African Multidisciplinary
Journal of Sciences and Artificial Intelligence

ISSN : 1595-7969

Index: Harvard, Boston, Sydney University, Dimensions, Lens, ResearchGet Scilit, Semantic, Google Scholar, Base etc

https://doi.org/10.58578/AMJSAI.v3i1.9307

Economics of Catfish Production in Taraba State

P. J. Tsokwa, F. B. Filli, J. L. Gizaki
Federal University Wukari, Taraba State, Nigeria
juliuspolycarptsokwa@gmail.com

Article Info:

Submitted:	Revised:	Accepted:	Published:
Jan 18, 2026	Feb 21, 2026	Mar 8, 2026	Mar 13, 2026

Abstract

Catfish production has emerged as a potentially important livelihood and food security enterprise in Taraba State; however, its productivity and sustainability remain shaped by farmer characteristics, input use, and persistent structural constraints. This study examined the economics of catfish production in Taraba State by describing the socioeconomic characteristics of fish farmers, analyzing profitability, identifying the factors influencing production output, and determining the major constraints affecting producers. Primary data were collected from 120 fish farmers across 14 local government areas using purposive sampling. The data were analyzed using descriptive statistics, gross margin analysis, and regression modeling. The findings showed that 65% of the farmers were male, 93% were below 50 years of age, 59% were married, 95% had formal education, 92% had 10 years or less of fish-farming experience, 65% belonged to cooperative societies, and 95% operated with a stocking density of 1,500 or less. Catfish farming was found to be economically viable, with a benefit–cost ratio of 1.51, although feed accounted for 54.42% of variable costs. The multiple regression model produced an R^2 of 0.889 and a high F-value of 823.110, significant at the 1% level, indicating strong explanatory power. Feed, labor, and water exerted positive and significant effects on output, whereas pond size had a negative and significant effect. The major constraints identified were lack of subsidies, insufficient capital, poor government support, and high feed costs. The study concludes that catfish production in Taraba State is profitable but constrained by high input costs and limited institutional support. These findings imply that targeted subsidies, improved access to credit, policy reforms to reduce production costs, infrastructure development, and farmer training are essential to enhance productivity, strengthen livelihoods, and expand the contribution of aquaculture to the state economy.

Keywords: Aquaculture Economics; Catfish Production; Farm Profitability; Production Constraints; Taraba State

INTRODUCTION

Nigeria is endowed with a wealth of fish resources in both fresh and marine waters. There are an estimated 12,478,818 hectares of inland waterways and about 741,509 hectares of brackish waters, the majority of which are suitable for aquaculture, according to information gathered from Manasseh Maiyaki David (2024). Furthermore, it described Nigeria's 200 nautical mile Exclusive Economic Zone (EEZ), which stretches across 853 kilometers of coastline and encompasses 192,000 square kilometers. And made it clear that Nigeria gets its fish from four main sources: aquaculture, artisanal fisheries, industrial trawlers, and significant frozen seafood. The Niger Delta provides more than half of Nigeria's total domestic fish supply (Manasseh, 2024).

Nigeria is blessed with over 14 million ha of reservoirs, lakes, ponds, and major rivers capable of producing over 980,000 metric tons of fish annually (Nwuba et al., 2022). According to National Bureau of Statistics (NBS) (2017), Nigeria's fish production data showed that 5,788,474 tons of fish had been produced between 2010 and 2015. The year 2014 recorded the highest tons of fish produced with 1,123,011 tons; the second highest tons of fish produced were recorded in 2015 while the least were recorded in 2010. Therefore, it can be concluded that Nigeria is endowed with abundant fishery resources to produce enough fish and fish products not only for domestic consumption but also for export.

The study on the economics of fish production in Taraba State aims to investigate the financial viability, challenges, and efficiency of fish farming in the region. Despite Taraba State's abundant water resources and potential for aquaculture, fish production remains underdeveloped, leading to a reliance on imported fish and low local supply. Small-scale fish farmers face constraints such as high feed costs, inadequate access to credit, poor storage facilities, and limited technical knowledge, which hinder productivity and profitability. Additionally, there is insufficient data on the cost-benefit analysis of fish farming, market dynamics, and the impact of government policies on the sector. Without a comprehensive understanding of these economic factors, policymakers and stakeholders cannot design effective interventions to boost fish production, improve farmers' income, and enhance food security in the state.

It is imperative that the value addition and profitability of small-scale fish farming and marketing operations in Taraba state's be looked at. Given how many people enjoy fishing as a hobby, there are also a lot of school dropouts who may pursue value addition through small-scale fish farming and marketing, but they are afraid of the business's capacity to make a profit. The gross margin cum net return on small-scale fish farming and marketing was calculated in this study. In this approach, young people without jobs can benefit from the constant supply of fish and the market to add value and successfully sell preserved fish. This research provides essential information for those who in addition to closing these knowledge gaps, could like to conduct more study in this area. The primary objective of this study was examine economics of fish production in Taraba State. Additionally, the study aimed to: analyze the profitability of catfish farmers; and determine the factors influencing catfish farmers.

METHODS

Study Area

The study was conducted in Taraba State, Nigeria. Taraba state is located at the North Eastern part of Nigeria. It has 16 Local Government Areas and two Special Development Areas. It is divided into four Agricultural Development Programmes (ADPs) zones; 1, 2, 3 and 4. It lies roughly between latitudes 7° 59' 57.702" N and 10° 46' 26.351 E. of the Greenwich meridian (Oruonye and Bashir, 2011). The state covers a land area of about 54,473km^2 with a projected population of 2.9 million people by 2013 (NPC, 2007). Taraba State is located at the North Eastern part of Nigeria. It has 16 Local Government Areas and two Special Development Areas. It is divided into four Agricultural Development Programmes (ADPs) zones; 1, 2, 3 and 4. It is bounded in the west by Nasarawa and Benue

State, North-west by Plateau State, North by Bauchi and Gombe State, North-east by Adamawa State and South-east by Republic of Cameroon.

Sources of Data

The targeted population for the study comprised of fish farmers in Taraba State, Nigeria. Data for this study was collected mainly from primary source. This was done manually through the administration of structured questionnaire to the respondents. Questionnaire administration was done by the researcher and some research assistants who were carefully selected and trained.

Sampling Technique

The population of the study comprises of fish farmers in Taraba State. Data for this study was derived mainly from primary source which was collected with the use of structured questionnaire. Snowball sampling technique, which was using the contacted respondents to identify subsequent respondents, this was used to contact 120 respondents for this analysis. The data was collected from across the state. This method is appropriate because of difficulty in accessing the fish farme**rs**

Method of Data Analysis

Gross margin was used to determine objective (i) the profitability of fish production. Objective (ii) was analyzed using Stochastic frontier model.

Model Specification

Multiple Regression

The regression model was used to analyzed relationship between dependent variable and independent variables: fingerlings, water, fuel drugs, pond size, feeds, labour and duration were measured using Cobb-Douglass production model (Shu'aib et al., 2010). In the Cobb-Douglass model, the dependent variable (Y) is related to the independent variables X_1, X_2… X_5, by

$Y = ß_0\ X_1ß_1\ X_2ß_2\ X_3ß_3X_4ß_4X_5ß_5$. This was linearized by taking log of the equation to become:

$\text{Log } \beta_0 = ß_1 \log X_1 + ß_2 \log X_2 + ß_3 \log X_3 + ß_4 \log X_4 + ß_5 \log X_5$ ……………………… (9)

Where

β_0 = is a constant term

Y= is the total fish output in (kilograms)

X_1 = fingerlings in (numbers)
X_2 = water in (liters)
X_3 = fuel in (liters)
X_4 = drugs in (grams)
X_5= pond size in (m3)
X_6 = feeds in (kilogram)
X_7 = labour in (manday)
X_8= duration in (weeks)
$ß_1 \ldots ß_5$ = regression coefficients

The production function exhibits increasing, decreasing or contract return to scale as

$ß_1 + ß_2 + ß_3 + ß_4 + ß_5 > 1$, $ß_1 + ß_2 + ß_3 + ß_4 + ß_5 < 1$ or $ß_1 + ß_2 + ß_3 + ß_4 + ß_5 = 1$ respectively.

The Functional forms describe the mathematical relationship between variables. Here are four common functional forms along with their general formulas:

1. Linear Function: $y = a + bx$.

A straight-line relationship where yy changes at a constant rate bb with respect to xx.

2. Quadratic Function: $y = a + bx + cx^2$

A parabolic relationship that allows for curvature (increasing or decreasing at a changing rate).

3. Exponential Function: $y = ae^{bx}$

Used for modeling exponential growth/decay; the log form is linear in parameters.

4. Cobb-Douglas Function: $y = Ax_1^{\alpha} x_2^{\beta}$

Captures multiplicative relationships with elasticities αα and ββ.

Gross Margin

Objective (ii) was analyzed using budgetary techniques analysis such as gross margin. This will enable the estimation of the total costs cum total revenue accrued to the enterprise within a specific production period. The difference between revenue (returns) and Total Variable Cost (TVC) makes up the Gross Margin (GM) (Edet et al. 2018).

$$GM = TR - TVC \quad \ldots\ldots (10)$$

where:

GM = Gross Margin

TR = Total Revenue
TVC= Total Variable Cost
Net Farm Income =TR - TC .... (11)

Net income analysis

The net income analysis was used to determine the cost and returns associated with fish farming in the study area to determine the profitability or otherwise of the enterprises. The formula is expressed as:

Net Farm Income =TR - TC .... (12)

Where; NFI = Net Farm Income (N)
TR = Total Revenue (N) i.e. cash income and imputed income (N)
TC = Total Cost of production in naira (TFC + TVC)
TFC =Total Fixed Cost (N)
TVC= Total Variable Cost (N)

RESULTS AND DISCUSSION

Profitability of Fish Production

The profitability analysis presented in Table 3 highlights key financial metrics in fish production, offering insights into cost structures and returns. The results indicate that variable costs dominate production expenses, accounting for 97.75% (₦1,262,824.61) of total costs, while fixed costs constitute a minimal 2.25% (₦29,058.33). This aligns with existing literature, which suggests that African aquaculture systems incur most expenses through recurrent inputs, particularly feed, water management, labour, and fingerlings FAO (2020 and Kam et al. (2016**)**, whose findings found that, Notably, feeding alone represents 54.42% of variable costs, reinforcing findings by Asche et al. (2018), who identified feed as the most significant cost driver in aquaculture. Feed alone accounted for 54.42% of total variable cost, a finding consistent with the global literature which states that feed constitutes between 50% and 70% of total aquaculture costs (Asche et al., 2018; Kaminski et al., 2020). This indicates a critical need for improved feed efficiency and local feed alternatives

The gross margin (₦686,365.45) and net farm income (₦648,307.12) indicate profitability, further supported by a benefit-cost ratio (BCR) of 1.51, suggesting that for every Naira invested, ₦1.51 is returned. This exceeds the threshold BCR of 1.0, confirming economic viability (Ukagwu et al., 2020). The return per Naira invested (51 kobo) implies a 51% profit margin, which is favorable compared to some small-scale aquaculture studies reporting 30–45% returns (Ogunbameru et al., 2020). However, the average cost per kg (₦3,536.07) may be high relative to market prices in some regions, indicating potential efficiency improvements in feed utilization and labor management (Hasan & Halwart, 2009).

The low fixed costs (5.51% for pond maintenance and 21.14% for scooping nets) suggest that producers rely on minimal infrastructure, possibly due to small-scale operations. This contrasts with commercial aquaculture systems where depreciation on large ponds and equipment significantly impacts costs (Brummett et al., 2017). The high labor cost (14.26%) aligns with studies emphasizing labor intensity in African aquaculture (Rurangwa et al., 2018), while transport (1.32%) and medication (1.86%) remain minor cost components, possibly due to localized production and preventive health measures.

Table 1: Average Profitability of Fish Production

Item	Value in Naira (₦)	Percentage (%)
Variable Cost		
Feeding	687,285.72	54.42
Water	137,690.31	10.91
Fingerlings	128,464.36	10.17
Transport	16,595.24	1.32
Labour	179,904.85	14.26
Fuel	89,208.69	7.06
Medication	23,675.44	1.86
Total	1,262,824.61	100
Fixed Cost		
Pond	1,600.23	5.51
Buckets	4,161.90	14.32
Bowls	7,823.81	26.93
Tables	3,704.76	12.75
Scales	5,623.81	19.35
Scooping net	6,143.82	21.14
Total	29,058.33	100
Total Cost	1,291,882.94	
Total Revenue	1,949,187.87	
Average Kg of Fish Harvested	551.23	

Item	Value in Naira (₦)	Percentage (%)
Average Cost per Kg of fish	3,536.07	
Analysis		
Gross Margin	686,363.26	
Net Farm Income	657,304.93	
Benefit Cost Ratio	1.51	
Return per Every Naira	51 Kobo	

Source: Field Survey. 2025

Factors that Influenced Fish Production

The provided regression output presents both unstandardized (B) and standardized (Beta) coefficients, along with their significance levels, for several variables influencing an outcome variable (likely related to fish production, given the variables). Double log was adopted as the best fit functional form. The model demonstrates a strong explanatory power, with an R^2 of 0.889 (88.9%), indicating that approximately 89% of the variance in the dependent variable is explained by the predictors (independent variables). The highly significant F-value (823.110***) confirms the overall robustness of the regression model and is best fit to solve the problem at hand (Ukpe., et al., 2017).

The fingerling was positive and significant at 10% level with coefficient of 3.650. This suggests that an additional fingerling on the farm will increase table size fish by 3.650kg. This means that increasing fingerling quantity and quality enhances production, aligning with studies emphasizing optimal stocking density for yield maximization (Sambo et al., 2021) Filli 2015). It also agreed with the findings of Onyebinama et al. (2017) which reported that costs of fingerlings and feeding were positive and significant variables in the determination of fish output and profitability in Obio-Akpor Local Government Area of Rivers State, Nigeria

Water availability was positive and significant at 5% level with coefficient of 0.624. This indicates that an additional litre of water will increase table size fish by 0.624kg. this is in line with the work of Sambo et al. (2021) that water quality and quantity are critical for fish productivity.

Pond size was negative and significant at 1% level with coefficient of (-1.988). This opined that an additional mitre cube of pond will decrease table size fish by 1.988kg. This is likely because an increase of pond without increase in other corresponding variables will lead to possibly diseconomies of scale in poorly managed large ponds (Ayushi and Ramchandra 2021).

Feeds supplied was positive and significant at 1% level with coefficient of 1.623. This depicts that an additional kg of feed will increase table size fish by 1.623kg. This proved that feeds directly translate to fish output in consistent with Ukagwu et al. (2020) assertion that feed quality directly influences yield supporting the argument that skilled labour enhances productivity.

Labour was positive and significant at 1% with coefficient of 22.523. This shows that a unit increase in labour will increase or have positive effect on production. This corroborates existing literature highlighting labour efficiency as critical drivers of fish yield (Adeoye et al., 2019).

The duration of fish in pond was positive and significant at 1% level with coefficient of 0.220 This revealed that an additional week of fish in pond will increase table size fish by 0.220. An additional week increased output by 0.220 units, this suggests that the longer stay in pond with proper management, the more it grows irrespective of the cost implication. consistent with Yi et al. (2018**)** who emphasized that longer grow-out periods increase biomass, provided that feeding and water quality are maintained.

Fuel and drugs were statistically insignificant at conventional level of this study this disagrees with Filli (2011) whose production elasticity of fuel was positive and statistically significant, this may as a result of differences in feed quality, pond management techniques, and overall farm technology may overshadow the effects of fuel and drugs, making them less significant.

Table 2: Factors that Influenced Catfish Production

Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	
	B	Std. Error	Beta	t-Value
Constant	-136.928	37.909		-3.612***
Fingerlings	3.650	1.846	0.086	1.977*
Water	0.624	0.254	0.059	2.459**
Fuel	5.394	4.075	0.064	1.324
Drugs	3.829	3.174	0.046	1.206
Pond Size	-1.988	0.410	-0.076	-4.852***
Feeds	1.623	0.357	0.484	4.547***

Labour	22.523	4.185	0.318	5.381***
Duration	0.220	0.065	0.045	3.369***
F-Value				823.110***
R-Square				0.889 (88.9%)

Source: Field survey 2025

significant at 10%, ** significant at 5% and significant at 1%**

CONCLUSION

This study examined the economics of fish production in Taraba State, Nigeria, focusing on profitability, influencing factors, and constraints faced by fish farmers. The findings reveal that fish farming is a viable economic activity in the state, with a favorable benefit-cost ratio (1.51) and a return of ₦1.51 for every naira invested. However, high variable costs, particularly feed (54.42% of total costs), significantly impact profitability. Key factors influencing production include feed quality, labor, and water availability, while pond size showed a negative correlation, possibly due to inefficiencies in large-scale management.

Major constraints identified include lack of subsidies, limited access to capital, poor government support policies, and high feed costs. These financial and institutional barriers hinder sector growth, despite the state's abundant water resources and potential for aquaculture expansion. Additionally, inadequate extension services and security concerns further limit productivity.

To enhance fish production in Taraba State, policymakers should prioritize financial interventions such as subsidies, low-interest loans, and feed cost reduction programs. Strengthening extension services, improving security, and promoting modern aquaculture techniques can also boost efficiency. By addressing these challenges, Taraba State can harness its aquaculture potential to improve food security, create employment, and contribute to economic development. Future research should explore climate-resilient fish farming practices and the impact of cooperative societies on small-scale fish producers.

Overall, this study provides valuable insights for stakeholders seeking to optimize fish production in Taraba State, emphasizing the need for targeted investments and policy reforms to ensure sustainable growth in the sector.

REFERENCES

Adeoye, A. A., Akegbejo-Samsons, Y., & Fagbenro, O. A. (2019). Economic analysis of small-scale aquaculture enterprises in Lagos State, Nigeria. *Journal of Applied Aquaculture, 31*(3), 231–245.

Asche, F., Bellemare, M. F., Roheim, C. A., Smith, M. D., & Tveteras, S. (2015). Fair enough? Food security and the international trade of seafood. *World Development, 67*, 151–160. https://doi.org/10.1016/j.worlddev.2014.10.013

Ayushi, S., & Ramchandra, V. (2021). Economics of scale in aquaculture: Evidence from Indian carp farming. *Aquaculture Economics & Management, 25*(2), 123–145.

Brummett, R. E., Lazard, J., & Moehl, J. (2008). African aquaculture: Realizing the potential. *Food Policy, 33*(5), 371–385. https://doi.org/10.1016/j.foodpol.2008.01.005

Ele, I. E., Ibok, O. W., Antia-Obong, E. A., Okon, I. E., & Udoh, E. S. (2013). Economic analysis of fish farming in Calabar, Cross River State, Nigeria. *Greener Journal of Agricultural Sciences, 3*(7), 542–549. https://doi.org/10.15580/GJAS.2013.3.061013653

Filli, B. B. (2011). Resource-use efficiency in fish farming in Adamawa State, Nigeria. *Journal of Agriculture and Social Research, 11*(2), 115–123.

Filli, B. B. (2015). Analysis of technical efficiency in fish farming in Adamawa State, Nigeria. *Journal of Economics and Sustainable Development, 6*(14), 126–132.

Food and Agriculture Organization of the United Nations. (2020). *The state of world fisheries and aquaculture 2020: Sustainability in action*. https://doi.org/10.4060/ca9229en

Hasan, M. R., & Halwart, M. (Eds.). (2009). *Fish as feed inputs for aquaculture: Practices, sustainability and implications* (FAO Fisheries and Aquaculture Technical Paper No. 518). Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/handle/20.500.14283/i1140e

Kam, L. E., Leung, P., & Ostrowski, A. C. (2003). Economics of offshore aquaculture of Pacific threadfin (*Polydactylus sexfilis*) in Hawaii. *Aquaculture, 223*(1–4), 63–87. https://doi.org/10.1016/S0044-8486(03)00162-5

Kaminski, A. M., Genschick, S., Kefi, A. S., & Kruijssen, F. (2020). Fish feed technology and management in sub-Saharan Africa. In *Feed and feeding practices in aquaculture* (pp. 273–303). Woodhead Publishing.

National Bureau of Statistics. (2017). *Nigeria's fish production: 2010–2015*. https://www.nigerianstat.gov.ng/pdfuploads/Nigeria%27s%20Fish%20Production%202010%20-2015.compressed.pdf

National Population Commission. (2007). *2006 population and housing census of the Federal Republic of Nigeria*.

Nwuba, E. I., Amao, O. A., & Eze, C. C. (2022). Assessment of fish production and consumption in Nigeria: Prospects for sustainability. *African Journal of Fisheries and Aquatic Resources Management, 7*(1), 45–58.

Ogunbameru, B. O., Ogunbameru, A. S., & Ojo, M. A. (2020). Profitability and constraints of small-scale fish farming in Osun State, Nigeria. *Journal of Agricultural Sciences, 65*(3), 285–300.

Onyebinama, C. C., Onyebinama, U. A., & Nwosu, C. S. (2017). Economic analysis of fish production in Obio-Akpor Local Government Area of Rivers State, Nigeria. *International Journal of Fisheries and Aquatic Studies, 5*(3), 146–150.

Oruonye, E. D., & Bashir, A. (2011). *The geography of Taraba State Nigeria*. LAP Lambert Academic Publishing.

Rurangwa, E., Agyakwah, S. K., Boon, H., & Bolman, B. C. (2018). Labour productivity in smallholder aquaculture in Ghana. *Aquaculture, 495*, 20–28.

Sambo, A. B., Gona, A., & Danbatta, B. G. (2021). Factors influencing fish production among small-scale farmers in Northern Nigeria. *Nigerian Journal of Fisheries and Aquaculture, 9*(1), 22–31.

Shu'aib, L., Ahmed, B., & Mohammed, A. (2010). Application of Cobb-Douglas production function in fisheries: A case study of Lake Chad. *Journal of Aquatic Sciences, 25*(2), 112–118.

Ukagwu, J. I., Nwachukwu, I. N., & Eze, C. C. (2020). Profitability and efficiency of catfish production in Imo State, Nigeria: A stochastic frontier approach. *Asian Journal of Agricultural Extension, Economics & Sociology, 38*(5), 48–59.

Ukpe, I. A., Essien, U. A., & Udoh, E. J. (2017). Determinants of output in artisanal fisheries in Akwa Ibom State, Nigeria. *Global Journal of Agricultural Sciences, 16*(1), 25–32.

Yi, Y., Fitzsimmons, K., & Diana, J. S. (2018). Growth, yield, and economic returns of Nile tilapia (*Oreochromis niloticus*) production in earthen ponds. *Aquaculture Reports, 12*, 12–17.