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Profitability of Catfish Production in Southern Agricultural Zone of Cross River State, Nigeria

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Abstract

Catfish production affords fish for people in the country, adds to foreign exchange earnings, supplies raw materials to industries and generates employment. Result of analysis showed that total variable cost per kilogram of catfish produced was ₦316.08 constituting about 96.89% of the total cost with feed cost showing the highest and most critical factor accounting for 88.96% of the total cost. Total revenue was ₦570.12, while the total cost was estimated to be ₦326.19. On the other hand, the gross margin (GM) per kilogram of catfish realized was ₦254.04 and the Net farm income was ₦243.93 while the net return on investment was ₦0.75. Therefore, revenue generated from fish sales exceeded total production costs, indicating positive returns on investment. The following variables: unit price of output, per unit price of stocking, per unit price of feed, per unit price of pond. Others such as age, educational status and farming experience all influenced profit of catfish production at different levels of probabilities. High cost of feed, inadequate capital and poor extension services were considered the most severe constraints faced by catfish producers in the area with mean responses of 4.92, 4.30 and 4.12 respectively. The study recommends following: (i.) any policy that substantially reduces the cost of feeding t should be provided by government (ii.) government should facilitate access to affordable credit facilities for catfish value chain actors, (iii.) investments should be made in aquaculture infrastructure and (iv) processing facilities and extension services should be intensified to promote improved production

Keywords: Catfish production, profitability, aquaculture, profit function,

Introduction Fish is widely recognized as one of the most important sources of animal protein globally and constitutes a major component of human nutrition, especially in developing countries. Fish provides high-quality protein, essential amino acids, vitamins, minerals, and omega-3 fatty acids required for healthy growth and development (Food and Agriculture Organization (FAO), 2025; United Nations Industrial Development Organization (UNIDO), 2019). In many African countries, including Nigeria, fish contributes substantially to dietary protein intake and plays a vital role in ensuring food and nutritional security. Nigeria remains one of the largest consumers of fish in Africa, with annual fish demand estimated at over 3.6 million metric tonnes. However, domestic fish production has consistently fallen below demand, thereby creating a substantial supply deficit that is met through importation (Federal Department of Fisheries (FDF), 2021). The increasing population growth, urbanization, and changing dietary preferences have further widened the demand-supply gap, necessitating increased investment in aquaculture production systems. Aquaculture has therefore emerged as a strategic intervention for addressing fish shortages in Nigeria. Among aquaculture species, catfish (*Clarias gariepinus*) has become the most cultivated fish species due to its adaptability to diverse environmental conditions, rapid growth rate, resistance to diseases, high survival rate, and strong consumer preference (Anetekhai, 2021; Ettah *et.al*. 2016). Catfish farming has increasingly become an important source of employment and income for many households in Nigeria. Beyond production, the catfish enterprise encompasses a series of interrelated activities involving input supply, production, processing, transportation, marketing, and consumption. These interconnected activities collectively constitute the catfish value chain. According to Kaplinsky and Morris (2024), a value chain refers to the full range of activities required to bring a product from conception through production, processing, distribution, and final consumption. This study is supported by the theory of production, which is the process of creating goods and services with the help of factors of production or inputs for satisfaction of human wants. The relationship between inputs and output of a commodity depends upon the state of technology because with the help of advanced technology more can be produced with the help of same inputs or same output can be produced with the help of less inputs (FAO, 2025, FDF 2021). It also is the systematic activity of changing resources into completed products in the form of commodities and services in order to meet demand. In Southern Agricultural Zone of Cross River State,

Catfish farming constitutes important livelihood activities among rural and urban households. However, empirical information on profitability and value chain performance within the area remains limited. Despite the enormous

potential of catfish production in Nigeria, several challenges continue to hinder the efficient functioning of the value chain. These include inadequate access to finance, high production costs, poor infrastructure, inadequate storage facilities, poor market information, weak institutional support, and fragmented marketing systems (Adewuyi, 2020; Ashley-Dejo, 2023). These constraints limit productivity, reduce profitability, and undermine the competitiveness of the subsector. Catfish farmers have not achieved the desired output expected from their production that can make a significant change in closing up the gap between fish demand and supply in the country. According to Bukenya *et.al*., (2000) factors such as low pricing of their product as a result of economic status of the consumers, availability of substitutes and competition for sales also constitute problems to catfish production in the area. Understanding the structure, profitability, and constraints of the catfish is essential for designing policies aimed at improving productivity, enhancing income, and promoting sustainable aquaculture development. This study therefore examined the profitability analysis of catfish production in Southern Agricultural Zone of Cross River State, Nigeria, with the following specific objectives:**;** i. estimate the profitability of catfish production in the are; ii determine the factors influencing profitability of catfish production in the area and constraints to catfish production in the area

Materials and Methods: Study Area: The study was conducted in Calabar Agricultural Zone of Cross River State, Nigeria consisting of seven Local Government Areas (LGAs) namely, Akamkpa, Akpabuyo, Bakassi, Biase, Calabar Municipal, Calabar South and Odukpani (CRADP, 2010). Temperature is relatively constant in the area ranging from 25 to 28°C. The zone has a population of 371,022 as at 2006 census. It is located between 40º 28' and 60º 55' north latitude and 70º 50' and 90º 28' east longitude of the Greenwich meridian. Calabar Agricultural Zone covers an area of 406 square kilometers. It features a tropical monsoon climate with lengthy wet season spanning ten months and a short dry season covering the remaining two months. The soil is fertile, well drained and aerated for cultivation of various crops which includes rice, maize, plantain, banana, cassava, pineapple, oil palm and rearing of homestead poultry, aquaculture etc. Majority of the people living in the area are engaged in artisanal fishing, subsistence farming and local trading (Abbas, 2015; Obot *et. al.*2021).

Sampling Procedure and Data Collection: The sampling population for the study is all registered catfish farmers in Calabar Municipal, Calabar South and Akpabuyo local government areas. A two- stage sampling method was adopted for the selection of a sample size for the study as follows: **stage one**; purposive sampling was used to select 3 Local Government Areas (LGAs) from the seven LGAs making up the zone on the basis of prevalence of catfish farming namely; Calabar Municipal, Calabar South and Akpabuyo LGAs. **stage two**; Snowball sampling method was used to select ninety catfish farmers was employed to select a total of 94 catfish farmers from a sampling frame of registered catfish farmers in the study area as obtained from the Department of Fisheries, Ministry of Agriculture, Cross River State.

Analytical Techniques: Data collected were analyzed using descriptive statistics, gross margin analysis, value chain mapping, marketing margin analysis, and multiple regression analysis.

Gross Margin Analysis

Gross Margin (GM) was estimated as:

$$GM = TR - TVC$$

Where:
GM = Gross Margin
TR = Total Revenue
TVC = Total Variable Cost
Net Farm Income (NFI) was estimated as:

$$NFI = TR - TC$$

Where:
TC = Total Cost.

The Profit Function Analysis

was used to test the effect of cost of individual input and socio-economic variables on profit. The profit function model is explicitly specified as follows:

$$\Pi^* = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + e$$

Where, Π^* = profit(₦);
X_1 = Quantity of fish harvested (kg)
X_2 = Price of fish per kilogramme(₦)
X_3 = Cost of fish feed (₦);
X_4 = Cost of stocking (₦);
X_5 = Cost of labour (₦)
X_6 = Pond size (m^2);
X_7 = Educational status (years)
X_8 = Farming experience (years)
X_9 = Household size
$\beta_0 - \beta_8$= Parameters to be estimated

e = Error term

Result and Discussion: Profitability of Catfish Production and Marketing: Gross margin analysis revealed that catfish production and marketing was profitable enterprises. Revenue generated from fish sales exceeded total production and marketing costs, indicating positive returns on investment. The profitability observed could be attributed to the strong market demand for catfish and the relatively high selling prices of processed fish products. Value chain actors engaged in processing recorded higher profits compared to those involved solely in production or marketing. The findings support the work of Ashley-Dejo *et. al*., (2023), who found catfish farming to be a highly profitable agribusiness enterprise in Nigeria. The result of the cost and returns analysis of catfish value addition among producers in the study area is presented in Table 1. The variable costs items used in the computation of gross margin were stocking, labour, fuel, feed, veterinary services and electricity while the fixed cost items were pond, plumbing, weighing scale, generator, pumping machine, net and wheelbarrow. From the analysis, the total variable cost per kilogram of catfish produced was ₦316.08 constituting about 96.89% of the total cost. The feed cost was the highest and most critical factor accounting for 88.96% of the total cost. The high feed cost has implication for the success of catfish farming as an agribusiness venture. First, it implies that feed cost must be constantly monitored and efficiently managed to achieve a profitable operation. It also means that the farmer must make adequate financial provision for feed otherwise the business may crumble. The high feed cost may probably be due to high inflation rate in the country. Cost of stocking, labour, fuel, veterinary services and electricity accounted for 6.17%, 0.25%, 0.16%, 1.82%, and 2.53% of the total cost respectively. The low labour cost could have resulted from the use of family labour by majority of the fish farmers who were married with fairly large family sizes. The average fixed cost per kilogram of catfish was estimated at ₦10.11 accounting for 3.10% of the total cost. The construction and maintenance of ponds constituted the greatest share of the fixed cost representing 0.85% of the total cost per kilogram of catfish. The cost of acquiring a generator was next in amount accounting for 24.23% of the fixed cost and 0.71% of the total cost. This is followed by the cost of rent and costs associated with pumping machine and plastic containers contributing 24.70%, 5.44%, and 8.11% respectively to the fixed cost and 0.62%, 0.55% and 0.25% respectively to the total cost, respectively. Total revenue of the producers was ₦570.12 while the total cost was estimated to be ₦326.19 The gross margin (GM) per kilogram of catfish realized was ₦254.04. The Net farm income was ₦243.93 while the net return on investment was ₦0.75. This meant that, a profit of ₦0.75 is realized for every ₦1 spent on catfish production. The implication is that the catfish production operation is highly profitable in the study area. Thus, it has a significant contribution to the national gross domestic product and income of the producer as a whole thereby uplifting the general standard of living. This result is in tandem with that of Jaji (2024) who studied economics of catfish production in Akwa-Ibom State and indicated that catfish production was profitable in the study area.

Profit Function Analysis: Estimates of profit function for producers: The profit function is used to estimate the contributions of prices of individual resource inputs and output as well as the effects of socio-economic factors on profit (Davies, 2021; Abbas, 2015). The variables used in this study include per unit price of output, per unit price of stocking, per unit price of feed, per unit price of pond. Others are the socio-economic factors including age, educational status and farming experience. The coefficient of price per kilogram of fish was positively related to the amount of maximum variable profit which is significant at 1%. This implies that, a unit increase in the price per kg of fish will lead to an increase in the total revenue and ultimately an increase in profit for farmers. The coefficient of cost of feed was negatively correlated to the profit realized from selling fish and significant at 1% level of probability. This is in line with the findings of Oyedira *et al.,* (2024). The importance of feed in fish production cannot be over-emphasized as under-utilization or over-utilization could cause significant damage. Fish that are fed very well reach marketable size within a short period of time. This implies that the greater the size of your fish as a farmer, the greater the amount of money spent on feeding, consequently the higher the total cost of production and a decrease in the amount of profit that farmers can actually realize from their investment. The coefficient of cost of stocking was negative and statistically significant at 1% probability level. For any tangible result to be achieved in fish farming or production; ponds - either earthen or concrete must be stocked with good quality fingerling or juvenile species and high-quality fingerlings or juvenile species are not cheap. The coefficient of labour cost was negatively related to the amount of variable profit and significant at 1% level of probability. This implies that the higher the cost of labour, the higher the overall cost that will be incurred in raising the fish. Therefore, high cost of labour will reduce the profit and lower costs will increase it. Farming experience had a positive relationship with maximum variable profit and insignificant at 1% level of probability. This implies that the higher the farming experience of the catfish producer, the higher the profit. On the other hand, educational status was negative and significant at 5% level of probability, meaning that most of the farmers may be engaged in other activities which would not allow them to give maximum attention to their fish farms. This result contradicts that of Osarenren *et. al.,* (2022) and Odok *et. al.,* (2017) whose result on educational level positively correlated with profit. The R^2 was 0.634 which implies that 63.4% of the total variation in the dependent variable was accounted for by the independent variables while 36.6% of the variation were due to other factors other than the ones listed.

Constraints to Catfish Production: Result as shown Table 3 revealed that high cost of feed, inadequate capital and poor extension services were considered the most severe constraints faced by catfish producers in the study area with mean responses of 4.92, 4.30 and 4.12 respectively. Feed is a major input in catfish production and also very expensive and sometimes not readily available. This corroborates the findings of Bukenya *et. al.,* (2022), Anetekhai *et al.,* (2021) and Adeyeye *et al.,* (2023). This is connected with the ban on importation of foreign feeds and high cost of available

ones. As a result of the over-dependence on imported feed, cost of purchase of fish feed is usually high. Since catfish production is a capital-intensive enterprise as money is required to carry out some constructions as well as purchase feed, the inadequacy of money to do these often poses a big threat to the catfish farmer. Catfish farmers in the study area lack access to credit and as a result have insufficient capital to run the business. Also, since most of the catfish producers (63%) do not have contact with extension agents, it was ranked 3rd among the respondents as innovative technologies which help maximize production and are usually conveyed by these agents are lacking. What this result of the study means is that if these constraints are not properly tackled, catfish farming will continually lag behind imported fish despite the improvement recorded in the past bearing in mind our vast potential to improve. The least severe constraints as revealed by the ranking were; poor infrastructure, high cost of labour and high cost of medication with mean responses of 2.3, 2.23 and 1.89, respectively. This could be as a result of the fact that catfish require minimal medication especially when the requirements for optimal production are met. Also, majority of the catfish producers have their ponds located in their homes and usually make use of household labour which is unpaid for in most cases.

Conclusion and Recommendations: The study established that catfish production is economically viable enterprises capable of contributing significantly to food security, employment generation, poverty reduction, and rural development in Southern Agricultural Zone of Cross River State. The catfish value chain comprises several interconnected actors whose activities create value and facilitate product distribution. Despite the profitability of the enterprise, challenges such as inadequate finance, poor infrastructure, high feed costs, weak market coordination, and inadequate storage facilities continue to limit the performance of the subsector. Addressing these challenges is essential for enhancing productivity, profitability, and competitiveness within the catfish industry. Based on the findings, the study recommends that: any policy and/or technical measure that substantially reduces the cost of feeding the fish should be provided by government so as to increase farm income and hence profit., government should facilitate access to affordable credit facilities for catfish value chain actors, investments should be made in aquaculture infrastructure, particularly cold storage and processing facilities and extension services should be intensified to promote improved production and processing technologies.

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Appendix

TABLE 1A; Average Costs and Returns Analysis of Catfish Production Per Kilogram, Per Cycle

Items	Value (₦)	Percentage of VC/FC	Percentage of TC
A: TOTAL REVENUE (per kg of catfish)	**570.12**		
B: VARIABLE COSTS (per kg of catfish)			

Stocking	20.14	6.37	6.17
Lime	0.02	0.01	0.01
Labour	0.82	0.25	0.25
Fuel	0.52	0.16	0.16
Feed	290.23	91.82	88.96
Vet services	1.82	0.56	0.56
Electricity	2.53	0.80	0.78
Total Variable Cost	**316.08**		**96.89**
C: FIXED COSTS			
Pond	2.80	27.70	0.85
Rent	2.05	20.28	0.62
Plumbing	0.08	0.79	0.02
Weighing scale	0.03	0.30	0.01
Generator	2.32	22.95	0.7
Pumping machine	1.80	17.80	0.55
Net	0.20	1.98	0.06
Wheelbarrow	0.05	0.49	0.02
Plastic containers	0.82	8.11	0.25

TABLE 1B

C: **Total Fixed Cost**	**10.11**	**3.09**
D: Total Cost	326.19	
E: Gross Margin	254.04	
F: NFI	243.93	
G: NROI	0.75	

Source: Field survey data, 2025

TABLE 2 Estimates of Profit Function Analysis for Producers

Variable	Coefficients	Standard error	t-value
(Constant)	-1276495.607***	67547.316	-18.898
Quantity of fish harvested (kg)	1893.901***	47.134	40.181
Price of fish per kilogramme(₦)	858.876***	51.924	16.541
Cost of fish feed (₦);	-.088***	.018	-4.820
Cost of stocking (₦);	-2.997***	.518	-5.788
Cost of labour(₦)	-6.170***	1.168	-5.283
Cost of Pond	.025	.048	.532
Educational status (years)	-22435.334**	10460.533	-2.145
Farming experience (years)	32844.996***	5915.116	5.553
R^2	0.634		
Adjusted R^2	0.592		
F-value	63078.195		

*** *Significant at 1%, ** Significant at 5%*

Source: Field survey data, 2025

TABLE 3 Constraints to Catfish Production

Source: Field survey data, 2025

S/N	Constraint	Mild		Moderate		Severe		Very severe		Critical		Mean	Rank
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1.	High cost of feed	0	0	0	0	0	0	7	7.45	87	92.5	4.92	1st
2.	Unavailability of quality feed	10	10.64	20	21.28	9	9.57	15	15.96	40	42.55	3.50	4th
3.	High cost of medication	40	42.55	25	26.59	28	29.79	1	1.06	0	0.00	1.89	13th
4.	Poor infrastructure	36	38.30	25	26.59	8	8.51	17	18.09	8	8.51	2.30	11th
5.	Poor extension services	7	7.45	8	8.51	6	6.38	18	19.15	55	58.51	4.12	3rd
6.	Inadequate capital	4	4.25	11	11.70	0	0.00	15	15.96	64	68.09	4.30	2nd
7.	High cost of labour	33	35.11	35	37.20	6	6.38	11	11.70	9	9.57	2.23	12th
8.	High mortality rate	15	15.96	20	21.28	7	7.45	35	37.20	17	18.09	3.20	6th
9.	Theft	25	26.59	20	21.28	40	42.55	5	5.32	4	4.25	2.39	10th
10.	Cannibalism	19	20.21	34	36.17	5	5.32	30	31.91	6	6.38	2.68	8th
11.	Poor quality water	15	15.96	20	21.28	55	58.51	3	3.19	1	1.06	2.52	9th
12.	Market price fluctuations	13	13.93	12	12.77	10	10.64	34	36.17	25	26.59	3.31	5th
13.	Lack of technical know-how	13	13.83	30	31.91	5	5.32	21	22.34	25	26.59	3.16	7th