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Understanding the Determinant of Income from Catfish Production in Imo State, Nigeria

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Abstract
Fish production is significant to Nigeria's aggregate economy. In Imo State in particular, it contributes to employment and income generation; food security; foreign exchange earnings and bridging protein demand-supply gap. Despite all these, empirical studies that logically, explain the determinant of income from catfish production are still relatively scanty. These creates a vacuum in research and knowledge thereby make it extremely difficult if not impossible for the government and other relevant stakeholders to know the method they can use in helping farmers realize huge income from catfish production as well as prospective farmers to venture into catfish farming. It was on this backdrop that the study was systematically undertaken in the area. Data were elicited from 90 catfish farmers' selected using multistage and purposive sampling procedure across Imo State, Nigeria. Data collected were analyzed using descriptive statistical tool, gross income and multiple regression analysis. Result show that the mean age was 45.00 years. Greater proportions (71.11%) were male. Majority (78.88%) were married with an average household size of 7 persons. The mean educational level and farming experience were 12 and 15.00 years respectively. Reasonable proportions (68.89%) have no access to credit. Average annual farm income was ₦650,000.00 ($1,570.64). Majority (45.56%) used concrete pond while approximately 47.78% of the farmers sourced their fingerling from commercials fish hatchery. Net farm income and return per capita invested were ₦3,050,714.69 ($7,371.65) and ₦15.41k respectively. The profitability index was ₦15.30, which implies that for every naira earned as revenue from the catfish farming, about 15.30kobo returned to farmer as net farm income. Estimated regression results shows that pond size (X_1); cost of fish feed (X_2); cost of labour (X_3); stocking rate (X_6); Educational Level (X_9); Farm Income (X_{10}) and Farming Experience (X_{11}) were the major determinant of income in catfish production. Findings provided evidence that catfish production is efficient and lucrative in the area. However, approximately 97.78% of the farmers complained of inadequate production capital. It was therefore recommended that farmers particularly on their own should judiciously pool productive resources together through strengthened and stable cooperative society group as this would enhance their profitability in catfish production in the area. Moreover, effective agricultural policies and programmes should focus on granting fish farmers improved access to farm credit as these would enable them increase their production frontier and realize huge profit overtime in the area.
Keywords: Catfish; Income, Profitability, Management System, Imo State, Nigeria
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1. Introduction

In Nigeria, agriculture provides between 80 to 90 percent of the country's food needs (National Bureau of Statistics (NBS), 2021). It, however, has diverse aspects and this includes fish farming which involves the rearing of fish for the purpose of consumption or sale. Fish is known to be the principal source of animal protein for over one billion people globally and provides many important nutritional and health benefits (Iruo *et al.,* 2020). Fish has the highest level of easily metabolisable proteins; it is reputed for its high quality proteins, fats, vitamins, calcium, iron and essential amino acids. The per capital consumption of animal protein in the country has been put at 5gm per day (Federal Ministry of Agriculture and Rural Development, (FMARD), 2020), this is a far cry from the FAO's recommended level of 35gm per day (Food and Agricultural Organization (FAO), 2021). Catfish farming implies intervention in the rearing process of fish to enhance production such as regular stocking, feeding, and protection from predators amongst others. It is an important revenue earning enterprise especially at such a time, when the nation seeks to diversity its productive base from the monolithic nature or near total dependence on the oil sector to other sectors like agriculture. Fish farming also moves the nation towards achieving its goals of food security generates employment and saves foreign exchange revenue through import substitution of fish and fish product (Esiobu and Onubuogu, 2014). As the human population increases and consequent protein demand, the over-exploitation of the natural fish resources has made aquaculture a major option to combat protein malnutrition in the country (Etuk *et al.,* 2021). The demand for fish protein is about 2.7million MT and only 800,000 MT is produced locally. It shows that there is still a short in supply of about 1.9million MT (Federal Department of

Fisheries (FDF), 2020). Considering the fact that Nigeria has a large suitable land for fish culture, the potential of the aquaculture sector to meet the fish demand of the increasing population cannot be questioned and over-emphasized. For the potential of this sector to be maximized, there must be a significant increase in the involvement of personnel in every area of the sector. For catfish, the absence of a solid estimate of the total economic cost and benefits are still scare. Even empirical evidence on the determinant of income from catfish production is still relatively shallow in the area. It was against these backdrops that the study was investigated

2. METHODOLOGY

The study was carried out in Imo State, Nigeria. Imo State is located in the eastern zone of Nigeria. The State lies between Latitudes *4°45*'N and 7°15'N and Longitude 6°50'E and 7°25'E (Nigerian Meteorological Agency (NiMET), 2016). It is bounded on the east by Abia State, on the west by the River Niger and Delta State; and on the north by Anambra State, while Rivers State lies to the south (National Boundary Commission (NBC), 2020). Imo State covers an area of about 5,067.20 km^2, with a population of 3,934,899 [(National Population Commission (NPC), 2006; National Bureau of Statistics (NBS), 2007)] and population density of about 725km^2 (Ministry of Land Survey and Urban Planning, 2015). The State has three Agricultural zones namely Okigwe, Orlu and Owerri Agricultural Zones. Structured questionnaire was used for data collection. The questionnaire was subjected to content and face validity through the help of experts. The population of the study consisted of all catfish farmers within Imo State. Multistage-sampling and purposive sampling procedures were used to select three agricultural zones in the State. From each sampled zone, three (3) Agricultural blocks was purposively selected based on the intensity of catfish farming. Then thirty (30) catfish farmers were selected from each of the three agricultural zones to give a total of ninety (90) catfish farmers for the study. Primary data were used for the study. The data were collected through the use of a set of structured questionnaire. This was supplemented with verbal interview in places where the respondents can neither read nor write. Descriptive statistics and inferential statistics were used in data analysis. The formular were stated as follows;

Gross Income;

GI = Q X P

Where Q = Quantity of fish (Kg)

P = Unit price of fish

Net Income is specified as

NI = GI – (TVC + TFC)

Where NI = Net Income (₦)

GI = Gross Income

TVC = Total Variable Cost

TFC = Total Fixed Cost

The multiple linear regression analysis was also stated as;

The implicit model is given as follows:

$Y = f(X_1,X_2,X_3,X_4,X_5 X_6,X_7,X_8, X_9,X_{10},X_{11})ei$

Where Y = Profitability (₦)

X_1= Pond size (cubic metres)

X_2 = Cost of Fish feed (₦)

X_3 = Cost of labour (Naira)

X_4 = Cost of pond establishment (Naira)

X_5 = Cost other implement (Naira)

X_6 = Stocking Rate

X_7 = Age (Years)

X_8 = Sex (Male; 1; Female;0)

X_9 = Educational level (years)

X_{10} = Farm Income (Naria)

X_{11} = Farming experience (Years)

U_i = Error term

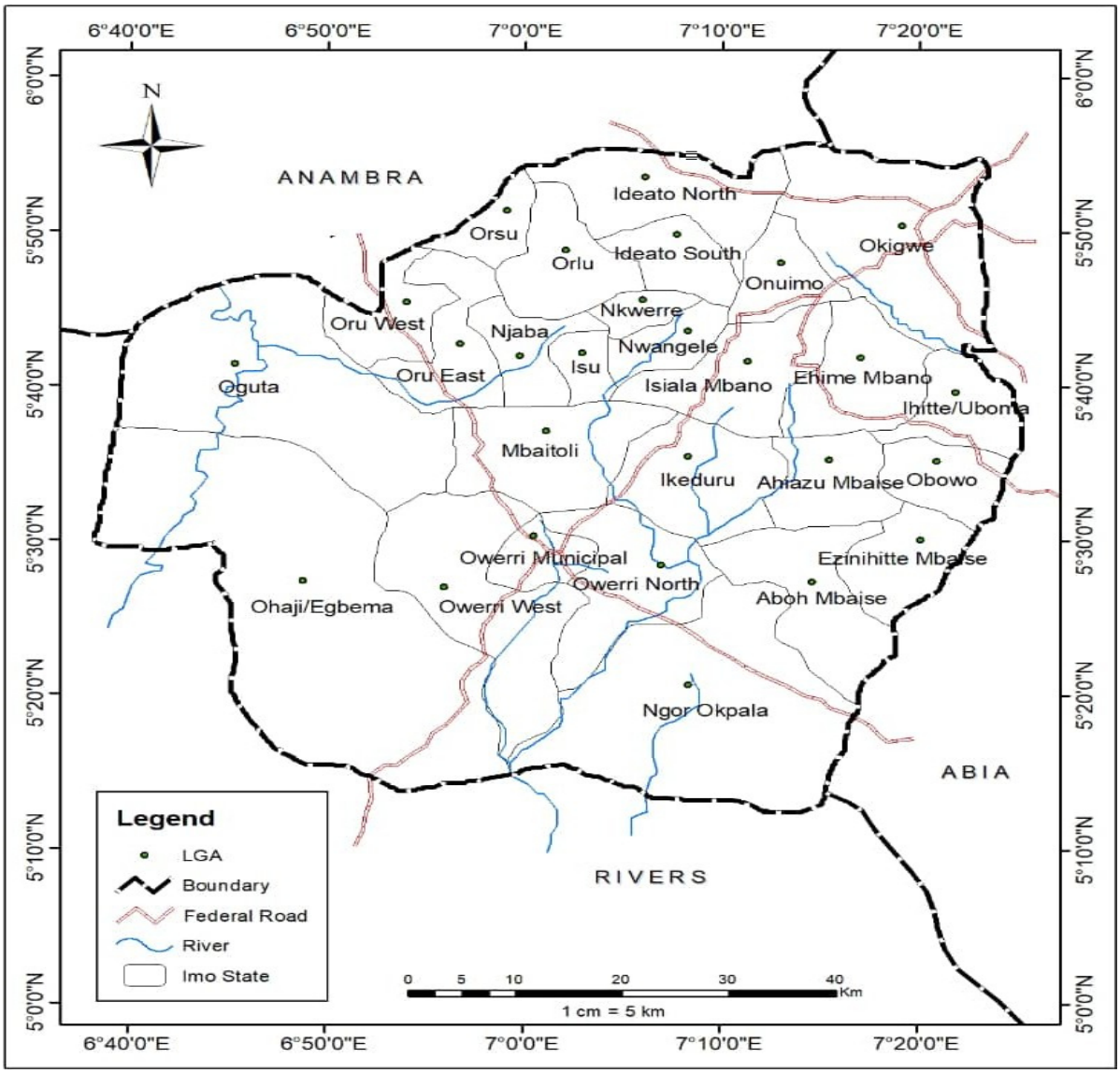

Figure 1: Map of Imo State Showing the 27 LGAs (Department of Geography, Imo State University, Owerri, Nigeria)

3. RESULTS AND DISCUSSION

1. Socio-economic Characteristics of Catfish Farmers

Table 1 revealed that majority (58.88%) fell within the age range of 41-50 years. The mean age was 45.00 years. This shows that farmers in the area are vibrant, young and still within the active age. Catfish farming is so strenuous. The implication is that younger farmers are more likely to withstand the stress and strain involved in catfish production in the area. Younger farmers are also more likely to make huge profit than their older counterpart. The result is in agreement with the study of Keremah and Esquire (2014) who reported that younger farmers normally dominate such strenuous ventures than older farmers are more likely to apply different method in increasing output and income in catfish farming. Table 1 also reveals that majority (71.11%) of the farmers were males. The finding implies that both sex are involved in catfish farming but male are more in number in the area. The implication of males greater proportion may be that technical efficiency and productivity is expected to be higher because males have the tendency to be more labour efficient (Esiobu, 2019).

TABLE 1: Socio-economic Characteristics of Catfish Farmers

Age (years)	**Frequency**	**Percentage (%)**	**Mean (X)**
30-40	15	16.67	
41-50	53	58.88	45.00 years
51-60	19	21.11	
61-70	3	3.33	
Total	**90**	**100.0**	
Sex	**Frequency**	**Percentage (%)**	
Male	73	71.11	
Female	17	18.88	
Total	**90**	**100.0**	
Educational Level	**Frequency**	**Percentage (%)**	
No formal education	2	2.22	
Primary	17	18.88	
Secondary	61	67.78	Secondary education
Tertiary	10	11.11	
Total	**90**	**100.00**	
Marital Status	**Frequency**	**Percentage (%)**	
Married	71	78.88	
Single	11	12.22	
Widowed	6	6.67	
Divorced	2	2.22	
Total	**90**	**100.0**	
Farming Experience (Years)	**Frequency**	**Percentage (%)**	
01-10	13	14.44	
10-19	68	75.56	**15 years**
20-30	9	10.00	
Total	**90**	**100.00**	
Household Size (Number of Persons)	**Frequency**	**Percentage (%)**	
1-5	13	14.44	
6-10	77	85.55	**7 persons**
Total	**90**	**100.00**	
Access to Credit	**Frequency**	**Percentage (%)**	
Access	28	31.11	
No-access	62	68.89	
Total	**90**	**100.00**	
Access to Credit	**Frequency**	**Percentage (%)**	
Access	307	75.80	
No-access	98	24.20	
Total	**90**	**100.00**	
Extension Contact	**Frequency**	**Percentage (%)**	
1-2	76	84.44	
3-4	14	15.56	
Total	**90**	**100.0**	
Average Annual Farm Income (₦)	Frequency	Percentage (%)	
100,001-300,000	13	14.44	
300,001-500,000	19	21.11	
500,001-700,000	53	58.89	₦650,000.00 ($1,570.64)
700,001-900,000	5	5.56	
Total	**90**	**100.00**	

Source: Field Survey Data, 2021

Entries in Table 1 also show that greater proportion (67.78%) had secondary school education. The finding implies that approximately 97.78% of the farmers had formal education which is expected to increase their level of understanding and decision making on catfish production in the area. The result also support the finding Olalekan *et al.,* (2014) who asserted that higher level of education determines the quality of skills of farmers and profitability of catfish fish production enterprise. Result in Table 1 shows that majority (84.44%) were married. The finding implies that catfish farming is an enterprise of married individual who are expected to be responsible

according to societal standard. This finding supports the result of Olawunmi *et al.,* (2010) who reported that married farmers tend to have easy access to production variables such as land and large family size which are traditionally owned and provided by household heads (husbands) to compliment family labour to enhance production, reduce the cost of hired labour and resource use efficiency of the household farmers. Result of farming experience is shown in Table 1 and it shows that about 75.56% of the farmers had a farming experience ranging from 10-19 years. The mean year of experience in farming was 15.00 years. This suggests that the fish farmers had been engaged in catfish production for a relatively short period of time in the study area. In the same vein, this may be attributed to the fact that commercial catfish production is a relatively new idea in the study area. It also show that the farmers have had an experience about the fish farming which implies that they have knowledge of managing the enterprise for the purpose of maximizing production. This finding also supports Orgu *et al.,* (2021) who reported that farmers with more experience would be more efficient, have better knowledge of climatic conditions to run a more efficient and profitable enterprise. Table 1 also shows that about 85.55% had a household size of 6-10. The mean household size was 7.0 persons. The study of Emokaro *et al.,* (2012) opined that large household size ensures availability of labour and expansion of farm size. Table 1 outcome also reveals that greater proportion (68.89%) do not have access to farm credit. The study of Ideba *et al.,* (2013) asserted that access to credit affords farmers the opportunity of accessing farm credit for the purchase of farm inputs and increase production. Outcome in Table 1 also show that majority (84.44%) %) of the farmers had no contact with extension agents. The implication of this finding is that since farmers in the study area are poorly visited by extension agents to ascertain their farming problems, know where they need assistance and pass across to them any new/improved technologies. In a similar way, Chukwu (2014) asserted that steady extension contact help to compliments farmers effort in their quest to increase yield, income and aggregate food production in Nigeria. Finally, Table 1 indicates that majority (58.89%) had an average monthly farm income was between ₦500,001-₦700,000. The mean annual farm income was ₦650,000.00 ($1,570.64) while the monthly farm income was estimated to be ₦54,166.66 (130.89USD). The finding implies that the farmers have a relatively high farm income which is above the monthly national minimum wage in the area. The finding implies that farmers have a relatively high monthly farm income. The studies of Olaoye *et al.,* (2013) asserted that farmers with higher farm income will perform better than those with low farm income since fish production requires reasonable among of fund.

2. Type of Pond Used by Farmers

The result of the farmers distribution based on type of pond used is presented in Figure 2. It shows that about 45.56% of the farmers used concrete pond in their catfish production. The high proportion observed in the use of concrete pond might be due to its convenience, ease in cleaning and management of the pond and in particular ease of harvesting and draining. It is commonly believed by the farmers to be advantageous in the area of high profitability, absence of weed growth or bank erosion, good control of diseases and predators inter alia. Concrete ponds are pond constructed using cement and concrete. It is the most expensive both in cost of construction and maintenance. The study of Dauda *et al.,* (2014) opined that concrete ponds, if properly constructed, can last a lifetime. In addition, they can be constructed with vertical walls to increase the ratio of gallonage to surface area. However, the material for concrete is generally expensive and requires much skill to install. Similarly, the study is in line with the findings of Akhilomen *et al.,* (2015) who reported that farmers use concrete pond in catfish production because of it high production ratio. More so, approximately, 24.44%, 17.78%, 10.00% and 2.22% of the farmers identified plastic pond, earthen pond, tarpaulin pond and case pond respectively as what they use in catfish production in the area. Simplicity and inexpensiveness of earthen pond in its construction could be the basic reasons for its preference. Earthen ponds are entirely constructed from soil materials. The study of Adeogun *et al.,* (2007) reported that earthen ponds involves digging the soil usually clay (25.00% clay) to a depth ranging from 0.5- 1.0 m at shallow end and 1.5- 2.0 m at the drain end to raise fish. Additionally, Nigerian farmers have limited land, therefore tank, tarpaulin, fish and case farming adapts well to their conditions than larger, more expensive earthen or concert ponds. It has also been noted that the quantity of fish harvested from such smaller production units is more easily marketed than harvests from large fish ponds (Igwe and Mgbaja, 2014).

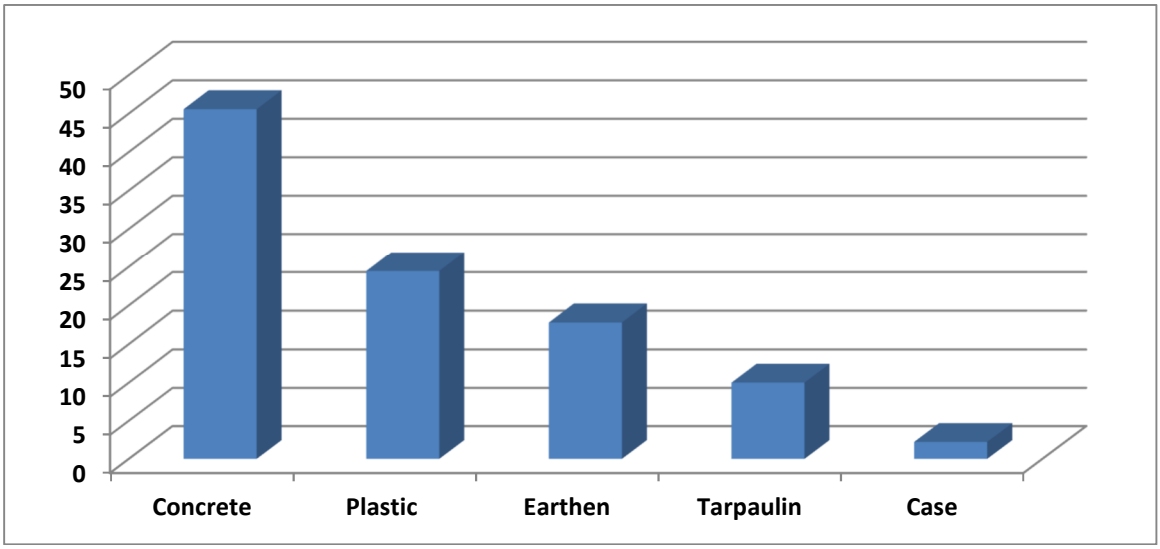

Figure 2: Type of Pond Used by Farmers; *Source: Field Survey Data, 2021*

3.0 Source of Fingerlings of Farmers in Catfish Production

Outcome of farmers distribution based on source of fingerlings is shown in table 2. It reveals that about 47.78% and 20.00% of the farmers identified commercials fish hatchery and Private/individual small scale farmers as their source of fingerlings used in fish production. The farmers reason for sourcing their fingerlings from commercials fish hatchery and private/individual small scale farmers could be that the source is trusted and reliable. The study of Aquaculture and Inland Fisheries Project (AIFP) (2012) asserted that farmers will only source for fingerlings from hatchery they can be able trust in term of healthy, early-maturity and disease-free breed. Approximately, 17.78%, 8.89% and 5.56% of the farmers sourced for their fingerlings from state government, federal fish hatchery and any available source. The low values recorded in Federal and State fish hatchery could be because of government poor support to her fishery ministry. During the fieldtrip, the study found out that most of State and Federal government staff owns a personally/commercial hatchery and also encourages fish farmers to buy from their hatchery than government owed.

Table 2: Source of Fingerlings of Farmers in Catfish Production

S/No	Source of Fingerlings	Frequency	Percentage (%)
1	Commercials Fish Hatchery	43	47.78
2	Private/individual small scale farmers	18	20.00
3	Federal Fish Hatchery	8	8.89
4	State government	16	17.78
5	Any available source	5	5.56
	Total	**90**	**100.0**

Field Survey Data, 2021

4. Costs, Return and Profitability of Catfish Production

The result of the farmers distribution based on costs and return of catfish production is compiled in Table 3. The result revealed that greater proportion (88.76%) of the cost was recorded in the total variable cost. Similarly, about 26.34% of the variable cost was from cost of fingerlings, approximately 2.50% of the variable cost was recorded in labour while about 3.32% of the variable cost was recorded in miscellaneous expenses. Additionally, about 5.01%, each of the total variable cost was utilized in water, vaccination, medication and storage. The highest contribution was in fish feed which contributed about 30.10% in the total variable cost. Moreover, several studies (Ugwumba and Chukwuji, 2010; Igwe and Mgbaja, 2014) on catfish production in Nigeria have confirmed that the cost of labour input is the most important of all cost components incurred in catfish production. The contribution of the fixed cost was relatively low compared to the variable costs incurred in production. The fixed cost contributed approximately 11.15% of the cost involved in catfish production in the area. The study of Crentsil and Inibehe, (2014) also confirmed that fixed cost is the least cost incurred in catfish production in Nigeria. The return on capital (ROC) invested was found to be ₦15.41. It could be inferred that for every naira invested, there is 15.41kobo returns for the farmer in catfish production in the area. The result also revealed that the total revenue (TR), gross margin (GM) and net farm income (NFI) were ₦3,250,000.00, ₦3,072,971.00 and ₦3,050,714.69 respectively. The finding also shows that net return on investment (NROI) (profitability index) was ₦15.30, which implies that for every naira earned as revenue from the catfish production enterprise 15.30kobo returned to farmer

as net farm income. In the same way, the finding shows that catfish production is a profitable enterprise and would yield more output/income when invested in a larger scale and efficiently managed. The result obtained confirmed the evidence of the finding of Olasunkanmi (2012) who revealed that catfish production is profitable and that farmers would realize good yield as well as income after sales when efficiently and effectively managed. These figure could yield more income if production scale is enhanced in the area and maybe beyond. The implication of the findings is that when efficiently, carefully, heavily invested and managed, catfish production is capable of producing good output/yield per hectare as well as reasonable net return over time to any agribusiness entrepreneur.

Table 3: Estimated Costs, Return and Profitability Analysis of Catfish Production/ Naira

Items	Average Cost (₦)	Quantity	Unit	Total Value (PxQ) (₦)	Percentage (%)
A. Revenue					
Catfish	2500.00	1300	2kg	3,250,000.00	
Total Revenue	**---**		---	**3,250,000.00**	
B. Variable Cost					
Fish feeds	10,000	6	Bags	60,000.00	30.10
Transportation	2,000.00	5.0	km	10,000.00	5.01
Fingering Stocking (kg)	35.00	1500	Fingerling	52,500.00	26.34
Labour	1,000.00	5.0	Man hour	5,000.00	2.50
Water	1,000.00	10.0	Litres	10,000.00	5.01
Medication	2,000.00	5.0	Times	10,000.00	5.01
Vaccination	2,000.00	5.0	Times	10,000.00	5.01
Storage	1,000.00	5	Days	10,000.00	5.01
Petrol	145.00	20		2,900.00	1.45
Miscellaneous cost	6,629.00	---	---	6,629.00	3.32
Total Variable Cost				**177,029.00**	88.76
C. Fixed Costs					
Depreciation on Equipments (Weighing scale, Bucket, generator and Pumping Sumor)	10,281.31	---	---	10,281.31	5.15
Depreciation on pond	2,395.00	5.00	Size	11,975.00	6.00
B. Total Fixed Cost				22,256.31	11.15
D. Total Cost (TFC+TVC)				**199,285.31**	**100.00**
Net farm income **[A-(B+C)]**	3,050,714.69	----	----	**3,050,714.69**	
Gross Margin (NFI + TFC)	3,072,971.00				
Return on Capital Invested	15.41				
Net Return on Investment	15.30				

Source: Field Survey Data, 2021; **Depreciation on equipment was calculated using the Straight Line Depreciation Method (SLDM)**

5. Influence of Farmers Socio-economic characteristic on Profitability of Catfish

The result of the farmers distribution based on estimation of farmers socio-economic characteristic on profitability of catfish production in the study area is presented in table 4. A multiple regression analysis was estimated in four functional forms (linear, semi log, double log, and exponential forms). Based on the statistical significance of the coefficients, goodness of fit and the economic theory that supports socio-economic model, the semi-log regression function was chosen as the lead equation. The semi-log regression function was chosen as the lead equation based on the value of R^2 (0.781), F-Ratio value (12.830), conformity of the signs with *a priori* expectations of the model and has the highest number of significant explanatory variables. The coefficient of multiple determinations (R^2) was found to be 78.10% and was statistically significant at 1% level of probability. This implies that the farmers socio-economic characteristic on had a significant influence profitability of catfish production and that the regression model has a very high explanatory power. This is an indication that 78.10% of the variation in Profitability of Catfish production was explained by the explanatory variables while the remaining 21.90% was explained by the stochastic variables. The marginal effect is presented as follows:

Pond Size (X_1): The coefficient of pond size was positive and also significant at 1% level of probability. It has a direct relationship with profitability of catfish production and implies an important determinant of for output in catfish production. This implies that the more the size of a fish pond, the higher the output/profit. Farmers how had large pond size had higher output/profit and income than their counterpart with smaller pond size. The result was in line with the finding of Asa and Valerie (2015) who asserted that increase in pond size will propel a significant increase in output/profit.

Cost of Fish Feed (X_2): The result of fish feed was positively related to the output/profit from catfish

production enterprise and statistically significant at 1% level of probability. This shows that the quantity of feed given to the fishes is an important productive input in catfish production and increases the output/profit of the enterprise. Farmers who have access and financial capacity to quality and quality fish feeds will realize huge output/profit than their counterpart who do not have and financial capacity to quality and quality fish feeds in the area. The study agrees with the finding of Nwosu and Onyeneke (2013) who opined that quality and quality fish feeds result to huge output for the farmer.

Cost of Labour (X_3): The coefficient of cost of labour was positively related to the output/profit from catfish production enterprise and statistically significant at 1% level of probability. This shows that the access to labour is an important productive input in catfish production and increases the output/profit of the enterprise. Farmers who have access and financial capacity to labour will realize huge output/profit than their counterpart who do not have access to labour in the area. This finding supports the result of Olawunmi *et al.,* (2010) who reported that married farmers tend to have easy access to production variables such as land and large family size which are traditionally owned and provided by household heads (husbands) to compliment family labour to enhance. This finding also supports the result Ajao (2012) who reported that large household size compliment labour to enhance production and reduce the cost of hired labour in catfish production.

Cost of Pond Establishment (X_4): The coefficient of cost of pond establishment was significant at 1% level of probability and is positively signed. This implies that it has a direct relationship on the output/profit of fish production. The implication of the result is that fish farmers who began the enterprise with higher capital recorded higher output/profit than their counterpart who started with little capital.

The farmers who had a sizeable amount of start-up capital would purchase all the need for production in larger quality and made huge return than there counterpart who had little start-up capital. The finding shares view that the studies of Asa and Valerie (2015) who reported that start-up capital is a proxy for huge return/profit over time in catfish production.

Stocking Rate (X_6): The coefficient of stocking rate was highly significant at 1% level of probability and positively signed. This implies that it has a direct influence on the output/profit margin of catfish production. Farmers who stocked more fingerlings recorded higher output/profit than their counterparts who stocked less. The finding tallies with the studies of Keremah and Esquire (2014) who asserted that higher stocking capacity of famers gives higher output/profit of the farmer over time in catfish production.

Table 4: Influence of Farmers Socio-economic Characteristic on Profitability of Catfish

Explanatory Variables	Linear	Semi-Log	Double-Log	Exponential
Constant	83.075	77.679	4.372	4.221
	(7.778)***	(3.176)***	(10.890)***	(31.626)***
Pond Size (X_1)	0.099	2.076	0.001	2.696E-030
	(1.004)	(3.758)***	(2.677)***	(3.873)***
Cost of Fish Feed (X_2)	0.341	0.397	0.007	3.855E-006
	(2.517)	(2.593)	(3.635)	(1.821)
Cost of Labour (X_3)	0.330	3.588	0.057	2.213E-008
	(2.289)**	(3.113)***	(2.078)**	(2.562)***
Cost of Pond Establishment (X_4)	0.072	2.784	0.031	2.631E-016
	(2.605)***	(4.957)***	(3.003)***	(2.248)**
Cost Other Implement (X_5)	0.496	0.345	0.069	0.007
	(0.216)	(0.187)	(2.147)**	(0.328)
Stocking Rate (X_6)	0.406	2.050	0.036	6.825E-006
	(0.519)	(3.390)***	(0.413)	(1.518)*
Age (X_7)	1.305E-005	9.903E-006	1.674E-007	2.397E-007
	(2.554)***	(5.135)***	(2.169)***	(1.706)*
Sex (X_8)	0.936	4.634	0.076	2.027
	(0.735)	(2.375)**	(0.379)	(3.824)***
Educational Level (X_9)	2.741	12.463	0.211	0.002
	(1.517)*	(5.607)***	(0.626)	(0.914)
Farm Income (X_{10})	0.251	8.952	0.152	0.004
	(0.077)	(3.578)***	(2.597)***	(0.313)
Farming Experience (X_{11})	1.266	4.206	0.020	7.976E-006
	(3.469)***	(2.501)***	(0.391)	(0.242)
R^2	66.10	78.10	55.20	60.50
F-Ratio	4.929***	12.830***	7.841***	8.829***

Source: Computer Printout of SPSS (2021); values in Parenthesis are t-values *Statistically Significant at 10%; **Statistically Significant at 5%; * Statistically Significant at 1%**

Age (X_7): The coefficient of age was positive and significant at 1% level of probability implying that increases

in the magnitude of age leads to a significant increases in profitability of catfish production. This implies that as fish farmers grows in age, experience increase and more profit will be realized in catfish production. The findings is in line with the study of Keremah and Esquire (2014) who argued that older farmers are not always enthusiastic about new farm technologies, especially if the benefits are not expected in the near future, but at the same time, farmers with advanced age are associated with more experience and thus likely to realize more profit in catfish production than their younger counterpart.

Sex (X_8): The coefficient of sex was positive and significant at 1% level of probability implying that male farmers realized more profit than their female counterpart. This result is also justified by the assertion of Brummett *et al.,* (2010) who opined that fishery activities are mostly dominated by men. However, aquaculture practices are not limited to a particular sex. Both male and female farmers are engaged in fish farming to increase fish production, improve food security, reduce hunger and also to increase their incomes. In the same vein, the result could also be attributed to the socio-cultural factor which gives males huge access to production variables such as like farmland, labour and other productive inputs more than female in the area.

Educational Level (X_9): The coefficient of education was positive and significant at 1% level of probability implying that increases in the magnitude of education leads to a significant increases in profitability of catfish production. The literacy level of these farmers is capable of promoting the sustainable fish production management practices in the area. Exposure to high level of education is positively and significantly related to profitability of catfish production. The result also support the findings Nwosu and Onyeneke (2013) and Olalekan *et al.,* (2014) who asserted that higher level of education determines the quality of skills of farmers and profitability of catfish fish production enterprise.

Farm Income (X_7): The coefficient of income was positive and significant at 1% level of probability implying that increases in the magnitude farm income leads to a significant increase in the profitability of catfish production in the study area. Farmers with higher farm income made more profit than their counterparts with smaller farm income. The finding implies that the farmers have a relatively high farm income which is above the monthly national minimum wage in the area. The finding implies that farmers have a relatively high monthly farm income. The studies of Olaoye *et al.,* (2013) asserted that farmers with higher farm income will perform better than those with low farm income since fish production requires reasonable among of fund.

Farming Experience (X_{11}): The coefficient of farming experience was positive and significant at 1% level of probability implying that increases in the magnitude of experience leads to a significant increases in catfish production in the study area. It is expected that higher year of farming experience will no doubt enhance their profit margin in catfish production in the area. The finding shares vein with the study of Obare *et al.,* (2010) and Olasunkanmi (2012) who opined that year of farming experience has a positive and significant relationship with farmers' economic efficiency. This implies that the higher the level of experience of the farmer, the higher his cost efficiency level will be. This finding also supports Adebayo (2012) who reported that farmers with more experience would be more efficient, have better knowledge of climatic conditions, better knowledge of efficient allocation of resources and market situation and are thus, expected to run a more efficient and profitable enterprise. The F-ratio (12.830) which determines the overall significance of the regression model is highly significant at 1% level of probability implying that the regression model has very high explanatory power, hence the study concludes that farmers socio-economic characteristic have a significant influence on the profitability of catfish production in the study area.

6 Constraints in Catfish Production

The result of the farmers distribution based on constraints in pond fish production is shown in table 5**.** It revealed that larger proportion (97.78%) of the farmers reported inadequate production capital. Fish farming is capital intensive and thus requires substantial volume of capital investment for reasonable profit to be made. This was indicated by Ugwumba and Chukwuji (2010) as one of the major problems facing catfish farmers in Anambra State, Nigeria. Adeogun *et al.* (2007) also reported lack of capital as one of the problems affecting aquaculture in Lagos State, Nigeria. In a similar way Nwosu and Onyeneke (2013) reported that poor capital is the bane of pond fish production in Imo State, Nigeria. The second serious constraint was the problem of high cost of feed as complained by 94.44% of the farmers. This is true as the study had earlier found that about 30.10% was incurred in feeds. More so, the scarcity of commercial pelleted and floating fish feed mills and problems associated with production and distribution of fish feeds could be the main reasons for the hike in feed prices. The studies of Keremah and Esquire (2014) opined that high cost feed as one of the problems of livestock production in Nigeria. These commercial fish feeds possess floating and high protein qualities and are therefore preferred by fish farmers (Ugwumba and Chukwuji, 2010). Furthermore, about 90.00% reported poor quality of fingerlings which was the third serious constraint. Farmers relied on the several hatchery sources which cannot be trusted. In the same vein, approximately 84.44%, 83.33%, 80.00%, 77.78%, 67.78%, 60.00% and 52.22% of the farmers complained of Long distance between farm and market, Poor access to suitable land/Site, Poor technical know-how, Poor quality of medication, Poor market outlet, Flooding and Theft respectively. Long distance to market makes most of the

farmers sell their produce at farm gate hence having low profit margin. However, there is no doubt that these constraints are responsible for subsistence level of the farmers in the area. Fighting these problems will be vital in promoting not just subsistence production but commercial fish production in the area**.**

Table 5: Distribution of the Fish Farmers by Constraints in Fish Production

S/No	Constraints	Frequency	Percentage (%)
1	Inadequate production capital	88	97.78
2	High cost of quality feeds	85	94.44
3	Poor quality of fingerings	81	90.00
4	Long distance between farm and market	76	84.44
5	Poor access to suitable land/Site	75	83.33
6	Poor technical know-how	72	80.00
7	Poor quality of medication	70	77.78
8	Poor market outlet	61	67.78
9	Flooding	54	60.00
10	Theft	47	52.22

Multiple Responses were Recorded*; *Source: Field Survey Data, 2021

6. CONCLUSION AND RECOMMENDATION

Fish production is significant to Nigeria's economy in terms of provision of income, employment, foreign exchange earnings and bridging protein demand-supply gap. However conclusively, Net farm income and return per capita invested were ₦3,050,714.69 ($7,371.65) and ₦15.41k respectively. The profitability index was ₦15.30, which implies that for every naira earned as revenue from the catfish farming, about 15.30kobo returned to farmer as net farm income. Estimated regression output shows that pond size (X_1); cost of fish feed (X_2); cost of labour (X_3); stocking rate (X_6); Educational Level (X_9); Farm Income (X_{10}) and Farming Experience (X_{11}) were the major determinant of income in the area. Findings provided evidence that catfish production is efficient and lucrative in the area. However, approximately 97.78% of the farmers complained of inadequate production capital.

7. Recommendation

i. It was therefore recommended that farmers particularly on their own should judiciously pool productive resources together through strengthened and stable cooperative society group as this would enhance their profitability in catfish production positively in the area.

ii. Moreover, effective agricultural policies and programmes should focus on granting fish farmers improved access to farm credit as these would enable them increase their production and realize huge profit positively in the area.

iii. It is also important the government at all level should identify genuine fish farmers and provide them with productive input as this would reduce the high cost of fish productive input in the area.

iv. Effective fishery policies should be directed to the establishment of commercial pelleted and floating fish feed mills, modern fish hatcheries, provision of credit facilities, provision of adequate infrastructural facilities and intensification of extension services.

v. Government should provide good feeder roads so that this fish produce can be transported easily and cheaply into areas where they are not produced.

vi. Farmers socio-economic characteristic was found to be one of the factors of profitability. Therefore, farmers education level, access to extension services and credit should be improved drastically.

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Conflicts of interest

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