TECHNICAL EFFICIENCY OF FAMILY POULTRY PRODUCTION IN NIGER-DELTA, NIGERIA

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ABSTRACT

This study assessed the technical efficiency of family poultry production in Niger- Delta, Nigeria. The technical efficiency estimate shows that the technical efficiency of family poultry ranges between 0.09 and 0.63, with mean of 0.22. This indicates that on the average, the respondents are 22% efficient in the use of combination of their inputs. The elasticity estimate of 12.29 indicates that the family poultry production is taking place at stage 1 (inefficient stage) in production curve. This study concludes that the output and technical efficiency of the family poultry production can be increased by the use of more feed, capital, medicine/vaccine and adoption of more innovations.

KEYWORDS: TECHNICAL, EFFICIENCY, FAMILY, POULTRY, PRODUCTION

INTRODUCTION

For industrial poultry birds to express their full genetic potential, certain basic requirements must be provided. These include environment, good management, balanced rations and adequate housing [2]. These facilities can be provided through adequate capital base, which is lacking in Nigeria. High cost of feeds, poor quality of day old chick (DOC), inadequate extension and training facilities has been the bane to industrial poultry production in Nigeria. These problems associated with industrial poultry production make family poultry production in Nigeria popular.

Family poultry at 104million out-number all other livestock in Nigeria . Commercial chicken holding account for only 10million chickens or 11% of the total chicken population of 82.4million [18]. Families maintain the bulk of poultry in Nigeria under low input, extensive system [16]. Family poultry are important as provider of eggs and meat. It is generally assumed that family poultry production systems are economically efficient because, although the output from the individual bird is low, the inputs are usually lower [19]. This assumption has not been properly investigated using econometric model. The econometric investigation is very important in transforming family poultry production system. According to Kitalyi[11], the transformation of family poultry into economically viable enterprises would require better understanding of the socio-economic aspects of the production system. This is consistent with view of Sonaiya[18]. He said that as the socio-economic importance of family poultry is being recognized, economic analysis is required to identify and evaluate problems, and plan appropriate intervention for development.

For family poultry production to grow in a sustainable manner, the present level of technical efficiency and productivity must be improved upon. However, only little is known about level of technical efficiency of the Nigerian poultry industry in general [1]. In fact no study exists on the technical efficiency of family poultry in Nigeria at the moment.

Technical efficiency implies ability to produce maximum output from a given set of inputs, given the available technology. Many past and present analyses of technical efficiency in Nigerian Agricultural sector involve the calculation of simple ratio measures, such as labour efficiency, capital efficiency, feed efficiency, etc. These measures can be very informative but can be quite misleading, because each measure only considers a single input in isolation [1]. This paper seeks to estimate the technical efficiency of production and the factors, which influence the level of efficiency in family poultry production in Niger- Delta, Nigeria.

This study becomes important in analyzing the technical efficiency of family poultry, since increased production and productivity are direct consequences of efficiency of production resulting from efficiency of inputs combination, given the available technology [1].

The broad objective of this study is to determine the technical efficiency of family backyard poultry production in Niger Delta

The specific objectives are: to assess the socio – economic characteristics of the family poultry production in the study area; to determine the cost and revenue structure of the family poultry production; to estimate technical efficiency of each producer and to determine the technical efficiency of family poultry production.

MATERIALS AND METHODS

The study was carried out in Niger Delta, Nigeria. Niger-Delta is made up of nine States out of 36 States of the Federal Republic of Nigeria [20]. Data collected from 116 respondents who are involved in family poultry production through multistage sampling were analysed using percentage distribution, profitability ratios and stochastic frontier production function.

The stochastic frontier production function was specified as,

$$I_nY = \beta_0 + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + (V_i - U_i) \quad \ldots (1)$$

Where:

Y = Income from family poultry (₦)

X_1 = Expenses on feeds (₦)

X_2 = Expenses on medicines/vaccines (₦)

X_3 = Income from other livestock (₦) [Proxy for capital]

V_i = random error assumed to be independent of U_i, identical and normally

Distributed with zero mean and constant variance $N(0, \delta^2_v)$

U_i, = technical inefficiency effects which are assumed to be independent of

V_i, they are non-negative truncation at zero or half normal distribution with $N(\mu,\delta^2_u)$

If U_i, = 0 no allocative inefficiency occurs, the production lies on the stochastic frontier. If U_i,> 0, production lies below the frontier and it is inefficient.

Technical Inefficiency Model

In addition to the general model, this inefficiency model was defined to estimate the influence of some farmer's socio-economic variables on the technical efficiencies of the farmers. The model is defined by:

$$U_i = \partial_0 + \partial_1 z_1 + \partial_2 z_2 + \partial_3 z_3 + \partial_4 z_4 \quad \ldots (2)$$

Where:

U_i is as defined before

Z_1 = Age of the farmers in years (years).

Z_2 = Family size (number)

Z_3 = Gender (dummy, 1 for male and 0, otherwise)

Z_4 = Index of innovation adoption (ratio of number of innovation adoption out of maximum of 6 specified in the questionnaire)

∂'s, β's and γ coefficients are unknown parameters to be estimated along with the various parameters which are expressed in terms of $\delta_s^2 = \delta v^2 + \delta u^2$; γ (gamma) = $\delta u^2 / \delta_s^2$

Where the γ - parameter has value between zero and one, ($0 \leq \gamma < 1$). The parameters of stochastic frontier production function (SFPF) model were obtained by maximum likelihood estimation method using the computer programme, FRONTIER VERSION 4.1 [8]; where equations (1) and (2) were jointly estimated.

RESULTS

Table 1 shows that the respondents are relatively young with mean age of 48years. The mean years of schooling is 9 years, which indicates that majority of them were educated above primary school (primary school certificate was scored 6 years). The table also indicates that the family size is 8. Female constitutes 58% of the family poultry producer in the study area as indicated in Table 1

Table 2 shows that the main reason for rearing family poultry is for sales. About 53% of the respondents indicated that they reared the family poultry for sales. The food security implication of family poultry is also implied in Table 2. The table indicates that about 39% and 6% of respondents in the study area consumed the family poultry product at home and during ceremonies respectively. Table 3 shows that medication/vaccine constitutes 80% of the variable cost of the producing family poultry in the study area, while feed constitutes about 20% of the variable cost. The costs of housing and replacement stock were excluded because majority of the respondents did not pay for housing and replacement stocks. The estimated cost of medication/vaccine is 20%. The table also indicates that sales of live birds and eggs constitute 79% and 21% of total revenue of the family poultry. Table 3 indicates that the annual average profit is N38834.60 ($290), the return on investment (ROI) is 7.60, and this shows that family poultry is highly profitable. Table 4 shows the maximum likelihood estimates of family poultry production in the study area. The table indicates a positive relationship between the expenses on feed, medicine and vaccines, income from other livestock (capital) and family poultry income. The relationship is also significant at 5%. Hawk attack is negatively related to the income of the family poultry. However, the hawk attack is not significant in this study. Considering the coefficient of the determinants of the income of the family poultry in Table 4, feed coefficient has the highest value of 5.699. Inefficiency parameters show that age is negatively related to family poultry production. However, it is not a significant at 5% level of significance. Family size, gender and index of innovation adoption have significant and negative relationships with the inefficiency of family production in the study area. The table also shows that the estimate of variance parameter(δ^2) is 32.784 and that the gamma (δ) is 0.92, close to one, which indicates that the inefficiency effects are highly significant in the analysis of the income of family poultry production in the study area The log likelihood function was estimated to be –288.022. This value represents the value that maximizes the joint densities in the estimated model. The predicted technical efficiency varies widely across the respondents, ranging between o.09 and 0.63 (on the scale of maximum one) with mean of 0.22. The elasticity estimate (Summation of coefficients of expenses on feed, hawk attack, expenses on medicine/ vaccine and income from other livestock) is 12.290.

DISCUSSIONS

The study shows that the level of education of the respondents is higher when compared with national adult illiteracy level of 30% and 48% for male and female in Nigeria respectively [21]. Illiteracy is heavily regarded as a major limitation to technology adoption in livestock and crop production in Nigeria. The high level of education will enable respondent to access relevant information that will stimulate their production. The respondents' large household size is above the recommended average of four per family in Nigeria. The large family size is relevant to family poultry because family labour constitutes the buck of labour supply in family poultry production in Nigeria [18]. The fact that majority of the family poultry keepers are women is consistent with 56% estimated by Sonaiya, [18] in Nigeria. It has been demonstrated that women in rural area of Nigeria generate most of their income from poultry [3]

It is evident from the result of the study that the main reason fro family poultry income generation. In fact, Sonaiya [16] noted that in poor producer families, female poultry products are not consumed but are mainly sold when household is in need of cash. The income from the sale of the poultry product is additional revenue

Table 1 socio-economic characteristics of the respondent

Socio-economic characteristics	Mean
Age	48years
Years of schooling	9 years
Family Size	8
Gender	58%female, 42% male

Source: field survey, 2003.

Table 2: Distribution of respondents according to their objectives of rearing family poultry.

Objective	Number of respondents	%
Sales	80	52.63
Home consumption	59	38.82
Ceremonial consumption	09	5.92
Rituals	01	0.66
Other	03	1.97
	152*	100

Source: Field Survey, 2003. *Multiple responses

Table 3: Cost and Returns component in family poultry production in the study area.

Cost	Amount (N)	%
Feed	116163	19.6
Medication/vaccine	476373	80.4
Total	592536	100
Returns		
Live Birds	4041780	79.3
Eggs	1055570	20.7
Total	5097350	
Profit	4504814	
Average Profit	38824	
Return on Investment	7.60	

Source: Computed from field survey, 2003.

Table 4: Maximum likelihood estimates of stochastic frontier production function and inefficiency parameters. Family poultry.

Variables	Coefficient	t-ratio
Constant	3.924	1.530
Expenses on feed	5.699	4.883*
Hawk attack	-1.387	-1.032
Expenses on medication/vaccine	5.149	4.136*
Income from other livestock	2.829	3.681*
Inefficiency Parameters		
Age of the farmers	-5.648	-1.460
Family size	-4.003	-5.802*
Gender	-2.714	-3.451*
Index of innovation adoption	-2.098	-3.921*
Gamma δ	0.92	27.966*
Gamma squared (δ^2)	32.784	5.846*
Log likelihood	-288.022	
Technical Efficiency (Mean = 0.22)	Minimum = 0.09	Maximum = 0.63

Source : Computed from field Survey, 2003
* Significant at 5%

earnings from cash crops from the field. Alabi and Osifo [4] demonstrated that income from family poultry contributes significantly to woman cash economy in Nigeria. Sonaiya [18] estimated that poultry product sold contribute about 15% of the annual financial income for rural household. The information on the breakdown of the sales of family poultry in Nigeria shows that 87% and 13% of the sales revenue were from sales of live bird and egg respectively [19]. The food security implication of family poultry is also implied in Table 2. Since protein from poultry products are biologically superior than protein from plant, consumption of these products will increase the supply of essential amino acids in their diet. Analysis of proportion of meat and egg from family poultry consumed by Nigerian shows that meat and egg constitute 82% and 18% respectively [18].

The cost structure in family poultry is slightly different from the cost component in commercial poultry production where feed accounts for more than 60% [6]. This is because family poultry depend on human habitat for their feed. Free-range birds do not receive sufficient feed but survive on scavenging, spent grain and chicken waste from household with minimum cost. The estimated cost of medication and vaccine of 20% is higher than 14% estimated by Sonaiya [18]. This may be due to the increase in prices of medicine and vaccines between 2000 and 2004 in Nigeria. The table also indicates that sales of live birds and eggs constitute 79% and 21% of total revenue of the family poultry. This is comparable with 87% and 13% for sales of live birds and eggs estimated by Obi and Sonaiya [16] in Osun State, Nigeria.

The annual average profit of N38834.60 ($290) which is higher that per capita income of $280 in Nigeria. The return on investment (ROI) of 7.60 shows that family poultry is highly profitable. This high profitability should attract financing by lending institutions. The direct interpretation is that if the family poultry is financed by lending institution with N10,000 ($74) and at interest rate of 10%, the family poultry will generate N76,000 ($563). This means that the borrower will be able to return the principal (N10, 000 or $74), the interest of N10000 ($7.4) and retain about N65, 000 or $482 as his profit.

The positive and significant relationship between expenses on the feed, medicine/vaccine and income from other livestock (capital) indicates that if more feeds, medicine and vaccines are given to the family poultry, there will be more than proportionate increase in the output of family poultry. The positive and significant relationships between feeds, drugs and output of commercial poultry production have been documented by [1]; [10]. The fact that hawk attack is negatively related to the income of the family poultry, suggests that increased hawk attack will reduce the income from family poultry. If the hawk attack is taken as indication of extensiveness of the family poultry; it then means that extensive system of rearing might reduce the income from family poultry.

Since feed has highest coefficient it means that increase can be more experienced in income of family poultry by increasing the feed (quality and quantity) given to the family poultry than by increase in any other factors

that influence family poultry income as specified in this study. The importance of feed in stimulating poultry production in Nigeria has been expressed by [14]. The relative importance of feed in family poultry production cannot be over-emphasised. According to Sonaiya [18], energy is the first limiting nutrient as food available on the range contains a lot of crude fibre. That is why energy supplements may increase production significantly.

Inefficiency parameters establish the fact that inefficiency of family poultry production decreases with increase in family size. This may be due to the fact that family poultry depends on family member as labour and feed supply. The significant and negative relationship between gender and inefficiency of family poultry production suggests that inefficiency is less among female than male. This may be due to the fact that women are more involved in family production than men, hence they have developed caring techniques superior to that of men. It may also be due to the fact they stay more at home caring for family poultry than men. It may also be attributed to tender nature of women that is more than that of men. The implication of this is that women may efficiently generate more income from family poultry than men. Hence, strategies/intervention that will increase women income may consider this option. The study also indicates that as the number of innovation adoption increases, inefficiency of family production decreases. Innovation adoption has been shown to improve the productivity of the farmers [13]. Innovation that are related to management of family poultry such as regular watering, light enclosure, vaccination, medication and feeding can bring about significant improvement in productivity of family poultry [15] (in Burkina Faso); [7] (in Niger); [18] (in Nigeria). The level of innovation adoption among the family poultry producer is low in Nigeria generally, because of low contact with extension agent [9]. Sonaiya [18] reported that less than 5% of family poultry producers in Nigeria had any contact with poultry extension agents. Even the crop of extension agents in Nigeria has no mandate for family poultry production. That is why any producer that has contact with technological information that can improve their production and make use of the information will be more efficient than those do are not.

The high variance parameter (δ^2) and gamma (δ) close to one, which indicates that the inefficiency effects are highly significant in the analysis of the income of family poultry production in the study area (if the gamma is zero, the variance of the inefficiency effect is zero and so the model reduces to traditional average response function in which the variables of age, family size, gender and index of innovation adoption are included in the production function). The log likelihood function estimated to be –288.022. This value represents the value that maximizes the joint densities in the estimated model. The mean technical efficiency of 0.22 suggests that the family poultry producers are 22% efficient in the use of combination of their inputs. Since the elasticity is greater than one, it suggests that the producers of family poultry are operating at stage one in production curve. At this stage, marginal product of family poultry is greater than average product. This is an inefficient stage, because increase in the use of inputs will lead to more than proportional increase in output. This means that the family poultry producers are inefficient at their level of production and that their income and output can be improved if more of feeds, capital, vaccine and medicine are used and more innovation that are related to improved management are adopted. It can therefore be recommended that extension agency should be mandated to disseminate improved technology that will stimulate family poultry production in the study area. Capital can be channeled to family poultry production through the provision of micro- credit and formation of cooperative societies. Medicine and vaccines should be provided for family poultry production at affordable prices.

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