Technical Efficiency and Production Elasticity of Broiler Producers in Edo State, Nigeria

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ABSTRACT

There is a pressing need to increase broiler output in Nigeria in order to meet the inadequate supply of animal protein. The relatively poor technology used in smallholder farms results in significantly lower feed efficiency, marketing of low weight broilers at the end of fattening period and very high mortality rates. This situation is mainly attributable to failure to exploit economies of scale and modern care systems such as fully automated feeding, which decreases feed waste. An awareness of the implicit relationship between the resources and the product will stimulate the farmers to improve on their existing methods of production. This will help in increasing production and productivity of the farmers at lower cost of production and hence increased profits. This study was designed to analyze the farm level technical efficiency and production elasticity of broiler farmers in the study area. A multi-stage sampling procedure was used in selecting the 140 broiler farmers interviewed in this study, through a combination of purposive, random and snowball sampling techniques. The data that were used in this study were collected from a cross-sectional survey of broiler farmers in the State via the use of a well-structured questionnaire. Maximum likelihood estimates of the parameters of the stochastic frontier production functions showed that all the coefficients of the variables of the production function conformed to a priori expectations and were positive, with the exception of medication cost. The estimated coefficient of feed intake was 0.19 and it was significant (p < 0.01). The estimated coefficient of stock size was 1.03 and it was significant (p < 0.01). Results also showed that 82.9% of the respondents had technical efficiency levels of 0.81 and above. Result of the diagnostic statistics indicated that there were technical inefficiency effects in broiler production in the study area, as confirmed by the large and significant value of the gamma coefficient (0.74). Also, the generalized likelihood ratio was significant (p < 0.01). The respondents were operating at increasing returns to scale (stage 3 of the production function) as shown by the summation of the elasticities of the inputs which was greater than one (1.2). It was concluded that some gaps exist at farm level technical efficiencies of broiler farmers in Edo State. Improved technical efficiency of broiler farmers can be achieved in the study area by filling these identified gaps. Also, broiler farmers could benefit from economies of scale linked to increasing returns at a way of enhancing production and reducing the susceptibility of the sector.

Keywords: Diagnostic, Estimate, Frontier, Poultry, Production, Returns, Scale, Smallholder.

INTRODUCTION

In Nigeria, the poultry population is estimated to be 180 million (Ocholu et al., 2006). In the past, poultry farming involved raising chickens in the backyard for daily egg production and family consumption. Effiong and Onyeweaku (2006) however reported that poultry business has changed from subsistence to commercial poultry farming. This agrees with the findings of Hamtra (2010), that poultry farming is now a huge business that is split into several operations including hatcheries, broiler farms for meat production and pullet farms for egg production. The poultry industry has emerged as the most dynamic and fastest expanding segment in the animal husbandry sector. Poultry production has been identified as a means of ensuring sustainable family income. It can be established with minimum capital and as a side project (Sani et al., 2000). Moreover they can feed for themselves on free range without much care. Depending on the farm size, broiler farming can be the main source of family income or can provide subsidiary income to farmers throughout the year. Broilers are marketed at an average age of around 56 days, it is a short term enterprise and therefore a number of batches can be raised within a year (Effiong and Onyeweaku, 2006). Broiler production is carried out in all parts of the country with no known religious, social or cultural inhibitions associated with their consumption. The structure of the poultry industry in Nigeria is represented by approximately 40% of commercial operations and 60% of backyard poultry farmers (Walshe, 2006).

The inadequate production of farm crops to meet the needs of man and his livestock (Babatunde, et al. 1990; Esonu et al., 2001) as well as the threat of desert encroachment in many parts of West Africa sub region has destroyed the vegetation and depleted livestock population (Idafucho, 1984, Madubaise, 1992). Thus for sustainable animal protein production (Nwagah, et al. 2000); Ekenyem 2002), and Esonu et al. 2003) have suggested immediate search for cheap and readily available sources of protein and energy particularly those not competed for between man and livestock.

Production cost for broilers is highly correlated with the scale or farm production, feed conversion rate, chick cost, feeding period, number of birds, market live weight, management pattern and enterprise type. Economies of scale arise mainly from effective and efficient management, high quality health care that reduces mortality rate, provision of high quality feed that enhances growth and result in large final live weight at marketing and also integration of various production stages with sufficient capacities. The relatively poor technology used in small scale farms results in significantly lower feed efficiency, marketing of low weight broilers at the end of fattening period and very high mortality rates. The poor technology used on small scale farms is due mainly to failure to exploit economies of scale and modern care systems such as fully automated feeding, which decreases feed waste. Higher production costs on smallholder farms have been accentuated by rising input prices and marketing problems due to inadequate marketing infrastructure such as slaughter houses and selling lots of broilers at above their economic marketing weights or beyond optimum marketing age. Consequently, marketing the broilers take more time which prolongs the fattening period. There is therefore, the problem of finding adequate means of increasing technical efficiency among broiler farmers. The study seeks to determine whether and to what extent resources are efficiently utilized by broiler farmers in the study area as well as the respective elasticities of production associated with the raising of broilers. The objective of this study was thus to determine the technical efficiency and production elasticity of broiler production in Edo State, Nigeria.

METHODOLOGY

The Study

The study was conducted in Edo State, Nigeria. The State lies within the geographical co-ordinates of Longitudes 050o 44’ and 060o 49’ and 040o 34’ and 050o 44’ of the Greenwich Meridian and Latitudes 050 44’ and 070 34’ North of the Equator. The State is characterized by a tropical climate that ranges from humid to sub humid at different times of the year. There are two distinct seasons - rainy and dry seasons and an average temperature ranging from a minimum of 24oc to a maximum of 33oc. The three distinct vegetations identified in the State are Marshland, Fresh Swamp and Savannah. The major occupations of Edo people outside the public sector employment are trading, farming (including livestock production), fishing, metal and wood work, carving and other related artisanal endeavours.

Sampling techniques

A multi stage sampling procedure was employed in selecting respondents for this study.

Stage I: The three Agro-Ecological Zones of the State (Edo South, Central and North) as delineated by Edo State Agricultural Development Programme (ADP), were purposively selected in order to have a State wide coverage.

Stage II: Three Local Government Areas (LGAs) were randomly selected from each of the three Agro – Ecological zones in the State, making a total of nine LGAs. The selected LGAs included: Ukpoko Okha, Oredo and Ovia North East from Edo South; Esan South East, Esan Central and Igbofen from Egor of Edo and Etsako East, Owan East and Owan West from Edo North.

Method of data collection

The data that were used in this study were collected from a cross-sectional survey of broiler farmers in the State using a well structured questionnaire. Data were collected on the socio-economic characteristics of the farmers, matured weight of broilers, farm size, number of batches reared annually, amount and cost of labour, feed and medication used, other variable costs, price of matured broilers and constraints faced by the broiler farmers.

Method of data analysis

The Stochastic Frontier Production Function (SFPF) was used in analyzing the data obtained from the questionnaire. Frontier model: The linearized Cobb – Douglas form of the production function, which is attributed to controllable factors (technical inefficiency) (It is independent of Vi, half normal and variation in output, which are due to the factors that are not within the influence of the producer (It is assumed to be constant). Stochastic Production Frontier is explicitly expressed as;

\[ \ln Y = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + (V_i – U_i) \] …………………………… (1)

Where; \( Y \) = output of broiler (Kg); \( \ln \) = natural logarithm; \( X_{1} \) = quantity of feed (Kg); \( X_{2} \) = labour (Man – days); \( X_{3} \) = cost of medication (naira); \( X_{4} \) = total number of birds (Broiler stock size); \( \beta_0 \) = unknown parameters to be estimated; \( V_i \) = ith farmer; \( V_i \) = random error term, which captures the random variation in output, which are due to the factors that are not within the influence of the producer; \( U_i \) = non – negative random error term representing the deviations from the frontier production function, which is attributed to controllable factors (technical inefficiency) (It is independent of Yi, half normal and identical distributed with zero mean and constant variance \( (0, 0.5) \)).

\[ \text{TE} = \text{Yi} - \text{Yi}^* \] …………………………… (2)

Where Yi = observed output of the ith farmer; Yi* = frontier output of the ith farmer.
RESULTS AND DISCUSSION

Socioeconomic characteristics of respondents

Results showed that majority (58.0%) of the respondents were males indicating that more males participated in broiler production in the study area. About 96.0% of the respondents was married indicating that more males participated in broiler farming was not popular among the unmarried people. With respect to education, 99.0% of the farmers was educated, ranging from primary to tertiary education with the majority (44.0%) having secondary education. This is in contrast with the report by Emokaro and Ezehabor (2005) in which 31% of respondent were educated up to secondary school level. Educated farmers would be highly receptive to new innovations which could enhance production and productivity.

Majority (61.0%) of the respondents had household sizes ranging between 1 – 6. Also, majority (56.0%) utilized family labour. This could be as a result of their scale of operation which was small, with an average of 666 birds/farmer. Omotosho and Ladele (1988), classified poultry farms into small scale (having less than 1,000 birds), medium scale (having between 1,000 and 5,000 birds) and large scale (having more than 5,000 birds) respectively.

These results also indicated that 56.0% of the farmers reared broilers on seasonal basis. This could be attributable to the fact that the demand for broilers is seasonal. About 61.0% of the respondents indicated that broiler production was their primary choice of business and about 34.0% indicated that it was a means of augmenting income. The respondents’ age ranged from 22 – 62 years with the majority (47.0%) falling in the range of 41 – 50 years. The respondents could be classified as middle aged as 78% of them were less 51 years old. With respect to farming experience, about 51.0% of the respondents had experience of less than six years. Only about 4.0% had acquired experience above 15 years. This implies that majority of the respondents were green hounds in the business. This is also in line with the findings of Taru, et al. (2010) that broiler producers are not adequately experienced, as their average years of experience in broiler production was found to be 3 years. The relatively low number of experienced farmers suggests that broiler farming is not an enduring occupation amongst the respondents. Perhaps, farmers abandon the occupation along the line owing to risks and uncertainties in the business. Majority of the respondents (46.0%) reared two batches of broilers annually. This may have been as a result of the observation that most of the respondents were seasonal farmers or that reared birds only during the Christian festive seasons of Easter and Christmas because of the seasonality in demand for the product. About 73.0% of the respondents sold their birds between the ages of 8 – 12 weeks because of the high demand during these festive periods.

Production function estimates

The Maximum Likelihood Estimates of the parameters of the SFPFs (Table 1), showed that all the coefficients of the variables of the production function, except for cost of medication conformity to a priori expectations and were positive. The estimated coefficient for feed intake was 0.19 and it was significant (p < 0.01), indicating that an increase in stock size will lead to an increase in the output of broilers. Subashah, et al. (1999) and Ajibefun (2000), demonstrated that increases in feed intake and stock size will bring about a corresponding increase in output. According to Bicanacho et al. (2000), an increase in stock size means that more inputs will be used and consequently more output is expected under good management. Since stock size had the highest coefficient, it means that more increase can be experienced in the output of broilers, by increasing the number of birds in their farms.

$$\ln Y = 1.12 + 0.19 X1 + 0.05 X2 - 0.04 X3 + 1.03 X4 + V1 + V2$$

Where D = fully efficient farm.

The technical inefficiency affects $$U_i$$ is defined by

$$Ui = 0 + 1Z1i + 2Z2i + 3Z3i + 4Z4i + 5Z5i + 6 Z6i + 7 Z7i + 8 Z8i$$

Where Z1 = age of farmers (years); Z2 = gender of farmers (Female = 1, Male = 0); Z3 = Household size; Z4 = level of education (years of formal schooling); Z5 = Years of experience; Z6 = Nature of farming (seasonal = 0, all year round = 1); Z7 = Age at which birds are sold (weeks); Z8 = Age2

About 96.0% of the respondents was married indicating that more males participated in broiler production. From the findings, the elasticity of feed intake was 0.19 meaning that a 100% change in feed intake will bring about a 19.0% change in output of broilers if other factors are held constant. This result compares favourably with the findings of Oladeebo and Ambe – Lamidi (2007), that variables of total number of birds stocked and feed intake by the birds were positively signed and significant in broiler production. Also, Efonjio (2005), Etim (2009), Ibe (2011), Ezeh, et al. (2012) and Areret – Tidose, et al. (2012), demonstrated that feed intake and stock size were significant determinants of output in broiler production.

The coefficient of labour use was also positive meaning that as labour use increased, more output accrued to the farmers. This can however be possible up to a certain limit, due to the law of diminishing returns. Bicanacho, et al. (2006), observed that this kind of relationship is expected where the available labour is not efficiently managed along with other resources in order to avoid diminishing returns to labour. Emenyonu, et al. (2006), reported that the coefficient of labour was positive but insignificant, due to the fact that the variables specified in the model (with the exception of stock size) had inelastic effect on output. The estimated elasticities of feed intake and labour use were in the stage of economic relevance in the production function. Their elasticities were less than unity indicating that output of broiler production is inelastic with respect to the above factors. As a result, a change in the use of these variables would lead to a less than proportionate change in the output of broilers. The elasticity of the coefficient of stock size was positive. It indicates that the variables specified in the model (with the exception of stock size) had inelastic effect on output.
irrational stage (stage 1), production could be increased by using more of the factors with positive elasticities especially stock size, which was observed to be the most important factor in broiler production in the study area. This agrees with the result of Alabi and Aruna (2005), who reported return to scale of 12.29 in their study of family poultry production in the Niger – Delta region of Nigeria. They concluded that the farmers were in stage 1 (inefficient stage) of the production process. It was recommended that more variable input be utilized in broiler production so as to enhance efficiency.

### Table 3: Estimated elasticities and return to scale in broiler production

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std error</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed</td>
<td>0.12</td>
<td>0.09</td>
<td>1.89***</td>
</tr>
<tr>
<td>Labour</td>
<td>0.01</td>
<td>0.01</td>
<td>1.73***</td>
</tr>
<tr>
<td>Medication cost</td>
<td>-0.04</td>
<td>0.05</td>
<td>-1.89</td>
</tr>
<tr>
<td>Chick size</td>
<td>1.00</td>
<td>1.00</td>
<td>1.73</td>
</tr>
</tbody>
</table>

### Inefficiency sources model analysis

Result of the diagnostic statistics presented in Table 3 indicated that there were technical inefficiency effects in broiler production in the study area. This is confirmed by the large and significant value of the gamma coefficient. The gamma value of 0.74 indicated that 74.0% of the variation in the output of broiler production by the respondents was attributable to technical inefficiency effects alone, while only about 26.0% was due to random effects. Also, the generalized likelihood ratio was significant at 1% level suggesting the presence of one sided error component. This means that inefficiency factors were significant in the stochastic frontier model.

The coefficients of farmers’ age, gender, nature of farming and age (squared) of the birds were positive and less than unity. This implies that these factors led to an increase in technical inefficiency. Age (squared) was significant at 1% level suggesting the presence of one sided error component. This means that inefficiency factors were significant in the stochastic frontier model.

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### Conclusion

It can thus be concluded that some gaps exist in the farm level technical efficiencies of broiler farmers in Edo State. Resources were inefficiently utilized by broiler farmers in this study. Inefficiency can be achieved technically by making input use more efficient through increased stock size and reduced cost of medication in broiler production. The study therefore recommends that broiler farmers be assisted in accessing credit facilities (especially soft loans) by relevant stakeholders. This would enable them to increase stock size, output and profit since there is some potential for increasing returns from broiler production in the study area.

### REFERENCES


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INTRODUCTION

Human existence relied on the forest for food, shelter, clothing, health, entertainment as well as industry and commerce. Man also depends on the forest for cultural, spiritual, environmental and aesthetic needs. His activities are therefore intricately connected to the conservation of the forest; hence the imperatives of indigenous knowledge-based conservation systems in forest conservation and sustainable development (Olufol and Bruh 1996, Bisong and Eissen, 2010). IUCN (2010) reported that many indigenous people who are living in forest areas have traditional links to their lands and are users and managers of these forest land resources. Byarugaba (2008) maintained that local people, through experience have acquired knowledge of the extent of variation in the traits usually displayed by individual trees. They can therefore use such knowledge to develop and adopt methods that can conserve and sustain these resources and the general ecosystem in perpetuity.

Indigenous knowledge-based conservation system is therefore seen as a complementary knowledge that is set to weld or harmonize the potentials of conservation in sustainable development.

According to the Rio Declaration on Environment and Development (1992), long term economic progress is ensured if it is linked with the protection of the environment and that indigenous people and their communities have vital roles to play in environmental management and development Indigenous knowledge is an important natural resource that can facilitate development. Indigenous knowledge-based conservation system is therefore imperative for improved forest resource management efforts in Benue State, Nigeria. Data for this study were collected with structured questionnaire administered on randomly selected 300 households from 50 out of the 23 Local Government Areas (LGA) of the State. Two respondents (male and female) were interviewed in each of the 150 households that were selected. Data were analyzed using descriptive statistics and Analysis of Variance (ANOVA). Tree identification methods, systems for determining flowering periods, and indicators of fruiting in forest trees constituted the indigenous knowledge systems of forest conservation in the area. For tree identification, respondents used leaf texture, trunk, flowers, fruits/seeds, leaf size, leaf colour, bark and tree size. Except for leaf size, there were no significant differences (p>0.05) across the ethnic groups. Identification of flowering periods was done using season, observation, presence of birds, bees, flowers, leaf sprouts among others with only bird indicators showing significant differences (p<0.05) among the ethnic groups. Indigenous indicators of fruiting included odour and presence of insects (bees, butterflies), birds, bats and snakes with no significant differences (p>0.05) in all the variables among the ethnic groups. The indigenous forestry knowledge systems should be integrated with the scientific approaches to produce a synergy that will encourage, stimulate, facilitate and promote effective forest management and indigenous people’s participation.

Keywords: Indigenous knowledge, Forest Resources Management, Benue State, Participation, Integration, Tree identification.