Analysis of Sustainable Small Scale Catfish Farming in South Eastern Nigeria

Chiekezie, N. R.[1], Ozor, M. U.[2], Nwankwo, E. C.[3], Ositanwosu, C. O.[2] and Obiekwe, N.J.[2]

[1]*Department of Agricultural Technology and related disciplines Anambra State Polytechnic, Mgbakwu, Anambra State, Nigeria*
[2]*Department of Agricultural Economics and Extension, Nnamdi Azikiwe University, Awka, Nigeria*
[3]*Department of Agricultural Economics and Extension, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State*

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*CORRESPONDING AUTHOR

chiekezienjideka@gmail.com

ABSTRACT

Small scale Catfish farming involves the rearing of catfish under controlled conditions for socio-economic benefits. It is regarded as excellent aquaculture specie because it grows fast, tolerates extreme temperature, and has a good feed conversion rate. Engaging in small scale catfish production is a way of substantially improving the demand-supply gap currently experienced in the industry. The study examined the socio-economic characteristics of the small scale catfish farmers in the study area, analysed the cost and returns of farmers and examined the influence of socio-economic characteristics on Net-income. Primary data used for the study was collected using well-structured questionnaires which were administered to sampled catfish farmers. In analyzing the data, descriptive statistical tools (frequency counts, means and percentages), enterprise budgeting techniques (Gross margin, Net-farm income) and Multiple Regression Analysis were used to analyse the data. The Return on Investment was ₦1.51 and it implies that the catfish production enterprise generated 1.51 times more income than expenses incurred for the production. In addition, the result indicates a Gross ratio of 66% and a Profitability Index (PI) of 0.34 which means that for every naira earned as revenue, 0.34kobo was returned to the farmer as net income. Out of the nine independent variables included in the model, five; (age, educational attainment, experience, flock size and membership of farmer's society) were statistically significance while the rest were not significance. This result indicated that catfish production is a highly lucrative enterprise to venture into in the study area.

INTRODUCTION

Fish production is very important not only as a source of animal protein to ensure food security but also to improve employment and income towards the elimination of poverty in developing countries (Okezie, et. al., 2008). In view of these positive characteristics, it is perhaps not surprising that fish farming has been among the world's fastest-growing food production sectors for nearly two decades (Tacon, 2001). According to Ugwumba (2003), the demand for fish in Nigeria has been on the increase with demand far exceeding supply. Average fish consumption in Nigeria is 3.5kg person per year which is below the average world consumption estimate of 15kg per person per year (FAO, 2000). According to Nnodim (2014), domestic fish production in Nigeria stands at about 800,000 metric tons while annual demand stands at about 2.7 million metric tons leaving a deficit of 1.9 million metric tons. This is evident in the fact that Nigeria still imports fish into the Country to supplement local fish production.

Catfish, *Heterobrachus bidoscarlis* has been the specie of choice and generally accepted and grown in monoculture or polyculture by fish farmers (Eyo, 2001). According to Ike and Chuks-Okonta (2014), many of the fish farmers in Nigeria focus on catfish production which has a market value of about three times that of tilapia. Catfish being the fastest-growing fish under captivity, It thrives in a wide range of conditions because it is hardy and can tolerate dense stockings and has the potential to create about 30 thousand profitable jobs and generate revenue of US$160 million on yearly basis, which would greatly boost the Nation's economy (Federal Ministry of Agriculture and Rural Development (FMARD, 2016).

ln Nigeria, factors that implicated the decline of capture fisheries include climate change, oil spillage and discharge of industrial wastes which results in pollution of river where people fish from, overfishing and rudimentary technology of fishing. Fish farming had received some attention from the government through her programmes on agriculture such as the establishment of Aquaculture and Inland Fisheries Project and the Presidential Initiative on Aquaculture to arrest this importation problem and to boost fish production however according to Umaru, Okoh, and Ishiwu, 2021 this brought only a minimal success. No doubt, the definite way to lessen the wide gap between the demand and the supply of fish in any country is through increased fish farming..

Based on the above drop, the study seeks to investigate the economics of catfish production with a view to establish its profitability and sustainability. In order to achieve this much-desired goal, catfish farming can provide food, income and a sustainable employment opportunity for the populace. In Nigeria, several studies have been conducted on economics of catfish farming which include economic efficiency and profitability of catfish production in Isoko Area of Delta State, Nigeria (Nkamigbo, et. al., (2014); Profitability analysis of catfish farming in Suleja local government area of Niger State, Nigeria (Yisa,et. al., 2015). However, in southeast, where there is a high rate of unemployment and with an appreciable number of catfish farmers, there is dearth of study on the potential of fish farming, hence this study. The main objective of the study is the economic analyses of catfish farming and its contributions to household poverty alleviation in Nigeria.

The specific objectives are to;

i. Examine the socio economics characteristics of the cat fish farmers.
ii. determine the cost and returns of catfish farming
iii. examine the influence of socio-economic characteristics of the catfish farmers on their net income

METHODOLOGY

The study adopted descriptive survey design. The study is carried out in SouthEast geopolitical zone of Nigeria. The zone comprises five states, namely, Abia, Anambra, Ebonyi, Enugu and Imo. Multistage and random sampling techniques were used to select 405 respondents for the study. At stage I, three States namely, Enugu, Anambra and Imo were randomly selected from the five states in the zone. At Stage II, three Local Government Areas (LGAs) known for catfish production were purposively selected from each of the three States to arrive at nine L.G.As. At stage III, three towns were selected from each of the nine selected L.G.As bringing the total number of towns to 27. The final stage (Stage IV) involved random sampling of 15 catfish farmers from each of the twenty seven selected Towns/Communities, thus arriving at 405 respondents. Primary data for the study and was collected using well structured questionnaire which was administered to sampled catfish farmers in the study areas with the help of trained enumerators and research assistants. Objective one was analyzed using descriptive statistics (means, frequency counts, and percentages). Objective two was achieved using the enterprise budgeting techniques; Gross margin, Net-farm income, Net return on investment, Gross ratio and profitability index. The methods are mathematically given as:

i. **Gross Margin =** Total Revenue – Total Variable Cost

ii. **Net Farm Income =** Total Revenue - Total Cost

Where: Total Cost (₦) = Total Variable Cost + Total Fixed Cost

iii. **Net return investment=** $\frac{\text{Net Farm Income}}{\text{Total Cost}}$

iv. **Gross Ratio=** $\frac{\text{Total cost}}{\text{Total Revenue}}$

v. **Profitability Index (PI)=** $\frac{\text{Net Farm Income}}{\text{Total Revenue}}$

Depreciation on capital items (machines, equipment and buildings) was obtained from the initial costs and useful lives of such fixed items. Straight line method of depreciation was used and the method is given as

$$D = \frac{C-S}{L}$$

Where: D= Annual depreciation (₦), C=Cost of fixed Assets (₦), S=Scrap salvage value (₦), L= Useful lifespan (years)

Objective three was realized using Multiple Regression Analysis. The implicit form of the multiple regression model employed for the analysis is given as:

NET FARM INCOME = f (GENDER, AGE,EDUCATIONAL ATTAINMENT, EXPERIENCE, FLOCK SIZE, MEMBERSHIP OF FARMERS SOCIETY, MARITAL STATUS, EXTENSION CONTACT, FARMING STATUS,HOUSEHOLD SIZE)

Where:
NET FARM INCOME = the amount of Profit attained (₦)
GENDER= this is measured as dummy variables, 1 for male and 2 for female.
AGE= Number of years
EDUCATIONAL ATTAINMENT = Years of formal education.
EXPERIENCE= Years of experience in poultry production.
FLOCK SIZE = Number
MEMBERSHIP OF FARMERS SOCIETY= Number.
MARITAL STATUS = If married = 2, otherwise = 1
EXTENSION CONTACT = Total number of visits/contacts within the period of production
FARMING STATUS = 2 if the farmer is a full time farmer and 1, if otherwise.
HOUSEHOLD SIZE = Actual number
e = Error term
Bo = Constant
$\beta_1 - \beta_{12}$ =Coefficients of the parameter estimates.

The above model was fitted with the data and tried with four (4) functional forms of the multiple regression models; linear, exponential, semi-log and double log. The equation with the best fit was chosen on the basis of conformity with *a priori* expectations of parameters, statistical as well as econometric criteria such as the magnitude of R^2, the t-values of the estimates and, the number of significant variables in each estimated equation.

RESULTS AND DISCUSION

Socio – Economic Characteristics of the Respondents

The Socio- economic characteristics of the respondents as highlighted in Table 1 are Gender, Age, Educational attainment, Number of fish stocked, Marital status, Extension contacts, Farming status, Household Size, experience and membership of Farmer's society. Table 1 shows that 52% of the respondents are males while 48% are females. This may be due to the fact that catfish production in a tedious and time consuming, hence males are made suitable for the job in than females. The table further shows that 46% of the respondents belong to the active age of 31 – 40. This is the economically active and productive age bracket. This is in line with Ugwumba (2011) who stated that age is an important factor influencing production. Production declines as one gets older. Adebayo, *et al*.,(2013) identified that most catfish farmers were in the active age of 31-49 years. The high proportion of age group of less than 51 years shows that they are in their active age; hence, more productivity of fish farming is expected because of the strength and physical ability to manage the fish pond (Williams, *et al.*, 2012). The results further indicated that 9% of the respondents have no formal education, 25% have primary education, 34% have secondary education while 32% have tertiary education. This shows that the bulk of the respondents have secondary and tertiary education. This is important because the level of education of the respondents determines the level of adoption of innovations. This finding supports the results of Adefalu, *et al.*,(2013), Salau, *et al* ., (2014), Olasunkanmi and Yusuf (2014), Okunlola, *et al* ., (2011) and Ideba, *et.al.*, (2013) who found out most catfish farmers are educated to tertiary education. The Number of fish stocked distribution showed that 52% of the farmers have stocked between 101 - 300, 26% have greater than or equals to 100, while 22% have of 301 – 500 catfish. This implies that the areas are dominated by small holder cat fish. Producers. Further analysis showed that 37% of the respondents are married, 50% are single while 13% are widowed, separated or divorced. This implies that cat fish production is mostly the business of married people who usually utilize the labor of the children in running the business. This finding corroborates that Asa, et. al., (2012) who noted that marriage is a highly cherished social value among fish farmers in Akwa Ibom State. The result further shows that 44% of the respondents had no extension contact while 56% had extension contacts. This is important because the level of awareness of innovations is a function of its practicability and production efficiency. This was as a result of the operation of the extension personnel at the grass root in the study area. On the distribution of the respondents according to farming status, the result indicates that 60% of the respondents were full time while 40% are part time. This could be as a result of the business being cited in the rural areas. On the distribution of the respondents according to household size, the result indicated that 35% have a household size of 1 – 3, 41% have a household size of 4 -6 while 24% have a household size of above 7. This implies that cat fish productions do not necessarily require a large household, but a small household that is technically knowledgeable in the business. The distribution of the respondents according to membership of farmer's society (cooperative society) shows that 60% of the respondents belong to farmer's society while 40% do not belong. This is as a result of the fact that most of the small holder cat fish producers live in the rural arrears where cooperatives are more functioning. This disagrees with the findings of Ezike and Adedeji, (2010) who stated that many farmers in the rural area don't enjoy the benefit of cooperative organization including training and credit access to members.

Table 1: Socio –Economic Characteristics Of the Respondents in the Study Area

VARIABLES	FREQUENCY	PERCENTAGES
GENDER:		
Male	212	52
Female	193	48
	405	100
AGE:		
21 – 30	95	23
31 – 40	185	46
41 – 50	87	21
50 and above	38	10
	405	100
EDUCATIONAL ATTAINMNET:		
No Formal education		
Primary education	37	09
Secondary education	101	25
Tertiary education	138	34
	129	32
	405	100
FLOCK SIZE:		
≥ 100	105	26
101 – 300	210	52
301 – 500	90	22
	405	100
MARITAL STATUS		
Married	204	50
Single	149	37
Widowed/Seperated/Divorced	52	13
	405	100
EXTENSION CONTACTS		
No	180	44
Yes	225	56
	405	100
FARMING STATUS		
Full time	245	
Part time	160	
	405	
HOUSE HOLD SIZE		
1 – 3	140	
4 – 6	165	
7 – above	100	
	405	
EXPERIENCE		
1 – 10	95	
11 – 20	106	
21 and above	200	
	405	
MEMBERSHIP OF FARMING:		
Yes		
No	243	60
	162	40
	405	100

Source : Field survey (2022)

Costs and Returns of Catfish Farming in the Study Area

As indicated in Table 2, the cost and returns analysis indicates that a total revenue of N2, 972, 400 was realized by an average catfish farmer for one production cycle. The result also shows that an average catfish farmer invested N1, 969, 933.8 as total costs of production for the enterprise per cycle. These consist of both total variable cost and total fixed cost. The total variable costs (N1, 607, 412. 05) accounted for 81% of the total cost of production and the variable expenses include the cost of stocking, feeding, labour, utility and among other costs. The feeding cost of N1,089, 958 constituted the largest share of the total costs with 55.3% of the total cost. This agrees with the findings of Idisi, et. at., (2019) who reported in their study that the cost of feed carries the highest proportion of the total average cost of production. Cost of feed was followed by cost of stock (Fingerlings, N211,801.51) and labour (N89, 296.28) accounting 10.8% and 4.53% of the total cost of production respectively. According to Yisa, et.al., (2015) fingerlings, labour, feed and water are essential inputs in catfish farming. The fixed cost covers rent and pond construction, tax and implements like; net, scale, pumping machine, shovel among others. The Gross margin of the enterprise for one production cycle was ₦1, 364, 987.95 while the Net farm income realized was 1,002, 466. 20. The Return on Investment was ₦1.51 and it implies that the catfish production enterprise generated 1.51 times more income than expenses incurred for the production. On the other hand, it indicates that every N1.00 invested, catfish production yielded a cash flow N 1.51. This suggests that the enterprise is in a healthy financial state. The Net return on investment shows that, for every naira invested in the production of catfish about N 0.51 returned to the farmer as income. In addition, the result indicates a Gross ratio of 66%. The implication of this is that 66% of the total revenue generated from the sales of the outputs was used to pay off all the costs incurred in the production. Profitability Index (PI) was 0.34 which means that for every naira earned as revenue, 0.34kobo was returned to the farmer as net income. This result surely indicates that cat fish production is highly lucrative enterprise to venture into in the study area.

Table 2: Costs and Returns of Catfish Farming in the Study Area

ITEMS	AMOUNT (₦)	
REVENUE:		
Sales: Average quantity of table size Catfish sold in kg 2477@N1200 per kg	2,972,400	
TOTAL REVENUE:	2,972,400	
ITEMS	AMOUNT (₦)	% OF TOTAL COST
VARIABLE COSTS		
Fingerlings	211,801.51	10.75
Fish feed/Supplement (5-6months)	1,089,958	55.32
Lime/Fertilizer	43,473.18	2.206
Labour	89,296.28	4.53
Fuel [for pumping water]	70,300.00	3.56
Transportation	47,351.08	2.40
Utilities/Miscellaneous	55,232.00	2.80
TOTAL VARIABLE COST	1,607,412.05	
FIXED COST		
Depreciation on		
Building	254,153.59	12.70
Deep well	11,500.00	0.583
Concrete tanks	15,554.11	0.789
Plumbing materials]	3,010.45	0.15
Ponds [Earthen pond/vats/plastic	49,806.00	2.52
Generator	15,261.00	0.774
Water pump	8,378.60	0.425
Wheel barrow	1,560	0.079
Shovel/Bowls/Cutlass	2,175	0.110
Pond net cover	1,123	0.057
TOTAL FIXED COST	362,521.7	
TOTAL COST	1,969,933.8	
GROSS MARGIN	1,364,987.95	
NET FARM INCOME	1.002, 466.2	
RETURN ON INVESTMENT	1.51	
NET RETURN ON INVESTMENT	0.51	
GROSS RATIO	0.66	
PROFITABILITY INDEX	34	

Influence of the Socio – Economic Factors on the Farmers on Net Farm Income

The multiple regression analysis was used to examine the influence of socio – economic factors (independent variables) of the respondents including age, gender, educational at attainment , Experience, Number of fish stocked, membership of Farmers Society , Marital Status, Extension Contacts, Farmers Status and Household Size on Net Farm Income (NFI) (the dependent variables). The MINITAB statistical package was used to run the analysis. Out of the four functional form of the regression (Table 3), output of semi – log form was best in terms of values of the coefficient; F-Statistics, $R^{2,}$ adjusted R^2 and Durbin – Watson statistics, and appropriateness signs of the regression coefficients and was therefore chosen as the lead equation.

The F – statistic value of 204.41 was significant at 5% possibility level. This is an indication of the overall significance and goodness of fit of the model. The R^2 value of 79% showed that 79% of variation in the net farm income of the respondents was due to the variation in the independent variables whiles the remaining 21% was attributed to error. Further result of the regression analysis showed that out of the nine independent variables included in the model, five; (age, educational attainment, experience, Number of fish stocked and membership of farmer's society) were statistically significance while the rest were not significant. The coefficient of age had positive and significant influence on net farm income at 5% probability level. This implies that the older farmers utilized their experience and accumulated capital to achieve better productivity and earned higher net farm income than the younger ones. This agrees with Ugwumba (2011) that the older farmers on catfish production are likely to make higher net farm income because of experience and accumulation of capital than younger farmers. The coefficient of educational attainment had a positive relationship with net farm income. This implies that education is a driving force for profit making. The coefficient of educational attainment had a positive relationship with net farm income. This implies that education is a driving force for profit making. This support the argument of the theory of Solo (1959) as cited by Kasum (2019) that knowledge is a key to efficient resource management and ease of adoption of new technology by farmers. This result is contrary to the work of Ugwumba and Chukwuji (2010) on the economics of catfish production in Anambra State, Nigeria. They noted that the level of education does not determine the amount of profit realised in fish production. The coefficient of years of farmers experience in catfish farming was positively related to farmer's net income. This proves that years of experience in catfish farming improves efficient use of input resources by the farmers. Economic scholars argued that efficiency increases with an increase in production experience (Ike and Ugwumba 2011): A positive co – efficient of stock size is according to a prior expectation. The positive relationship implies that an increase in stock size will result to an increase in output level and consequently net income. This is contrary to the work of Ele, *et. al.,* (2013) on economic analysis of fish farming in Calabar, Cross River State, Nigeria. They reported that one does not need to have much experience before going into fish production. The coefficient of membership of farmer's society is positively related to farmer's net worth. This implies that farmers who belong to cooperative societies can easily access loan from financial institutions which will enhance proper stocking and eventually high farm income.

Table 3: Influence of the Socio–Economic Factors of the Farmers on their Net Farm Income

	Linear	Experiential	Semi - log	Double log
Constant	392.32	2.973	7.33	10.19
Age	36.33	-0.007	-3.76	-0.02
	(3.56)**	(-3.067)**	(-2.36)**	(-3.41)**
Educational attainment	14.96	0.006	2.28	0.08
	(3.18)**	(2.74)**	(3.11)**	(2.95)**
Experience	10.34	0.004	2.86	0.06
	(2.13)**	(2.32)**	(3.46)**	(1.78)**
Number of fish stocked	-79.84	-0.007	-3.76	0.04
	(-6.34)**	(-3.067)**	(2.36)**	(1.08)
Membership of farmers society	-44.3	0.09	2.62	-6.35
	(-1.23)	(0.97)	(-1.84)**	(0.030)
Marital status	17.43	0.003	0.37	0.06
	(0.73)	(1.813)	(0.66)	(1.28)
Extention contact	3.46	0.003	1.76	0.03
	(0.81)	(1.462)	(1.34)	(1.26)
Farmers status	14.30	*0.005*	0.01	-0.07
	(0.18)	*(-1.33)*	(-2.33)	(1.65)**
Household size	10.34	0.003	2.77	-0.06
	(2.3)**	(0.412)	(1.39)	(-1.38)
R^2	71%	69%	79%	68%
R^2 (Adj)	68%	65%	77%	63%
F. Statistic	20.36	12.42	204.41	14.76

CONCLUSION AND RECOMMENDATION

The study reveals that catfish production is viable venture and consequently if the production processes are technically and resourcefully managed, it is capable of not only yielding a reasonable net return over time to any catfish farmer, but, it will go a long way to help in reducing Green- House-Emissions. It can also be adduced from the study that catfish production will timely and in future help in maintaining natural conservation and climate changes. Based on this study the following recommendations are made: Since catfish production are profitable and of immense help in maintaining environmental friendliness, attention should be paid to the catfish farmers to ensure that the best practices are adopted for sustainability and agric-business. There is need for promotion of raw infrastructure, better credit facilities and proper awareness to climatic changes by the government at all levels.

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