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ECONOMIC ANALYSIS OF CATFISH FARMING AND ITS CONTRIBUTIONS TO HOUSEHOLD POVERTY ALLEVIATION IN ANAMBRA STATE, SOUTHEAST NIGERIA

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Abstract

The study analyzed factors influencing the potency of catfish farming determined the cost and returns of catfish farming, estimated the poverty status among catfish farmers and ascertained the contribution of catfish farming to household poverty alleviation in the study area. Primary data used for the study was collected using well-structured questionnaire which was administered to sampled Catfish farmers in the study area. In analyzing the data, descriptive statistical tools (frequency counts, means and percentages), enterprise budgeting techniques, Tobit regression model, expenditure approach of determining poverty line, Foster, Greer and Thorbecke technique and z-test were used. The results indicated that factors such as pond size (0.0004), feed (0.6411), labour (-0.0003), and farming experience (0.0105) had influence on potency of catfish farming . Net returns analysis result reveals a return on investment of ₦1.51 and it implies that the catfish production enterprise generated 1.51 times more income than expenses incurred for the production, 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. This result surely indicates that cat fish production is highly lucrative in the study area. At 0.05 probability level, the calculated z value was statistically significant and thereby ascertained the positive contribution of catfish farming to household poverty alleviation. Based on this study, the following recommendations are made: Since catfish production are profitable, government need to devote more resources to the catfish farmers to ensure that the best practices are adopted for further sustainability of the agribusiness, farmers should be trained on how to compound different types of fish feed to enable them reduce cost of feed. In addition Government should ensure increased credit facilities by the financial institutions to enable the farmers spread out their scale of operation

Keywords: *Profitability, Poverty, Potency, Household, Poverty Alleviation*

INTRODUCTION

In Nigeria, like in other developing Countries of the world, aquaculture farmers contributed about 0.5 percent to the Gross Domestic Product (GDP) (Central Bank of Nigeria, 2015). Aquaculture is the breeding, rearing, and harvesting of fish, shellfish, algae, and other organisms in all types of water environments. f. Fish farming is one of the aquaculture products contributing immensely to the worldwide economy. It 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, Igwe, Nnabugwu, & Okezie, 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). Edwards (1999) opines that fish farming contributes to alleviation of poverty directly through small-scale household farming of aquatic organisms for domestic consumption and/or income; or indirectly through employment of the poor as service providers to aquaculture or as workers on fish farms of wealthier farmers. Over 60% of the overall protein needs of rural people are derived from fish. According to Ugwumba and Ugwumba (2003), the demand for fish in Nigeria has been on the increase with demand far exceeding supply. Fish production from aquaculture is seen as the only means to bridge the widening gap between domestic fish supply from depleting return from capture fisheries and demand.

ln Nigeria, aquaculture industry has been plagued with problems and amongst is of low productivity, high mortality, water scarcity, high cost of feed and poor management practices. 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. This brought only minimal success (Umaru, Okoh, & Ishiwu, 2021). No doubt, the definite way to lessen the wide gap between the demand and the supply of fish any country is through increased fish farming. The fishery sector is significant for developing Nations, in some cases accounting for more than half of the total value of traded commodities. Majority of Catfish farmers in the State are small scale farmers producing less than 5,000 food fish per season. Medium scale farmers include those that produce between 5,000 and 20,000 number while large scale farmers are classified as producers of 20,000 food fish and above (Stone, 2006). Generally, small scale farmers constitute about 80 percent of the fish farming population in Nigeria (Awoke & Okorji, 2004). Smallholder fish farming in Nigeria is practiced under four major systems: extensive, semi-intensive, integrated and intensive. The extensive system, according to Omitoyin (2007) is characterized by low stocking density, low production with little or no nutritional inputs and low investment cost. In the semi-intensive culture system, fish is stocked at a higher stocking density than the extensive system and fed with supplementary feed to support the natural food supply (Ozigbo, Anyadike, Adegbite, & Kolawole, 2014). The integrated system is the culture of fish alongside other forms of agriculture. It is a farming system where resources are efficiently utilized and recycled to achieve higher production than would be obtained from a single production system (Otubusin, 1994). On the other hand, intensive fish culture system is one where fishes are stocked at a high density and fed exclusively on a nutritionally-balanced diet to meet their nutrient requirements (Ozigbo *et al.,* 2014).

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, 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). 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, Ovuomarie, Maduka, & Isibor (2014); Profitability analysis of catfish farming in Suleja local government area of Niger State, Nigeria (Yisa, Adebayo, Mohammed & Anaweta (2015). However, in Anambra state, where there is a high rate of unemployment and with an appreciable number of catfish farmers, there is dearth of study on the poverty alleviation potential of fish farming in Anambra State, Nigeria, hence this study . Based on the above drop, the study seeks to investigate the economics of catfish production with a view to establish its profitability and contribution in alleviating poverty among the rural poor. The specific objectives are to:

1. analyze factors influencing the potency of catfish farming
2. determine the cost and returns of catfish farming in the study area
3. estimate the poverty status among catfish farmers in the study area
4. ascertain the contribution of fish farming to household poverty alleviation

METHODOLOGY

The study which adopts descriptive survey design is carried out in Anambra State in the South-Eastern part of Nigeria. The State is bounded in the east by Enugu State, in the West by Delta State, in the South by Imo State and in the North by Kogi State. It has an estimated population of 5,846,198 and located between latitude 5038'N and 6047'E and longitude 6036'N and 7021'E (ADP bulletin, 2018). There are four agricultural zones in the state. The major occupation of the people are trading and farming. Majority of the farmers are small scale farmers and are majorly known for growing such crops as rice, cassava, yam, cocoyam, okro, palm oil and melon and keeping of some livestock like the poultry and sheep

Sample size and sampling Technique
The study population comprises all catfish Farmers in the four Agricultural Zones (AZs) of the state namely Onitsha, Aguata, Awka and Anambra. Multistage, purposive and random sampling techniques were used to select the respondents for the study. The first stage was the purposive selection of the four agricultural zones in the state since catfish farming is spread accross the four Agricultural Zones (ADP bulletin, 2018). In stage two, four Local Government Areas known for catfish production were purposively selected from each of the four zones in the state to arrive at sixteen (16) LGAs. ln stage III, a random selection of four Communities across the sixteen (16) selected Local Government Areas making it a total number of 64 communities. The fourth stage was random sampling of 5 catfish farmers from each of the 64 Communities giving a sample size of 320 respondents.

Data collection
Primary data used 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.

Data Analysis
Out of the 320 copies of questionnaires distributed, 300 was found worthy and used for the analysis.

Objective one: Factors influencing the potency of catfish farming was analyzes using Tobit regression model . Potency of fish farming was categorized into small, medium and large scale of catfish production. This classification was adapted from the work of Abbas (2015). The scale was generated from the number of juveniles stocked;
0 – 5,000 = small scale (which was denoted as 1),
> 5000 -10,000 = medium scale (which was denoted as 2) and
> 10,000 = large scale (which was denoted as 3).

The Tobit model is expressed thus:
$Yi^* = +Xi\beta j + \mu i$, $\mu i \sim$)
(8) $Yi = Yi^*$ if $Yi^* > 0$
(9) $Yi = 0$ if $Yi^* \leq 0$
.(10) Yi^* = Latent variable Yi = Dependent variable Xi = Vector of explanatory variables
βj = Parameters to be estimated
μi = Error term i.e. random variable which captures factors outside farmer ‟s control

Where, Yi = Intensity of fish farming
The independent variables specified as factors influencing the intensity of fish farming were defined as follows: X1 = Pond size (m2), X2 = Number of ponds owned (number), X3 = Feed (kg), X4 = Start-up capital (Naira), X5 = Labour (man days), X6 = Farming experience (number of years) and X7 = Level of education (schooling years)

Objective two: Cost and returns of catfish farming 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: To estimate the poverty status among catfish farmers in the study area; Expenditure approach of determining poverty line and Foster, Greer, and Thorbecke weighted poverty index were employed.

i.The poverty line value was calculated from the household expenditure of the sampled catfish farmers and two-third of the mean per adult equivalent of the household expenditure of the sampled catfish farmers was used as the poverty line value for the study.

The model is specified as follows:
$P = 2/3$ X $MAHE$

Where; P = Poverty Line Value,
MAHE = Mean Adult equivalent Household Expenditure,
Adult equivalent = 1+ 0.7(*N*adults – 1) + 0.5*N*children
N = Number

ii. The Foster, Greer, and Thorbecke weighted poverty index is used in quantitative poverty assessment. The *P-alpha* measures in analyzing poverty relate to different dimensions of the indices of poverty *P0, P1* and *P2* and are used for head count ratio, depth and severity of poverty. Each index puts different weights on the degree to which an individual falls below the poverty line (Foster *et al*., 1984) Mathematically, it is defined as follows:
P= 1/n $\sum_{i=1}^{q} [Z - Y/Z]\sigma$

Where:
σ =The Foster, Greer, and Thorbecke index and it takes values of 0,1,2
n=total number of households
q=number of households below poverty line
Z=Poverty line and
Y=expenditure of the households in which individual ith lives

Objective four: Z- test was used to ascertain whether the profit realised from catfish farming made any significant contribution to household poverty alleviation or not

$$Z = \frac{P - P^*}{\sigma / \sqrt{n}}$$

Where; Z = Calculated Z value,
P = mean profit from fish farming,
P^* = Poverty line value,
σ = Sample Standard Deviation and
n = Sample size

RESULTS AND DISCUSION

FACTORS INFLUENCING THE POTENCY OF CATFISH FARMING

The results of the Tobit model estimates of factors influencing the intensity of fish farming are presented in Table 1

Table 1: Tobit Model estimates of factors influencing the potency of catfish farming

	Coefficients	**SE**	**t-ratio**
Constant	0.4240	0.0224	3.765**
Pond size	0.0002	0.0002	3.515**
Number of ponds owned	0.0020	0.0123	0.0017
Feed	0.2400	0.1200	4.891**
Labour	-0.3341	0.1243	0.0047
Start-up capital	-0.0001	0.0003	-2.828**
Farming experience	0.0002	0.0024	1.798**
Educational level	0.0024	0.0031	0003
Number of observations			
Sigma	0.3095	0.0104	14.142**
Log likelihood	-24.6139		

The results in Table 1 indicates that factors such as pond size (0.0004), feed (0.6411), labour (-0.0003), and farming experience (0.0105) had influence on potency of catfish farming. The coefficient of pond size was found to be positive and significant at 5%. The size of a pond whether it is concrete or earthen plays a significant role in catfish farming. The implication of this is that, the bigger the size of a pond the larger the number of fish it can accommodate and the net returns. This agrees with the work of Abbas (2015) who reported that an increase in the quantity of table size catfish harvested at end of the production cycle could be affected by the size of the pond. The coefficient of the amount of feed used was positive and significant at 5%. The implication of this is that there was a direct relationship between the amount of feed consumed by catfish and the scale of production of the farmer and invariably the yield at the end of the cycle. Feeds are vital components of fish farming that if under or over utilized can affect total output of fish farmers (Abbas, 2015). The result of this study is in tandem with the work of Onoja and Achike (2011) on resource productivity in small scale catfish farming in Rivers State who reported that fish feed administered had the highest contribution to fish output.

The coefficient of capital was positive and significant at 5% . This result agrees with the work of Nwosu and Onyeneke (2013) on the effect of productive factors of pond fish on the output of fish in Owerri, Imo State. They reported that high capital made positive and significant contribution to the output of farmers. The amount of capital at the disposal of a farmer will determine how much to be utilized in buying feed, drugs and employing labour. The coefficient of farming experience was positive and significant at 5%. This indicates that there was a direct relationship between the years of experience of catfish farmers and scale of fish production. This further connotes that an increase in the years of farmers experience could lead to farmers intensifying their scale of fish production. This agrees with Abbas 2015 that years of catfish farming experience could lead to high intensification of fish production and may determine the ultimate goal of scale of fish production which is profit maximization and this is contrary to the result of Ele, et. at.,2013

COSTS AND RETURNS OF CATFISH FARMING 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	2.40
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	

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 ₦1, 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 ₦1.00 invested, catfish production yielded a cash flow ₦ 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 ₦ 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.

POVERTY STATUS OF CATFISH FARMERS.

The expenditure approach was used to estimate Poverty line while Foster, Greer, and Thorbecke weighted poverty index was used to determine the poverty status of catfish farmers. (Foster *et al*., 1984).

In determining the poverty line, the study measured the well being of the fish farmers by their consumption expenditure and their household size using the adult equivalent.

Expenditure per adult equivalent for each household:
Each household expenditure on monthly basis
The adult equivalent.
The expenditure per adult equivalent for all the households was summed up to give a total expenditure value of N10,392,251.65

Mean Household expenditure:
Total expenditure per adult equivalent household
Sample size of 300
= N10,392,251.65
300 = N34,640.84

***The poverty line value*:**
Two-third of the mean household expenditure
2/3 of (N34,640.84) = N23,093.89
A poverty line value of **N23, 093.89** per month which implies that 66.67% of the catfish farmers are above the poverty line. With this value, it is clearly shown that only 33.33% of the catfish farmers were below the poverty line.

Average expenditure of the poor (AEP)
With the poverty line value (Z) calculated,
Total expenditure of the poor (TEP) was calculated by summing up all the expenditures of all the households below the poverty line
Total expenditure of the poor
Number of those below the poverty line
=1,852,587.15
99
=**N18,713**

Poverty incidence (P0) was calculated
Total number of poor households
The sample size;
= 99
300
= 0.33

The poverty incidence value of 0.33 indicates that 33% of the farmers were below the poverty line.

Poverty gap ratio (PGR)
The difference between poverty line value and the average expenditure of the poor
and expressing it as a fraction of the poverty line;

= N23,093.89 - N18,713
N23,093.89
= 0.19

This indicates the ratio of average extra consumption that would be required to bring all poor catfish farmers to the poverty line.

Poverty depth (P1)
Poverty incidence X Poverty gap ratio
(0.33 x 0.19) = 0.06

This implies that the depth of poverty among the farmers was only 6%.

Poverty severity (P2)
Poverty incidence X Poverty gap ratio raised to the power of 2;
0.33 X $(0.19)^2$ to give 0.01 which indicates that the severity of poverty among the fish farmers was just 1%.

CONTRIBUTION OF FISH FARMING TO POVERTY ALLEVIATION
Z- test was used to ascertain the contribution of fish farming to poverty alleviation. At 5% level of significance, the calculated z value (71,450.01) was greater than the tabulated or critical value (1.96). This result implies that fish farming contributed significantly to household poverty alleviation. This agrees with the studies of Abbas (2015) and Agbebi (2011) who reported that catfish farming was lucrative and contributed towards poverty alleviation. A poverty line value of N23, 093.89 per month which implies that 66.67% of the catfish farmers are above the poverty line. With this value, it is clearly shown that only 33.33% of the catfish farmers were below the poverty line. With the poverty line value of N23, 093.89 per month and N769.79 per day, which is higher than one dollar a day poverty line benchmark of the World Bank, the implication is that household spending is greatly being supported by profit realized from catfish production

CONCLUSION AND RECOMMENDATION
The study reveals that catfish farming is a profitable agribusiness and capable of yielding a reasonable net return over time to any catfish farmer thereby alleviating poverty. At 0.05 probability level, the calculated z value was statistically significant and thereby ascertained the positive contribution of fish farming to household poverty alleviation. Based on this study, the following recommendations are made: Since catfish production are profitable, government need to devote more resources to the catfish farmers to ensure that the best practices are adopted for further sustainability of the agribusiness, farmers should be trained on how to compound different types of fish feed to enable them reduce cost of feed. In addition Government should ensure increased credit facilities by the financial institutions to enable the farmers spread out their scale of operation

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