ALLOCATIVE EFFICIENCY OF FEEDS AMONG POULTRY FARMERS IN DELTA STATE, NIGERIA

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ABSTRACT

Efficiency and profitability are the objectives of poultry production. Investigating allocative efficiency of feeds will bring development to the poultry industry in Nigeria. Using a set of structured questionnaire, primary data were collected from 60 poultry farmers (30 broiler farmers and 30 layer farmers). Collected data were analyzed using a combination of descriptive and inferential statistics (regression model), convectional profit model and feed use efficiency model. The result revealed that the shadow price of a 25kg bag of layer mash (N=2498.2) is less than the ruling price (Market price) of N2500 by N1.8. The result further shows a shadow price of N1991.4. for broiler mash. This is less than the ruling price (market price) of N2000 by N8.6. That at the ruling price of feeds, egg producers and broiler producers should decrease the quantity of feeds consumed per bird and that farmers should buy feeds directly through cooperatives from feed producing companies to enjoy the advantage of price efficiency.

KEY WORDS

Allocative efficiency; Profitability; Feed utilization; Shadow price; Poultry.

The major objective of poultry farmers is to produce meat and eggs efficiently at economic rate. This can be achieved by utilizing feeds efficiently. Poultry eggs and meat production contributed 26% to Nigerian Gross Domestic Product in 1995 and 27% in 1999 (CBN, 1999). The poultry sub sector has some advantages over other livestock: Poultry birds are good converters of feed into useable protein in form of meat and eggs. The production cost per unit is low relative to other types of livestock, thus farmers need just a small amount of capital to start a poultry business. The return on investment (ROI) is high. It has short production cycle (pay back period), as a result invested capital is not tied down over a long period. Consumers' preference/acceptability for poultry meat and egg is very high, hence there is ready market for the products. (Ojo, 2003) Poultry has always been an important livestock sector (Supic *et al.*, 2001; Bosnjak and Rodic, 2008). Poultry provides abundant relatively cheap food of high quality (Mack *et al.*, 2005; Alders and Pym, 2009; Hodges, 2009).

The average gross weight of slaughtered chicken is between 1.6 to 1.8kg (Radic *et al.*, 2010). Whole Fresh carcasses still dominate the broiler market in Nigeria, although consumer preferences are slowly changing towards cut and processed chicken parts. Though this is in line with global trend in poultry meat consumption (Magdalaine *et al.*, 2008; Magdalaine, 2009. Vukasovic, 2009), the level of technology in poultry industry in Nigeria has not developed fully to meet this standard. The economics of poultry meat and table eggs production are different for different types of producers.

Nigerian is among the popular consumers of poultry product (egg and meat) in the world. Average consumption value for Nigeria was estimated at 7.6g/head/day (Ikheola, 2005). This is far below 35g/head/day as recommended by that food and Agriculture Organisation (FAO, 1992) of the works. The importance of feeds in commercial poultry production has become a topical issue in global debates. In poultry production bird's growth rate, meat yield and hatchability depend to a large extent on the quantity and quality of feed used. (Decuypere *et al.*, 2001, Decuypere and Bruggeman, 2007). Feed allocation efficiency to a large extent would translate to profitability in poultry production. Hence feed allocation decision becomes very crucial in poultry management systems. The major challenge in the poultry sector is how farmers can improve feed utilization efficiency.

This is because feed accounts for about 70%-75% of total cost of production. Yet the price of poultry feeds fluctuates sharply leading to unsteady returns to poultry farmers. Hence there is the need to investigate the efficiency of poultry feed allocation in poultry egg and broiler production systems. This could have some implications for resource allocation in the poultry industry in Delta State, Nigeria.

In a world of scarce resources, the two enigmatic problems of under utilization and over utilization of resources are evident. Resource under utilization and over utilization are associated with low returns. Both have become the focus of concern by producers and policy makers. Under utilization and over utilization are deeply rooted in the resource structure of poultry industry. They are features of poor management systems in poultry industry. But one of the chief objectives of poultry industry should be the attainment of efficiency in resource allocation. It is essential to rigorously examine the efficiency in resource (feed) allocation in relation to profitability in the poultry industry. An increase in the efficiency of resource allocation in poultry production, will amount to increased profitability and progress in the industry. The resource use structure is the overall frame work of relationship between inputs and output. This relationship determines output level, efficiency, profitability and income in poultry business. This is because resource allocation is influenced by relative prices of resources.

The issue of economic efficiency in poultry industry in Nigeria has received some attentions in the literature (Sani, *et al.*, 2000; Umeh and Odo, 2002; Olarinde and Kaponiyi, 2004; Adebayo and Adeola, 2005; Ekunwe, *et al.*, 2006; Amos, 2006 and Okafor, *et al.*, 2006A). The results of resource use efficiency in poultry production in Ogun State revealed that farmers were economically efficient within a range of 55% to 84% efficiency levels. This suggests a favorable future for poultry farmers. Although, feed accounts for 70-75% of total cost of production, none of the above studies analysed feed utilization efficiency in isolation. Determining the allocative efficiency of feed as a separate study becomes very necessary in Delta State, Nigeria. Ascertaining the optimal expenditure on feed use is therefore a major determinant of progress in poultry industry in Nigeria.

The maximum price of feed that farm owners are willing to pay for extra unit is called SHADOW PRICE. This is different from the general market price of the resource. Until feed shadow price is determined with accuracy, poultry farm management decision with respect to feed utilization may be fraught with error. This will impact negatively on the profitability of poultry egg producers and broiler producers in Delta State, Nigeria. There is therefore the need to analyze the monetary value of the additional unit (Shadow price) of poultry feed. This is the contribution margin (opportunity cost) that would be lost by not increasing feed utilization in egg and broiler production systems. Therefore, there is a great need to estimate the optimal profit that will place the poultry producers in the state of equilibrium. To this extent, there is the need to analyze efficient feed utilization in poultry egg production and broiler production systems in the study area. By finding efficient solutions for the utilization of poultry feed, the use of shadow price can in the long run lead to more sustainable development in the poultry industry. There is therefore the need to estimate the relative rate of contribution of poultry feed to profit in poultry egg and broiler production systems in the study area.

Efficiency can be summarized as the elimination of wastage of resources in a production process. Efficiency is the ratio of effective output to the required input, it is the ratio of total revenue to total cost. It measures how efficiently the goal of the farm firm (profit maximization) is achieved. Efficiency can be divided into technical efficiency and allocative efficiency. Allocative efficiency refers to the adjustment of inputs and outputs relationship until marginal value product (MVP) equals the marginal factor cost (MFC) for any single variable input, (the equi-marginal principle). Optimal efficiency is achieved when the most efficient production technology is used and when the marginal value of feed is equal to its price. The contribution of the poultry industry to the economy can be enhanced and sustained with a proper analysis of the allocative efficiency of feed as factor of poultry production systems. The main thrust of this paper is to estimate the allocative efficiency of feed and its effect on profitability in commercial egg and broiler production systems in Delta

State, Nigeria. This is a research gap whose investigation would bring about improvement in the poultry industry in Nigeria and stimulate future and further research regarding related issue in poultry management.

The specific objectives of this study include: (i) to evaluate the efficiency of feeds utilization in poultry production system; (ii) to ascertain the effect of feeds utilization on the profitability of poultry farmers; (iii) to determine optimum expenditure on poultry feeds.

MATERIALS AND METHODS

Study Area, Sampling Procedure and Data Collection Techniques. This study was carried out in Delta State. The study area comprises communities/towns in which the major economic activities of the people include civil service, petty trading and farming. The major crops cultivated are cassava, maize, water yam, banana and plantain. The major livestock reared in the area include poultry, fishes, pigs, cows, goats and sheep. The major agricultural problem affecting the area include inadequate land, high cost of farm inputs, inadequate credit facilities, low net returns to farmers.

A two stage random sampling technique was used to select 60 respondents. The first sampling stage involves the selection of six (6) local government area and six (6) communities. Secondly, random sampling technique was used to select 60 poultry farmers from the 6 communities. The sample comprised of 30 poultry egg farmers and 30 broiler poultry farmers.

Primary and secondary data were used for this study. The primary data were obtained with the use of structured questionnaire. Questionnaires were personally administered to and retrieved from the respondents. Secondary information were obtained from published and unpublished materials.

Analytical Framework. Profit equation was used to determine the profitability of the poultry business while resource use efficiency model was used to determine feed use efficiency in egg and broiler production enterprises.

Profit Equation is given as flows:

$$\pi = TR - TC,$$

where π = Net Profit; TR = Total Revenue; TC = Total Cost. Total revenue equation is given as $Q \cdot P_q$ (N), where Q = Quantity of output, P_q = Unit price of output (N).

Total cost equation is given as:

$$TC = \sum P_i X_i + F,$$

where $P_i X_i$ is the variable cost of the i th input; F = Fixed cost of input.

Hence $\pi = Q \cdot P_q - \sum P_i X_i + F$.

Allocative Efficiency of Feed Utilization. Feed Use Efficiency was determined by dividing the marginal value product (MVP) by marginal factor cost (MFC).

Feeds Use Efficiency (FUE). Feed allocative efficiency was determined by in a step-wise manner. First step was to estimate Marginal Physical Product (MPP) and Marginal Cost (MC). using production and cost functions respectively.

Regression Analysis. Here the output of egg and broiler was regressed against the various input variables. The ordinary least squares of multiple regression model was specified as:

$$Q = f(X_1, X_2, X_3, X_4, X_5, X_6, \dots, X_n),$$

where Q = value of egg output (N); X_1 = cost of feeds (N); X_2 = cost of Day old chick (N); X_3 = cost of drugs /medication (N); X_4 = cost of labour (N); X_5 = flock size (Number); X_6 = Egg cracking rate (%); X_7 = mortality rate (%).

The production function for broiler enterprise is specified as:

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

where Q = value of broiler output (₦); X_1 = cost of feed (₦); X_2 = cost of day old chicks (₦); X_3 = cost of drugs/medication (₦); X_4 = cost of labour (₦); X_5 = flock size (Number); X_6 = mortality rate (%).

Linear, double log, exponential and semilog specification were tried and the one that gave the best fit in terms of R^2 values and in conformity with a priori expectation was selected as the lead equation and used to draw inference. Secondly, depending on the functional form selected as lead equation for regression, the MPP and the corresponding values of MVP were obtained as follow:

$$\text{Linear: MPP} = dQ/dx = B_i$$

$$\text{Double log: MPP} = B_i \cdot q/x_i$$

$$\text{Exponential: MPP} = B_i/x_i$$

$$\text{MVP} = B_i (Q \cdot p_q)$$

$$\text{MVP} = B_i (Q_i x_i p_q)$$

$$\text{Allocative Efficiency} = \frac{\text{MVP}}{P_{x_i}} \text{ i.e } \frac{\text{MVP}}{\text{MFC}}$$

where: B_i = Regression coefficient for cost of feed; Q = Mean output of poultry products; X_1 = Mean value of resource; dQ/dx = Derivative of Q_i and x_i ; P_{x_i} = price of feed per bag; P_q = price of output per unit; MFC = marginal factor cost; when feed use efficiency (FUE) = 1 (feed are optimally utilized); when $FUE < 1$, (Feed are over utilized); when $FUE > 1$, (feeds are under utilized).

Optimal contribution of feed to net profit was estimated by the notation: $d\pi/d_E$. This implies maximum profit obtained from egg or broiler production with respect to expenditure on feeds.

Shepherd-Futrel Efficiency Model. Shepherd-futrel efficiency model was used to further analyze feed use efficiency as shown below:

$$\text{Feed use efficiency coefficient} = \frac{\text{cost of feed used}}{\text{Net profit}} \times \frac{100}{1}$$

RESULTS AND DISCUSION

The result of the study showed that majority of the poultry farmers fall within the age bracket of 31-40 years. This constitutes 46.7% with a mean of 36 years. This finding implies that poultry producers in the study area are predominantly middle age people. The young people dominated poultry production systems. This portends a bright future for the poultry industry in Ibadan metropolis, in Oyo State. The result of the study also shows that most of the poultry producers had been in the business for the period of 1-10 years and this constitutes 83.3% of the sample. This shows an average year of experience of 6 years. This could positively influence their performance. It was also revealed that 96.7% of the respondents had tertiary education. This implies that they are aware of the importance of keeping production and financial records.

Besides, the educated poultry farmer knows how he could combine inputs more efficiently as to improve their performance. The studies also revealed that majority of the respondents are married. The married group constitutes 63.3%. Married people have tendencies for settled business life and take advantage of family labour in poultry production system. The result of the study further revealed that 70% of the poultry producers are males. The implication of this is that, males are commonly involved in poultry production.

Table 1. Distribution of the Socio-economic Characteristics of Respondents

Variable	Frequency \Percentage	Mean/ Mode
Age		
21-30	21(40)	–
31-40	14(46.7)	36 years
41-50	4(13.3)	–
Total	30(100)	–
Years of Experience		
1-10	25(83.3)	–
11-20	3 (10)	6 years
21-30	2(6.7)	–
Total	30(100)	–
Educational Level		
Primary (1)	1(3.3)	–
Secondary (2)	0(0)	–
Tertiary education (3)	29(96.7)	3(Tertiary education)
Total	30(100)	–
Gender		
Male (1)	21(70)	1 (male)
Female (2)	9(30)	–
Total	30(100)	–
Reason for Embarking		
Natural interest (1)	19(63.3)	1 (Natural interest)
Influenced by parent (2)	7(23.3)	–
To alleviate (3)	2(6.7)	–
Unemployment	2(6.7)	–
Total	30(100)	–

Source: field Survey, 2009.

Male farmers are more disposed to taking risk than their female counter parts. Hence males dominate poultry production which is associated with high risk. It was obvious in the study that, the reasons for embarking on poultry business were to alleviate poverty and create jobs for themselves. Hence poultry business is a source of livelihood in Delta State Nigeria.

Efficiency of feed utilization in poultry eggs and broiler production.

H_0 : Poultry feeds are not efficiently utilized in egg and broiler productions in the study area. Feed utilization efficiency indicators in poultry production systems are presented in table 2 below.

Table 2. Distribution of Efficiency indicators of feed utilization in poultry egg and broiler production

Enterprise	Shadow price	Feed Use Efficiency Ratio	Shepherd Futrel Coefficient	Remark
Broiler	₦1991.4(N8.6)	2.4 > 1	8.3%	Under Utilized
Egg	₦2498.2(N1.8)	0.008 < 1	26.1%	Over Utilized

Note: The values in parentheses are the corresponding shadow price short falls from market prices.

The feed use efficiency in egg production is 0.0081 which is less than one. Since feed use efficiency is $0.008 < 1$ (less than 1) it means, feeds are over utilized in egg production. This result shows that egg producers are spending too much on the purchase of feeds. This has implication for profitability of the enterprise. This finding is in agreement with the earlier report of Uzu (2008) who asserted that egg producers were spending too much on feed utilization in egg production in Ndokwa Local Government Area of Delta State. With respect to feed utilization, egg producers in Ibadan metropolis are operating in stage three of the production surface. This is the irrational region of production surface where marginal product is negative. In broiler production, the feed use efficiency is 2.4 which is greater than one. This implies that broiler producers are under utilizing feeds. They must be operating in stage 1 of the production surface. For them to be efficient, they need to increase feed utilization. At this point output of broiler is responding positively to increase in feed utilization.

Percentage Efficiency of Feeds Utilization in Poultry Enterprises. The percentage efficiency of feed utilization in poultry egg and broiler production, was achieved by adopting the conventional model for percentage efficiency of resources use. That is, the rate of return on investment(ROI) with respect to feed.

The formula is given as:

$$\text{ROI with respect to Poultry feed} = \frac{\text{Profit}}{\text{Cost of feed}} \times \frac{100}{1}$$

For Broiler = 7.65%; For layer = 20.7%

About Twenty-One percent (21%) is the percentage efficiency in the use of layer mash in egg production and 7.65% is the percentage efficiency in the use of broiler mash in broiler production in the study area. This result implies that poultry feed is contributing approximately 21% and 8% to total profit in egg and broiler production respectively. It further implies that for every ₦100 invested on feed will generate about ₦21 and 8 profit in egg and broiler production will be generated respectively, all other things being equal. Hence, the opportunity cost of alternative use of feed is 21% and 8% in egg and broiler production respectively in the study area. It also implies that egg production is more profitable than broiler production in the study area.

Sheperd-Futrel efficiency coefficient of 21.1% and 8.3% for broiler production and egg production respectively indicated that 8.3% of net revenue was gulped by over expenditure on feed utilization, while in broiler production 21.1% of net revenue was lost due to under utilization of feed. This shows that egg producer is relatively more efficient than broiler producers in feed utilization on the basis of net return loss.

Effect of feed expenditure on Profitability in poultry Production enterprises in Delta state. For Egg production system:

$$\text{Profitability } (\pi_B) = 29.75 - 1.7661\text{FEXP} \\ (4.5988)^* (-2.706)^* \\ \pi_B = \text{Profit in Egg Enterprise} \\ \text{FEXP} = \text{Feed Expenditure} \\ * = \text{significant at 5\%}$$

The result of the regression analysis indicates that there is a negative relationship between profitability and the cost of feed in egg production system. That is to say, as the expenditure on feed is increasing, the profit margin of the egg producers will be decreasing, all things being equal. Producers must reduce expenditure on feed for profit to increase.

For Broilers production system:

$$\text{Profitability } (\pi_B) = 104.65 - 8.629\text{FEXP} \\ (6.4061)^* (-3.5801)^* \\ \pi_B = \text{Profit in Broiler Enterprise} \\ \text{FEXP} = \text{Feeds Expenditure} \\ * = \text{significant at 5\%}$$

The result of the regression analysis indicates that there is a negative relationship between profitability and the cost of feed. That is to say, as the cost of feed is increasing, the profit margin of broiler producers will be decreasing by ₦8.6, all things being equal.

Optimum Expenditure on Poultry Feeds in Egg Production and Broiler Production. The study revealed that the mean ruling price per bag of poultry feed was ₦2500 for layers mash. This was higher than the shadow price. The difference (margin) between the market price of feed and shadow price (industry price) was determined by the use of Lagragian multiplier model.

The value of lagragian multiplier (₦1.8) indicates the difference between the selling price and the shadow price of layers mash per-bag. If the ₦1.8 is subtracted from the ruling price of bag of poultry feed in the study area optimum point is attained. Dilion and Hardaker (1982)

have earlier reported that shadow price reflects more appropriately the worth of input than the prevailing price. From the finding, it was observed that a unit increase in the expenditure on layer mash by ₦1 will negatively affect the profit by about ₦1.8. Shadow price is the maximum price that management is willing to pay for an extra unit of feed to attain efficiency in operations. The shadow price of ₦2498.2 is less than the ruling price of feed (₦2500). The negative difference between the prevailing price and the shadow price of feed implies that egg producers are paying too much for feed in the study area. The egg producers must be operating in the stage III of production surface. The feed use efficiency (FUE) is less than (one) 1; it will be irrational or uneconomical for egg producers to increase the quantity of feed intake per bird. Poultry egg producers should not spend too much on feed particularly if the money was borrowed. Meguigan and Moyer (1983) had maintained that a change in the level of an economic activity is only desirable and should be undertaken as long as the marginal benefit exceeds or equal the marginal cost. In this study, the result demonstrated that the marginal value product in egg production was less than marginal cost by ₦1.8. The optimal profit will hold where marginal cost of feed is equal to the marginal revenue.

The study shows that the mean price per bag of feed used in broiler production was ₦2000. This was the ruling price of poultry feed. This is different from the shadow price. The difference (margin between the market price of feed and shadow price industry price) was determined by the use of lagrangian model. The value of lagrangian multiplier (₦8.6) indicates the difference between the ruling price and the shadow price of poultry feed per bag. If the ₦8.6 is subtracted from the ruling price of feed (₦2000), we have (₦1991.4). This is the shadow price of a bag of poultry feed in the study area. Dillon and Hardaker (1982) had earlier reported that the shadow price reflects appropriately the worth of input than the prevailing price. From the findings, it was observed that a unit increase in the price per bag of poultry feed by ₦1 will negatively affect the profit by about ₦2. Shadow price is the maximum price that management is willing to pay for an extra unit of feed. The shadow price of (₦1991.4) is less than the ruling price of feed (₦2000). The negative difference between the prevailing price and the shadow price of feed implies that broiler producers are paying too much for feed in the study area. Meguigan and Moyer (1983) had maintained that a change in the level of an economic activity is only desirable and should be undertaken as long as the marginal benefit exceeds the marginal cost. In this study, the result demonstrated that the marginal profit in broiler production was less than marginal cost by ₦8.6. The optimal profit condition will hold where marginal cost of feed is equal to the marginal revenue.

CONCLUSION

The allocative efficiency feed utilization in poultry production systems in Delta state, Nigeria was investigated. The result of the study shows that feeds allocative efficiency was higher in egg production (21%) than in broiler production (8%). This implies that every ₦100 expended on poultry feeds will contribute about ₦21 to total profit realized by egg producers and ₦8 to total profit realized by broiler producers in the study area. The negative shadow price of ₦1.8, implies that when cost of feed increases by ₦1, profitability in egg production will drop by about ₦2, also, the negative shadow price of ₦8.6 implies that when cost of feed increases by ₦1, profitability in broiler production will drop by about ₦9. This study has demonstrated a positive relationship between feed allocative efficiency and profitability in commercial egg and broiler production in the study area. Policy issue therefore should be directed towards subsidizing poultry feed cost, this will reduce the share of feed cost from about 70% of poultry total cost as reported by previous authors. This will increase profit obtained by producers; there by culminating in improvement in the poultry industry.

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