International Journal of Authentic Agriculture
Volume 2, Number 1, April 2026
ISSN: 2734-2956(Print) 2795-3114(Online)
Published By
International Centre for Integrated Development Research, Nigeria
In collaboration with
Copperstone University, Luanshya, Zambia

Access to Credit and Profitability in Aquaculture Enterprises: A Financial and Production Analysis of Small-Scale Fish Farmers

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ABSTRACT

This study examines access to credit and profitability in small-scale aquaculture enterprises, integrating financial and production perspectives. A mixed-methods approach was employed, combining primary data collected from 150 fish farmers with secondary data from institutional reports. Descriptive statistics and regression analysis were used to assess the impact of credit access on production output, cost efficiency, and profitability. The findings indicate that farmers with access to formal credit exhibit higher production levels, improved input utilization, and greater profitability compared to those relying on informal financing sources. However, high interest rates, collateral requirements, and limited financial literacy restrict effective access to credit. Furthermore, inefficiencies in resource utilization and weak market linkages reduce the overall benefits of financial access. The results underscore the importance of financial inclusion in enhancing aquaculture productivity and sustainability. Strengthening institutional support, improving access to affordable credit, and promoting financial literacy among farmers are essential for maximizing the benefits of aquaculture investments. The study concludes that access to credit has a significant influence on profitability in aquaculture enterprises and plays a pivotal role in transforming small-scale fish farming into a commercially viable and sustainable sector. Policy interventions aimed at improving financial access and production efficiency will enhance the sector's contribution to food security, employment generation, and economic development.

Keywords: *Credit access, profitability, aquaculture enterprises, financial analysis, production Analysis, fish farmers*

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INTRODUCTION

Access to credit is widely recognized as a critical driver of agricultural productivity and enterprise profitability, particularly among small-scale farmers in developing economies. In aquaculture, where production requires significant upfront investment in pond construction, feed, fingerlings, and water management systems, limited access to finance remains a major constraint to growth. Aquaculture has emerged as one of the fastest-growing segments of the global agricultural sector, contributing significantly to food security, employment generation, and income diversification in developing countries (FAO, 2022). As capture fisheries decline due to overfishing and environmental degradation, aquaculture provides an alternative means of meeting the increasing demand for fish protein (World Bank, 2021). In many African countries, including Nigeria, small-scale fish farmers dominate the aquaculture sector, producing a substantial share of domestic fish supply (Béné et al., 2016).

Despite its potential, aquaculture development is constrained by several factors, among which limited access to credit is particularly significant (OECD, 2020). Fish farming is capital-intensive, requiring substantial investments in infrastructure, feed, fingerlings, and disease management. Small-scale farmers often lack the financial resources to meet these requirements, thereby limiting their production capacity and profitability (Kumar et al., 2018).

Access to credit enables farmers to invest in productivity-enhancing inputs, adopt improved technologies, and expand their scale of operation (Karlan et al., 2014). Financial institutions, including commercial banks and microfinance institutions, play a crucial role in providing these resources. However, lending to small-scale farmers is often perceived as risky due to factors such as production uncertainties, market volatility, and lack of collateral (Beck & Demirgüç-Kunt, 2006).

Profitability in aquaculture is influenced by both financial and production factors. Efficient resource utilization, cost management, and access to markets are essential for achieving optimal returns (Engle, 2010). Farmers with adequate financial support are better positioned to adopt best practices, reduce inefficiencies, and improve output quality. Conversely, those with limited financial access often rely on suboptimal inputs and traditional methods, resulting in lower productivity and profitability (WorldFish, 2019).

In Nigeria, the aquaculture sector has witnessed significant growth in recent years, driven by increasing demand for fish and government efforts to promote local production (FMARD, 2021). However, the sector remains underdeveloped compared to its potential, largely due to financial constraints and infrastructural challenges (Adu et al., 2019).

Despite the recognized importance of aquaculture in enhancing food security and economic development, small-scale fish farmers continue to face significant barriers in accessing credit. Financial institutions often impose stringent lending conditions, including high interest rates and collateral requirements, which many farmers cannot meet (Demirgüç-Kunt

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et al., 2018). As a result, farmers rely on informal sources of finance, which are often inadequate and expensive. This financial exclusion limits their ability to invest in modern production technologies, leading to low productivity and reduced profitability.

Furthermore, there is limited empirical evidence integrating both financial and production analyses in assessing the impact of credit on aquaculture profitability. Many studies focus either on financial access or production efficiency, without examining their combined effects. This gap limits the understanding of how credit influences overall enterprise performance. Addressing this issue is essential for designing effective policies and financial products that support sustainable aquaculture development.

The objectives of the study include

1. To examine the effect of access to credit on the profitability of small-scale fish farmers.
2. To analyze the relationship between credit access and aquaculture production efficiency.
3. To identify the key constraints limiting access to credit among fish farmers.

METHOD

The study adopted a cross-sectional survey design. Primary data were collected from 150 small-scale fish farmers in Bayelsa State, using structured questionnaires, while secondary data were sourced from FAO and national reports. A multistage sampling technique was used to select respondents. Descriptive statistics were used to analyze socioeconomic characteristics and credit access patterns. Profitability was measured using gross margin and net farm income analysis. Regression analysis was employed to examine the relationship between credit access and profitability:

$$Profitability = \beta_0 + \beta_1(Credit\ Access) + \beta_2(Input\ Cost) + \beta_3(Output\ Level) + \varepsilon$$

Efficiency was assessed using a production function model. Data reliability was ensured through pilot testing and Cronbach's alpha (0.80).

RESULTS

Table 1: Socioeconomic Characteristics of Fish Farmers

Variable	Percentage (%)
Male	70
Female	30
Access to Credit	55
No Access	45

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The distribution of socioeconomic characteristics presented in Table 1 provides important insights into the structure of small-scale aquaculture enterprises and their financial dynamics. The predominance of male fish farmers (70%) highlights a significant gender imbalance in participation, which has implications for both access to resources and enterprise profitability. In many developing economies, women often face systemic barriers such as limited land ownership rights, lower access to collateral, and restricted participation in formal financial systems. As a result, their limited representation in aquaculture may also reflect unequal access to credit facilities, which in turn affects overall sector productivity and inclusiveness. Addressing this gender gap is therefore essential for broadening the economic base of aquaculture and enhancing aggregate output.

The finding that 55% of farmers have access to credit indicates moderate financial inclusion, but the remaining 45% without access represents a substantial constraint on sectoral growth. This divide suggests that while financial institutions are beginning to engage with aquaculture enterprises, a large proportion of farmers still operate under financial limitations. Farmers without access to credit are more likely to depend on personal savings or informal lending sources, which are often insufficient and costly. This limits their ability to invest in quality inputs such as improved fingerlings, feed, and pond management systems, ultimately reducing production efficiency and profitability.

From the perspective of the study on access to credit and profitability, the implications are clear. The uneven distribution of credit access creates disparities in production capacity and income levels among fish farmers. Those with credit access are better positioned to expand operations, adopt improved technologies, and achieve economies of scale, while those without access remain trapped in low-input, low-output cycles. Consequently, improving equitable access to credit, particularly for marginalized groups such as women and financially excluded farmers, is critical for enhancing profitability and ensuring sustainable growth in aquaculture enterprises.

Table 2: Profitability Analysis

Variable	With Credit	Without Credit
Output (kg)	1500	900
Revenue (₦)	1,200,000	700,000
Profit (₦)	500,000	250,000

The profitability results presented in Table 2 clearly demonstrate a strong and positive relationship between access to credit and the financial performance of small-scale aquaculture enterprises. Farmers with access to credit recorded substantially higher output levels (1,500 kg) compared to those without credit (900 kg), indicating that financial access directly influences production capacity. This difference is largely attributed to the ability of

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credit-enabled farmers to invest adequately in key inputs such as high-quality fingerlings, nutritionally balanced feed, improved pond infrastructure, and better water management systems. These inputs are essential for achieving optimal growth rates and survival of fish stocks, which ultimately translate into higher yields.

In terms of revenue, farmers with credit generated ₦1,200,000 compared to ₦700,000 for those without credit. This substantial difference reflects not only higher production volume but also improved product quality and marketability. Credit-access farmers are more likely to adopt improved management practices that enhance fish size and uniformity, making their products more attractive in competitive markets. Additionally, access to finance enables timely harvesting and better market timing, reducing distress sales and allowing farmers to secure more favorable prices.

Profitability results further reinforce the importance of financial access, with credit-access farmers earning ₦500,000 compared to ₦250,000 among those without credit. This twofold increase in profit underscores the critical role of financial inclusion in improving enterprise sustainability and income generation. It also highlights the multiplier effect of credit in aquaculture systems, where initial financial input leads to improved production efficiency, higher revenue, and ultimately greater net returns.

Relating these findings to the core theme of the study, access to credit and profitability in aquaculture enterprises, it becomes evident that credit serves as a catalytic factor in transforming small-scale fish farming from subsistence-level activity into a commercially viable enterprise. Without adequate financial support, farmers remain constrained by low input usage, limited scale of operation, and reduced profitability. Therefore, improving access to affordable credit is essential not only for enhancing production efficiency but also for ensuring long-term financial sustainability and sectoral growth in aquaculture.

Table 3: Regression Results

Variable	Coefficient	p-value
Credit Access	0.68	0.001
Input Cost	-0.40	0.003
Output Level	0.75	0.000

The regression results presented in Table 3 provide robust empirical evidence on the determinants of profitability in small-scale aquaculture enterprises, with particular emphasis on the role of credit access. The coefficient for credit access (0.68) is positive and statistically significant at the 1% level ($p = 0.001$), indicating that improved access to financial resources has a strong and direct effect on profitability. This suggests that farmers who are able to obtain credit are better positioned to expand production, purchase quality

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inputs, and adopt improved aquaculture technologies that enhance operational efficiency. From the perspective of the study's central theme, this finding confirms that access to credit is not merely a supportive factor but a critical driver of financial performance in aquaculture enterprises.

The negative coefficient for input cost (-0.40, p = 0.003) highlights the adverse effect of rising production costs on profitability. High input costs, particularly for feed—which typically accounts for the largest share of aquaculture operating expenses—reduce net returns and limit farmers' ability to scale production. This result implies that even when credit is available, inefficient cost structures or inflationary pressures in input markets can significantly erode profitability gains. Therefore, financial access must be complemented with cost management strategies to maximize the benefits of credit in aquaculture systems.

Conversely, output level shows a strong positive relationship with profitability (0.75, p = 0.000), reinforcing the importance of production efficiency in determining financial outcomes. Higher output levels increase revenue potential and allow farmers to achieve economies of scale, thereby reducing per-unit production costs. Credit plays an indirect but crucial role in this relationship by enabling farmers to invest in productivity-enhancing inputs that raise output levels.

These findings underscore a critical interaction between financial access and production performance. Credit access improves profitability not in isolation, but through its influence on input acquisition and output expansion. Therefore, aquaculture profitability is best understood as a function of integrated financial and production dynamics. Strengthening credit systems, improving cost efficiency, and enhancing productivity are therefore essential policy directions for achieving sustainable aquaculture development and economic resilience among small-scale fish farmers.

Constraints to Credit Access

The key constraints affecting access to credit among small-scale fish farmers in Bayelsa State are presented in Figure 1.

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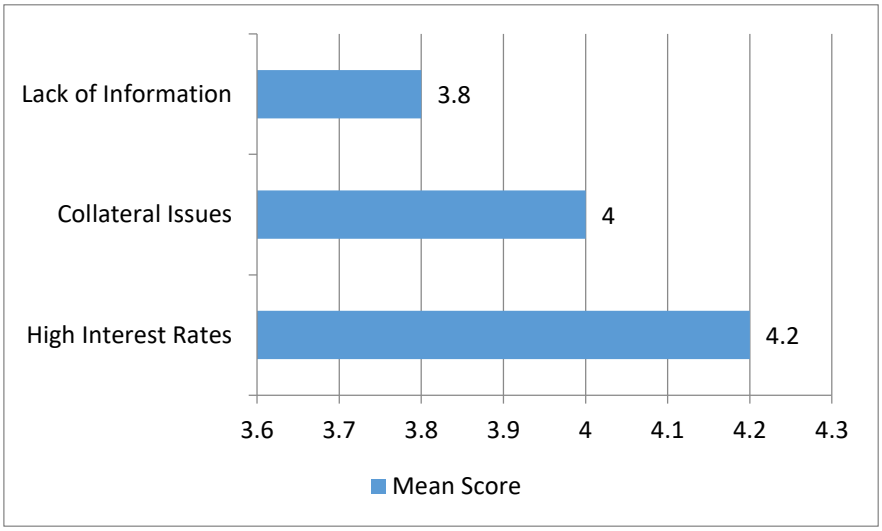

Figure 1: Constraints to Credit Access

The findings presented in Figure 1 highlight the major constraints affecting access to credit among small-scale fish farmers, with significant implications for aquaculture profitability and enterprise development. High interest rates recorded the highest mean score (4.2), indicating that the cost of borrowing is the most critical barrier limiting farmers' ability to access formal financial services. In the context of aquaculture, where production cycles are relatively long and returns are not immediate, high interest rates discourage investment and reduce the viability of credit-funded operations. Many farmers are unable to service loans profitably, leading to reluctance in seeking formal credit facilities. This constraint directly undermines the study's central focus on access to credit and profitability, as it restricts the very financial input needed to enhance production and income generation.

Collateral requirements, with a mean score of 4.0, represent the second most significant barrier. Most small-scale fish farmers operate on informal or communal land tenure systems, which limits their ability to provide acceptable collateral to financial institutions. This structural limitation excludes a large proportion of aquaculture practitioners from accessing formal credit markets. The implication is that even financially viable and productive farmers may be constrained by institutional lending policies that do not align with the realities of rural agricultural enterprises. This reinforces financial exclusion and perpetuates low productivity cycles within the sector.

Lack of information, with a mean score of 3.8, further compounds the credit access problem. Many farmers are unaware of available credit schemes, eligibility requirements, and application procedures. This information asymmetry reduces participation in financial programs and weakens the effectiveness of government and institutional interventions

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aimed at supporting agricultural finance. Additionally, limited financial literacy affects farmers' ability to manage loans effectively, assess repayment structures, and make informed investment decisions.

Relating these constraints to the study topic, it is evident that access to credit in aquaculture enterprises is not determined solely by the availability of financial institutions but also by structural, informational, and economic barriers. These constraints collectively reduce profitability by limiting investment capacity, restricting production expansion, and increasing financial vulnerability. Addressing them requires coordinated policy interventions, including interest rate subsidies, flexible collateral frameworks, and targeted financial literacy programs to enhance inclusion and improve the profitability of small-scale fish farming enterprises.

CONCLUSION

The study demonstrates that access to credit plays a crucial role in enhancing the profitability of aquaculture enterprises. Farmers with access to credit achieve higher production levels, better resource utilization, and increased income. However, significant barriers remain, including high interest rates and collateral requirements. Improving financial inclusion and addressing these constraints will enhance the sustainability and growth of the aquaculture sector.

Beyond these findings, the study also highlights the broader structural importance of financial systems in shaping the performance of small-scale aquaculture enterprises. Credit access not only influences immediate production decisions but also determines long-term investment capacity, adoption of improved technologies, and resilience against production risks. The results further suggest that without targeted financial reforms, many small-scale fish farmers will remain trapped in low-productivity cycles. Therefore, strengthening institutional support mechanisms and ensuring equitable access to credit will be essential for unlocking the full economic potential of aquaculture. Ultimately, improved financial inclusion will contribute significantly to food security, employment generation, and rural economic development in emerging economies.

RECOMMENDATIONS

i. Financial institutions should provide low-interest credit schemes for fish farmers.
ii. Financial institutions should promote financial literacy programs.
iii. Financial institutions should develop collateral-free lending mechanisms.
iv. Financial institutions should strengthen farmer cooperatives for credit access.

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