an average poultry egg farmer while Table 4 shows the analysis of the margin of safety for an average poultry farmer in Abuja. The regression results of the four models in Equations 4–7 are presented in Table 5. Based on the desirable properties mentioned earlier, the linear model was chosen as the lead equation. The results presented in Table 5 show the MVP of each input compared with its MFC.

Table 1 Distribution of respondents by socio-economic characteristics

Demographic factor	n	%
Age (years)		
21–30	2	3
31–40	7	11
41–50	30	48
51–60	17	27
61–70	6	11
Total	62	100
$\overline{X}$ = 49		
Gender		
Male	4	76
Female	15	24
Total	62	100
Marital status		
Single	4	6
Married	57	92
Separated	1	2
Total	62	100
Educational level		
Secondary	5	8
College of Education	11	18
College of Agriculture or Technical College	4	6
Polytechnic	7	11
University	35	56
Total	62	100
Mean years of schooling = 15 years		
Household size		
1–4	8	13
5–8	39	63
9–12	15	24
Total	62	100
$\overline{X}$ = 7		
Years of experience		
1–5	6	10
5–8	35	56
9–12	20	32
13–16	1	2
Total	62	100
$\overline{X}$ = 7 years		

Source: Field survey (2010).

The results in Table 1 show that the mean age of the respondents was 49 years but the largest number of respondents (48%) were in the 41–50 years range indicating that the poultry egg farmers were relatively young and still in their productive years. This is an indication that raising poultry is an attractive business that is able to engage some young individuals that would otherwise perhaps have been looking for office jobs in Abuja where job vacancies may not be available. It also means that poultry production will continue to be sustained in Abuja since these young people will remain in business for the long term to guarantee the supply of eggs to the growing population of Abuja city. Most of the respondents were male (76%) and married (92%). The dominance of males in the poultry business may not be unconnected with the huge sums of money needed to start the business which is often difficult for women to raise in this part of the world but much easier for their male counterparts to obtain. All the respondents were educated with a majority (56%) having a university education. This finding is quite contrary to many findings that have always indicated a low educational achievement by farmers. For example, Hamid and Chiaman (2010), in their study on nomadic cattle pastoralists, reported that the education background of the nomads was low as the largest category (39%) had not attended any formal type of education. However, the cosmopolitan nature of Abuja City which is seen as the convergent zone for all Nigerians may be responsible for these groups of farmers who are more educated than their counterparts in the rural villages. The mean household size of the respondents was seven which is above the recommended average of four per family in Nigeria (Alabi and Haruna, 2005). According to Sonaiya (2001), the large family size enables farmers to use family labor especially when labor-intensive techniques are required. A majority of the respondents (74%) did not belong to any cooperative. The essence of cooperatives is to enable individuals to solve their problems both individually and collectively (International Labour Organization, 1965). The finding here is similar to those by Ibrahim, Zongoma, and Shettima (2006) and Omolehin, Adeniji, Maingawa, and Oguntolu, (2007), who in their separate studies showed that a majority of the farmers refused to participate in cooperatives due to cultural and religious beliefs, but is contrary to the finding of Hamid and Jongur (2010) that reported full participation of farmers in cooperatives. Most probably, the respondents did not belong to cooperatives because they are medium-to-large-scale farmers and probably have greater access to credit and other inputs through financial institutions which would have been inaccessible to small scale operators without being a member of a cooperative.

On management practices, a majority (84%) of the respondents reared hen layers on a deep litter system while 10 percent of the respondents reared birds using a battery cage system. This was contrary to what was expected, as a battery cage system, according to Amos (2006), provides easy collection of eggs, supply of water and feed, and safety of the eggs. The bigger capital outlay required for the takeoff of a battery cages system may have been the reason for the preponderance of deep litter systems in this area. About 82 percent of the farmers relied on commercial feed for which they had little or no control over the quality and cost. This accounted for the high cost of feed experienced by most farmers (79% of total cost) which was higher than that reported by Olagunju (2007) of 64.5 percent. About 42 percent of the farmers hired labor, 21 percent used family labor while the rest relied on both family and hired labor. The mean flock size was 5,694 birds implying that egg production was in the medium scale category in the study area and consistent with the classification of Ojo (2003). The stock size produced an average of 36,416 crates of eggs per year. The break-even point (3,978 crates of eggs per year) is the production level at which there is sufficient revenue to cover the total costs or the point of equilibrium in production—the farmer

Table 2 Costs and returns analysis of poultry egg production per annum

Item	Value (NGN)	% of TC
Variable cost		
Casual labor	4,882	0.04
Water	114,783	0.85
Fuel/Electricity	128,048	0.95
Repairs/Maintenance	50,782	0.38
Transport	71,024	0.53
Chicks	1,075,097	7.96
Feed	10,670,451	79.01
Medication and service	256,136	1.9
Advertising	3,758	0.03
Miscellaneous	52,500	0.39
Total variable cost	12,427,461	92.03
Fixed cost		
Depreciation charges	195,983	1.45
Rent	77,512	0.57
Permanent labor	755,355	5.59
Interest on loaned Capital	12,742	0.09
Tax	2,097	0.02
Insurance	33,202	0.25
Total fixed cost	1,076,891	7.97
Total production cost	13,504,352	100
Revenue		
Eggs	22,286,724.19	
Spent layers	1,016,400	
Total revenue	23,303,124.19	
Gross margin (TR-TVC)	10,875,663.19	
Net income (TR-TC)	9,798,772.19	
Gross return per NGN invested (TR/TC)	1.72	
Net income per layer	1,720.89	

NGN = Nigerian naira currency; TC = Total cost; TR = total revenue; TVC = total variable cost;
Source: Field survey (2010).

neither loses money nor makes a profit. Higher quantities mean a profit while lower quantities mean a loss. The margin of safety was 32,438 crates of eggs per annum. The positive figure of the margin of safety reveals the shock-absorbing capacity of the poultry egg enterprises in the event of fluctuation in returns owing to any unforeseen eventuality. The margin of safety ratio of 0.89 (89%) was very large. The larger the margin of safety ratio, the safer the poultry egg business.

The results in Table 2 show that an average poultry farmer invested NGN 13,504,352 in the poultry business in the form of costs of feed, labor, chicks, fuel, transportation, veterinary services, and other necessary items. The cost of feed had the greatest share (79%) of the total cost of production. This compared favorably with the findings of Okafor, Odii, Emeyonu, and Obih (2006) and Adepoju (2008) that the feed cost is the major important cost element in poultry egg production.

Table 3 Production function estimates for poultry egg enterprise

Variable	Functional form			
	Linear	Double-log	Semi- log	Exponential
Constant	36543.3	2.887	-564007.09	4.693
	(6.72)***	(2.173)***	(-2.994)	(47.483)***
Stock of birds	13.44	1.469	165486.39	8.661E-5
	(8.089)***	(3.474)	(2.760)**	(2.850)***
Hired labor	-14.347	-0.371	-13221.706	0.000
	(-5.75)***	(-1.781)*	(-0.498)	(3.840)***
Family labor	-16.27	-0.210	15962.93	0.000
	(-3.725)***	(-1.099)	(0.59)	(4.871)***
Cost of medication and veterinary services	-0.04	-0.126	17249.89	5.667E-7
	(-1.577)	(-0.747)	(0.721)	(1.104)
Feed consumed	0.67	-0.213	-25776.39	1.154E-6
	(2.09)**	(-1.289)	(-1.101)	(1.981)*
Transportation cost	0.34	0.010	16530.92	3.317E-7
	(0.59)	(0.029)	(0.353)	(0.319)
R^2 value	0.969	0.780	0.802	0.568
Adjusted R^2 value	0.965	0.713	0.743	0.521
F-value	283.938***	11.79***	13.502***	12.066***

Note: ***$p < .01$, ** $p < .05$, * $p < .10$. Values in parenthesis are *t*-ratios.
Source: Field data (2010).

The total variable cost items constituted 92.03 percent while the fixed cost items constituted 7.97 percent of the total cost of production. Total annual revenue of NGN 23,303,124 was earned by an average poultry egg famer in Abuja. This was obtained from sales of egg and spent layers. The GM, NFI and gross return per naira invested are shown in Table 2 suggesting that poultry egg production was profitable in Abuja, the high cost of production notwithstanding. Indeed the gross return per naira invested shows that NGN 0.72 was earned as profit on each naira invested. The high profitability of this enterprise might actually attract credit and other financing institutions to extend credit to the farms thus confirming an earlier assertion that the respondents do not belong to cooperatives because they have easier access to credit.

The results in Table 3 indicated that the included explanatory variables explained about 96 percent of the variability in the quantity of eggs (Q). The linear model also indicated that all other relevant variables will increase the output of poultry products to 36,543 kg. Altogether, all the included variables were statistically significant ($p < .01$) as indicated by the *F*-value, suggesting that their joint effect on egg production is significant. The results showed that the stock size (x_3), the hired labor input (x_2), family labor input (x_3), and quantity of feed (X_5) were significant ($p < .01$) explanatory variables for egg output (Q). Hired and family labor inputs were negatively signed. This contradicts the *a priori* expectation and implies that increasing these variables would cause a decrease in the level of poultry egg production. Probably, these resources have been overutilized. This is not surprising since

most poultry farmers have their residential apartment on the farm and hence the families are always on the farm and can share the jobs required, thus allowing for potential overuse of the labor resource. Both the stock size and the quantity of feed consumed were positively signed which means that increasing these variables would lead to an increase in the level of egg output. This shows that the level of production is still within the positive, increasing phase and increasing these inputs will lead to higher efficiency. In view of this, the farmers should therefore be encouraged to improve their management techniques and earn higher profits.

The elasticity of production values (Table 4) for hired labor, family labor, and the cost of medication and veterinary services were all negative which implies that production will decrease when there is an increase in any of these variables. The elasticity of production for stock of birds was greater than one which is indicative of elastic production. The values of the production elasticity for feed and the cost of transportation were less than one which is suggestive of inelastic production. The sum of the elasticity coefficients, that is, the return to scale (0.508) was less than one but greater than zero. This is indicative of positive, decreasing returns to scale, implying that the respondents were producing within the rational zone of production, which is Stage 2. This means that if all the variables are each increased by a unit, the egg output will increase by 0.51. The nature of the returns to scale obtained in this study compares favorably with a similar study by Oladeebo and Ambe-Lamidi (2007).

The allocative efficiency index (Table 5) revealed that hired labor, family labor, cost of medication and veterinary services, quantity of feed, and cost of transportation were overutilized. The low resource use ratio of 0.134 for feed might not be unconnected to the fact that the feed cost was too high due to the study revealing that about 82 percent of the farmers utilized commercial feed. The inefficiency in the use of both hired and family labor

Table 4 Elasticity of productive resources and returns to scale

Input	Elasticity
Stock of birds (Stock size)	1.035
Hired labor	-0.391
Family labor	-0.151
Cost of medication and veterinary services	-0.152
Quantity of feed	0.134
Cost of transportation	0.033
Returns to scale	0.508

Source: Field data analysis (2010).

Table 5 Resource use efficiency indicators

Resource	MPP	MVP (NGN)	MFC (NGN)	Allocative efficiency index
Stock size	13.44	4112.64	200	20.56
Hired labor	-14.347	-4390.18	700	-6.27
Family labor	-16.272	-4979.23	700	-7.11
Cost of medication and veterinary services	-0.04	-13.46	701	- 0.019
Quantity of feed	0.067	20.50	88	0.23
Cost of transportation	0.034	10.40	195	0.05

NGN = Nigerian naira currency

Source: Field data analysis (2010).

might be connected to the fact that labor input was overutilized since the same set of workers are used as poultry attendants and workers in the feed mill and other farm activities which without doubt reduced the labor efficiency. Therefore, there should be reorganization in such a way that labor is used for necessary activities. The overutilization of the transportation might be due to too frequent movement of egg shipments that are below the maximum carrying capacity of vehicles used in an environment where fuel prices are irregular and often high while medication and veterinary services costs might be a result of using too high dosages on a few birds since the medication and services cannot be purchased in subunits suited to a smaller bird population. The implication is that there are wastages incurred each time transportation is used and medication is applied. The stock of birds had a resource use efficiency index of 20.56 which is indicative of underutilization. This necessitates the need to expand the scale of operation which could be achieved if some production credit were to be made available under affordable conditions.

CONCLUSION AND RECOMMENDATIONS

The research revealed that poultry production was profitable in Abuja. However, farmers were far from being efficient in their use of productive resources in spite of the fact that they were producing in the rational stage (Stage 2) of production. The study revealed that some of the inputs (hired labor, family labor, quantity of feed, cost of transportation, and cost of medication and veterinary services) were overutilized while stock of birds (stock size) was underutilized. Therefore, one of the policy implications of this result is that the extension activities of the Agricultural Development Project of the Federal Capital Territory should focus attention on ways farmers could be trained in poultry feed preparation to substantially reduce the cost of feeding which represents the highest component of the variable cost of poultry egg production. A deliberate policy on labor management practices should also be encouraged so that farmers further reduce costs by expending labor only on necessary activities. The break-even analysis revealed that for poultry farmers to break-even, they have to produce 3,978 crates of eggs and the margin of safety ratio of 89 percent indicated a high level of safety in the enterprise. Poultry egg farmers should be encouraged not to produce below 3,978 crates of eggs per annum as doing so will mean incurring losses. Since Abuja is one of the fastest growing capital cities in the world to where young people moving in the hope of finding jobs in a very tight market and where the growing population is placing increased pressure on food supplies, the Nigerian government as a policy should encourage young individuals interested in agriculture to undertake potentially profitable businesses in various fields of agricultural production. On the one hand, this will help to generate employment for the expanding number of youths and on the other hand, it will help to moderate food prices for the urban population. Lastly, to improve the profitability and resource use efficiency of poultry production, poultry egg farmers should implement better management practices to minimize the incidence of disease outbreaks, thereby reducing the cost of production.

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