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ORIGINAL RESEARCH ARTICLE

Resource Use Efficiency in Commercial Poultry Production in Oyo State, Nigeria.

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ABSTRACT

Poultry is a major livestock subsector which offers the least expensive way of filling the protein gap in human nutrition. However, low productivity in poultry subsector of livestock industry and inadequate knowledge on efficiency of resource allocation have scared many interested farmers from investing fully in the enterprise. The study ascertained the determinants of poultry productivity and allocative efficiency of each of the major resource inputs in commercial poultry production in Oyo State. Primary data were collected using well structured questionnaires. A multistage sampling technique was used to sample 90 poultry farmers to represent the commercial poultry farmers in the study area. Data collected were analyzed by using descriptive statistics and production function model. The result showed that the poultry farmers in the study area were educated and quite experienced in poultry farming with an average of 8 years. The number of birds raised, labour, feed and drugs/vaccines were found to be the most significant inputs in poultry production and thus, require special attention. Poultry production in the study area was found in stage two of production surface as indicated by Returns to Scale (RTS) of 0.798. The result further showed that flock size, labour, feed and drugs/vaccines had efficiency indices of 0.046, 0.960, 0.00095 and 0.587 respectively implying that these inputs were inefficiently allocated and utilized except labour that was close to the economic optimum. It is therefore recommended that there should be policies aimed at educating poultry farmers in the study area on efficient resource management techniques most importantly efficient administration of feeds and drugs/vaccines, adequate stocking density of flock and efficient management practices.

Keywords: Resource use efficiency, Poultry production, Production function Models, Nigeria.

Introduction

Poultry refers to a wide variety of winged animal species raised and fattened for their products that are economically and nutritionally useful to man. Domestic fowl, geese and turkey are examples of poultry bird. Poultry is kept in many areas of Nigeria in one form or the other due to little or no taboo associated with the enterprise. Poultry enterprise generally requires lesser capital than that of cattle, sheep and goat. It is also more prolific with shorter gestation period when compared with other livestock species (Musa and Olarinde, 2008). Generally, poultry production is about twice as effective as producing pork and three times as more as producing beef due to its very short cycle, thus, making it easy for producer to respond to the circumstances of the day (Ad Bal, 2011).

The current investment in poultry production is about eighty billion naira (N80b) in Nigeria and it is the most industrialized livestock commodity (Omotoso, 2013). Poultry as a major livestock subsector of agriculture requires significant political attention to improve its contribution to the overall economic development. Africa is only playing a minor role in the global poultry industry when compared to its population. African countries had a high negative balance of trade with chicken meat and in 2008, 666,000 tonnes had to be imported to meet the domestic demand though the import volume for shell egg was about 32,000 tonnes (Windhorst, 2011).

Moreover, in Nigeria today, the prevalence of malnutrition among urban and rural dwellers especially the children have been aggravated by the decline in the protein intake which is a result of inadequate supply of animal protein food (Oladele *et*

al., 2013). The current average level of animal protein consumption in Nigeria is 15g/person/day which is grossly below the Food and Agricultural Organization (FAO) recommended level of 35g/person/day for developing countries (Nbah, 2013).

Poultry production offers the least expensive way of filling the protein gap to overcome the problem of malnutrition as it is the commonest source of animal protein (Oladele *et al.,* 2013). The ban on the importation of broilers meat in Nigeria and the change in the taste of many consumers from red to white meat such as broilers meat is a further indication of the need to boost the poultry production (Anzaku *et al.*, 2013). An improvement in poultry production in Nigeria is imperative for food security sustainability. Low productivity in poultry subsector of livestock and inadequate knowledge on the level of efficiency on the use of resources by the poultry farmers in the study area necessitated the study. Thus, the study attempted to examine determinants of productivity in poultry production and investigate efficiency of resource allocation and utilization by the poultry farmers in order to bring about the desired improvement in poultry subsector of livestock industry.

Materials and Methods

The study was carried out in Oyo State of Nigeria. The state has a land area of 28,454km^2 and a population of about 5.6 million (NPC, 2006). Farming is the major occupation of the rural communities of the state cultivating both arable and cash crops. They are also involved in small scale production of pigs, sheep and goats while poultry is undertaken in small, medium and large scales.

A multistage sampling technique was employed to sample 90 commercial poultry farmers. The first stage involved purposive selection of two ADP zones: Ibadan and Ogbomoso, based on the knowledge that they are the leading poultry farming areas in the state. Second stage involved purposive selection of two LGAs from each of the zones due to the dominance of poultry farmers in these areas, namely; Lagelu, Ido, Surulere and Orire LGAs. The third stage involved the stratification of poultry farmers into small scale, medium scale and large scale farmers. All farmers from large scale stratum constituted the sample frame. However, only 80 questionnaires were used in the analyses. Inadequate information and inconsistency necessitated the rejection of others. Primary data were collected, using set of structured questionnaires, on values of eggs and meat production, feed consumption (kg), labour (mandays), drugs/vaccines (No), labour cost (#) and other operating expenses. Information was also collected on age, poultry farming experience, years of schooling, and household size among others.

Method of data collection: Data collected were analyzed using descriptive statistics (means, frequency tables, standard deviation and percentages) and inferential statistics (Production function analysis).

a) Descriptive analysis: Descriptive statistics was used to examine and describe the socio-economic characteristics of the poultry farmers in the study area.

b) Production function analysis: Production function is used to determine the extent to which output and productivity can be increased from the given resource stock. The four functional forms: Linear, Exponential, Semi-log and Double log, were fitted into the Production function in this study. The double log equation was chosen as the lead equation based on the econometric and statistical criteria: the value of the coefficient of multiple determination (R^2), the signs and significance of the estimated parameters of poultry production.

The lead functional form is expressed explicitly as:

Double log: $\log Y = b_o+b_1\log X_1+b_2\log X_2+b_3\log X_3+b_4\log X_4+b_5\log X_5+b_6\log X_6+\mu$ … (1)

Where:

Log	=	Natural logarithm
Y	=	Output of the ith farmer
X_1	=	Flock size (No)
X_2	=	Labour (Mandays)
X_3	=	Feed consumed (kg)
X_4	=	Quantity of drugs/vaccines (No)
X_5	=	Years of experience in poultry farming
X_6	=	Years of schooling
μ	=	error term
b_0	=	constant term
$b_1 - b_6$	=	Regression coefficients

The result of the estimated production function was used to compute the marginal value products of the inputs. Marginal Value Product (MVP) is defined as the change in total value product as a result of a unit

change in the variable input (Olukosi and Ogungbile, 1989). The MVP could be calculated as shown below:

$MVPx_{\bar{i}} = bi\ P_y$ ..... (2)

Where:

MVP = Marginal value product of ith input

$\bar{x}_i$ = Geometric mean of ith input

bi = Estimated co-efficient with respect to ith input

P_y = Geometric mean of output price/output price per unit

The Marginal Factor Cost (MFC) was also generated and it is defined as the addition to total cost resulting from using an extra unit of input (Jatbong *et al.*, 2013). It could be calculated using the formula below:

$MFC = \partial TC / \partial X_i = P_{xi}$ ..... (3)

Where:

∂ = differentiation sign

TC = total cost

$\bar{X}_i$ = geometric mean of ith input

Px_i = price of ith input

Thus, allocative efficiency of the resources used was estimated based on the ratios of the Marginal Value Product (MVP) to the Marginal Factor Cost (MFC).

$\gamma_1 = MVP_i / MFC_i$ ..... (4)

Where:

γ_1 = Allocative efficiency of ith input

MVP_i = Marginal Value Product of ith input

MFC_i = Marginal factor cost of ith input

$\gamma < 1$: Indicates resources are over utilized

$\gamma = 1$: Indicates resources are efficiently utilized

$\gamma > 1$: Indicates resources are under utilized

Results and Discussion

The results showed that majority (87.5%) of the respondents were still in their active age group (≤ 60years) which is required for effective management and optimum production in poultry business. The mean age of 45 years and standard deviation of 13 years also established the finding. The result is consistent with the previous studies (Ajetumobi and Binuomote, 2006; Musa and Olarinde, 2008) that reported that poultry farmers mostly belonged to the active labour force. 7.5% of the poultry farmers had secondary school education and 92.5% of the farmers had tertiary education. This implies that the poultry farmers in the study area were well educated as indicated by the average of 16 years spent schooling. 20% of the farmers had between 1-3 households, 43.75% of the farmers had between 4-6 households while 36.25% of the farmers had between 7-10 household members. The mean household size was approximately 6. This is a relatively large household size which might be required to augment the labour force. 41.25% of the farmers had between 3-6 years of experience in poultry farming, 35% of the farmers had between 7-10 years of experience while 23.75% of the farmers had between 11-15 years of experience. The mean years of experience of 8 and the standard deviation of 4 years indicated that the respondents were quite experienced in poultry farming. The average number of birds raised by a farmer was 8652 with a standard deviation of 4501 birds. This confirmed that commercialization was the basis for the number of sampled farmers.

The Coefficient of Multiple Determination (R^2) was 0.825 indicating that about 82.5% of the total variation in poultry outputs were jointly explained by the production inputs included in the model. The value of R^2 and the significance of F-ratio at 5% level of probability confirmed a good fit of the specification of the assumed production technology (Cobb Douglas), implying that Cobb Douglas Production Function was the lead equation among the functional forms employed in the study.

The estimated coefficients for flock sizes (X_1) was directly related with output, implying that a unit increase in flock size brings about 0.637 unit increase in output. The positive relationship was expected because increased numbers of birds raised are expected to increase output. This agrees with the work of Ojo (2005) that reported that the number of birds raised is positively related with output. Labour (X_1) was found to be positively signed and significant at 5% level. This implies that an increase in labour input leads to a corresponding increase in poultry output in the study area. The reason is not far-fetched and it stems from the fact that labour was relatively cheap in the study area and as a result, poultry farmers could afford employment of labour force required for optimum production.

Table 1: Socio-economic characteristics distribution of the poultry farmers

Characteristics	Frequency	Percentage	Mean	Standard Deviation
Age in years				
25-30	12	15.0	45	13
31-40	24	30.0		
41-50	22	27.5		
51-60	12	15.0		
> 60	10	12.5		
Total	**80**	**100**		
Level of education				
Secondary education	6	7.5	16	2
Tertiary education	74	92.5		
Total	**80**	**100**		
Household size				
1-3	16	20.00	6	2
4-6	35	43.75		
7-10	29	36.25		
Total	**80**	**100**		
Flock size				
5,000-9,500	61	76.25	8652	4501
10,000-14,500	9	11.25		
15,000-19,500	8	10.00		
≥ 20,000	2	2.50		
Total	**80**	**100**		
Farming experience(years)				
3-6	33	41.25	8	4
7-10	28	35.00		
11-15	19	23.75		
Total	**80**	**100**		

Source: Field Survey, 2014.

Conversely, co-efficient for feed (X_3) was inversely related to output, implying that an increased use of feed will decline the marginal productivity. This could be attributed to the regular pattern of growth relative to age (weeks) in birds irrespective of the quantity of feed consumed. As a result, a farmer who practices intensive feeding could only be succeeded in wasting his scarce resources as there would be no corresponding significant gain in the weight of birds. Drugs/Vaccines (X_4) had a negative significant relationship at 5% level. This implies that additional use of this production inputs brings down the level of production. The result contradicts the work of Musa and Ojutalayo (2013) that reported positive relationship of drugs/vaccines with poultry output. This contradiction could be linked to the wastage of drugs/vaccines in commercial poultry farming as a bottle is packaged for 1000 birds and no farmer could buy less even if he has to vaccinate just 100 birds.

Table 2: Estimated production functions of poultry farming in Oyo State

Variables	Parameters	Double log (+)	Exponential	Linear	Semi log
Constant	b_o	17.2807*** (4.1789)	7.8542*** (0.4686)	2030.091 (3926.683)	-43923.15 (3413)
Flock size (No)	b_1	0.6367** (0.2697)	0.00008*** (0.00003)	0.5833** (0.2234)	2366.511 (2227.108)
Labour (Mandays)	b_2	0.5831** (0.2561)	0.000063 (0.000063)	0.1546 (0.5278)	1707.738 (2280.587)
Feed (kg)	b_3	-0.4042** (0.1381)	0.00076*** (0.00024)	-2.8083 (1.9922)	2515.66 (2280.587)
Drugs/Vaccines (No)	b_4	-0.2887** (0.0994)	0.00014 (0.000119)	-0.9558 (0.0998)	-642.2871 (611.5082)
Years of Experience	b_5	0.0877 (0.0701)	0.00506 (0.000092)	-24.8387 (74.7351)	88.9429 (579.0194)
Years of Schooling	b_6	0.1835 (0.2212)	0.000443 (0.00036)	1.8616 (3.0318)	486.4179 (34513.29)
R-Square	R^2	0.8253	0.7423	0.6377	0.5472
Adjusted R-Square	$\bar{R}^2$	0.7863	0.7047	0.5998	0.4998
F-value	F	15.46	14.42	14.15	13.45

(+) Lead equation
Note: *** and ** estimates are significant at 1% and 5% level of probability respectively
Figures in parentheses are standard errors of the estimates
Source: Data Analysis, 2014.

The coefficient of years of experience (X_5) and schooling (X_6) were also positively signed but not significant at any level of probability. This could be attributed to the simple managerial skills required in poultry farming from which economic optimum might be achieved regardless of years of experience in poultry farming and academic attainment. This result is consistent with the findings of Ojo (2005) and Musa and Ojutalayo (2013) that confirmed non-significant positive relationship of years of experience in poultry farming and level of education with poultry production.

The estimated coefficients also represented the individual production input elasticities from which the Return to Scale (RTS) was computed via their summation as shown in Table 3. The elasticities of flock size (X_1), labour (X_2), years of experience (X_5) and schooling (X_6) were positively decreasing marginal returns to the inputs while feed (X_3) and drugs/vaccines (X_4) were negatively decreasing marginal returns to the input indicating inefficient allocation and utilization. The additional usage of these inputs would lead to a decline in the level of output. However, the return to scale was 0.798 implying that poultry production was in stage two of the production process, which is the rational zone where efficient allocation and utilization of resources is obtainable.

The results in table 4 represent the estimation of allocative efficiency of the resources used in poultry production in the study area. The ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) revealed that only the labour input was quite close to economic optimum with efficiency index of 0.96, implying that poultry farmers in the study area were operating towards economically rational production region in the use of labour input. Conversely, the efficiency indices of flock size, feed and drugs/vaccines were 0.046, 0.00095 and 0.587 respectively. The result implies that none of these inputs was optimally or efficiently allocated by the poultry farmers in the study area. The result further indicated that commercial poultry farmers over-utilized all these resources in the study area. The result unveils the possibility of increasing output given the same production technology by reducing the level of use of these production inputs

Table 3: Elasticities and returns to scale of poultry production

Variables	Elasticities
Flock size	0.6367
Labour	0.5831
Feed	-0.4042
Drugs/Vaccines	-0.2887
Years of experience	0.0877
Years of schooling	0.1835
$\sum Ep$ (*RTS*)	**0.7981**

Source: Data Analysis, 2014.

Table 4: Estimation of marginal productivity and allocative efficiency of poultry farmers

Parameters	Numeric values
Geometric means of inputs and output	
Output (#)	111,803.70
Flock size	8652.50
Labour	7.9875
Feed	451910.60
Drugs/vaccines	68.4125
Marginal Value Products (MVPs)	
Flock size	8.227
Labour	8161.845
Feed	0.100
Drugs/vaccines	470.013
Marginal Factor Cost (MFC)	
Flock size	180.50
Labour	8500.50
Feed	105.20
Drugs/vaccines	800.63
Allocative Efficiency indices (γ)	
Flock size	0.046
Labour	0.960
Feed	0.00095
Drugs/vaccines	0.587

Source: Data Analysis, 2014.

CONCLUSION

The study reveals that flock size, labour, feed consumed and drugs/vaccines were the most significant inputs in poultry production and as a result require special attention. Flock size, feed and drugs/vaccines were over utilized and thus inefficiently allocated. The results of the study therefore call for policies aimed at educating poultry farmers in the study area on efficient resource management techniques most importantly efficient administration of feeds and drugs/vaccines, adequate stocking density of flock and efficient management practices.

CONFLICT OF INTEREST

The authors declare that there is no known conflict of interest as regards the conduct of this study and the data reported in this work.

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