Pancasila International Journal of Applied Social Science
E-ISSN 2988-0750 P-ISSN 2988-0769
Volume 3 Issue 02, May 2025, Pp. 348-363
DOI: https://doi.org/10.59653/pancasila.v3i02.1728

Analysing Resource Use Efficiency and Determinants of Catfish Output in Ondo State, Nigeria

Olanrewaju Peter Oladoyin[1*], Temitope Olanrewaju Bello[2], Justin Orimisan Ijigbade[3], Oluwajuwon Emmanuel Adaba[4], Julius Olumide Ilesanmi[5]
Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria[1]
Federal University of Technology, Akure, Nigeria[2]
Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria[3]
Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria[4]
Bamidele Olumilua University of Education, Science and Technology, Ikere-Ekiti, Nigeria[5]
Corresponding Email: ooladoy24@gmail.com

Received: 19-03-2025 *Reviewed: 22-04-2025* *Accepted: 17-06-2025*

Abstract

This study evaluated resource use efficiency in catfish production in Ondo East Local Government Area, Ondo State, Nigeria. A multistage sampling technique was employed to select 150 catfish farmers across five purposively chosen communities. Structured questionnaires were used to collect primary data, which were analysed using descriptive statistics, budgetary analysis, and multiple regression models. Findings indicate that the average age of respondents was 45 years, with most being male (80%), married (80%), and formally educated (97.3%). The mean household size was five, and the average farming experience was 11 years. The majority (87.3%) sourced fingerlings through purchase, and over half (51.3%) relied on personal savings as their main capital source. The mean farm size was 6.17 units. Profitability analysis revealed that for every ₦1.00 invested, farmers earned ₦3.90, confirming the viability of catfish farming in the area. Regression analysis identified fingerlings, feed, labour, and pesticides as significant inputs influencing output ($p < 0.05$), while farm size and fertiliser had no significant effect. Efficiency analysis showed underutilization of fingerlings (12.6) and pesticides (1.2), while inputs such as feed, labour, fertiliser, and farm size were overutilized. Major production constraints included limited access to credit (98.7%), high feed costs (97.3%), and pollution (83.3%). The study concludes that while catfish farming is profitable, inefficiencies and structural challenges persist. It recommends improving farmers' access to credit, promoting investment in fingerlings, and encouraging youth participation to enhance productivity and reduce rural unemployment.

Keywords: Catfish, Resource Use Efficiency, Production, Marginal Value Product, Return on Investment

Introduction

Fish production, a vital branch of aquaculture, involves the cultivation of fish in controlled or semi-controlled environments to generate both nutritional and economic benefits (Ochiaka & Kaine, 2022). In Nigeria, the African catfish (*Clarias gariepinus*), a member of the Clariidae family, is the most commonly farmed species due to its adaptability, rapid growth, and high consumer demand. Catfish production occupies a significant position in the country's agricultural economy, with the fisheries sub-sector recently recording the fastest growth rate in its contribution to national GDP (Fasakin & Omonona, 2020). Fish serves as a major source of animal protein, which is critically needed in Nigeria due to persistent protein deficiency. While protein can be obtained from both plant and animal sources, the supply of animal-based protein has declined due to a range of factors, including rapid population growth, livestock disease outbreaks, climate change, desertification, drought, scarcity of high-quality feed, and limited availability of genetically superior indigenous breeds (Oyewole et al., 2023). Consequently, fish has become a more accessible and affordable alternative for meeting protein needs.

Currently, Nigeria requires an estimated 2.66 million metric tons of fish annually to meet dietary requirements (Ogunwande, Goodness, & Olasoji, 2020). However, total domestic production from both capture and culture fisheries is less than 700,000 metric tons per annum. To bridge the supply gap, the country imports approximately 1.96 million metric tons of fish each year, valued at around $500 million, ranking Nigeria as Africa's largest importer of frozen fish (Ogunwande et al., 2020). This significant reliance on imports underscores the urgent need to strengthen local fish production capacity. According to Ogunwande et al. (2020), with increased investment and efficient use of resources, Nigeria could become self-sufficient in fish production and potentially emerge as a net exporter. Achieving this goal requires optimising resource allocation to maximise yield and profitability, shorten production cycles, and meet market demand efficiently.

Fish farming in Nigeria spans both extensive and intensive production systems and includes a wide variety of species. However, catfish remains the most widely cultivated species due to its high commercial value, ease of farming, and broad market acceptance (Aloysius et al., 2020). Catfish farming is not only economically viable but also well-suited to Nigeria's climatic conditions. Its high protein content and affordability make it a preferred choice among consumers. In recent years, the catfish industry has experienced sustained growth, with food-size catfish sales increasing by 5%, reaching $442 million in 2022 (Aloysius et al., 2020). Moreover, demand for value-added products such as smoked catfish and fillets continues to rise, driven by consumer preferences for convenient, ready-to-cook foods.

Despite its profitability, catfish farming is often constrained by inefficiencies in production, particularly in the use of resources such as feed, fingerlings, labour, and pesticides. Challenges such as poor access to credit, high input costs, and environmental issues like water pollution further exacerbate these inefficiencies (Ogunwande et al., 2020). According to Ogunwande et al. (2020), improving the knowledge base around profitability and production constraints can facilitate more efficient use of inputs and enhance overall farm productivity. Several studies have examined resource use efficiency in catfish farming across Nigeria. For instance, Aloysius et al. (2020) analyzed technical efficiency among small-scale catfish farmers in Benin metropolis, Vargas (2019) focused on resource use in Akoko North East of Ondo State, and Ogunwande et al. (2020) explored resource optimization in Minna, Niger State.

Understanding allocative efficiency and optimal resource use is essential for reducing waste and enhancing farm profitability. However, there is a dearth of localised research focusing on resource use efficiency in catfish production within the Ondo East Local Government Area of Ondo State. The limited studies available are largely based outside the state or region and may not reflect local conditions and practices. This research gap necessitates a context-specific analysis to provide evidence-based recommendations that can improve productivity and sustainability in catfish farming.

Therefore, this study seeks to assess resource use efficiency in catfish production in the Ondo East Local Government Area. The specific objectives are to: (i) describe the socioeconomic characteristics of catfish farmers; (ii) determine the cost and returns of catfish production; (iii) identify factors influencing catfish output; (iv) analyze the efficiency of input use; and (v) identify the key constraints affecting catfish production in the study area.

Research Method

This study was conducted in Ondo East Local Government Area (LGA), one of the eighteen LGAs in Ondo State, located in the southwestern region of Nigeria. The area was purposively selected due to its significant engagement in aquaculture, particularly catfish farming, which plays a central role in the local economy. Ondo State spans a total land area of approximately 15,195.2 km², making it one of the more agriculturally diverse states in the region. Ondo East LGA lies within the tropical rainforest agro-ecological zone and is characterised by a humid climate, with mean annual rainfall ranging from 2,000 to 4,000 mm. The average maximum temperature reaches 30°C, and the region experiences two distinct seasons: the wet season, which typically lasts from March to October (interrupted briefly by the August Break), and the dry season, which spans from late November to early March. Agriculture constitutes the backbone of the local economy, with a large proportion of the population engaged in farming. The LGA supports the cultivation of a range of cash crops, including cocoa, oil palm, groundnut, melon, cotton, and maize. In addition, food crops such as yam, cassava, cocoyam, and maize are grown extensively for both subsistence and commercial purposes. Of particular relevance to this study is the prevalence of fish farming, which has become a major livelihood activity for many residents. The concentration of aquaculture activities in the area, especially small- to medium-scale catfish production, justifies its selection as the study site for assessing resource use efficiency in catfish farming.

Primary data were used for this study. The primary data were collected using a structured questionnaire administered to catfish farmers in the study area. The questions were tailored towards meeting the set objectives of the study. Data on personal characteristics as well as production were collected from 150 catfish farmers. A multistage sampling technique was used to select 150 respondents. The first stage involved the purposive selection of five communities from the Local Government Area based on the preponderance of fish farmers.

The second stage involved the random selection of thirty respondents from each of the selected fifty communities using the snowball sampling technique, thus giving a sample size of one hundred fifty (150) respondents. Descriptive statistics, budgetary technique and multiple regression model were used to analyse the data.

Description statistics, such as frequency distribution, mean values, mode and standard deviation, were employed to describe the socio-economic characteristics of catfish farmers in Ondo East.

The budgeting technique was used to determine the costs and returns of catfish production in the study area. These include: Return on Investment (ROI). The following arithmetical relations were used in the study:

NFI = TR-TC …………………… (i)

Where:

NFI = Net Farm Income (Naira/Ha)

TR = Total Revenue (Naira/ha)

TC = Total Cost of Production (Naira/ha)

TC = TVC + TFC

Total Cost (TC) = Total Fixed Cost (TFC) + Total Variable Cost (TVC)

TVC = (cost of fingerlings, fertiliser, labour, agrochemicals, feeds, lime, fuel, transportations, drugs and medication, Repair and maintenance)

TFC = (Depreciation on fixed assets)

A multiple regression model was used to analyse the resource use efficiency of catfish production in the study area. Data generated and analysed using a multiple regression model specified as the relationship between the output of quantity of catfish sold (Y) in Naira and the explanatory variables is stated implicitly as:

Y = f(X1, X2,……..X7) …………………………………………(ii)

Where;

Y = output of quantity of catfish sold (kg)

X_1 = Pond size (m^2)

X_2 = Fingerlings (numbers)

X_3 = Feeds (Naira)

X_4 = Labour (Man-day)

X_5 = Fertilizer (kg)

X_6 = Pesticide (litres)

X_7 = Pond types (1=Earthen, 0=Concrete)

Explicitly, the models are represented as follows:

The linear regression model is expressed below:

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + U_i$

Semi log

$Y = \beta_0 + \beta_1 LogX_1 + \beta_2 LogX_2 + \beta_3 LogX_3 + \beta_4 LogX_4 + \beta_5 LogX_5 + \beta_6 LogX_6 + \beta_7 LogX_7 + \beta_8 LogX_8 + \beta_9 LogX_9 + \mu;$

Exponential

$Log\ Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \mu;$

Double log

$LogY = \beta_0 + \beta_1 LogX_1 + \beta_2 LogX_2 + \beta_3 LogX_3 + \beta_4 LogX_4 + \beta_5 LogX_5 + \beta_6 LogX_6 + \beta_7 LogX_7 + \beta_8 LogX_8 + \beta_9 LogX_9 + \mu;$

Efficiency of resource use was determined by the Ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) of inputs.

The inputs MVPxi/MFCxi will be computed for each factor evaluated as follows:

MVPxi = 1 implies optimum use level for i,

MVP/Pxi<1 implies over-utilisation of input i,

MVP/Pxi> 1 implies under-utilisation of input i,

Descriptive statistics, such as a five-point Likert rating scale, which includes Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD) were used to identify the major constraints to catfish production in the study area.

Results and Discussion

Socioeconomic Characteristics of Respondents

The demographic profile of respondents is presented in Table 1. Results indicate that catfish farming in the study area is male-dominated, with 80% of respondents being male and 20% female. This finding aligns with prior studies by Oyita and Aberji (2024) and Deji and Koledoye (2013), which report that men traditionally assume more active roles in agricultural production, particularly in resource-intensive enterprises such as aquaculture. The age distribution reveals that 21.3% of respondents were aged 30–39 years, 56% were 40–49 years, 16% were 50–59 years, and 6.7% were aged 60 years and above. The mean age was estimated at 45 years, suggesting that most catfish farmers in the area are in their economically productive years. This figure is notably higher than the average age of 36 years reported by Oyita and Aberji (2024), implying that fish farming in this locality may attract older, more experienced individuals.

In terms of marital status, 80% of respondents were married, while 9.3% were single. Divorced and widowed farmers accounted for 6% and 4.7%, respectively. The high proportion of married respondents is consistent with the observations of Asadu and Egbuche (2020) and Afolayan et al. (2024), who argued that marital status often correlates with increased responsibilities and the availability of household labour. Similarly, Oyita and Aberji (2024), Ilesanmi et al. (2024), and Oladoyin et al. (2025) noted that married farmers tend to benefit from family labour, which can enhance farm operations and reduce reliance on hired workers.

Regarding farming experience, 8.7% of respondents had 1–5 years of experience, 54.7% had 6–10 years, 26% had 11–15 years, 8% had 15–20 years, and 2.6% had over 20 years of experience. The mean farming experience was approximately 10 years. This distribution suggests a balance between novice and experienced farmers in the area. It supports findings by Bello et al. (2025), Oyita and Aberji (2024) and Inoni et al. (2017), who emphasised the importance of experience in enhancing technical skills and management capabilities in aquaculture.

The educational attainment of respondents indicates a relatively high literacy level. Half (50%) of the farmers had tertiary education, 38.3% had secondary education, 8% had primary education, and only 2.07% had no formal education. This high level of education suggests a strong potential for the adoption of improved production techniques and technologies. Similar trends have been reported by Oyita and Aberji (2024), who found that higher education among farmers facilitates innovation and efficiency in fish farming.

Household size data show that 26.7% of respondents had 1–3 household members, 68% had 4–6 members, and 18% had 7–11 members. The average household size was approximately five persons. This suggests that many households likely include young adults who can contribute labour to farming activities, reducing dependency on hired labour. These findings are consistent with Egware and Alakiri (2023) and George et al. (2014), who highlighted the role of Nigeria's extended family system in ensuring labour availability and farm sustainability.

Table 1: Socio- economic Characteristics of the Respondents

Gender	Frequency	Percentage	Mean
Male	120	80.0	
Female	30	20.0	
Total	150	100.0	
Marital Status			
Single	14	9.3	
Married	120	80.0	
Widowed	7	4.7	
Divorced	9	6.0	
Total	150	100.0	
Age			
30-39	32	21.3	
40-49	84	56.0	
50-59	24	16.0	
60 and above	10	6.7	
Total	150	100	

Household Size			
1-3	21	26.7	
4-6	102	68.0	**5.1**
7-11	27	18.0	
Total	150	100.0	
Experience			
1-5	13	8.7	
6-10	82	54.7	**10.46**
11-15	39	26.0	
15-20	12	8.0	
Above 20	4	2.6	
Total	150	100.0	
Farm Size(plots)			
1-3	47	30.7	
4-6	41	22.7	
7-9	20	24.6	
10 and above	33	22.0	
Total	120	100.0	
Level of Education			
No formai education	4	2.7	
Primary education	12	8.0	
Secondary education	59	38.3	
Tertiary education	75	50.0	
Total	150	100	

Source: Field Survey, 2025

Type of Fish Ponds Used by Respondents

The distribution of pond types among catfish farmers in the study area is presented in Table 2. Findings reveal that the majority of respondents (86.7%) utilised earthen ponds, while 6% operated plastic ponds and 7.3% used concrete ponds. The predominance of earthen ponds suggests a preference for low-cost, locally available construction materials. However, earthen ponds can be prone to structural challenges such as excessive water loss through seepage and evaporation, and they may also face a higher risk of collapse if not properly constructed and maintained. The preference for earthen ponds in this study contrasts with the findings of Dauda et al. (2018), who reported a higher prevalence of concrete ponds among fish farmers in their study area. This discrepancy may be attributed to regional variations in pond construction costs, soil types, technical know-how, and access to capital. While earthen ponds remain popular due to affordability and ease of setup, ensuring proper construction and management practices is essential to minimise water loss and enhance productivity.

Table 2: Distribution of Respondents by Type of Ponds

Type of Ponds	Frequency	Percentage
Earthen pond	130	86.7
Plastic pond	9	6.0
Concrete pond	11	7.3
Total	150	100.0

Source: Field Survey, 2025

Cost and Returns of Catfish Production

Table 3 presents the cost and returns analysis of catfish production in the study area. Results indicate that the total fixed cost (TFC) amounted to ₦1,679,253.98, with pond construction accounting for the largest share at 58.4%. Other notable components include wells (11.1%), water tanks (7.9%), land (7.8%), generators (6.2%), pumping machines (4.8%), wheelbarrows (2.3%), weighing scales (1.0%), fishnets (0.3%), and baskets (0.3%). The depreciated value of these fixed assets was estimated at ₦120,643.47.

The total variable cost (TVC) was recorded at ₦2,625,229.96. Labour accounted for the largest proportion of variable cost at 53.6%, followed by feeding costs (30.4%) and fingerlings (12.5%). Other expenses included transportation (1.8%), electricity (0.6%), pesticides (0.6%), and fertilisers (0.5%). The average total revenue generated by the respondents was ₦10,715,189.55, while the total cost of production, calculated as the sum of the depreciated fixed costs and total variable costs, amounted to ₦2,745,873.43. The resulting average profit was ₦7,969,316.12.

The analysis yielded a return on investment (ROI) of 3.90, indicating that for every ₦1.00 invested in catfish production, farmers realised an additional ₦3.90 in revenue. This high ROI underscores the economic viability and profitability of catfish farming in the study area, likely driven by strong market demand and favourable pricing. These findings are consistent with those of Oyita and Aberji (2024) and Onyekuru et al. (2019), who reported that catfish farming remains a financially rewarding enterprise with potential for significant income generation.

Table 3: Cost and Returns of Catfish Production in the Study Area

Item	Value in (₦)	Percentage	Expected Life Span	Depreciation Value
	FIXED COST			
Well	₦185,666.67	11.1	25	₦7,426.67
Water tank	₦132,233.33	7.9	15	₦8,815.55
Wheelbarrow	₦37,966.67	2.3	5	₦7,593.33
Generator	₦105,466.00	6.2	7	₦15,066.57
Pumping machine	₦80,578.00	4.8	7	₦11,511.14
Pond	₦980,866.67	58.4	20	₦49,043.30
Weighing scale	₦17,220.00	1.0	8	₦11,511.14
Land	₦131,733.3	7.8	1	₦2,152.50
Basket	₦3,436.67	0.2	1	₦3,436.67

Fishnet	₦4,086.67	0.3	1	₦4,086.67
TFC	₦1,679,253.98	**100.0**		**₦120,643.47**
	VARIABLE COST			
Feeding	₦796880.00	30.4		
Pesticide	₦15,515.33	0.6		
Fertilizer	₦11,833.3	0.5		
Transportation	₦47,178.00	1.8		
Electricity	₦15,160.00	0.6		
Cost of fingerlings	₦330,703.33	12.5		
Labour Input	₦1,407,960.00	53.6		
TVC	**₦2,625,229.96**	**100.0**		
	REVENUE			
TOTAL REVENUE	**₦10,715,189.55**			
TOTAL COST (TVC+TFC depreciation value)	₦2,745,873.43			
PROFIT = TR-TC	₦7,969.316.12			
ROI=TR/TC	3.90			

Source: Field Survey, 2025

Factors Affecting Catfish Production in the Study Area

Table 4 presents the results of the regression analysis conducted to identify the key factors influencing catfish production in the study area. Four functional forms of regression, linear, exponential, semi-log, and double-log, were tested, with the linear model selected as the lead equation. This selection was based on its superior performance in meeting economic, statistical, and econometric criteria, including the highest number of statistically significant variables at the 5% level. The linear model recorded an R-squared value of 0.739, indicating that approximately 73.9% of the variation in catfish output was explained by the independent variables: farm size, number of fingerlings, feeding, labour, fertiliser, and pesticide use. The model also yielded a statistically significant F-statistic of 67.135 ($p < 0.001$), confirming the joint explanatory power of the independent variables and validating the overall model fit. Among the variables assessed, several fingerlings, feed, labour, and pesticide use were statistically significant predictors of catfish production ($p < 0.05$). Conversely, farm size and fertiliser application were not significant ($p > 0.05$).

The number of fingerlings showed a positive and significant effect on production, with a coefficient of 0.189 ($p = 0.013$), suggesting that a 1% increase in fingerlings would lead to an 18.9% increase in output. This is consistent with findings by Ogunnaike et al. (2021), who emphasised the critical role of fingerling quantity in determining farm productivity.

Feed quantity was also positively associated with production, displaying a high coefficient of 0.899 ($p < 0.001$). This indicates that increasing feed input by one unit results in an 89.9% rise in output. These findings support earlier studies by Oluwasola and Ige (2015) and Oluwasola and Ajayi (2013), who observed that feed quantity is a primary determinant of catfish yield and profitability. The labour variable was significant, with a coefficient of 0.079 ($p = 0.004$). This implies that a unit increase in labour use leads to a 7.9% increase in catfish output. The result corroborates the findings of Ogunnaike et al. (2021) and Bello (2025), who noted that efficient labour allocation enhances aquaculture productivity.

Lastly, pesticide use had a strong positive effect, with a coefficient of 3.598 ($p = 0.031$), indicating that increased pesticide application can boost production by 359.8%. This suggests an important role for pest control in aquaculture, although the result diverges from findings by Abdullahi and Ibrahim (2021), who reported that excessive pesticide use may impair fish physiology and behaviour. The significant positive impact observed here may reflect the responsible or targeted use of pest management practices among farmers in the study area.

In summary, the regression analysis underscores the importance of input optimisation, particularly in the use of fingerlings, feed, labour, and pesticides, in enhancing catfish production efficiency in Ondo East LGA.

Table 4: Regression Analysis of Factors Affecting Catfish Production in the Study Area

Independent Variables Names	Variable Letter Code	Linear	Exponential	Semi log	Double log
Constant	Coefficient	121.682	13263.472	63.018	21928543.957
	T-value	(2.977)	(4.084)	(3.475)	(3.243)
	P-value	.030	.000	.010	.014
Farm size	X1	-.022	2721.847*	3.990*	1551768.352*
		(-.694)	(2.879)	(2.888)	(3.012)
		.489	.005	.023	.020
Number of fingerlings	X2	.189*	-10.381	-1.183	-495190.146
		(.961)	(-.021)	(-1.134)	(-1.273)
		.013	.978	.294	.244
Feeding	X3	.899*	-191.546	-2.031	-838777.469
		(19.073)	(-2.154)	(-1.721)	(-1.906)
		.000	.33	.129	.098
Labour	X4	.079*	1527.44*	.258	147567.913*
		(.287)	(-2.956)	1.574	(2.413)
		.004	.004	.160	.047
Fertilizer	X5	.026	124.4400	-.427	-27427.804
		(.197)	(.498)	(-.308)	(-.053)
		.844	.620	.767	.959
Pesticide	X6	3.598*	13263.472*	-1.869	-1057527.314
		(2.183)	(4.084)	-1.133	(-1.720)
		.031	.000	.295	.129
Pond Type	X7	-0.130	5.323	42.232	2.232
		(-.401)	(.232)	(2.392)	(12.2)
		.141	.212	.911	.644
R square		**.739**	**.591**	**.831**	**0.591**
Adj R^2		**.728**	**.571**	**.661**	**0.519**
F-ratio		**67.135 (.000)**	**3.856 (.001)**	**4.908 (.026)**	**8.179**

Figure in first line= estimated coefficient

Figures in parenthesis = t value

Figure in third line= p value

* Significant at 0.05.

Resource Use Efficiency in Catfish Production

Table 5 presents the analysis of resource use efficiency among catfish farmers in the study area. The table reports the marginal physical product (MPP) of key inputs used in production, alongside the unit price of catfish, which was estimated at ₦2,004.60. Also displayed are the marginal value product (MVP) and marginal factor cost (MFC) for each input, with the resulting efficiency index calculated as the ratio of MVP to MFC. The efficiency indices for the inputs analysed are as follows: farm size (0.1), number of fingerlings (12.6), feeding (0.6), labour (0.5), fertiliser (0.1), and pesticide (1.2). An efficiency index greater than 1 suggests underutilization, while values less than 1 indicate overutilization.

The results show that pesticide (1.2) and number of fingerlings (12.6) are underutilised, indicating that these inputs have not been applied at optimal levels relative to their marginal returns. In particular, the high index for fingerlings highlights substantial room for increasing productivity through better stocking practices. However, while pesticides are underutilised in the economic sense, caution is warranted. Excessive use of pesticides, if improperly managed, may lead to adverse physiological and behavioural effects on fish, including erratic swimming, feeding irregularities, oxidative stress, tissue damage, and impaired growth performance (Abdullahi & Ibrahim, 2021). Thus, any increase in pesticide use must be guided by environmental safety standards and best aquaculture practices.

In contrast, inputs such as farm size (0.1), feeding (0.6), labour (0.5), and fertiliser (0.1) exhibited efficiency indices below 1, indicating overutilization. This suggests that these inputs are being used beyond their economically optimal levels, leading to diminishing returns. The overuse of these resources may reduce profitability and indicate a need for improved input management strategies, including precision feeding, efficient labour scheduling, and better input allocation.

In sum, the efficiency analysis reveals a mixed pattern of under- and over-utilisation of inputs in catfish production. Enhancing productivity and profitability will require better technical guidance, resource planning, and extension services to help farmers make informed decisions about input use.

Table 5: Ratio of the Marginal Value Product (MVP) to Marginal Factor Cost (MFC)

Input	MPP	Price of catfish (Pc) per kg	MVP (MPP × Pc)	MFC	MVP/MFC (Efficiency index)	Interpretation
Pond size	.322	2004.60	645.48	6,539.11	0.1	Over-utilized
Number of fingerlings	.189	2004.60	378.87	30.01	12.6	Under-utilized
Feeding	.899	2004.60	1,802.14	3000.53	0.6	Over-utilized

Labour	.779	2004.60	1561.12	3000.2	0.5	Over-utilized
Fertilizer	.026	2004.60	52.12	1000.1	0.1	Over-utilized
Pesticide	3.598	2004.60	7,212.55	6000	1.2	Under-utilized

Constraints Faced by Catfish Farmers

Table 6 outlines the major constraints encountered by catfish farmers in the study area. The most pressing challenges reported were lack of access to credit facilities (98.7%), high cost of feed (97.3%), and environmental pollution (83.3%). These constraints significantly affect both the scalability and profitability of catfish farming, limiting the ability of farmers to expand operations or adopt improved technologies. In contrast, other constraints were identified by fewer respondents and were therefore considered less severe. These include poaching (46.7%), poor extension services (46.0%), inadequate storage facilities (38.0%), pest and disease outbreaks (28.0%), market access limitations (16.7%), lack of technical efficiency (14.7%), unreliable power supply (12.7%), management issues (9.3%), and shortage of quality fingerlings (5.3%). The dominance of financial and input-related barriers is consistent with the findings of Oyita and Aberji (2024), who also reported that limited access to affordable credit, high input costs, poor infrastructure, and weak government support were key obstacles in similar aquaculture settings. Additionally, this study's findings align with Mishra, Behera, and Behera (2023), who noted that input price volatility and market fluctuations are persistent challenges for agricultural producers globally. Collectively, these constraints highlight the need for targeted policy interventions, including access to affordable credit, subsidised feed, pollution control mechanisms, and strengthened extension services. Addressing these issues will be crucial for enhancing the resilience, productivity, and sustainability of catfish farming in the study area.

Table 6: Constraints faced by Catfish Farming

Constraints	Yes		No		Rank
	F	%	F	%	
Lack of credits/facilities	148	98.7	2	1.3	1st
High cost of feed	146	97.3	4	2.7	2nd
Pollution	125	83.3	25	16.7	3rd
Poaching	70	46.7	80	53.3	4rd
Poor extension service	69	46.0	81	54.0	5th
Inadequate storage facilities	57	38.0	93	62.0	6th
Pest and diseases infection	42	28.0	108	72.0	7th
Inadequate market	25	16.7	125	83.3	8th
Lack of technical efficiency	22	14.7	128	85.3	9th
Inadequate power supply	19	12.7	131	87.3	10th
Management problem	14	9.3	136	90.7	11th
Insufficient fingerlings	8	5.3	142	94.7	12th

% ≥ 50.0 – Major constraints

Conclusion

This study concludes that catfish production is highly profitable in the study area, with an average return of ₦2.90 for every ₦1.00 invested, underscoring its viability as a sustainable agribusiness venture. Regression analysis identified the number of fingerlings, feed quantity, labour input, and pesticide use as statistically significant factors ($p < 0.05$) influencing catfish output. In contrast, farm size and fertiliser use were not found to have a significant effect ($p > 0.05$). Efficiency analysis revealed that pesticide (1.2) and number of fingerlings (12.6) were underutilised, suggesting that these inputs have potential for increased productivity if better optimised. Conversely, farm size (0.1), feeding (0.6), labour (0.5), and fertiliser (0.1) were overutilized, reflecting inefficiencies in input allocation that may lead to diminishing returns. In terms of constraints, the most critical challenges identified were limited access to credit facilities (98.7%), high cost of fish feed (97.3%), and environmental pollution (83.3%). These barriers hinder production efficiency and expansion, threatening the long-term sustainability of the sector.

Recommendations

Based on these findings, the following recommendations are proposed:

1. Catfish farmers should be encouraged to increase investment in fingerlings, as this study has shown that fingerling quantity is positively and significantly correlated with output.
2. Access to affordable credit should be improved through cooperative lending schemes or subsidised loans, to address one of the primary constraints hindering aquaculture growth.
3. Extension services and training programs should be strengthened to support farmers in adopting efficient input management practices and sustainable pesticide use.
4. Feed subsidies or local feed innovation should be considered to mitigate the high cost of inputs and improve profitability.

References

Abdullahi, S. N., and Ibrahim, S. (2021). Implication of pesticides usage on freshwater fish: a review. *FUDMA Journal of Sciences*, *5*(1), 319-332.

Afolayan TT, Olutumise AI, Oguntade AE, Bello TO, Oparinde LO, Oladoyin OP. Herdsmen-farmer conflicts and their effects on agricultural productivity and rural livelihoods. International Journal of Agricultural Science, Research & Technology (IJASRT) in Extension & Education Systems. 2024; 14(4): 261–273. Available online on: http://ijasrt.iau-shoushtar.ac.ir

Alawode, O. O., Abegunde, V. O., and Abdullahi, A. O. (2016). Rural land market and commercialization among crop farming households in South-western Nigeria. *International Journal of Innovative Food, Nutrition and Sustainable Agriculture*, *6*(3), 54-62.

Alawode, O. O., and Ajagbe, S. O. (2020). Profitability of small-scale catfish production in Southwest Nigeria: the challenges. *Journal of Agriculture and Ecosystem Management*, 4(2), 23-37.

Aloysius, O. C., Matthew, N. C., Odinaka, A. O. and Johnpaul, O. C. (2020). Analysis of theResource Management Ability by Catfish Farmers in Nigeria: A Case of Ogbaru Local Government Area, Anambra State. *Journal of Agricultural Economics*, 5(5), 156-164.

Aminu, F.O., Mohammed, H.A., Akhigbe-Ahonkhai, C.E. and O. B. Samuel, O.B. (2021). Analysis of Risk Coping Strategies Among Catfish Farmers in Ikorodu Division, Lagos State, Nigeria. *European Journal of Agriculture and Food Sciences*,3(6):89-94

Asadu, N., and Egbuche, M. (2020). Effect of marital infidelity on the family: A perception study of Ihe/Owerre in Nsukka Local Government Area of Enugu State. *Renaissance University Journal of Management and Social Sciences, 6 (1)*, 21-31.

Bello, T.O. (2025). Econometric analysis of resource-use efficiency and profitability in cowpea-based farming systems of Ondo State, Nigeria. Advances in Modern Agriculture, 6(2): 3550. https://doi.org/10.24294/ama3550

Bello, T.O., Oguntade, A.E., Afolayan, T.T. (2025). Profitability and efficiency of cassava production in Ekiti State, Nigeria. Agriculture Archives: an International Journal, 4(1): 10–19. doi: 10.51470/AGRI.2025.4.1.10.

Dauda, A. B., Ajadi, A., Tola-Fabunmi, A. S., and Akinwole, A. O. (2018). Waste production in aquaculture: Sources, components and managements in different culture systems. *Aquaculture and Fisheries*, *4*(3), 81-88.

Deji, O. F., Koledoye, G. F., and Owombo, P. T. (2013). Gender analysis of constraints to get vegetable production in Ondo State, Nigeria. *Nigerian Journal of Rural Sociology*, *13*(3), 72-80.

Egware, R. A., and Alakiri, A. A. (2023). Determinants of Profitability of Fresh Catfish Marketing in Uvwie Local Government Area of Delta State, Nigeria. *Journal of Agribusiness and Rural Development*, *69*(3), 269-277.

Fasakin, I. J. and Omonona, B. T. (2020). Resource Use Efficiency among Rain-Fed and Non-Rainfed Catfish Farmers in South West and North Central Nigeria. Agricultural Journal, 15(6).

Food and Agriculture Organization (2022). The State of Food Security and Nutrition in the World. https://www.fao.org/3/cc0639en/cc0639en.pdf. (Accessed 14 February 2024).

George, G., Howard-Grenville, J., Joshi, A., and Tihanyi, L. (2014). Understanding and tackling societal grand challenges through management research. *Academy of management journal*, *59*(6), 1880-1895.

Hodapp, D., Hillebrand, H. and Striebel, M. (2019). Unifying the concept of resource use efficiencyin ecology. *Frontiers in ecology and evolution*, 6, 233.

Ilesanmi, J.O., Bello, T.O., Oladoyin, O.P. (2024). Evaluating the effect of microcredit on rural livelihoods: A case study of farming households in Southwest Nigeria. International Journal of Economic, Finance and Business Statistics, 2(5): 289–302. doi: 10.59890/ijefbs.v2i5.2619.

Inoni, O. E., Ogisi, O. D., and Achoja, F. O. (2017). Profitability and technical efficiency in homestead catfish production in Delta State, Nigeria. *Економика пољопривреде*, *64*(4), 1449-1465.

Mishra, P., Behera, B., and Behera D. B. (2023). *Development of capitals and capabilities of smallholder farmers for promoting inclusive intensification in agriculture: Experiences from northern West Bengal, India* (No. 1356). ADBI Working Paper.

Mohamed, E. S., Belal, A. A., Abd-Elmabod, S. K., El-Shirbeny, M. A., Gad, A., and Zahran, M. B. (2021). Smart farming for improving agricultural management. *The Egyptian Journal of Remote Sensing and Space Science*, *24*(3), 971-981.

Ochiaka, C. D. and Kaine, A. I. N. (2022). Resource Use Efficiency in Catfish Farming in SouthEast Nigeria. *Journal of Agriculture and Ecosystem Management*, 2(1), 1-12.

Ogah, S.I., Miteu, G.D., Oyewole, E.O.,Adebayo, J.O. and Benneth, E.O. (2022). The Role of Technology in Nigerian Catfish Production: A Review. Agricultural Reviews.RF-219.

Ogunnaike, M. G., Kehinde, M. O., Olabode, O. J., and Kehinde, O. E. (2021). Resource Use Efficiency in Catfish Production in Oyo State, Nigeria. *FUW Trends in Science & Technology journal*, *6*(3), 903-906.

Ogunwande, I. O., Goodness, E. A., &Olasoji, O. A. (2020). Measurement of Resource Use Efficiency and Rural Household's Welfare of Catfish Farmers under Earthen Pond System in OyoState, Nigeria. *European Journal of Social Sciences*, 60(4), 222-236.

Okunola, O.S Olapade-Ogunwole, F. and Adesiyan, I. (2022). Profitability Analysis of Plantain Production in Ondo East Local Government Area of Ondo State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 40(10): 1097-1106.

Oladoyin, O.P., Bello, T.O., Akinrotimi, A.F., Olubunmi-Ajayi, T.S., Ilesanmi, J.O. (2025). Assessing the profitability and choice of feed-type determinants in egg production: Evidence from Ondo State, Nigeria. Innovare Journal of Agricultural Science, 13(2). https://10.22159/ijags.2025v13i2.53700

Oluwasola, O., and Ige, A. O. (2015). Factors determining the profitability of catfish production in Ibadan, Oyo State, Nigeria. *Sustainable Agriculture Research*, *4*(4).

Oluwasola, O. and Ajayi, D. (2013). Socio-economic and policy issues determining sustainable fish farming in Nigeria. International Journal of Livestock Production, 4(1), 1-8.

Onyekuru, N. A., Ihemezie, E. J and Chima, C. C. (2019). Socioeconomic and profitability analysis of catfish production: a case study of Nsukka Local Government Area of Enugu State, Nigeria. *Agro-Science*, *18*(2), 51-58.

Oyewole, B. O., Ibitoye, S. J., Adejo, P. E., &Oyibo, F. O. (2023). Resource Use Efficiency and Profitability Analysis of Catfish (*Clariasgariepinus*) Production in Kogi State, Nigeria. *Asian Journal of Agricultural Extension, Economics and Sociology*, 41(9): 103-116.

Oyewole, B. O., Ibitoye, S. J., Adejo, P. E., &Oyibo, F. O. (2023). Resource Use Efficiency and Profitability Analysis of Catfish (*Clariasgariepinus*) Production in Kogi State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 41(9), 103-116.

Oyita, G. E., and Aberji, O. D. (2024, March). Contribution of Catfish Farming to Household Income in Ukwuani Local Government Area, Delta State, Nigeria. In *e-Proceedings of the Faculty of Agriculture International Conference* (pp. 268-275).

Vargas, A. (2019). Comportamientoproductivo de materiales de siembra de ñame*(Dioscoreaalata)* en la regiónHuetar Norte, Costa Rica. Undergraduate thesis. Campus Tecnológico Local San Carlos, Tecnológico de Costa Rica, Santa Clara de San Carlos, Costa Rica.

Walter, F., Tara, G., Elin, R. and David, L. (2019). What is environmental efficiency? And is itsustainable? https://www.tabledebates.org/building-blocks/what-environmental-efficiency-and-it-sustainable (Accessed 8 February, 2024).