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Efficiency of productive resources used in backyard poultry farms in Niger State of Nigeria

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ABSTRACT

This present research used cross-sectional data elicited from 92 broiler producers to determine the efficiency of productive resources used in homestead poultry farms in Niger state of Nigeria. The objectives of the study were achieved using descriptive and inferential tools. The results showed that majority of the poultry entrepreneurs in the studied area were economically active, literate

and maintain a fair household size; and, the enterprise was found to be profitable in the studied area. Furthermore, evidenced showed that the critical issue of broiler production in the studied area was that of inefficiency in resource allocation and utilization, thereby, adversely affected the production and supply chain of broiler product. Therefore, the study recommended that the farmers should be enlightened on the need to be efficient in allocation of their input mix in order to enable them maximize profit in poultry enterprise in the studied area.

Keywords: Resources; Efficiency; Poultry; Homestead; Nigeria

1. INTRODUCTION

No nation will under-estimate the position of its poultry sub-sector as its importance is not only limited to its economic activities but also in the quest to achieve food security of animal protein (Banjoko *et al*. 2014). The role of Africa in the global poultry industry is very minimal when compared to its present population. The global population share of Africa as at 2017 is approximately 16.41% with an annual population growth rate of more than 2.25% (UNDESA, 2017), but its global egg and poultry productions stood at 4.51% (FAO, 2014a) and 5.1% (FAO, 2014b) respectively, with Nigeria share contribution in Africa for the eggs and poultry meat production been 21.39% (FAO, 2014a) and 6.17% (FAO, 2014b) respectively. Till date, Africa has a high negative balance of trade in chicken meat with export been 56.2 tonnes and import been1254.4 tonnes (FAO, 2014c), thus, large quantum of import to meet up the domestic demand.

Poultry protein could be a solution to the protein malnutrition which is a major challenge to food security especially in Africa (NDHS, 2008). This is obvious in Nigeria whose current per capita animal protein is 10 g/day as against the minimum of 34g/day recommended by FAO for healthy life (Owen and Dike, 2013; FAO, 2014d). Thereafter, the Nigerian per capita poultry meat consumption is 1.41 kg, far behind what is obtainable in Ghana (7.67kg/capita), South Africa (32.98kg/capita) and brazil (941.34kg/capita) (SAHEL, 2015). The incessant closure of small, medium and large poultry farms which most entrepreneurs alluded to high cost of operational materials (especially feeds) that is caused by scarcity of the raw materials has been become a source of concern to the populace in Niger State of Nigeria. This is because it will adversely affect the already existing insufficient animal protein food security and also increase the over saturated unemployed labour market in the studied area. This worrisome is evidenced by the recent policy reversal by the policymakers to re-establish the Ministry of livestock and fisheries which was abrogated in the year 2015. Given the above scenario, the researchers were prompted with the question, what ought to be the way out in the studied area in view of the prevailing increasing domestic demand for poultry meat as the policy on ban of importation of poultry products is operating effectively in the country and how to sustain this ailing sub-sector in the studied area. The broad objective of this research was to determine the allocative efficiency of the productive resources committed to the broiler poultry production, while the specific objectives were to describe the socio-economic profile of the farmers; to estimate the costs and incomes of poultry enterprise in the studied area; and, to determine the allocative efficiency of inputs used in poultry production.

2. RESEARCH METHODOLOGY

The study was conducted in Niger state of Nigeria, and the coordinates of the state are latitudes 8°20'N and 11°30'N of equator and longitudes 3°30'E and 7°20'E of the Greenwich Meridian time. The vegetation of the state is northern guinea savannah with sparse of southern guinea savannah. Agriculture is the major occupation in the study area complemented with civil service jobs, artisanal, craft work, *ayurveda* medicine and petty trade. The research relied on cross sectional data obtained from 97 active homestead poultry broiler farms drawn from the studied area sampling frame using multi-stage sampling design. The sampling procedure were: convenient selection of Kuta agricultural zone out of the 3 existing agricultural zones in the state due to time and costs constraints of the researchers; purposive selection of two Local Government Areas (LGAs) *viz.* Chanchaga and Bosso due to high density of poultry entrepreneurs coupled with readily available demand driven-market; proportionate sampling of 50% of the respondents across the board of the selected LGAs in the sampling frame provided by NSAMDA; and, a representative sample size of 97 active broiler farmers using simple random technique were drawn for the study. The data were elicited using structured questionnaire complemented with interview schedule on fortnight basis during the 2016 production period. The collected data were analyzed using descriptive and inferential statistics. The first, second and third objectives were achieved using descriptive statistics, cost concepts and income measure; and, multiple regression and allocative efficiency index respectively.

Table 1 Sampling frame of active poultry broiler producers

LGAs	Population	Sample size
Bosso	93	47
Chanchaga	99	50
Total	**192**	**97**

Source: NAMDA, 2016

Empirical models

1. Cost concepts and Income measures

Following Subba *et al*.(2004; 2016) the cost concepts and income measures are specified below:

a. Cost Concepts: Costs related to broiler production are split up into various cost concepts such as A_1, A_2, B, C and D

Opportunity/Implicit cost: costs of self-owned and self-employed resource i.e. imputed cost

Accounting/Explicit cost: costs for purchasing and hiring of inputs and input services i.e. paid out costs/cash costs/ nominal/money cost

Economic cost: Opportunity cost + Accounting cost

Cost A_1: The following items are included in Cost A_1

Wages of hired labour

Market rate of feeds

Market rate of brooding stocks, liter, H_2O, kerosene etc

Electricity tariff

Market value of drugs and vaccines

Land revenue, cess and other tax

Depreciation of farm implements/ equipment's

Interest on working capital

Miscellaneous expenses

Cost A_2: Cost A_1 + rent paid for leased in land

Cost B: Cost A_1 or A_2 + interest on fixed capital excluding land + rental value of owned land

Cost C: Cost B + imputed value of family labour

Cost D: Cost C + 10% of TVC as management cost (Sidharth and Pankaj, 2012)

b. Income Measures

These are the returns over different cost concepts. Different income measures are derived using the cost concepts. These measures are given below:

Farm business income = Gross income – Cost A_1 or A_2 ..... (1)

Family labour income = Gross income – Cost B ..... (2)

Net income = Gross income – Cost D ..... (3)

Farm investment income = Farm business income – Imputed value of family labour – Imputed management cost (OR) Net income + Imputed rental value of owned land

Return on Naira invested (ROI) = $\frac{\text{Gross margin}}{\text{Total variable cost}}$ ..... (4)

Rate of return on capital invested (RORCI) = $\frac{Net\ farm\ income}{Total\ cost}$ ..... (5)

Note: Unit of plant = 200 birds (Subba *et al*., 2004; 2016)

Plant = Enterprise (Sidharth and Pankaj, 2012)

2. Multiple regression model

The implicit form is as follow:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8)$ ..... (6)

While, the explicit form is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_t \text{ ..... (7)}$$

Where:

Y = Broiler Output (kg)
X_1 = Chicks (gram)
X_2 = Human labour (manhour)
X_3 = Feeds (kg)
X_4 = Liter (kg)
X_5 = H_2O (litre)
X_6 = Electricity (kw/hr)
X_7 = Medication (kg)
X_8 = Depreciation on capital items (₦)
β_0 = Intercept
β_{1-8} = Regression coefficients
ε_t = Noise
The functional forms fitted into the specified equation are as follow:

a. Linear function

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots\ldots\ldots + \beta_n X_n + \varepsilon_t$ ..... (8)
MPP= β
Elasticity = $\beta * \overline{X}/\overline{Y}$

(b) Semi–log function

$Y = \beta_0 + \beta_1 logX_1 + \beta_2 logX_2 + \beta_3 logX_3 \ldots\ldots\ldots\ldots + \beta_n logX_n + \varepsilon_t$ ..... (9)
MPP = $\beta/\overline{X}$
Elasticity = $\beta/\overline{Y}$

(c) The Cobb Douglas (double log) function

$logY = \beta_0 + \beta_1 logX_1 + \beta_2 logX_2 + \beta_3 logX_3 \ldots\ldots\ldots\ldots + \beta_n logX_n + \varepsilon_t$ ..... (10)
MPP = $\beta * \overline{Y}/\overline{X}$
Elasticity = β

(d) Exponential function

$logY = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots\ldots\ldots + \beta_n X_n + \varepsilon_t$ ..... (11)
MPP = $\beta * \overline{Y}$
Elasticity = $\beta * \overline{X}$

Determining technical efficiency of resource use

The elasticity of production was used to estimate the rate of return to scale which is a measure of a firm's success in producing maximum output from a set of variable inputs.

$EP = MPP/APP$ ..... (12)
Where:
EP = elasticity of production
MPP = marginal physical product
APP = average physical product
If
EP =1: constant return to scale
EP < 1: decreasing return to scale
EP > 1: increasing return to scale

Marginal rate of technical substitution (MRTS)

Following Dawson and Lingard (1982); and, Hussain (2013), the MRTS approach adopted is given below:

$MRTS_{L/C} = \beta_L/\beta_C \times CL^{-1}$ ..... (13)

Where $MRTS_{L/C}$ represents marginal rate of substitution of input L for C, β_L is the ouput elasticity of L and β_C is the output elasticity of C.

Determining the allocative efficiency of resource-use

The following ratio was used to estimate the relative efficiency of resource use (r)

AEI = MVP/MFC ..... (14)

Where:

MFC or P_x = unit cost of a particular resource

MVP = value added to poultry output due to the use of an additional unit of input, calculated by multiplying the MPP by the price of output i.e. MPP_{xi}* P_y

Rule of Thumb

If r = 1, resource is efficiently utilized

If r > 1, resource is underutilized

If r < 1, resource is over utilized

Economic optimum takes place where *MVP = MFC*. If *AEI* is not equal to *1*, it suggests that resources are not efficiently utilized. Adjustments could be therefore be made in the quantity of inputs used and costs in the production process to restore *r = 1* and the model is given as follows:

Divergence percentage (D %) = $1/r_i$ $(1 - 1/r_i) \times 100$ *or* $(r_i - 1/r_i) \times 100$ ..... (15)

3. RESULTS AND DISCUSSION

Socio-economic profile of broiler farmers in the studied area

Shown in Table 2 are the socio-economic profiles of the poultry broiler farmers in the studied area. The results showed that most of the labour force that participated in the enterprise were active and economic virile; they maintain fair family size typical to African setting and have few years of poultry management experience as indicated by the mean age of 35.22 ± 7.34; mean family size of 7 ± 3.9 and mean experience of 5 ± 4.2, respectively. Female farmers' participation in the enterprise was very marginal when compared to their male counterpart which may be attributed to economic and religion constraints; and married people were the majority in the sampling population that relied on the enterprise for livelihood sustenance. The literacy level of the farming population was very high, majority possessed title of ownership i.e. owned the farmers they raised their birds in and few were full-time poultry entrepreneurs. The farmers' access to credit, extension contacts and social participation were found to be very poor and most of the farmers used their own savings as the capital for the poultry investment during the period of study. A slight difference in the results was observed between the number of farms located in the rural and urban area and most of the farms were affected by outbreak of poultry diseases during the period of study. With the exception of source of capital, discrepancies were observed in the distribution proportion of each of the socio-economic characteristics considered as evident by their chi^2 statistics probability levels which were different from zero at 10% probability level.

Table 2 Socio-economic profile of the broiler farmers

Variables	Frequency	Percentage	Variables	Frequency	Percentage
Age			**Total**	**97**	**100** [38.36^{***}]
≤ 19	1	1.0	**Occupation**		
20-29	27	27.8	Farmer	26	26.8
30-39	39	40.2	Farmer Artisanal	38	39.2
40-49	28	28.9	Farmer/Civil servant (CS)	5	5.2
50-59	2	2.1	Farmer/Artisanal/CS	28	28.9
Total	**97** (35.22 ± 7.3)	**100** [59.65^{***}]	**Total**	**97**	**100** [23.78^{***}]
Household size			**Access to credit**		
≤ 3	8	8.2	Yes	17	17.5

4-6	52	53.6	No	80	82.5
7-9	25	25.8	**Total**	**97**	**100** [40.92^{***}]
≥ 10	12	12.4	**Extension contact**		
Total	**97** (6.8 ± 3.9)	**100** [48.86^{***}]	Yes	31	32
Experience			No	66	68
≤ 3	49	50.5	**Total**	**97**	**100** [12.63^{***}]
4-6	25	25.8	**Social participation**		
7-9	9	9.3	Yes	22	22.7
≥ 10	14	14.4	No	75	77.3
Total	**97** (4.9 ± 4.17)	**100** [39.21^{***}]	**Total**	**97**	**100** [28.96^{***}]
Gender			**Farm location**		
Male	84	13.4	Urban	47	48.5
Female	13	86.6	Rural	50	51.5
Total	**97**	**100** [51.97^{***}]	**Total**	**97**	**100** [0.09^{NS}]
Marital status			**Disease outbreak**		
Married	73	75.3	Yes	70	72.2
Single	24	24.7	No	27	27.8
Total	**97**	**100** [142.79^{***}]	**Total**	**97**	**100** [19.06^{***}]
Education			**Source of capital**		
Non-formal	16	16.5	Own savings	92	94.8
Formal	81	83.5	Formal credit	5	5.2
Total	**97**	**100** [43.56^{***}]	Total	97	100 [78.03***]
Farm ownership					
Owned	79	81.4			
Rented	18	18.6			

Source: Field survey, 2016 Note: *** NS; are 1% risk level and Non-significant; while values in ( ); [ ] are mean and standard error; and, Chi^2 respectively

Cost concepts and income measures of poultry broiler enterprise

The poultry farmers, like any other entrepreneurs, would be interested in the profitability of the farm enterprise, and for this purpose efforts were made to estimate the cost incurred and the accrued revenue to the farmers' efforts.

Presented in Table 3 are the cost concepts and income measures of poultry broiler enterprise in the studied area. The disaggregation figures showed the incurred economic and accounting costs of an enterprise to be ₦225774.20 and ₦163461.80 respectively; and the accrued accounting revenue of ₦307327.40. The proportion of incurred total economic variable cost (TEVC) and total economic fixed cost (TEFC) in the economic cost of an enterprise were 53.70% and 46.30% respectively; while the proportion of incurred total accounting variable cost (TAVC) and total accounting fixed cost (TAFC) in the accounting cost of an enterprise were 58.25% and 41.75% respectively.

Table 3 Cost concepts and income measures of broiler enterprise

Items	Quantity	Unit price (₦)	Amount (₦)	Items	Amount (₦)
Variable costs				Total fixed accounting cost	68252.06
Family labour	52.13 manhours	200	10426.29	Total accounting cost	163461.80
Hired labour	26.45 manhours	200	5289.92	Total variable economic cost	121236.10
chicks	239.64	204.64	49040.33	Total fixed economic cost	104538.10
Feeds	135.87 kg	113.36	15402.17	Total economic cost	225774.20
Liter	1577.37 kg	10	15773.66	Cost A_1	154899.40
H_2O	46.36 litres	1	46.36	Cost A_2	179061.80

Kerosene	6.48 litres	150	971.55	Cost B	203224.30
Electricity	230.32 kw/hr	14	3224.43	Cost C	213650.50
Drugs	1.94 kg	800	1552.93	Cost D	225774.2
Vaccines	-	-	3036.45	**Income measures**	
Veterinary services	-	-	872	Implicit revenue	-
IV of interest on working capital	12 % @ 130000	-	15600	Explicit revenue	307327.40
Total variable cost (TVC)			**121236.10**	Economic revenue	307327.40
Fixed costs				Accounting gross margin	212117.60
Depreciation on capital items			44089.65	Accounting net farm income	143865.50
Economic rent (lease-in)			24162.40	AROI	2.23
Imputed economic rent (owned land)			24162.40	ARORCI	0.88
Imputed managerial cost	10% of TVC		12123.61	Account cost of production	817.31
Total fixed cost (TFC)			**104538.10**	Farm business income	128265.50
Total cost (TC)			**225774.20**	Family labour income	104103.10
Returns				Economic gross margin	186091.30
Manure quantity	732.74 kg	10	7327.37	Economic net farm income	81553.21
Broiler quantity	200 birds	1500	300000	Farm investment income	117839.20
Total revenue (TR)			**307327.40**	EROI	1.54
Cost concepts				ERORCI	0.36
Total variable opportunity cost			26026.29	Economic cost of production	1128.87
Total fixed opportunity cost			36286.01		
Total opportunity cost			62312.30		
Total variable accounting cost			95209.79		

Source: Field survey, 2016 Note: IV means Imputed value

Furthermore, the profitability decomposition figures revealed an economic gross margin cum net farm income of ₦186091.30 and ₦81553.21 respectively, while the accounting gross margin cum net farm income were ₦212117.60 and ₦143865.50 respectively. The economic and accounting ROIs were 1.54 and 2.23 respectively, implying that for every ₦1 invested in the enterprise, the invested ₦1 was returned, and an economic and accounting profit of ₦0.54kobos and ₦1.85kobos respectively, were gained. This profit margin should stimulate financing from the lending institutions because if poultry farmers in the studied area are funded with ₦130000 at commercial interest rate of 12%, the farmer will return the principal of ₦130000, an interest rate of ₦15600 and still retain ₦161727.40. Therefore, at the enterprise level, it can be concluded that poultry farming is a profitable venture in the studied area because of the remunerative or considerable profit margin. The rate of return per unit of capital invested (RORCI) which indicates what is earned by the business through capital outlay revealed an economic RORCI (36%) and accounting RORCI (88%) that were greater than the prevailing commercial bank lending rate of 12%, implying that if a poultry broiler entrepreneur takes a

loan from the bank to finance poultry enterprise, in respect of economic and accounting RORCIs, he/her will be 24% and 76% respectively better off on every one naira spent after paying the loan at the prevailing interest rate.

Table 4a Production determinants of broiler output

Inputs	Ordinary least square (OLS)				WLS	Collinearity test
	Linear (+)	Exponential	Semi-log	Double log	Linear (+)	VIF (WLS +)
Constant	-38.36 (63.998)	5.087 (0.165)	-4530.94 (358.18)	-3.310 (0.650)	-37.187 (61.47)	-
	[0. 5995]^{NS}	[30.84]***	[12.65]***	[5.092]***	[0.604]^{NS}	
Chicks	0.00013 (8.63E-05)	3.09E-07 (2.22E-07)	211.95 (31.77)	0.6063 (0.057)	1.79E-05 (9.645E-05)	1.328
	[1.53]^{NS}	[1.39]NS	[6.734]***	[10.62]***	[1.856]*	
Labour	0.916 (0.342)	0.0024 (0.00088)	34.56 (28.67)	0.0525 (0.0520)	0.836 (0.3009)	1.401
	[2.68]***	[2.698]***	[1.206]^{NS}	[1.009]NS	[2.777]***	
Feeds	0.934 (0.203)	0.0016 (0.0005)	172.23 (43.28)	0.1855 (0.079)	0.886 (0.186)	1.472
	[4.61]***	[3.097]***	[3.98]***	[2.36]**	[4.77]***	
Liter	0.011 (0.002)	9.84 (6.105E-06)	66.40 (21.77)	-0.0099 (0.040)	0.0098 (0.0024)	1.256
	[4.59]***	[1.613]^{NS}	[3.05]***	[0.249]^{NS}	[4.058]***	
H_2O	1.721 (0.486)	0.0033 (0.00124)	34.01 (39.98)	-0.0039 (0.073)	1.899 (0.366)	1.280
	[3.54]***	[2.646]***	[0.851]^{NS}	[0.054]^{NS}	[5.19]***	
Electricity	0.254 (0.142)	0.00045 (0.00037)	83.69 (52.69)	0.091 (0.096)	0.254 (0.125)	1.333
	[1.785]*	[1.23]^{NS}	[1.588]^{NS}	[0.949]NS	[2.039]**	
Medication	-11.493 (7.832)	-0.0022 (0.0202)	-31.66 (33.29)	0.0072 (0.0604)	-7.497 (4.02)	1.328
	[1.467]^{NS}	[1.107]^{NS}	[0.952]^{NS}	[0.119]NS	[1.867]*	
Depreciation	0.00016 (3.92E-05)	2.1058 (1.009E-07)	36.977 (14.63)	0.0585 (0.0265)	1.2E-05 (2.58E-05)	1.689
	[4.18]***	[2.086]**	[2.528]**	[2.203]**	[4.698]***	
R^2	0.749	0.552	0.784	0.809	0.851	
Adjusted R^2	0.726	0.512	0.764	0.792	0.838	
F-stat	32.80***	13.58***	39.93***	46.65***	62.95***	
Heteroskedasticity (B-G)	[30.43] {0.0002}	-	-	-	-	
Normality test	[0.745] {0.689}	-	-	-	[0.745]^{NS}	

Source: Field survey, 2016

Note: * ** *** ^{NS} significance at 1%, 5%, 10% and Non-significant respectively.

Values in ( ); [ ]; and { } are standard error, t-statistic and probability value

Production determinants of poultry broiler farmers

Of the four functional forms *viz.* linear, semi-logarithm, exponential and double-logarithm fitted into the specified production equation and estimated using ordinary least squares (OLS), the linear functional form performed better but found to fail the test of homoscedasticity (Table 4a). However, the linear functional form was re-estimated using the weighted least square (WLS) and it yielded desireable results, thus, the best fit for the specified equation as its least squares satisfied the specified criteria-economic

(size and sign of the least squares), statistical (R^2 and standard error) and econometric (Gauss Markov's assumptions and theorem). In addition, the diagnostic tests results *viz.* normality and multicollinearity exonerated the chosen functional form from the problem of non-normality in the distribution of the residual and collinear or covariance between the predictor variables captured in the model as evident from their probability values which were not different from zero at 10% degree of freedom (Table 4a). Furthermore, the results showed that the predictor variables captured in the model accounted for 85.2% of variation in the broiler output with random error accounting for the left over percentage as evident from the R^2 result. All the predictor variables included in the model were found to exert significance influence on the output as evident from their probability levels which were different from zero at 10% risk level, and, with the exception of medication predictor which exhibited indirect-inelastic relationship with the output all the remaining estimated parameters had direct-inelastic relationship with the broiler output in the studied area. The estimated elasticity coefficients of the significant explanatory variables with direct-inelastic relationship with output level *viz.* chicks, feeds, labour, liter, electricity, H_20 and capital depreciation were 0.052 ($p<0.10$), 0.365 ($p<0.01$), 0.145 ($p<0.01$), 0.047 ($p<0.01$), 0.177 ($p<0.5$), 0.267 ($p<0.01$) and 0.064 ($p<0.01$) respectively, and the implication of a unit increase with respect to the above in descending order would lead to an increase in the body weight of the broiler birds (output) by 0.052%, 0.365%, 0.145%, 0.047%, 0.177%, 0.267% and 0.064% respectively. However, the resultant implication of a unit increase in medication predictor whose estimated elasticity coefficient of 0.044 was found to exhibit indirect-inelastic relationship with the output level would be a decrease in the body weight of the broiler birds by 0.04%.

The estimated RTS value of 1.073 implies that the poultry farmers in the studied area were operating at stage I of the production surface which is irrational i.e. increasing return to scale because the resultant corresponding output level to any additional input mix would increase at an increasing rate. Therefore, in order to maximize profit farmers are advised to increase the use of their inputs mix rationally till they reached the economic production point.

The results of technical efficiency measurement (MPP) showed that the farmers were more efficient and inefficient in the utilization of H_2O and medication respectively, when compared to the counterpart resources committed to the production process, and the implication of an additional extra litre of H_2O and 1kg of medication dosage would lead to an increase and decrease in body weight of the poultry broilers by 1.90kg and 7.50kg respectively (Table 4b). Thus, in order to ensure efficiency of the medication dosage applied, farmers should reduce its usage in the production process.

Furthermore, the estimated marginal rate of technical substitution (MRTS) depicts how the scale of production responds to two input substitution when others are held constant (Table 4c). Empirical results of the MRTS of chicks in pair showed that 1 unit of chick can be substituted for 0.081kg of feeds, 0.085manhour of labour, 7.28kg of liter, 0.28kilowatts of electricity, 0.038litre of water, ₦ 597.96 of depreciation and 0.0096kg dosage of medication without changing the output level. Similar MRTS substitution techniques applied to the remaining inputs used in the production process when consider in pair. A cursory review of the MRTS inputs in pair indicated that the MRTS of chick input in pair was more efficient when compared to the results of utilized counterpart inputs in pair.

Table 4b Technical and Allocative efficiencies

Inputs	Mean	APP	MPP	EP	MPV	MFC	AEI (D%)	Decision
Chicks	1.546E+05	0.0034	1.79E-04	0.052	760.01	124.24	6.12 (83.66)	**UU**
Labour	91.98	5.785	0.836	0.145	760.01	200	3.80 (73.68)	**UU**
Feeds	219.07	2.429	0.886	0.365	805.46	113.36	7.11 (85.94)	**UU**
Liter	2543.3	0.209	0.0098	0.047	8.91	10	0.89 (12.35)	**OU**
H2O	74.75	7.118	1.899	0.267	1.899	1	1.899 (47.34)	**UU**
Electricity	371.35	1.433	0.254	0.177	230.91	14	16.50 (93.94)	**UU**
Medication	3.13	169.99	-7.497	0.044	-6818.25	1200	-5.68 (82.39)	**OU**
Depreciation	2.844E+05	0.00187	1.21E-04	0.064	0.109	1.08	0.101 (890)	**OU**

Source: Field survey, 2016

Note: UU = Under-utilization; OU = Over-utilization

RTS = 1.073; Output $\overline{Y}$ = 532.08; P_y/kg = ₦909.10

Table 4c MRTS of inputs used

Inputs	Chicks ↓	Labour ↓	Feeds ↓	Liter ↓	H_2O ↓	Electricity ↓	Medication ↓	Depreciation ↓
Chicks ↑	1	11.7141	3.9796	0.1373	26.524	3.5418	104.46	0.0018
Labour ↑	0.0854	1	1.0569	0.0117	2.2658	0.3024	8.9173	1.43E-04
Feeds ↑	0.8077	0.9462	1	0.0111	2.1438	0.2861	8.4372	1.35E-04
Liter ↑	7.2822	85.305	90.159	1	193.28	25.792	760.69	0.01218
H_2O ↑	0.0377	0.4413	0.4665	0.0052	1	0.1334	3.9356	6.30E-05
Electricity ↑	0.2823	3.3074	3.4956	0.0388	7.4939	1	29.493	4.72E-04
Medication ↑	0.0096	0.1121	0.1185	0.0013	0.2541	0.0339	1	1.60E-05
Depreciation ↑	597.94	7004.27	7402.84	82.109	15870	2117.77	62459.27	1

Note: The weight of chicks in gram was converted to chicks in number (400gm = 1chick); ↓, ↑ means increase and decrease respectively

The results of the allocative efficiency showed that the farmers were not efficient in their input mix as none was on the frontier (1) and this may be attributed to poor or low technical knowledge coupled with high input costs and paucity of funds (Table 4b). The resources *viz.* chicks, feeds, human labour, H_2O and electricity were under-utilized while liter, medication and capital items used were over-utilized. Furthermore, the resources with high increase and decrease adjustment requirements were depreciation on capital items and medication dosage in respect of 890% and 82.39% respectively. However, liter and H_2O resources had the least (12.36%) and moderate (47.34%) adjustment requirements respectively, among the resources used in the production cycle.

4. CONCLUSIONS AND RECOMMENDATIONS

The farming population was economically virile, majority been literate with fair household size, and most of them owned the farm they operated on. However, they are faced with limitation of access to credit, extension service delivery and poor social participation; and, the farming population is skewed towards male gender. The enterprise was found to be profitable despite pocket of constraints pointed out be the farmers. Furthermore, broiler farmers were not efficient in the allocation of their scare resources which in the long-run would likely impact negatively on the going concern of poultry enterprise in the study area. Sequel to these findings the following recommendations were made:

- Government and non-governmental agency should look towards gender balance by applying tacit strategies to pacify the strong influence of religion and cultural factors as women are mostly the victim of vicious cycle of poverty.
- Private-public partnership (PPP) should be explored in the study area in order to take care of inadequate credit facilities, extension service delivery, weak social organizations etc.
- Farmers should be enlightened on the need to be efficient in allocation of their input mix so they can be able to maximize profit in poultry enterprise.
- Also, any policy intervention aimed at addressing the problems affecting this sub-sector in the studied area should comply with the ranking inferred by this study.

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