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Resource use efficiency of broiler production in Owerri Agricultural Zone of Imo State, Nigeria

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ABSTRACT: The study analysed the resource use efficiency of broiler production in Owerri rural agricultural zone, Imo State. Data for the study were collected using structured questionnaire, administered to 120 broiler farmers who were selected using two stage sampling techniques. Data were analysed using descriptive and econometric tools such as ordinary least square regression analysis to estimate the production function of the broiler farmers and allocative efficiency model to determine the resource use efficiency of the farm inputs in broiler production. The results showed that stock size, labour and depreciation were significant for output of broiler at 1 and 5% respectively. The results further showed that resources used to produce broiler were not efficiently and effectively utilized, most of the resources were either overutilized or underutilized in the production of broilers in the study area. The factors of production such as fixed assets (-54.31) and expenses on feed (-6.16) were overused while stock size (27.82), labour (630.47), and drugs/vaccines (5.7496) were underused. The results also showed that the returns to scale of broiler production was 1.055, showing an increase of 1% input used in the production will lead to a proportionate increase of 0.06% in the broiler output. The need to educate the farmers in the study area on the efficient use of farm input resources to achieve optimum output and increase profit was recommended. It was also recommended that government should provide long term credit access to broiler farmers to enable them to allocate resources more efficiently for optimal production.

Keyword: Broiler production, efficiency, resource use.

INTRODUCTION

Agriculture is very important to the economic development of a nation. Its crucial position in the economy lies in its distribution to employment, contribution to nation's Gross Domestic Product (GDP), foreign exchange earnings, saving and the provision of food and fiber for local consumption and raw materials for agro-allied industries (Awojobi, 2004). Livestock keeping is of great importance to the Nigerian society and economy as 13 million households keep farm animals and the sector contributes 6 to 8% of the national GDP (ASL 2050, 2018). Increasing population and growing income has led increasing demand for poultry products in Nigeria and therefore has become the fastest expanding segment of animal husbandry sector (Heise et al., 2015). It has become one of the most sought-after animal protein and its contributions to the economy has made the poultry sector a pivotal one.

The poultry subsector is the most commercialized of all the sub-sectors of the Nigerian agriculture. The types of poultry that are commonly reared in Nigeria are chickens, ducks, guinea fowls, turkeys, pigeons and recently ostriches (Adene and Oguntade, 2006). Nigeria has the second largest chicken population in Africa after South Africa (SAHEL, 2015). Poultry production in Nigeria amounts up to 454 billion tons of meat and 3.8 million eggs per year, with a standing population of 180 million birds. About 80 million chicken are raised in extensive systems, 60 million in semi-intensive systems and the remaining 40 million in intensive systems (ASL 2050, 2018). Poultry production is carried out in most communities in Nigeria as a result of its economic viability and potentials for wealth creation and employment opportunities (Ezeano and Ohaemesi, 2019).

Broiler production is the most practiced aspect of poultry production in Nigeria. Many individual poultry farmers,

venture into broiler production mostly for consumption and to generate income for their families. This is because the return on broiler investment can be achieved earlier compared to other livestock enterprises (Ukwuaba and Inoni, 2012). Unlike some other poultry products (such as layers for example), broilers are reared mostly for meat production.

Broiler farming is known to be one of the riskiest industries in livestock production due to vulnerability to diseases, change of seasons and high feed costs. It is noted that the amount of labour in man days as one of the resources employed in broiler determines the production efficiency, however, this also depends on the scale of production (Ng'eno et al., 2010). Feed costs were found to account for more than 50% of overall broiler production costs, making it one of the most significant inputs in broiler production (Ng'eno et al., 2010; Louw et al., 2011).

The size of the broiler house also contributes in production efficiency through stock density. The optimum growth space/bird which also helps to reduce mortality in broiler production is 4.5 m^2/bird. More or less than the specified occupation may result in reduction in growth rate and overcrowded houses and this may cause stress and increase in mortality rate due to stress and heat, hence production inefficiency (Ugwumba and Lamidi, 2011).

The concept of efficiency in the use of farm resources is concerned with the relative performance of the processes used in transforming given inputs into outputs. There are basically three major types of efficiency, viz, technical, allocative and economic efficiency. Technical efficiency refers to the ability of firms to employ the best practice in the production process so that not more than the necessary amount of a given set of inputs is used in producing the "best" level of output (Onyenweaku and Nwaru 2005). Allocative efficiency refers to the choice of optimum combination of inputs consistent with the relative factor prices (Nwaru, 1993). On the other hand, economic efficiency is the ability of a farm to maximize profit (Onyenweaku et al., 2005).

In spite of the important role played by the poultry subsector in reducing the scourge of poverty, unemployment, and malnutrition in Nigeria; the poultry sector is faced with numerous challenges (Dewa and Tikau, 2019). The major problem of poultry production in Nigeria is that of low productivity and inefficiency in resource allocation and utilization (Onyenweaku and Effiong, 2006). The low productivity associated with poultry production in Nigeria can be connected to problems experiences during the process of production (Tsado et al., 2017). Despite the many challenges that are involved in broiler production, the study seeks to determine the resource use efficiency of broiler production in Owerri agricultural zone. The specific objectives of the study are to:

1. Estimate production function and
2. Determine resource use efficiency.

METHODS AND MATERIALS

The study was carried out in Owerri Agricultural zone of Imo state. The zone has eleven (11) Local Government Area; Owerri-West, Owerri-North, Owerri-Municipal, Ngor-Okpala, Ohaji-Egbema, Aboh-Mbaise, Ezinihite-Mbaise, Ahiazu-Mbaise, Oguta, Ikeduru and Mbaitoli. The population of the zone is estimated at 401,873 people (Census, 2006). The zone enjoys relative humidity of 90% and an average rainfall of 20000 mm. The major occupations of the people in zone are farming, trading, civil service etc.

A multi-stage sampling technique was adopted for selecting farmers in the study area. In the first stage, four (4) Local Government Areas were purposively selected from the eleven (11) local government areas of the zone (Owerri-North, Owerri-West, Ezinihite-Mbaise and Aboh-Mbaise). The local government selected have highest broilers farm in the zone. In the second stage, six (6) communities were randomly selected from each of the four (4) Local Government Areas giving a total of 24 communities. In the last stage, five (5) broilers farmers each were randomly selected from the list of broilers farmers in the 24 communities making a sample size of 120 broiler farmers in the study area. The primary data for this study was collected using a well-structured questionnaire administered on the selected broiler farmers while secondary data was obtained from annual reports from the state ministry of agriculture/ADP, conference papers, journals etc.

Ordinary Least Square regression analysis was used to achieve the production function of broiler production. The model is implicitly expressed as follows;

$$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, e) \quad 1$$

Where: Y = Value of output of broiler farmers, X_1 = Stock size (Number of day old birds), X_2 = Quantity of labor (Man-day), X_3 = Quantity of feed (kg), X_4 = Cost of drugs and vaccines (₦), X_5 = Depreciation of capital input (₦) and e = stochastic error term

And resource use efficiency was achieved using allocative efficiency model, the model was expressed as follows;

$$A.E = \frac{MVP}{MFC} = 1 \quad 2$$

Where: A.E = Allocative efficiency ratio, MVP = Marginal value product and MFC = Marginal factor cost.

Marginal value product (MVP) was obtained from the product of marginal physical product and the unit cost of output of broiler produced in the area. The allocative efficiency of farm inputs used in broiler product must equate to unity (1.0). Any deviation from unit implies that the input is not efficiently allocated for broiler production in the area. The decision rule is as follows:

Table. Production function.

Explanatory variables	Exponential	Cobb- Douglas	Semi-log	Linear function
Intercept	7.15939	2.880332	-10824.8	291.9134
	(0.131314)	(0.622017)	(4546.407)	(563.5941)
Stock size	0.000513***	0.927996***	5172.929***	3.152675***
	(11.89591)	(18.14818)	(13.8407)	(17.0305)
Labor	0.008187	0.283732***	1890.028***	307.0527*
	(0.191916)	(3.041721)	(2.772129)	(1.677014)
Feed	0.00011**	-0.08173	-3410.3***	-0.28036
	(2.583061)	(0.92915)	(5.30413)	(1.53154)
Drugs and vaccines	1.16E-06	0.025274	94.70891	0.001914
	(0.520677)	(0.672257)	(0.34466)	(0.200169)
Depreciation	-8.3E-07**	-0.09992**	333.7721	-0.00181
	(2.15056)	(2.52225)	(1.152666)	(-1.0922)
R^2	0.693646	0.85431	0.729907	0.804164
Adjusted R^2	0.679463	0.847566	0.717402	0.795098
F-Ratio	48.90657	126.660	58.3723	88.6965

*** = Significant at 1%; ** = Significant at 5%, * = Significant at 10%.
Source: Field survey data, 2019.

If A.E = 1 (Efficient utilization of resources);
A.E > 1 (Underutilization of resources); and
A.E < 1 (Overutilization of resources).

RESULTS AND DISCUSSIONS

The results of the production function of the broiler farmers is presented in Table 1. The results showed that the Cobb-Douglas functional form was selected as the lead equation on the basis of having the highest coefficient of multiple determinations (R^2), highest F-value, lowest standard error and a high number of statistically significant independent variables at 5% level of significance. The value of coefficient of multiple determination (R^2) was 0.854, which implied that 85.4% of the variation of the production of broiler in the study area were accounted for by the explanatory variables in the model. Variables such as stock size, labour and depreciated fixed assets were significant at 1% and 5% respectively.

The variable, stock size was significant at 1% and positively related to the value of output of broiler farmers. This implies that there is a positive relationship between the stock size and the value of output of broiler farmers which further implies that the value of output of broiler farmers increases by a unit increase in stock size. This finding conforms to *apriori* expectation.

The result also shows that the coefficient of labour was significant at 1% and positively related to the output of broiler production in the study area. The implication is that as the marginal change in labour increases, the value of the broiler farmers output increases. However, this result disagrees with the findings of Nwachukwu and Onyenweaku (2007) and Onyenweaku and Nwaru (2005) which showed household size and technical efficiency to be negative and significantly related.

Finally, the result shows that depreciation is significant at 5% and negatively related to the output of broiler production in the study area. The implication is that as the depreciation increases the farmer value of output decrease and vice versa. There is a 1.3% decrease in the value of output of broiler farmers for every unit increase in depreciation value.

The results of Table 2 shows that none of the allocative efficiency was equal to one. This therefore implies that they are allocatively inefficient. This was because the ratio of the MVP to MFC was not unity. This result suggests that increasing the farm size until MVP becomes equal to MFC could increase profit on the other hand reducing the costs of labour, feed, medication would increase profit. This finding was consistent with the findings of Ukwuaba and Inoni (2012), Oladeebo and Ambe-lamidi (2007) and Ng'eno et al. (2010).

The allocative efficiency of stock size is 27.82. This shows that allocative efficiency for stock size is greater than one. This implies that the inputs were under-utilized, and the farmer requires more of the farm inputs to become allocatively efficient. Also, the allocative efficiency of labour is 630.47 which shows that the allocative efficiency for labour is greater than one. This implies that it is under-utilized and requires the farmer to put more of that input. This disagreed with the findings of Ng'eno et al. (2010). More so, the allocative efficiency of drugs/vaccines, is 5.7496, showing that drugs/vaccines were under-utilized. This implied that the farmers in the study area did not use the required quantities of medication for their broiler production. This implies that the broiler farmers could increase their total returns by increasing the stock size,

Table 2. Allocative efficiency ratio of broiler farmers.

Input	Marginal productivity (MPP)	Unit price of output (PY)	Marginal value product (MVP)	Marginal factor cost (MFC)	Allocative Efficiency (A.E)
Stock size	3.152675	3003.98	9470.6	340.4	27.82
Labour	307.0527	3003.98	922380.2	1463 per man-day	630.47
Feed	-0.28036	3003.98	-842.20	136.63 per kg	-6.16
Drugs/vaccines	0.001914	3003.98	5.7496	1	5.7496
Depreciation	-0.00181	3003.98	-54.31	1	-54.31

Source: Field survey data, 2019.

Table 3. Elasticity of production and returns to scale in broiler production Owerri, Imo State.

Variables	Elasticity of production	Returns to scale
Stock size	**0.928**	
Labour	0.284	
Feed	-0.082	1.055
Drug and Vaccine	0.025	
Depreciation	-0.100	

Source: Field survey data, 2019.

labour and drugs/vaccines.

Feed has allocative efficiency of -6.16; this shows that the allocative efficiency for feed is less than one. This implies over utilization of feed by the broiler farmers in the study area. In addition, the allocative efficiency for depreciation is -54.31, showing over-utilization of fixed assets. This implied that the farmers spent more on fixed assets and vaccine which may cause reduction in total returns from broiler production in the study area. Therefore, the farmer could reduce cost of fixed inputs and feed used in the farm to increase total returns.

The results of Table 3 show that the returns to scale of broiler production is more than unity with a value of 1.055. This implies that as the aggregate input uses in broiler production increases by 1% there is an increase in broiler output by 0.06% in the area.

Conclusion

The findings showed that the resources were not efficiently utilized for broiler production in the study area. The available resources such as stock size, labour and drugs/vaccines were underutilized while fixed assets and feed were overutilized by the broiler farmers. The finding also revealed that stock size, labour and depreciated assets were significant to the output of broiler.

Recommendation

Based on the findings of the study, it is recommended that extension workers should intensify effort on educating farmers on how to allocate resources to achieve optimal production. Also, Government through relevant agencies should grant the broiler farmers access to low cost and long tenure finance to enable them increase inputs such as stock size, labour, and drugs/vaccines for more efficient production process.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

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