

**ESTIMATION OF EFFICIENCY CONSTRAINTS USING COBB-DOUGLASS
PRODUCTION FUNCTION IN SNAIL (*Archachatina marginata*) PRODUCTION BY
SMALL FARMERS IN CROSS RIVER STATE, NIGERIA**

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ABSTRACT

This study examined constraints militating against the profitability potentials of snail (*Archachatina marginata*) production by small-scale snail farmers in Cross River State, Nigeria. Data were obtained from a random sample of 120 respondents in the study area by means of structured and semi-structured questionnaire. The first stage involved random selection of three local government areas from (Ogoja, Ikom and Odukpani) eighteen local government areas in Cross River State, Nigeria. This was followed by random selection of three villages (Igoli in Ogoja Local Government Area, Alesi in Ikom Local Government Area and Adiabo in Odukpani Local Government Area) in Cross River State. Fourty (40) respondents were randomly selected from each of the villages. Data collected were analyzed using descriptive statistics and costs-returns analysis. The results indicated that Cobb-Douglas production function had the best fit in explaining the relationship between output of snail and inputs used, the coefficient of multiple determinant ($R^2=0.60$ indicates that sixty percent of the variability in output of snail is explained by the independent variables). Results from the analysis revealed that the marginal value products of farm size, labour, farm management practices and operating costs were ₦1080, ₦20.6, ₦972.8, ₦ 14.84 respectively, there existed allocative in-efficiency, there is a high potential for snail farmers to increase their yields and income. Further analysis of results revealed that net returns on snail is ₦2,935,000.00 with return on every naira invested of ₦ 0.14 is also positive indicating a profit from the business, with attractive net return on investment. This study shows that snail farmers are faced with several problems in their production activities. These problems or constraints affect the efficiency of snail production in the study area. Notable among them are high cost of feed supplement, lack of capital, inaccessibility of formal credit source due to lack of collaterals, lack of extension agents, lack of medication/vaccines, poor production infrastructures and lack of good farm management practices occupied 15%, 14.17%, 11.67%, 10%, 9.17%, 9.17% and 8.33%, respectively. The constraints associated with the business as highlighted in this paper if tackled could pave a way to increase profit and this will reduce poverty in Cross River State. Hence, for efficient production of snail in the study area, these constraints must be reduced. This can be done through efficient policy formulation and implementation, proper supervision of snail production programme, effective extension services and proper agricultural financing. Snail farmers in the study area should be trained by extension agents on how to control some of constraints that militate against the profitability potential of snail production. Beside that snail farmers should form cooperative group(s) in order to obtain loans from bank(s) to increase their capital base for higher output.

Key words: Constraints, Profitability, Potential, Snail farming

INTRODUCTION

Successive governments had embarked on policies and programmes aimed at boosting sustainable macro and micro/ livestock production in Nigeria, (Effiong and Onyenweaku, 2006). Micro livestock production refers to species of animals that are associated with small body size, moderate nutrition and management (Akinnusi; 1998). The small size of these micro/ livestock animals is undoubtedly one of their most significant assets since it makes it possible to produce and manage on small areas and in cluster (Thys, 2001).

During small body size, micro livestock animal (snail) can be easily handled, transported and managed by children and women with minimum training, thus keeping down production cost (Ekanem and Umoh, 1997). Capital owing cost for snail production is low due to moderate level of expanses incurred on nutrition; small area of farm size and costs equipment involved low in this industry. In most cases, housing and equipment requirements can be adequately satisfied by improvisations from local farm products and scraps. It makes production affordable for people with small compound or poor ones. It is possible to feed these

micro/mini-livestock with household wastes (Ayodele and Asimalowo, 1999). Furthermore, snail growth potentials make it possible to have very good output (Lameed, 2006).

Snail originated from south of the Saharan in East Africa (Belot *et al.*, 1991; Thompson and Cheney, 1996; Akinnusi, 1998; Ebenso, 2002 and Adinya, 2006). There are various species of snail in Cross River State namely: Golden snail (*Pomacea sp*), African giant edible tropical land snail (*Limicolaria aurora*), *Achatina fulica*, *Achatina achatina*, *Archachatina marginata*, *Limicolaria flammae*, *Lymnaea natalensis*, *Bulinus forskalii*, *Bulinus globosus* *Biomphalaria pfeifferi* and Freshwater snail (*Lymnaea acuminata*) (Ebenso, 2002; Adinya, 2006).

Out of all the animal protein foods produced and consumed in Nigeria, snail is of importance as it has remained a source of protein in the diet of rural and urban poor households in southern, eastern and western Nigeria which is rich in essential-amino acids (Nwandu, 1999). Snail has great advantages and potential in the areas of nutrition, growth and reproductive biology (Ekanem and Umoh, 1997). African giant edible tropical land snail (*Limicolaria aurora*) has nutritive value of 18.3% protein, 1.3% fat and 1.6% phosphorus (Ajayi and Tewe, 1984). They have very high rate of reproduction. The golden snail (*Pomacea sp*) may lay up to 1000 eggs per month (Datuin, 1993).

In Cross River State, the production and marketing of snail products is a thriving business that provides employment to hundreds of people. It provides an important source of livelihood for middlemen. Given the importance of snail in the Cross River State economy, one would have expected that the state would have been the largest exporter of snail products to other countries. Furthermore, Cross River State is supposed to be the largest producer of snail in world because the state is endowed with human and natural resources and beside that the environmental conditions favours snail production. In local markets, there is wide gap between production and consumption of snail. The Food and Agriculture Organization and World Health Organization (WHO) of the United Nations recommend a minimum of 65 grams of protein per day including 35grams from animal source for an average human adult. However, according to the Nigerian Livestock Perspective Plan for 1991-2005, the daily per capita animal protein intake in Nigeria is only about 16.36 grams (Otchere, 1995; Adinya, *et al.*, 2007). There is problem of protein malnutrition as a result of non-optimal use of resource (snail farmers are inefficient in resource utilization in snail production) and slow in adopting improved technology. Constraints to the production of snail in the study area are insufficient credit, poor wage rate discourages labourers from working hard, non-adoption of recommended practices, lack of processing tools for snail products, lack of educational training, poor storage

facilities and stagnant production technology among Nigerian's farming community majority of whom are the small-scale producers (Adinya, 2006).

To increase productivity in the state, sound macro and micro-economic farm policies are needed. These require knowledge of aggregate farm level resource availability and the differences in productivities of these resources in different areas (Adinya *et al.*, 2008a). In addition to that, snail farmers must learn to use improved technologies and improve in efficiency of resource use in snail production (Adinya, 2006). Ekanem and Umoh, (1997) revealed that due to low investment risk, high returns and flexible operation Agricultural Credit Guarantee Scheme Fund easily gives credit to snail farmers with out collateral (Adinya *et al.*, 2008a).

Theoretical framework: Farm Budget Model: The farm budget as a tool of analysis is one of the oldest and simplest, used in farm management and production studies. It has been used in number of economic studies for analyzing the profitability of farm production practice. Different methods of budgeting exist. However, these methods can be subdivided into two major categories: (a) total or complete budgeting and (b) partial budgeting. A total budgeting is used when contemplating a complete re-organization of the entire farm business, while partial farm budget is used when the action intend to be implemented does not affect the whole farm, for example, introducing a new business or purchasing new equipment for the farm. The choice of any type of budgeting tool depends on the circumstance under which the farm business is taking place, goal achievement objective and convenience. This study used partial budget as an analytical tool. Basically, it involves operations leading to estimates of net revenue and total cost for the same production period. The differences between two parameters are measure of profit or loss or net farm income for that period (Oluwole, 1970; Osifo and Anthonio, 1970; Olayemi and Oni, 1971; Adinya *et al.*, 2008d). The purpose of the model is to identify the costs, returns, profitability or loss per hectare. The total revenue represents the value of the output from the farm (i.e. physical quantity of snail multiplied by the unit price). The total cost on the other hand, is made up of the variables and fixed components. Variables costs also called specific costs vary directly with the level of production and include expenditure on labour and transportation cost etc. Fixed cost known as overhead costs do not vary with the level of output and consists of cash expenses (on repairs and maintenance, interest on loan) etc and non-cash adjustment like depreciation of farm tools and equipment. The computed returns and costs would be used to derive various measures of profitability including net return and return on capital invested in snail enterprise.

The central objective of farm business management is to increase the efficiency with which farm resources are used in the production of snail such that maximum farm profit is realized (Ogunfowora, 1986).

Production function gives the possible output that can be produced from given quantities of a set of inputs (resources) and their quantities can be varied to obtain optimal output. In carry out econometric analysis, production function provides the basis of decision making for snail farmers.

Economic theory identifies three important production efficiencies. These include allocative, technical and economic efficiencies. Allocative efficiency is the ability of the farmer to use the inputs in optimal proportions given their respective prices and the production technology. Technical efficiency is the measure of the farms success in producing maximum output from a given set of resources (inputs) i.e. ability to operate on the production frontier (Farrel, 1984).

Economic efficiency is the product of the technical efficiency and allocative efficiency. There is evidence that snail farmers in developing country like Nigeria fail to exploit fully the potential of resources and make allocative errors; which results to low yields. Several studies have shown that resources are not efficiently utilized by snail farmers in Nigeria (Akinnusi, 1995; Ayodele and Asimalowo, 1999; Amusan and Omidiji, 1999; Lameed, 2006). Therefore, having established the obvious fact that resources are not efficiently utilized in snail production in other states in Western Nigeria but none in Cross River State where snail is highly consumed because snail meat consumption is not abomination or taboo, it is the aim of this study to examine critically the problems of resource use in snail production. Ultimately, it is hoped that the study will help to bridge the gap between resources availability and efficient utilization in snail production in Cross River State. This study seeks to examine the production efficiency in snail (*Archachatina marginata*) in Cross River State, Nigeria; therefore this paper tried to provide some useful information in policies towards increasing snail production in Nigeria.

METHODOLOGY

The research study was conducted from 9th January, 2008 to 9th January, 2009 in Cross River State, Nigeria. The state occupies an area of about 22,342.176 square kilometers (Quarterly News Letter of the Ministry of Local Government Affairs, Cross River State, 2006). It is located at Latitude 5° 25'N and longitude 25° 00'E. The soils of Cross River State are ultisol and alfisol but predominantly ultisol (FAO/UNESCO, 1974).

Cross River State is producing milk, honey and snail for the nation and it has the largest rainforest covering about 7,290 square kilometers described as one

of Africa's largest remaining virgin forest harbouring as many as five million species of insects (bees, butterfly, mosquitoes, locust, etc), plants and animals (macro-livestock and micro/mini-livestock like snail (MOFINES,2004).

Cross River State is located within the evergreen rainforest zone that promotes the growth of snail. The rainfall has a bimodal pattern of distribution giving rise two growing seasons, from late March to the end of July. This followed by a short dry spell which starts by August and ends in December. According to Cross River Agricultural Development Program (CRADP, 1992b) there are two distinct climate seasons in the area, rainy season from March to October and dry season from November to February. The annual rainfall varies from 2,000mm to 3, 424mm. The average temperature is around 25°C (CRADP, 1992a; CRADP, 1992b).

Fishing and subsistence agriculture are the main occupations of the people. Crops and animals are grown in the locality. Population depends largely on natural water sources for all their water-related activities as piped water supply is limited and grossly inadequate. Both primary and secondary sources of data were used. The secondary sources of data include Review of Annual Reports, books, census data, journals and statistical documents whereas the primary source of data was mainly from field survey. Data were obtained through administration of structured and semi-structured questionnaire to 120 randomly selected respondents for the study. The first stage involved random selection of three (Ogoja, Ikom and Odukpani) local government areas from eighteen local government areas in Cross River State. This was followed by random selection of three villages (Igoli in Ogoja Local Government Area in the Northern senatorial district, Alesi in Ikom Local Government Area in the Central senatorial district and Adiabo in Odukpani Local Government Area in the Southern senatorial district) in Cross River State. The respondents were randomly selected from each of the villages, 40 respondents were selected each from three villages, making a total number of 120 respondents all together. The types of data collected for the study include information on cost of production and return from the sales of product. Also data were collected on constraints faced by snail farmers in the study area.

Data Analysis: The descriptive statistics such as frequencies distribution and percentages were used and Costs-returns analysis as described by Adinya *et al.*, 2008c; were used to estimate net returns, total cost of production and profitability of the business including net return and return on capital invested in snail business. A general model of the costs and returns analysis presented in the equation below was used in the analysis.

$$NR=TR-TC. \text{ Equation (1)} \quad TR=Q \times P \text{ equation (2)}$$

$$RI=\frac{NR}{TC} \text{ equation (3)}$$

TC

where NR=Net Return on snail produced (naira)

TR=Total Revenue from snail (naira)

TC= Total Cost of snail (naira)

Q= Quantity of snail produced in (kg)

P= Price of snail per kilogram

Ri=Return on capital invested in snail (naira)

The data obtained were analyzed using the Ordinary Least Square (OLS) multiple regression technique to determine the relationship between snail output and the selected variables. The linear, double-log and semi-log function forms were used to determine which of the forms would best fit the relationship between snail output and the explanatory variables.

The implicit form of regression model for this analysis was given as:

$$Y = F(X_1, X_2, X_3, X_4, X_5, e)$$

Where: Y = Value of total output of snail in (naira / hectare)

X₁ = Area of plots (farm size) devoted to snail production in (hectare)

X₂ = Total labour in (man-days/hectare)

X₃ = Farm management practices (measured on 5 point scale of diet containing 28% crude protein, yellow maize, groundnut cake, oil, bone meal, oyster shell, AD-Vitamin) or feed supplement = 1, provision of clean drinking water = 2, medication / vaccines = 3, construction of snail pen/cage with mosquito netting on the lid to cover loamy soil up to 3-5cm spread on the floor of the snail pen = 4, weeding of grasses around the snail farm = 5)

X₄ = Operating costs (naira/hectare)

X₅ = Farming experience (years)

E = Error (or disturbance term is included to capture the effects of exogenous and endogenous variables not included in the model). The functional forms were tried to ascertain the one that gives the best fit. There are Ordinary Linear Function, Cobb-Douglas (double-log), and semi-log production function forms. Whichever model that has the highest R² and shows many statistical significant variables was adopted following (Kmenta, 1971; Koutsoyiannis, 1977 and Awoke, 2001; Adinya *et al.*, 2008b).

The functional forms fitted are specified below:

(a) Linear production function: $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$...equation (1)

X₁-X₅ = are defined in the implicit form

b₁-b₅ = Regression coefficients of variables X₁-X₅

a = Constant term

e = Error term

(b) Cobb-Douglas Production Function (double log)

$$\text{Log } Y = \text{Log } a + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + b_3 \text{Log } X_3 + b_4 \text{Log } X_4 + b_5 \text{Log } X_5 + e$$
...equation (2)

(c) Semi-Log Production Function:

$$Y = \text{Log } a + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + b_3 \text{Log } X_3 + b_4 \text{Log } X_4 + b_5 \text{Log } X_5 + e$$
 equation (3)

Each resource was measured using the formula:

The average physical product (APP) was derived by dividing total output by total input i.e. $APP = \frac{Y}{X}$

The marginal physical product (MPP) was derived by dividing total output by total inputs $MPP = \frac{DY}{DX}$

$MPP \times \text{Price of snail product} = \text{marginal value product (MVP)}$

The allocative efficiency (AEL) of resource was determined by ascertaining whether or not the ratio of the marginal value product to the inputs price was equal to one

$$AEL = \frac{MVP}{P} = 1$$

where MVP = Marginal Value Product

P = Unit Price of Input

The marginal Products (MP) were derived by multiplying the average product (AP) by the elasticity of production (EP), given that: $MP = AP \times EP$

$$EP = \frac{MP}{AP}$$

RESULTS AND DISCUSSION

The socio economic characteristics of respondents presented in Table 1 show that respondents were all (100%) adults from above of 21 years, however, 83.33 percent of the respondents were age between 21-50 years. Only 16.67 percent of the respondents were aged between 51 years and above. Most of the respondents were within the economically active age. These findings are synonymous with Asa (2003) that people in age groups of 41-60 are more economically active and independent than those in the age group of less than 21 years and above 60 years. Data in Table 1 also reveals that 73.33 percent of the respondents were married while 14.17 percent were single. Only 12.50 percent of the respondents were widowed. The table also shows that the participation of married men and women in snail production is higher than single men and women. Table 1 revealed that 65.83 percent of the respondents had different levels of education and 16.67 percent of the respondents had no formal education. Some of the respondents (16.67%) saw lack of educational training as a factor militating against production of snail in the study area. The result implies that education was one of the most serious constraints against the efficiency of snail production in the study area. Of course this goes to confirm the earlier deduction by Stewart, (1975); that education acquired by farmers has a positive influence on farmers' labour and income. Adekunle (1978) stated that, technical and commercial education broaden the farmers/marketers intelligence and lay the basis for vocational training. In addition, it enables the farmers/marketers to perform the farm activities/ tasks intelligently and with a full appreciation of their contribution to the final product.

Table 1: Socio-economic characteristics of respondents in Cross River State

Age group(years)	Frequency of respondents in Igoli in Ogoja L.G.A.	Frequency of respondents in Alesi in Ikom L.G.A.	Frequency of respondents in Adiabo in Odukpani L.G.A.	Total frequency	Percentage
21-30	10	6	4	20	16.67
31-40	12	14	15	41	34.17
41-50	13	16	14	43	35.83
51- above	5	4	7	16	13.33
Total	40	40	40	120	100
Gender					
Male	35	38	37	110	91.67
Female	5	2	3	10	8.33
Total	40	40	40	120	100.00
Marital status					
Married	33	28	27	88	73.33
Widowed	3	7	5	15	12.50
Single	4	5	8	17	14.17
Total	40	40	40	120	100.00
Educational attainment					
OND/HND/BSC/MSC/Ph.D	1	2	1	4	3.33
JSSC/SSSC	8	5	4	17	14.17
FSLC	22	27	30	79	65.83
No education	9	6	5	20	16.67
Total	40	40	40	120	100.00

Source: Field survey, 2009

Table 2: Costs-returns of some farm management practices cost on output of snail in Cross River State

Cost/Return component	Quantity	Unit Price (₦)	Total value(₦)
Quantity of snail produced(kilogram)	78,998.34	300	23,699,500.50
Variable Cost(TVC)			
Cost of feed supplement			58,675.00
Cost of labour in man-days (hired labour)	720	500	360,000.00
Cost of construction of snail cage			17,550.00
Cost medication /vaccines			8,600.00
Cost of other operating expenses (transportation)			10,600.00
Cost of plastic container used for supply of clean drinking water	360	40	14,400.00
Cot of wheel barrow	120	6,000	720,000.00
Cost of shovels	120	1,800	216,000.00
Cost of rakes	120	450	54,000.00
Cost of head pan	120	1500	180,000.00
Fixed Cost (TFC)			
Cost of hiring land (hectares)	206	1,500	309,000.00
Buildings	120	135,000	16,200,000.00
Fencings	98	12,500	1,225,000.00
Interest on loan of (N450,000) at 8.5%	--	8.5	8,250.00
Depreciation of farm equipment(straight line method);			8,626,950.00
Total cost (TC) = (TVC +TFC)			20,764,500.50
Netreturn(TR-TC)			2,935,000.00
Return on investment			
NR (Net Revenue)			
(Ri) = $\frac{NR}{TC}$ (Total Production Cost) = 0.14			

Source: Field survey, 2009

Table 2 revealed that the per hectare cost of snail was ₦ 20,764,500.50. Human labour accounted for ₦ 360,000.00 of the total cost of production process (₦ 20,764,500.50). A total of 720 man-days were used in snail production. While the total revenue was ₦ 23,699,500.50. The net return on snail is ₦ 2,935,000.00.

The result in Table 2 indicated that the net returns on snail is ₦2,935,000.00 with return on every naira invested of ₦ 0.14 is also positive indicating a profit from the business. The result of the study agree

with the earlier contentious of Datuin (1993) and Lameed (2006) which stressed that snail farming is a profitable business.

Table 3: Constraints against the efficiency of snail production in Cross River State

Constraints	Frequency of respondents in Igoli in Ogoja L.G.A.	Frequency of respondents in Alesi in Ikom L.G.A.	Frequency of respondents in Adiabo in Odukpani L.G.A.	Total frequency	Percentage
High cost of feed supplement	7	5	6	18	15
Lack of extension agents	4	3	5	12	10
lack of good farm management practices	5	2	3	10	8.33
Lack of price information	2	5	4	11	9.17
Lack of capital	10	4	3	17	14.17
Inaccessibility of formal credit source because lack of collaterals	3	6	5	14	11.67
lack of medication/vaccines	3	5	3	11	9.17
Inaccessibility of formal credit source because of short repayment period	3	3	2	8	6.66
poor production infrastructures	2	4	5	11	9.17
Lack of storage facilities	1	3	4	8	6.66
Total	40	40	40	120	100

Source: Field survey, 2009

The study revealed that several constraints militating against the efficient snail production in Cross River State. These constraints are presented in Table 3. Notable among constraints are high cost of feed supplement, lack of capital, inaccessibility of formal credit source because lack of collaterals, lack of extension agents, lack of medication/vaccines, poor production infrastructures and lack of good farm management practices.

The result of the study agrees with the findings of Vietmeyer, 1991; Ekanem and Umoh (1997); Akinnusi, (1998) and Lameed, (2006) that some constraints militating against the efficient production of snail. The identified factors were based on level of severity and less number of specialized extension agents in snail farming was the highest (90.3%).

Table 4: Multiple Regression Equations for Snail (*Archachatina marginata*) Production in Cross River State, Nigeria

Production function forms	Constant	X ₁ Farm size	X ₂ Labour	X ₃ Farm management practices(measured on 5 point scale)	X ₄ Operating costs (naira/hectare)	X ₅ Farming experience (years)	R ²	Adj R ²	F-Value
Linear	-2.659 (1.498)	0.281 (0.374)	1.139 (0.026)	2.076* (0.042)	205 (0.102)	3.521* (0.000)	0.60	0.56	16.43
Semi-log	-5.754 (5.058)	0.991 (1.306)	0.111* (1.306)	0.330* (0.940)	-1.440 (0.690)	1.275* (0.906)	0.55	0.50	13.39
Cobb-Douglas	-1.313 (0.710)	0.164 (0.183)	0.276* (0.290)	9.146 (0.132)	0.194 (0.97)	0.372 (0.127)	0.60	0.57	17.16

Source: Field survey, 2009 Note: * = Values significant at 1%, Figure in parentheses are standard errors.

The value of the R² indicate that for the three production function forms, Cobb-Douglas equation is a good one compared to all other functional forms (linear and semi-log production functions). Cobb-Douglas production function is the lead equation because it has the highest R² value (0.60) and meeting other econometric criteria. The F-value for the functions are also significant at 1 percent indicating that there is a significant linear

relationship between the independent variables taken together and the yield of snail produced in Cross River State, Nigeria (Table-4).

The regression analysis, however, revealed that farm size, labour, farm management practices, operating costs and farming experience has positive influence on output of snail production and are significant at 1 percent level of significance. Lameed (2006) reported similar

results for operational cost and farming experience, he further stated that many snail farmers (46.7%) had been involved in snail production for the past two years and farming experience has positive influence on output of

snail production; while Nweke, and Winch, (1979); Adesimi, (1982), Datin (1993); Ekanem and Umoh, 1997, Ogar *et al.*, (2002) reported similar results for labour.

Table 5: Estimated Elasticities of Production Function (EP), Average Product (AP) Marginal Product (AP), Marginal Value Product (MVP) and Allocative efficiency (AEL) for Snail (*Archachatina marginata*) Production in Cross River State, Nigeria

Variables	EP	AP	MPP	MVP	P	AEL	Inference
X ₁ (farm size)	0.007	154.286	1.08	1080	1000	1.08	Under utilized
X ₂ (Total labour)	0.06	17.167	1.03	20.6	20	1.03	Under utilized
X ₃ Farm management practices(measured on 5 point scale)	0.04	152	6.08	972.8	160	6.08	Under utilized
X ₄ (Operating costs)	0.08	132.5	1.06	14.84	14	1.06	Under utilized

Source: Field survey, 2009

Table 5 revealed the marginal value products of farm size, labour, farm management practices and operating costs. There existed allocative in-efficiency and there is a high potential for snail farmers to increase their yields and income. These findings agree with the findings of Vietmeyer, (1991); Akinnusi, (1995); Aduku, (1996); Ayodele and Asimalowo, (1999); Amusan and Omidiji, (1999); Francis and Anim, (2001); Lameed (2006) that snail farmers are in-efficient in snail production because not all of them possess the skills necessary to know how to improve productivity and this implies that actually farmers are operating below their full potential due to lack of skills, the cost per unit output was proportionately higher.

Conclusion and Recommendations: This study revealed that snail production was profitable, with attractive net return on investment but snail farmers are not allocative efficient. Snail farmers are faced with several problems in their production activities. Notable among constraints are high cost of feed supplement, lack of capital, inaccessibility of formal credit source because lack of collaterals, lack of extension agents, lack of medication/vaccines, poor production infrastructures and lack of good farm management practices. These constraints must be drastically reduced to the barest minimum. This can be done through effective and efficient micro and macro-economic policy formulation and implementation, proper supervision of snail production programme, effective extension services and proper agricultural financing. The constraints associated with the business, if tackled could pave a way to increase profit and this will alleviate poverty in Cross River State. It is recommended that snail farmers in the study area should form cooperative group(s) in order to obtain loans from bank(s) to increase their capital base for higher output. In addition to that, snail farmers should increase their yield and income by expansion of their farms, improving efficiency and adopting new technologies.

Beside that, extension agents should train snail farmers on the adoption of new technologies in snail production.

REFERENCES

- Adinya, I. B. (2006). Snail Production: Extension Bulletin Guide. 1(1):1-3
- Adinya, I. B., O. O. Kuye and V. E. Enya (2007). Structure of Ofatura Goat Market. Global J. Agri. Sci. 6(1):55-59. Adinya, I. B., A. D. Idio and O. O. Kuye (2008a). Farmers' Awareness of Sources of Credit for Improved Farm Practices in Cross River State Nigeria. Global J. Social Sci. 7(1):5-8.
- Adinya, I. B., O. O. Kuye, M. U. Awoke, S. Ajayi, I. E. Ele, K. I. Ogbonna, S. O. Akpet and O. A. Agba (2008b). Production Function Analysis of Cassava Sole Cropping Systems in Akwa Ibom State, Nigeria. Global J. Pure and Applied Sci. 14(1):13-17.
- Adinya, I. B. and M. U. Awoke (2008). Economic Analysis of Yam Marketing in Obubra Local Government Area of Cross River State, Nigeria. J. Forestry and the Social Sci.
- Adinya, I. B. and G. U. Ikpi (2008c). Production Efficiency in Catfish (*Clarias gariepinus*) Burchell, 1822 in Cross River State, Nigeria. Continental J. Fisheries and Aquatic Sciences 2:13-22.
- Adinya, I. B., Ayuk, E. A., Akpet, S. O. and Agiopu, B. F. (2008d). Determining Costs-Return Analysis in Honey Marketing in Cross River State. Continental J. Agri. Econ. 2:44-51
- Adesimi, A. A. (1982). Resource Use Productivity and Efficiency in Maize Production in the Farm Settlement of Western Nigeria. Ife J. Agri. 4(1):88-131.

- Adekunle, A. (1978). Modern Analysis Economics. Aromolaran Publishing Company Limited, Ibadan, Nigeria. Pp12-13.
- Aduku, A. O. (1996). Developing Micro-livestock Potential for increased Animal Protein Supply. The 21st Conference of Nigerian Society for Animal Production, University of Uyo, Nigeria, March 24- 28 pp24
- Ajayi, S. S. and O. O. Tewe (1984). Potentials of Wildlife Production and Processing in Nigeria. Nigeria Food J., 2 (2,3):57-61.
- Akinnusi, O. (1995). A Practical Approach to Backyard Snail Farming Nigeria J. Anim. Prod. 25 (2): 193-197.
- Akinnusi, O. (1996). Developing Micro-livestock Potential for Increased Animal Protein Supply. The 21st Conference of Nigerian Society for Animal Production, University of Uyo, Nigeria , March 24 – 28 Pp24.
- Akinnusi, O. (1998). Introduction to Snail Farming. Lagos Omega Science Publisher, Tinuose House, Nigierapp1-18.
- Amusan, J. A and M. O. Omidiji (1999). Edible Land Snail: A Technical Guide to Snail Farming in the Tropics, Ibadan, Nigeria. Verity Home Printers Pp 4-12.
- Arene, Ibanga F.O. I., E. S. and J. E. Asor (1999) Fresh Water Snail and Crab Intermediate Hosts of Paragonimus Species in Two Rural Communities in Cross River Basin, Nigeria. Global J. Pure and Applied Sci. 5(2):184-187.
- Asa, U. A. (2003). Effect of Akwa Rubber Estates Limited on the Livelihood of Rural People in Akwa Ibom State. Unpublished M.Sc. Thesis Department of Agricultural Economics and Extension University of Uyo , Akwa Ibom State , Nigeria . Pp1-20.
- Awoke, M. U. (2001). Econometrics: Theory and Application, WillyRose and Appleseed Publishing Company Abakaliki, Nigeria pp1-10
- Awoke, M. U. and Okorji, E. C (2003). Analysis of Constraints in Resource Use Efficiency in Multiple Cropping System by Small-Holder Farmers in Ebonyi State of Nigeria. Global J. Agri. Sci. 2(2):132-137.
- Ayodele, I. A and A. A. Asimalowo (1999). Essentials of Snail Farming: A Technical Guide to Snail Farming in the Tropics. Agape Printer, Ibadan.Pp1-30.
- Belot, J., P., Bornarel, M. Diouf and A. M. Polderman (1991). Molluscicidal Effects on the Land Snails From Senegal on Ambrosia Maritima. Pesticide Sci. 74:167-170.
- Cross River Agricultural Development Project (CRADP) (1992a). Crop Production Guide Pp 1-10.
- Cross River Agricultural Development Project (CRADP) (1992b). Report on Wetlands of Cross River State, Nigeria. Pp115.
- Datuin, J. (1993). Research and Development of the Golden Snail (*Pomacea* sp) in the Philippines. In: Proceedings of the Seminar on Mini-Livestock Farming. Tropical Animal Production Unit, Institute of Tropical Medicine, Antriverpen, Belgium.
- Ebenso, I. E. (2002). Consumption and Sales of Domesticated Snail(*Archachatina marginata*) in Rural Southern Nigeria. Tropical Science , England 42:185-187.
- Effiong, E. O. and C. E. Onyenweaku, (2006). Profit Efficiency in Broiler Production in Akwa Ibom State , Nigeria. Global J. Agri. Sci. 5(1):43-47.
- Ekanem, E. O. and B. I. Umoh (1997). Development of Micro-livestock as a Complementary Macro-Economic Strategy for Animal Protein Supply in Nigeria In: Issues in Sustainable Agricultural Development. edited by Fabiyi Y. L. Nyienakuna M. G. Vol.1.
- FAO/UNESCO (1974). Soil Map of the World FAO 1994. Paris.
- Farrel, M. J. (1984). The Measurement of Production Efficiency. J. Royal Statistic Society Series A 120 Part 3, pp253-281
- Francis, E. B. and Anim O. A. (2001). An Economic Analysis of Women's Dependence on Forest Resources in the Rainforest Communities of South-East Nigeria. Global J. Pure and Applied Sci. 7(7):345-350.
- Kmenta, J. (1971). Elements of Econometrics, Macmillan Co. Inc. New York pp1-18.
- Koutsoyiannis, A. (1977). Theory of Econometrics. Published by Macmillan pp1-667.
- Lameed, G.A. (2006). Socio-Economic Characteristics of Snail Farmers, Consumers and Sellers in Selected Zones of Oyo State Agricultural Development Programme. J. Agri., Forestry and the Social Sciences (JOAFSS) 4(2):68-78.
- LEISA Magazine, 24. 4 December, (2008). Dealing with Climate Change. December, 2008 24(4):4.
- Matanmi, J. (1986). Farm Management in Nigeria. Proceedings of Farm Management Association of Nigeria (FAMAN) at the 3rd Annual National Conference of Farm Management Association of Nigeria held in Nigeria. p6
- MOFINEWS (2004). Why Agriculture Cross River State: Producing Milk and Honey for the Nation Finance Incorporated, Calabar, Cross River State, Nigeria.3(6): 4-5.
- MOFINEWS (2007). Population Growth and Economic Development. January- February (2007). Cross River State Privatization Exercise, Journey So

- Far. J. Finance Incorporated, Calabar, Cross River State, Nigeria. 6(3): 7-8.
- Nwandu, E. B. (1999). Socio-Cultural and Traditional Medicinal Value of The Giant African Land Snail (*Archachatina marginata*) in Southern Nigeria. *FAO Bulletin, Bureau for Exchange and Distribution of Information on Mini-Livestock (BEDIM)* 8(2) p26.
- Nweke, F. I. and Winch, F. E. (1979). Bases of Farm Resource Allocation in Small-Holder Cropping Systems of South Eastern Nigeria: A Case Study of Awka and Abakaliki Villages, International Institute of Tropical Agriculture, Ibadan Discussion Paper4/80.
- Ogar, C. U., D. S. Idiong, and S .O. Abang (2002). Allocative efficiency of labour resources in swamp rice production in Obudu Local Government Area of Cross River State, Nigeria. *Global J. Agri. Sci.* 1(2):143-148.
- Ogunfowora, O. (1986). The Role of Farm Management in improving Food Production in Nigeria. *Proceedings of Farm Management Association of Nigeria.* 2(8):8
- Olayemi, J. K. and S. A. Oni (1971). Costs and Returns in Coca Production: A case Study of Western Nigeria. *Bulletin of Rural Economics and Sociology* 6(2):1-10.
- Olukosi, J. O. and P. O. Erhabor (1988). *Introduction to Farm Management Economics*, Agitab Publications, Zaria.
- Oluwole, O. O. (1970). The Economics of Fluid Cured Tobacco Production Under Peasant Agricultural Conditions in Western State of Nigeria. Unpublished M.Sc. Thesis University of Ibadan Pp1-29.
- Osifo, D. E. and Q. B. O. Anthonio(1970). Costs and Returns, A Case Study of upland Paddy Production Under Traditional Farming Conditions in Wasimi and Ilaro Areas of the Western State of Nigeria. *The Nigeria J. Econ. and Social Studies* 12(13):1-12.
- Otchere, E. O. 1995. Technology and Management of Cattle, Sheep and Goatin Northern Nigeria. Delivered at the 20th Conference of Nigerian Society for Animal Production. Federal University of Technology Minna, Nigeria March 20-24 pp3-10.
- Population Census, (2006). Spread, State by State, In: MOFINEWS (2007). Population Growth and Economic Development. January- February 2007. Cross River State Privatization Exercise, Journey So Far. Finance Incorporated, Calabar, Cross River State, Nigeria. 6(3): 7-8.
- Quarterly News Letter of the Ministry of Local Government Affairs, Cross River State, (2006).Pp4-8.
- Robin, C. (1974). *Labour and Politics in Nigeria 1945-1971* .Heinemann Education Books Limited, 48 Charles Street, London on WIX8aH Pp78-185.
- Stewart ,F. (1975). *Employment, Income Distribution and Development*. Frankcass and Company Limited Pp1-157.
- Thompson, R and S. Cheney (1996). *Raising Snails*. Special Reference and Brief series. No. SRB 96-05 Maryland USDA/ARS/NAL, Beltsville 42p.
- Thys, E. (2001). Survival Strategy in Urban Context in Central Africa. Potential Role of Mini-livestock in Poverty Alleviation. *Semestrial Bulletin of Information on Mini-livestock (BEDIM)* 10(2):11.
- Vietmeyer, N. D. (1991). *Micro-livestock: Little-Known Small Animals with a Promising Economic Future*. Nation Academy Press, Washington D. C.