

The aquaculture financing gap: Understanding fish farmers' needs in Oyo State Nigeria

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Abstract

This study examines the demand for credit facilities among fish farmers in Oyo State, Nigeria, focusing on the socio-economic and institutional factors influencing borrowing behaviour. Primary data were collected from 120 fish farmers selected from 10 rural communities using structured questionnaires, focus group discussions, and in-depth interviews. Descriptive statistics and a binary Logit regression model were employed for analysis. Results show that commercial banks and cooperative societies are the primary sources of credit, while money lenders charge high interest rates exceeding 20%, despite their ease of access. The Logit regression results indicate that age, marital status, education level, gender, household size, credit availability, repayment terms, and farm size significantly influence credit demand. Farm size exhibits a negative and significant relationship with borrowing behaviour, suggesting that larger farms rely more on internal financing, while smaller farms face liquidity constraints. Flexible repayment schedules and improved credit availability significantly increase borrowing propensity, underscoring the relevance of credit rationing and agricultural household decision-making frameworks. Major challenges identified include bureaucratic lending procedures, stringent collateral requirements, high interest rates, and poor lender–borrower relations. The study recommends aquaculture-specific credit products, reduced administrative bottlenecks, and repayment schedules aligned with aquaculture production cycles to enhance financial inclusion and sustainable fish farming in Nigeria.

Nomenclature and units

Money (₦)

1.0.Introduction

Aquaculture, defined as the controlled cultivation of aquatic organisms, has emerged as one of the fastest-growing food production sectors globally and plays a crucial role in addressing food security, nutrition, and rural livelihoods in developing countries (Mudashiru, 2025). Nigeria, in particular, has become the second largest aquaculture producer in Africa, with fish farming increasingly recognized as a viable economic venture, driven by high local fish demand and shrinking supply from capture fisheries (Okun & Ndufu Alike, 2023).

Credit is widely recognized as a critical driver of agricultural transformation and technology adoption, enabling farmers to purchase inputs, adopt improved production methods, and invest in infrastructure (Olutumise, 2023). However, formal financial institutions in Nigeria often allocate a small share of their portfolios to agriculture, partly due to perceived risks, information asymmetries, and inadequate collateral among farmers (Fregene & Ojo, 2023). As a result, many aquaculture operators rely on informal sources, which offer rapid access but at much higher interest rates and unfavorable terms. These dynamics contribute to persistent financing gaps that constrain productivity and immobilize growth potential.

Recent national financing initiatives reflect growing policy attention on aquaculture. For example, the FISH4ACP input finance initiative, supported by the Food and Agriculture Organization (FAO) and multilateral partners, aims to improve access to finance and technical support for smallholder fish farmers across Nigeria, providing targeted loans and business model development support (FAO, 2025).

Despite these interventions, empirical evidence on the determinants of credit demand among fish farmers remains limited, particularly with respect to socio-economic characteristics and institutional credit conditions. Understanding these factors is vital for designing financial products and policy frameworks that bridge the aquaculture financing gap. Accordingly, this study investigates the demand for credit facilities among fish farmers in Oyo State, Nigeria, focusing on key determinants of borrowing behavior, preferred sources, and major constraints to access. The findings provide insights for policymakers, financial institutions, and development partners seeking to enhance credit accessibility and promote sustainable aquaculture growth.

1.1 Theoretical and Conceptual Framework

This study is anchored in Credit Rationing Theory as developed by Stiglitz and Weiss (1981), which explains why credit markets—particularly in agriculture—often fail to allocate loans efficiently through interest rates alone. According to the theory, lenders may ration credit rather than raise interest rates due to problems of information asymmetry, adverse selection, and moral hazard. In the context of fish farming, lenders face difficulties in

accurately assessing production risks associated with disease outbreaks, water quality fluctuations, and feed price volatility. As a result, even creditworthy fish farmers may be denied loans or face restrictive lending conditions, regardless of their willingness to pay higher interest rates.

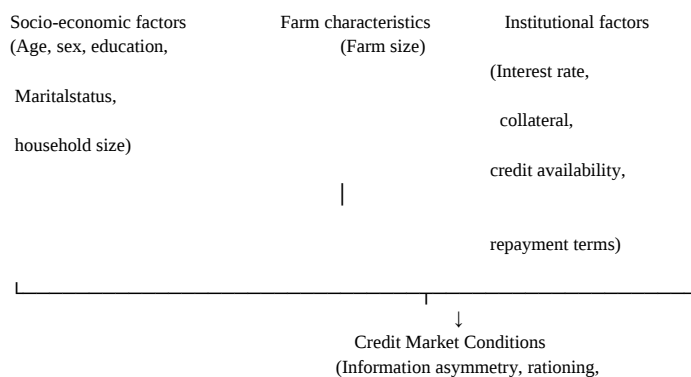
The theory provides a strong basis for examining why variables such as age, education, collateral availability, farm size, and repayment terms influence credit access. Financial institutions may favor borrowers who signal lower risk through experience, asset ownership, or stable household structures, while rationing credit to others perceived as riskier.

The study is further informed by the Agricultural Household Model, which views farm households as both production and consumption units. Under this framework, credit demand arises from the need to finance productive activities while smoothing household consumption. In aquaculture, household characteristics such as family size and marital status affect labor availability, income diversification, and repayment capacity, thereby influencing borrowing behavior.

In addition, elements of the Sustainable Livelihoods Framework (SLF) are relevant in explaining how access to financial capital interacts with human, physical, and social capital to shape livelihood outcomes. For fish farmers, access to credit enhances productive capacity, supports investment in ponds, feed, and fingerlings, and improves resilience against shocks. Conversely, limited access to affordable credit constrains livelihood sustainability and reinforces vulnerability.

Finally, the study aligns with the Financing Gap Theory, which highlights the mismatch between the financial needs of small-scale producers and the lending criteria of formal financial institutions. This gap explains the continued reliance of fish farmers on informal credit sources such as money lenders and family networks despite unfavorable terms.

Figure 1 (Conceptual Framework) illustrates the relationship between socio-demographic characteristics, farm-specific factors, and institutional credit conditions, and how these jointly influence fish farmers' credit demand and access. This framework guided the selection of explanatory variables and informed the empirical Logit model used in the study.



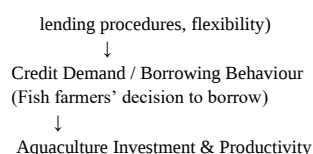


Figure 1. Conceptual framework for determinants of credit demand among fish farmers

Source: Author's conceptualization based on Stiglitz and Weiss (1981) and Singh et al. (1986).

2.0 Materials and Methods

2.1 Study Area

The study was conducted in Oyo State, southwestern Nigeria, which lies between latitudes 7°03' and 9°12'N and longitudes 2°47' and 4°23'E. The state covers approximately 28,454 km² and experiences a tropical climate characterized by distinct wet and dry seasons, with average temperatures ranging from 25°C to 35°C. Agriculture constitutes a major economic activity in the state, with aquaculture gaining prominence due to favorable climatic conditions and growing urban fish demand. Oyo State is divided into four agro-ecological zones: Ibadan/Ibarapa, Oyo/Ogbomoshos, Oke-Ogun, and Ogbomoso, which host a substantial number of small-, medium-, and large-scale fish farms. These characteristics make the state suitable for examining credit demand behavior among fish farmers.

2.2 Sampling Procedure and Sample Size

A multistage sampling technique was employed to select respondents for the study.

In the first stage, Oyo State was purposively selected due to its concentration of aquaculture activities and presence of both formal and informal credit institutions serving fish farmers.

In the second stage, three agro-ecological zones (Ibadan/Ibarapa, Oyo/Ogbomoshos, and Oke-Ogun) were selected to ensure spatial and production diversity. Villages within these zones were selected using proportional allocation, based on the estimated distribution of fish farms across the zones.

In the third stage, a total of 10 villages were randomly selected from the three zones (5 from Ibadan/Ibarapa, 3 from Oyo/Ogbomoshos, and 2 from Oke-Ogun). These villages were selected because they had identifiable clusters of active fish farming households.

In the final stage, 12 fish farmers were randomly selected from each village using farmers' association registers and extension officers' listings, resulting in a total sample size of 120 respondents.

The choice of 12 farmers per village ensured equal representation across locations while maintaining manageability and statistical adequacy. A sample size of 120 is considered sufficient for binary logistic regression analysis, exceeding the minimum requirement

of 10 observations per explanatory variable, given the 11 predictors included in the model.

2.3 Data Collection Methods

The study employed a mixed-methods approach, combining quantitative and qualitative data collection techniques.

2.3.1 Quantitative Data

Primary quantitative data were collected using structured questionnaires administered to the selected fish farmers between January and October 2024. The questionnaire captured information on:

- Socio-economic characteristics
- Credit demand and borrowing behavior
- Sources of credit
- Interest rates, collateral requirements, and repayment terms
- Challenges encountered in accessing credit facilities

2.3.2. Qualitative Data

To complement the survey, Focus Group Discussions (FGDs) were conducted during zonal fish farmers' meetings. Each FGD comprised 8–12 participants and focused on:

- Common credit access challenges
- Perceptions of formal and informal lenders
- Loan repayment experiences
- Institutional bottlenecks affecting borrowing decisions

Insights from the FGDs were used to refine questionnaire design, particularly in defining credit sources, repayment conditions, and perceived constraints. The qualitative findings were therefore integrated at the instrument development and interpretation stages, rather than being analyzed as standalone results.

2.4 Analytical Techniques

2.4.1 Descriptive Statistical Analysis

Descriptive statistics such as frequencies, percentages, and mean scores were used to summarize respondents' socio-economic characteristics and credit access patterns. A 5-point Likert-type rating scale was employed to assess the frequency of credit use across different lending sources.

To identify factors influencing fish farmers' demand for credit, a binary logistic regression (Logit) model was applied.

2.4.2 Logit Model Specification

The Logit model specifies the probability that a fish farmer demands credit as a function of a set of explanatory variables. Let P_i denote the probability that the i^{th} respondent demands credit, such that:

$$P_i = \Pr(Y_i = 1) = \frac{1}{1 + e^{-Z_i}}$$

Where Z_i is a linear combination of explanatory variables defined as:

$$Z_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}$$

The probability that the respondent does not demand credit is therefore:

$$1 - P_i = \frac{1}{1 + e^{Z_i}}$$

The odd ratio of demanding credit is expressed as:

$$\frac{P_i}{1 - P_i} = e^{Z_i}$$

Taking the natural logarithm of the odds ratio yields the Logit (log-odds) function:

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + \varepsilon_i$$

where:

P_i = probability of demanding credit

X_i = vector of explanatory variables,

B = parameters to be estimated, and

ε = error term

2.4.3 Definition of Variables

The explanatory variables included in the model are defined as follows:

- X_1 (Age): Age of respondent (years)
- X_2 (Marital status): 1 = married, 0 = otherwise
- X_3 (Education level): 1 = formal education, 0 = non-formal
- X_4 (Gender): 1 = male, 0 = female
- X_5 (Household size): Number of household members
- X_6 (Interest rate): Annual interest rate (%)
- X_7 (Collateral security): 1 = landed property, 0 = other assets
- X_8 (Credit availability): 1 = available, 0 = not available
- X_9 (Repayment term): 1 = beginning of production season, 0 = otherwise

- X_{10} (Fish farm size): Farm size (hectares)
- X_{11} (Preferred credit source):
1 = formal sources (commercial banks, microfinance banks, cooperative societies)
0 = informal sources (money lenders, family, friends, savings groups)

3.0. Results and Discussion

3.1 Loan Uptake Rates among Fish Farmers

Table 1 presents fish farmers' frequency of credit uptake from various sources. Loan uptake intensity was measured using a 5-point Likert scale, and mean scores were computed as weighted averages to rank credit sources rather than as simple percentage means.

Table 1: Loan Uptake Rates among Fish Farmers by Credit Source (%)

Credit Source	Extremely High	High	Average	Low	Extremely Low	Mean
Banks	22.0	17.0	10.0	7.1	3.5	11.94
Cooperative Societies (CICS)	6.7	5.1	4.3	2.9	1.9	4.18
Money Lenders	1.4	0.9	0.6	0.3	0.1	0.66
Family/Friends	6.1	3.8	3.2	2.4	0.6	3.22

Source: Field Survey, 2024.

(Based on a 5-point rating scale: Extremely High → Extremely Low)

Commercial banks recorded the highest mean score (11.94), indicating that they are the most frequently utilized credit source among respondents. Cooperative societies ranked second (mean = 4.18), while money lenders recorded the lowest mean score (0.66), reflecting their limited patronage due to unfavorable lending terms. Although family and friends serve as alternative credit sources, their utilization remains relatively low compared to formal institutions.

3.2 Collateral Requirements for Credit Access

As shown in Table 2, guarantors constitute the most common form of collateral across all credit sources. Notably, money lenders frequently rely on social guarantors, reflecting trust-based informal lending arrangements rather than formal asset-based collateral. This explains the relatively high proportion (78%) of guarantor usage among money lenders.

Table 2: Collateral Requirements for Accessing Credit Facilities by Source (%)

Credit Source	Landed	Jewelry	Promissory Note	Guarantors
Banks	80	23	39	100
Cooperative Societies (CICS)	35	5	41	98
Family/Friends	1	–	23	20
Savings Groups	4	–	17	7
Money Lenders	67	31	52	78

Source: Field Survey, 2024.

Landed property is predominantly required by banks and cooperative societies, reflecting formal credit risk assessment procedures. Jewelry and promissory notes are less frequently accepted, particularly by formal institutions.

3.3 Interest Rate Structure of Credit Facilities

Table 3 reveals that money lenders impose the highest interest rates, with a substantial proportion of respondents paying rates exceeding 20%. In contrast, cooperative societies and savings schemes offer more favorable terms, often charging minimal interest or administrative fees. These differences significantly influence farmers' credit source preferences.

Table 3: Interest Rate Structure of Credit Facilities by Lending Institution (%)

Credit Source	≤5%	≤10%	≤20%	>20%
Banks	10	15	41	30
Cooperative Societies (CICS)	40	70	10	5
Family/Friends	6	5	1	0
Savings Groups	5	0	0	0
Money Lenders	18	38	50	65

Source: Field Survey, 2024.

Note: Percentages reflect respondent distributions by source, not row totals

3.4 Credit Access Mode and Flexibility

Results in Table 4 indicate that fish farmers prefer credit sources that offer regular access and adaptable repayment conditions. Savings groups and cooperative societies were rated highest in terms of accessibility and flexibility, while money lenders were perceived as highly restrictive and irregular.

Table 4: Access to Credit Facilities by Mode and Flexibility of Terms (%)

Credit Source	Usual Access	Unusual Access	Flexible Terms	Strict Terms
Banks	65	35	35	65
Cooperative Societies (CICS)	70	30	60	40
Family/Friends	30	70	80	20
Savings Groups	80	20	85	15
Money Lenders	25	75	20	80

Source: Field Survey, 2024

3.5 Repayment Terms

Table 5 shows that formal institutions such as banks and money lenders impose strict repayment schedules, whereas family, friends, and cooperative societies provide more flexible repayment arrangements. While flexibility can reduce financial pressure, it may also encourage repayment delays, particularly in informal arrangements.

Table 5: Loan Repayment Terms across Credit Sources (%)

Credit Source	Regular	Irregular	Flexible	Strict
Banks	55	45	20	80
Cooperative Societies (CICS)	60	40	65	35
Family/Friends	20	80	70	30
Savings Groups	80	20	70	30
Money Lenders	70	30	10	90

Source: Field Survey, 2024

3.6 Constraints to Credit Access

As shown in Table 6, bureaucratic procedures remain a major constraint in banks, while insufficient funds limit credit provision among cooperative societies and family-based lenders. Abusive treatment and ridicule were most frequently reported in dealings with money lenders, discouraging their use.

Table 6: Constraints and Challenges in Accessing Credit Facilities (%)

Credit Source	Bureaucracy / Regulation	Insults / Ridicule	Insufficient Funds
Banks	50	19	22
Cooperative Societies (CICS)	30	20	70
Family/Friends	20	15	70
Savings Groups	6	12	15
Money Lenders	19	80	27

Source: Field Survey, 2024

3.7 Determinants of Credit Demand

The binary Logit regression results are presented in Table 7. The model exhibits satisfactory explanatory power, with a Pseudo R² of 0.64, indicating that the included variables reasonably explain variations in fish farmers' credit demand.

Table 7: Logit Regression Results on Determinants of Fish Farmers' Borrowing Behaviour

Variable	Coefficient	Std. Error	z-value
Constant	-0.5541	0.2779	-1.99
Age (X ₁)	0.0061**	0.0056	2.11
Marital Status (X ₂)	-0.0008***	0.0081	-3.45
Education (X ₃)	-0.0881*	0.0480	-1.84
Sex (X ₄)	0.0925*	0.0904	1.72
Household Size (X ₅)	0.0564*	0.0904	1.69
Interest Rate (X ₆)	0.0100	0.0522	0.19
Collateral (X ₇)	0.4800	1.0200	0.47
Credit Availability (X ₈)	0.0035**	0.7520	2.04
Repayment Term (X ₉)	0.0209*	0.2002	1.88
Farm Size (X ₁₀)	-0.0061**	0.6700	-2.06
Credit Source Preference (X ₁₁)	0.0001	1.7000	0.01

Model statistics:

- Pseudo R² (McFadden) = 0.640
- Log likelihood = -64.871
- Chi-square = 34.12
- N = 120

Significance: p < 0.10, ** p < 0.05, *** p < 0.01

3.7 Determinants of Fish Farmers' Borrowing Behaviour

The Logit regression results presented in Table 7 identify key socio-economic and institutional factors influencing fish farmers' borrowing decisions in Oyo State. The overall model exhibits strong explanatory power, as evidenced by a Pseudo R² of 0.640 and a statistically significant likelihood ratio chi-square statistic, indicating that the included variables jointly explain variations in credit demand.

As shown in Table 7, age has a positive and statistically significant effect on borrowing behaviour at the 5% level. This

suggests that older fish farmers are more likely to demand credit, possibly due to accumulated production experience, stronger social capital, and enhanced credibility with lenders. Similar findings have been reported in studies on agricultural credit access, where age proxies experience and trustworthiness in rural financial markets (Feder et al., 1990; Obilor, 2013).

Marital status exhibits a negative and statistically significant relationship with credit demand at the 1% level (**Table 7**). This implies that married fish farmers are less likely to apply for credit compared to unmarried farmers. This outcome may reflect greater reliance on household savings, spousal income, or informal financial support among married households. Moreover, married farmers may exhibit higher risk aversion due to family responsibilities, which discourages borrowing under the production and market uncertainties inherent in aquaculture. This finding is consistent with the agricultural household model, which emphasizes the role of household structure in financial decision-making (Singh et al., 1986).

Education level shows a negative and weakly significant effect on borrowing behaviour (Table 7). Although contrary to expectations, this result suggests that more educated farmers may rely less on external credit due to better income diversification opportunities or improved capacity for self-financing. Educated farmers may also be more aware of the transaction costs, collateral requirements, and rigid repayment conditions associated with formal lending institutions, thereby discouraging loan applications (Boucher et al., 2008).

Sex has a positive and statistically significant influence on credit demand, indicating that male fish farmers are more likely to borrow than female farmers (Table 7). This result reflects persistent gender disparities in access to assets, collateral ownership, and formal financial services in rural Nigeria. Previous studies have documented that women face structural and institutional barriers that limit their participation in formal credit markets, particularly in capital-intensive agricultural enterprises such as aquaculture (Fletschner, 2009; World Bank, 2019).

Household size positively influences borrowing behaviour at the 10% significance level (Table 7). Larger households tend to exert greater consumption pressure on farm income, thereby increasing the need for credit to sustain production. Additionally, larger households may provide family labour, which encourages farm expansion and increases capital requirements. This finding aligns with earlier studies linking household size to higher demand for agricultural credit (Diagne & Zeller, 2001).

Interest rate is not statistically significant in explaining borrowing behaviour (Table 7), suggesting that fish farmers' credit demand is relatively insensitive to borrowing costs. This supports the Credit Rationing Theory, which posits that access constraints dominate price mechanisms in imperfect rural credit markets (Stiglitz & Weiss, 1981). In such settings, farmers prioritize loan availability over interest rate considerations due to limited financing alternatives.

Credit availability exerts a positive and statistically significant effect on borrowing behaviour (Table 7), underscoring the importance of institutional access in stimulating credit demand. When farmers perceive credit to be available, they are more likely to apply for loans. This result highlights the critical role of financial inclusion and proximity of lending institutions in enhancing aquaculture investment (Diagne, 1999).

Repayment terms also show a positive and significant relationship with borrowing behaviour (Table 7). Flexible repayment schedules increase the likelihood of credit demand, reflecting the biological production cycle of aquaculture, where revenues are realized after a gestation period. Flexible repayment reduces default risk and aligns loan obligations with production realities, thereby encouraging farmers to borrow (Binswanger & Rosenzweig, 1986).

Farm size has a negative and statistically significant effect on borrowing behaviour (Table 7), indicating that larger-scale fish farmers are less likely to demand credit. This may be due to greater internal capital generation or a preference for self-financing among larger farms. In contrast, smaller-scale farmers often face liquidity constraints and rely more heavily on external financing, reinforcing the existence of a financing gap in smallholder aquaculture systems (Petrick, 2004).

Overall, the results in Table 7 support the relevance of Credit Rationing Theory and the Agricultural Household Model, demonstrating that borrowing behaviour among fish farmers is shaped more by access conditions, household characteristics, and institutional constraints than by interest rates alone. These findings underscore the need for aquaculture-specific credit policies that address structural barriers, promote inclusive lending, and offer flexible repayment arrangements tailored to production cycles.

4.0 Conclusion and Policy Implications

4.1 Conclusion

This study analyzed credit demand and borrowing behaviour among fish farmers in Oyo State, Nigeria, with emphasis on the socio-economic and institutional factors shaping access to finance in the aquaculture sector. Using primary data from 120 fish farmers and a binary Logit regression model, the study provides empirical evidence on the determinants of credit demand within a credit-constrained agricultural environment.

The findings reveal that commercial banks and cooperative societies constitute the dominant sources of formal credit, while informal lenders, particularly money lenders, remain relevant despite charging prohibitively high interest rates. This reliance on informal credit reflects structural constraints in formal lending, including bureaucratic procedures, stringent collateral requirements, and rigid repayment schedules. The Logit regression results demonstrate that age, marital status, education level, gender, household size, credit availability, repayment

terms, and farm size significantly influence borrowing behaviour. Notably, the negative relationship between farm size and credit demand suggests that larger fish farms rely more on internal financing, while smaller farms experience greater liquidity constraints.

The results also highlight that access conditions—such as credit availability and repayment flexibility—play a more critical role in shaping borrowing decisions than interest rates alone, reinforcing the relevance of credit rationing theory and the agricultural household decision-making framework. Overall, the study contributes to the literature by providing aquaculture-specific evidence on financing gaps in smallholder fish farming, a relatively under-researched area in Nigeria's agricultural finance discourse.

Despite its contributions, the study is limited by its cross-sectional design and geographical focus on Oyo State, which may restrict the generalization of findings. Future research could adopt longitudinal data, expand coverage to other aquaculture-producing regions, and incorporate supply-side perspectives from financial institutions to deepen understanding of aquaculture finance dynamics.

4.2 Policy Implications

The findings of this study have important implications for policymakers, financial institutions, and development agencies seeking to enhance financial inclusion and investment in Nigeria's aquaculture sector.

First, financial institutions should design aquaculture-specific credit products that reflect the biological production cycle of fish farming. Flexible repayment schedules aligned with harvesting periods would significantly improve loan uptake and repayment performance.

Second, government and regulatory agencies should streamline lending procedures by reducing bureaucratic bottlenecks and simplifying documentation requirements. Digital credit platforms and decentralized lending mechanisms could improve accessibility, particularly for small-scale fish farmers.

Third, the high dependence on informal lenders underscores the need for interest rate moderation and risk-sharing mechanisms in formal credit markets. Government-backed credit guarantees and insurance schemes could encourage banks to lend to fish farmers while mitigating perceived default risks.

Fourth, gender disparities in credit access call for targeted interventions, such as collateral-free loans, group lending models, and capacity-building programs aimed at improving women's participation in aquaculture finance.

Finally, cooperative societies should be strengthened through financial literacy training, improved capitalization, and regulatory support, given their role in providing relatively flexible and accessible credit to fish farmers.

By addressing institutional constraints and aligning financial products with aquaculture realities, these policy measures can

bridge the financing gap in fish farming, enhance productivity, and promote sustainable livelihoods in Nigeria's aquaculture sector

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Declaration of Conflict of Interest

All authors were actively involved in the formulation of the research idea, study design, and implementation of the work. They also participated in writing the manuscript and conducting thorough critical revisions to ensure substantial scholarly contribution. This work has not been submitted to, nor evaluated by, any other journal or publication outlet. The authors declare that they have no personal or financial relationships with any entities that could be perceived as influencing the research presented in this manuscript.

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