TECHNICAL EFFICIENCY OF SNAIL FARMING IN NGOR OKPALA LGA OF IMO STATE, NIGERIA.

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ABSTRACT

Low productivity in agriculture is mainly due to the inability of the farmers to exploit the available technologies fully, resulting in lower efficiencies of production. This study employed a Cobb-Douglas stochastic frontier production function to measure the level of technical efficiency and its determinants in snail production in Ngor Okpala LGA of Imo state, Nigeria. Primary data was generated through the use of closed and open ended structured questionnaire in line with the objectives of the study. Respondents were selected through a systematic random sampling procedure. 40 snail farmers were selected, from whom socioeconomic and input-output data were obtained using the cost-route approach. The parameters of the stochastic frontier production function were estimated using the maximum likelihood method. The study found farm size, labour and feed to be positively and significantly related to output at 5% level of significance. Socioeconomic factors influencing technical efficiency directly were farming experience and credit access at 5% level of significance. Age and stock size were negatively and significantly related to technical efficiency at 5% level of significance. Result of returns to scale analysis showed that snail production is at the stage of increasing returns to scale. We recommend that Snail farmers should have greater access to formal credit facilities from lending institutions in order to expand and improve their production. They should be encouraged to form stronger co-operative societies so as to expand their scope of production and marketing. Farmers are advised to grow most of the green feed stuffs the snails eat to save costs.

Key words: Technical efficiency, Snail farming, Ngor Okpala LGA, Imo State

Introduction

As enterprises utilize various inputs for production, the outcome of input processing is not directly related to the amount and cost of inputs. It is the technical process that affects the final output. Hence, two identical firms having identical input structures may end up with different quantities of outputs or different cost-revenue structures. However, the evaluation of success of the enterprises in terms of effective use of inputs and maintenance of a sound cost structure lies in the technical efficiency analysis of the process (Ozkan *et al.*, 2009). Thus snail farming an aspect of micro livestock, being a relatively new business enterprise in Nigeria requires a scrutiny of their technical efficiency of production. The most common commercial types in Nigeria are the *Archachatina maginata* and *Achatina achatina*.

Snail farming can be a lucrative enterprise because these days snails are seen as rich people`s stuff because of their costs that are usually out of reach of the average Nigerian. Most of the snails come from the wild and it is only recently that snails have been raised domestically. Nigeria is naturally endowed with a high population of edible snails. They have huge export potentials to earn foreign exchange either as primary or finished goods. Local demands are high and usually command premium prices in restaurants and drinking bars (Akinnusi, 1995).

Snails are treasured as traditional sources of nutrition and delicacy in the study area even in other parts of the country where snail consumption is not regarded as a taboo. This endowment can best be harnessed by establishing commercial farms for snails; else they will become less available or even extinct as a result of the present uncontrolled destruction of their natural habitat through bush burning and other forms of deforestation (Ajayi *et al.*, 1978). According to Awah (1992), snail meat is rich in protein and irons. In addition, it is low in total fat content 1.64%; saturated fatty acid 28.71%; and cholesterol content 20.28mg/100g fresh sample when compared to other samples (Beef, Broiler meat, Goat meat, Mutton, Pork, *Clarias lazera*, and *Tilapia macrocephala)* while its amino acid profile was generally similar to those of other samples. He also showed that snail meat is a rich source of minerals particularly calcium and phosphorous, with values of 185.70mg/100g and 61.24mg/100g dry sample respectively Again the amounts of these minerals in the others for example beef sample 53.00mg/100g calcium and 24.05mg/100g phosphorous is much lower than is present in snail meat (Awah,1992). Hodasi (1984) posited the merits of snails as food along the West African coast was not only because of the nutritive value of the meat; he asserted that scientific reports proved that snail is used for the treatment of hypertension, vitality in men, heart diseases, stomach ulcer, anaemia, pile, asthma and many others. He also asserted that it is also good for pregnant women.

Regrettably, we are faced with the precarious situation where the cost of conventional protein sources which cannot be kept by the poor, such as cattle, goat, sheep and fish has become so prohibitive in recent times. The animal protein intake/capita/day of Nigerians has been estimated at 15g and this is only about 43% of the recommended daily requirement (Udedibie, 1989).

Hence, in view of this protein deficiency, the role of increased efficiency and productivity of snail farms is no longer debatable but a great necessity in order to reverse the seemingly low technical efficiency of snail farms in Nigeria, since it has the potential for bridging the protein gap. This study is aimed at opening a new dimension to farmers and policy makers on how to increase snail production by determining the extent to which it is possible to raise efficiency of snail farms with the existing resource base and available technology in order to address fully the snail production problems in Nigeria.

Methodology:

Study area:

Ngor Okpala Local Government Area in Imo State of Nigeria which is located in the rain forest belt of Nigeria; was carved out of Owerri North and Owerri Municipal. Ngor Okpala lie between latitude 5^o 25`N and 5$^o$ 31`N and longitude 6^0 59`E and 7$^o$ 04`E. Ngor Okpala has a land area of about 12, 145 square kilometres, with population of about 950,000. Climatically, Ngor Okpala is characterized with heavy rainfall pattern averaging about 1900mm (190cm) per annum, temperature ranging from 22^0 C-34^0 C daily (Imo State Government, 2007). The area was chosen because most of the inhabitants are engaged in snail farming; this is justified by the presence of thick forests in the area which from time origin portrayed the natural habitats for snails.

Sampling Procedure:

The Local Government was purposively chosen because it has a large number of commercial snail farmers. From the thirteen (13) towns that make up the Local Government Area, four (4) were randomly selected. From this four, ten (10) snail farmers were systematically selected to make a total of forty (40) respondents for financial and logistic reasons. Here every other 10^{th} farm starting from the house of the traditional ruler of each town was sampled. Primary data were drawn using oral interview and structured questionnaire to elicit information on socioeconomic attributes, labour use, feeding, access to credit among others.

Estimation of Technical efficiency: The Cobb-Douglas functional form using the stochastic frontier production function was used to estimate the technical efficiency of the farmers. The stochastic frontier production model is specified as follows following Aigner *et al.,(* 1992), Meeusen and van den Broeck, (1997)

$Yi = F (Xi;\beta) \exp (Vi - Ui); : =1,2,- -n$ ---------------------- (1)

Where,

Yi = denotes number of matured snails from the i^{th} farm
Xi = is a vector of functions of actual input quantities used by the i^{th} snail farm
β = is a vector of parameters to be estimated
$Vi - Ui$ = is the composite error term

Where,

Vi and Ui = are assumed to be independently and identically distributed
Ui = is a non-negative random variable, associated with technical inefficiency in production.
Vi = is a random error, which is associated with random factors not under the control of the snail farmers. The functional form of this model used in estimating the level of technical efficiency is the Cobb-Douglas type (Bravo-Ureta and Evenson, 1994) is

$Ln\, Y_i = \beta_0 + \beta_1 Ln\, X_1 + \beta_2 Ln X_2 + \beta_3 Ln X_3 + \beta_4 Ln X_4 + \beta_5 Ln X_5 + V_i - U_i$ ………(2)
Where,

Ln = represents the natural logarithm
The subscript i represents i-th sample farmer
Y_i = Snail output in numbers for the i-th farm
X_1 = stock size measured as total number of snails per farm
X_2 =Labour used, in mandays used in production

X_3 =Quantity of green and supplementary feeds used in kg
X_4 = Number of breeding stock
X_5 = Depreciation on capital inputs such as wooden boxes and concrete trenches(physical structures in naira)
β_0 = intercept.
β_1 -β_5 = coefficients estimated

Determinants of Technical Efficiency: In order to determine factors contributing to the observed technical efficiency in snail production, the following model was formulated and estimated jointly with the stochastic frontier model in a single stage maximum likelihood estimation procedure.

$$TEi:= ao+a_1Z_1+a_2Z_2+a_3Z_3+a_4Z_4+a_5Z_5+a_6Z_6+a_7Z_7+a_8Z_8 \ldots\ldots (3)$$

Where

TEi, is the technical efficiency of the i^{th} farmer, Z1 is farmers age in years, Z2 is farmers level of education in years, Z3 is the number of extension contacts made by the farmer in the year, Z4 is household size, Z5 is stock size , Z6 is farmer's farming experience in years, Z7 is supplementary feed, a dummy variable which takes the value of unity for supplementary feed use and zero otherwise, Z8 is credit access, a dummy variable which takes the value of unity if the farmer has access to credit and zero otherwise, while a0 and a1,a2….a8 are regression parameters to be estimated. We expect a1,a2, a3, a5, a6, a7 and a8 to be positive(i.e >0) and a4 negative(i.e <0).

Returns to Scale:

The coefficients of the model in Equation (2) are the measures of elasticity of production. Coefficient $\beta 1$ is the percent change in output resulting from a one percent change in the input $x1$. Similarly, the coefficient on each input is the percent change in output resulting from a one percent change in the input. In a Cobb-Douglas production function, the sum of these coefficients, $\beta 1+\beta 2+\beta 3$, is the degree of homogeneity, which measures whether the production function is constant, increasing, or decreasing returns to scale. Three possibilities exist:

(1) If ($\beta 1+\beta 2+\beta 3 \ldots n$) = 1, there are constant returns to scale.
(2) If ($\beta 1+\beta 2+\beta 3 \ldots n$) < 1, there are decreasing returns to scale.
(3) If ($\beta 1+\beta 2+\beta 3 \ldots n$) > 1, there are increasing returns to scale.

Result and Discussion:

Table 1 show that the estimate of the variance parameter (0.0835) was significantly different from zero at 5% level of significance, indicating a good fit and the correctness of the distributional assumption specified. The variance ratio (γ) which was significantly different from zero at 5% level of significance showed that the farm specific variability contributed about 26% variation in yield among the respondents, which implies that about 26% of the differences between the observed and maximum production frontier outputs were due to differences in farmer's levels of technical inefficiency and not related to random variability. Hence, labour, stock size and feed are under the control of the farmer and the influence of which can be minimized to enhance technical efficiency.

As expected, the signs of the slope coefficients of the stochastic frontier were all positive. This implies that any increase in the variables whose coefficient was positive would lead to increase in output which agrees with a priori expectations. Labour has the highest coefficient of 0.56 followed by stock size at 0.16 and supplementary feed at 0.45, being significant at 5%.

Determinants of Technical Efficiency:

The result of the determinants of technical efficiency in Table 1 show that the coefficient for age was negative and significantly related to technical efficiency, which agrees with a priori expectation at 5.0% level of probability. This implies that increasing age would lead to decreased technical efficiency. Ageing farmers would be less energetic to do strenuous work thus , leading to low productivity as well as low technical efficiency, this is in line with the findings of Okoye *et al.*, (2007), Ajibefun and Daramola (2003) and Ajibefun and Aderionla (2004).

Stock size had a positive coefficient and highly significant at 5% level of probability. This corroborates the findings of Baba and Adeleke (2006) who posited that stock size was the most important factor determining profitability and hence technical efficiency of snail enterprises. Hazarika and Subramanian (1999) in their study reported that the coefficient for level of experience was also positive and significant at 5% level of probability. This also confirmed a priori expectations; more experienced farmers are expected to have higher level of technical efficiency than farmers with lower farming experience. This result agrees with the findings of Onyenweaku and Effiong, (2005), Onyenweaku and Nwaru (2005), Onyenweaku, Igwe and Mbanasor (2005) and Okoye *et al.,* (2007). Access to credit also had a positive coefficient at 5.0% level of significance which confirms a priori expectation.

Returns to scale (RTS):

The Cobb-Douglas production function was estimated to measure the degree of returns to scale for snail farms in the study area. The regression results were presented in Table 1 while the RTS is tabulated in Table 2. For testing that the production function was constant returns to scale, the null hypothesis that h=1 was also tested. As the t-statistic in absolute terms was less than 2.00, the test rejected the null hypothesis, as the coefficient h was greater than 1 by this test. As described in methodology, $h = \beta 1+\beta 2+\beta 3+ \beta 4+ \beta 5$, which measures the degree of homogeneity. As $\sum \beta`s > 1$ (h=1.3098) by the above test, these results showed that the production function for snails exhibited increasing returns to scale. *T-statistics* and p-value were significant. These results indicated that if all inputs are increased proportionately, the output is increased by a larger proportion (Varian, 1992).

Conclusion and Recommendations.

The parameters of the stochastic frontier production function were estimated using the maximum likelihood method. The study found farm size, labour and supplementary feed to be positively and significantly related to output at 5% level of significance. Socio economic factors influencing technical efficiency directly were farming experiences and credit access at 5% level of significance. Age and stock size were negatively and significantly related to technical efficiency at 5% level of significance. Result of returns to scale analysis showed that snail production is at the stage of increasing returns to scale and as such all efforts should be geared towards increasing output. We recommend that Snail farmers should have greater access to formal credit facilities from lending institutions in order to expand and improve their production. They should be encouraged to form stronger co-operative societies so as to expand their scope of production and marketing. Farmers should learn to grow most of the green feed stuffs the snails eat to save costs.

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Table 1: Estimation of the Cobb-Douglas Stochastic Production Function of factors affecting snail production.

Production factors	Parameter	Coefficient	Standard error	t-value
Constant term	β_0	4.8534	0.4421	10.9767
Stock size	β_1	0.1626	0.0608	2.6747
Labour	β_2	0.5630	0.0863	6.5256
Feed	β_3	0.4522	0.0204	2.2134
Breeding stock	β_4	0.0872	0.0510	1.7100
Depreciation of assets	β_5	0.0448	0.0468	0.9609
Factors of inefficiency				
Constant term	α_0	0.4527	0.2512	1.8019
Age	α_1	-0.0148	0.0061	2.4376
Education	α_2	0.0133	0.0130	1.0276
No of ext. visits	α_3	-0.0092	0.0300	-0.3065
Household size	α_4	0.0086	0.0153	0.5621
Stock size	α_5	-0.9595	0.3653	2.6267
Yrs of farming exp.	α_6	0.0174	0.0067	2.5902
Feeds	α_7	0.02343	0.1354	1.7296
Access to credit	α_8	0.2730	0.1258	2.1769
Diagnostic Tests				
Total variance	σ^2	0.0835	0.0094	8.9140
Variance ratio	γ	0.2601	0.1502	2.6718
LR Test		16.6180		
Log-likelihood function		-5.7863		

Source: Author`s computation from field data using Frontier version 4.1

Table 2: Elasticity of snail production and returns to scale

Variable	**Elasticity**
Stock size	0.1626
Labour	0.5630
Feed	0.4522
No of breeding stock	0.0872
Depreciation of assets	0.0448
RTS	1.3098

Source: Author`s calculation, 2009