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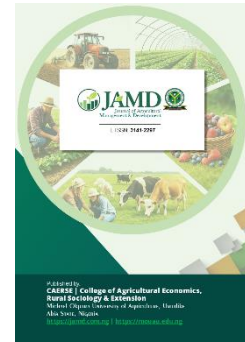
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Dynamics and Patterns of Financial Investment in Fishery Enterprises in Southern Nigeria

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ABSTRACT

This study examined the dimension and pattern of financial investment in fishery enterprises in Southern Nigeria, focusing on ownership types, enterprise size, production systems, and sources of finance. Data were collected from 105 fishery enterprises through field surveys in 2025. Results showed that sole proprietorships (42.9%) and partnerships (41.0%) dominated the sector, while cooperatives (12.4%) and limited liability companies (3.8%) were less common. Aquaculture enterprises accounted for 60% of operations, capture fisheries 32.4%, and integrated systems 7.6%. Medium-scale enterprises (61.9%) employed 6–10 workers (62.9%) and typically operated two production cycles per year (62.9%). The mean initial capital investment was ₦795,238.60, the mean current capital was ₦730,476.69, the mean annual investment was ₦566,908.33, the mean loan amount accessed was ₦675,238.60, and the mean equity contribution was ₦368,571.93. Microfinance institutions (96.2%), personal savings (83.8%), cooperatives (69.5%), and family/friends (68.6%) were the most frequently used sources of finance, while government grants (7.6%) and NGOs (35.2%) were less utilized. The findings indicate that formalized, diversified, and larger enterprises attract higher investment, whereas small-scale operators rely heavily on informal and semi-formal financing. It is recommended that fishery entrepreneurs formalize their businesses, participate in cooperatives, diversify production systems, and adopt modern technologies, while government and development partners should improve access to credit, grants, and training to enhance investment, productivity, and sustainability in the sector.

Introduction

Fishery sector is a vital pillar of Nigeria’s economy, playing an essential role in food security, employment generation, and economic diversifications (Odioko and Becer 2022). The enterprise in Southern Nigeria is a vital component of the national economy and food system, contributing approximately 4.5% to agricultural GDP and supplying over 40% of the animal protein consumed by the population (FAO, 2021). In particular, Southern Nigeria comprising coastal and riparian states such as Lagos, Bayelsa, Rivers, Akwa Ibom, Delta, Ondo, and Cross River—hosts a significant proportion of the nation’s fishery activities. The region is

endowed with diverse aquatic ecosystems including rivers, estuaries, creeks, and coastal waters, making it highly conducive to both capture fisheries and aquaculture. As the largest fish consumer in Africa and among the top globally, the country consumes approximately 3.2 million metric tons of fish annually. This underscores the importance of the enterprise as a source of livelihood, particularly for coastal and riverine communities (FAO, 2021, NBS, 2021, WorldFish, 2022).

Despite its importance, the sector faces two significant challenges that threaten its sustainability and growth: inadequate financial investment and the adverse impacts of climate change. Firstly, limited access to sufficient capital for investment in modern technologies, infrastructure, and sustainable practices constrains the sector's potential (Clark and Munro, 2017). Many fishery entrepreneurs struggle to scale operations, improve productivity, and adapt to external shocks due to financial constraints. Without adequate funding, the modernization of aquaculture, value-chain development, and the adoption of innovative practices remain out of reach. In the year 2010, Nigeria spent ₦97 billion (\$642,384,105) on fish and fish products importation at the exchange rate of \$1 to ₦151 (FAO, 2025), this value rose to ₦125 billion (\$625,000,000) per annum on the importation of 1.90 million metric tons of fish in 2015 (Agbo, 2015). In 2020 the import value of fish and fishery products was \$1.27 billion (Dauada, 2021) despite all the endowed marine resources, rivers lakes, and creeks of the nation. The most affordable source of animal protein in Southern Nigeria is frozen food and its consumption is increasing as the population of the country increase (TrendEconomy, 2021). The country is a potential market for approximately 2.5 million metric tons of fish valued at \$3 billion (TrendEconomy, 2021). With these figures, Southern Nigeria has been considered the largest consumer in Africa and among the largest fish consumer in the world with the largest fish and fish products importation in the developing world (FAO, 2021). Nwokedi *et al.* (2020), noted that with a national fish demand of 2.1 million metric tonnes per annum and a domestic production estimated at about 800,000 metric tonnes, Southern Nigeria has a shortfall of about 1.3 million metric tonnes in fish production. This means that Southern Nigeria spend a huge sum of money supposed to be used to developed the fishery sector and other sectors of the economy to fish importation, thereby slowing the economic growth of the nation.

Secondly, the sector is increasingly disrupted by climate change. Rising temperatures, erratic rainfall patterns, coastal erosion, and the growing frequency of extreme weather events are significantly altering aquatic ecosystems. These changes threaten fish stocks, disrupt aquaculture operations, and negatively impact fishing activities, particularly in Southern Nigeria's vulnerable coastal regions. Many entrepreneurs lack the resources, technical knowledge, and institutional support to adopt adaptive strategies to mitigate these impacts.

While financial investment is essential for bridging infrastructure gaps, adopting climate-resilient practices, and fostering innovation, the compounded effects of financial limitations and climate change create a complex challenge for the sector. The interplay between these factors and their influence on fishery entrepreneurs' adaptive strategies has not been adequately explored. Existing research often isolates financial or environmental challenges without integrating these dimensions to provide a holistic understanding of their combined impact.

Methodology

The study is conducted in Southern Nigeria. Southern Nigeria encompasses the southern portion of the Federal Republic of Nigeria, lying roughly between latitudes 3°N to 7°N and longitudes 2.5°E to 9.7°E. It is bounded to the south by the Atlantic Ocean, to the north by the Middle-belt region, to the west by Benin Republic, and to the east by Cameroon. The region includes states in the South-West, South-South, and South-East geopolitical zones. The terrain in Southern Nigeria consists of coastal lowlands, swamp forests, mangrove zones, freshwater bodies, estuaries, and tropical rainforests. Inland from the coast, there are freshwater swamp forests, mangroves, and derived rainforest, gradually transitioning toward less dense forest or savanna in the northern fringes of the region (FAO, 1979; FAO, 2024). The climate is tropical, humid, and characterised by well-defined wet and dry seasons. Southern Nigeria experiences high annual rainfall, generally ranging from about 1,500 mm to over 4,000 mm, with coastal areas, especially in the Niger Delta, receiving the highest amounts. Temperature is relatively stable, often averaging between 26°C and 32°C in many locations. Humidity is high, especially along the coast, due to proximity to the Atlantic Ocean and the influence of maritime tropical air masses. Southern Nigeria comprises multiple states within the South-West, South-South, and South-East zones, including Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Lagos, Ogun, Ondo, Abia, Ebonyi, Anambra, Enugu, and Rivers States. The region is densely populated,

with rapid urban growth and significant rural populations involved in agriculture, fishing, trade, and other small-scale enterprises. Data for this study were cross-sectional and collected from primary sources.

Results and Discussion

The study revealed that sole proprietorships constituted the largest proportion of fishery enterprises (42.9%), followed closely by partnerships (41.0%), cooperatives (12.4%), and limited liability companies (3.8%). This pattern indicates that the majority of fishery enterprises in the study area are individually or jointly managed, reflecting the informal and small-scale nature of the sector. This result aligns with the findings of Aminu, Ojo, and Adekunle (2017), who noted that artisanal fishery enterprises in Lagos State were predominantly sole proprietorships and partnerships, with formal companies being less common due to the higher cost of registration and administrative requirements.

Analysis of current investment across ownership types shows that limited liability companies had the highest average investment (₦819,347.66), followed by cooperatives (₦732,458.23), sole proprietorships (₦698,512.74), and partnerships (₦671,588.13). This suggests a positive correlation between formal ownership and the capacity to attract capital. Limited liability companies are typically more structured, have legal recognition, and can access formal credit facilities more easily, which enables higher investment in equipment, feed, and other production inputs (Anene, Ezech, and Oputa, 2010). Cooperative enterprises also demonstrated substantial investment, which may reflect the collective pooling of resources among members to support infrastructure development and operational efficiency. Conversely, sole proprietorships and partnerships, although numerically dominant, exhibited lower investment levels, likely due to constraints in individual or joint capital accumulation. These results imply that enterprise formalization and collaborative ownership models are crucial in mobilizing resources for investment and sustaining production in the fishery sector (Akinsorotan *et al.*, 2019).

Analysis of fishery types showed that aquaculture enterprises dominated the sector, accounting for 60% of all enterprises, while capture fisheries comprised 32.4%, and enterprises practicing both systems accounted for 7.6%. The predominance of aquaculture aligns with current trends in Nigeria and globally, where controlled fish production systems are being increasingly adopted to supplement declining wild fish stocks and ensure consistent supply for growing populations (Agnishwaran *et al.*, 2024; Akinsorotan *et al.*, 2019). The investment patterns observed indicate that enterprises engaged in both aquaculture and capture fisheries had the highest average investment (₦883,674.32), followed by aquaculture (₦664,817.18), and capture fisheries (₦642,938.57). This finding suggests that diversification in fishery operations requires substantial capital, particularly when integrating intensive aquaculture systems with capture fisheries. The higher investment in combined enterprises is consistent with observations by Arimi (2014), who noted that hybrid production systems involve more complex management, infrastructure, and input requirements, but potentially offer higher returns and reduced risk of production failure. These findings highlight the importance of capital investment in enhancing productivity and operational resilience, particularly for enterprises seeking to adopt diversified production strategies.

The distribution of enterprise sizes indicated that medium-scale enterprises constituted the majority (61.9%), followed by small-scale enterprises (33.3%) and large-scale enterprises (4.8%). This suggests that the fishery sector in the study area is dominated by operations transitioning from subsistence or small-scale production toward commercial-level operations. Aminu, Ojo, and Adekunle (2017) reported similar patterns, noting that medium-scale enterprises often dominate artisanal fisheries due to their ability to combine efficiency with manageability.

Investment levels increased with enterprise size, with large-scale enterprises recording the highest average investment (₦789,369.29), closely followed by medium-scale enterprises (₦788,467.93), and small-scale enterprises (₦613,592.85). The higher investment in larger enterprises reflects the need for greater capital to support expanded production infrastructure, higher input requirements, and additional labour. This result is consistent with findings by Amosu *et al.* (2012), who noted that enterprise size is positively correlated with financial investment and productivity in fisheries, as larger operations are better able to achieve economies of scale and invest in technology. This indicates that policies encouraging the scaling up of fishery enterprises could foster higher capital deployment and improve the overall economic performance of the sector.

The study revealed that most enterprises employed between six and ten workers (62.9%), while 22.9% employed 1–5 workers, and 14.3% employed 11–15 workers. This suggests that fishery enterprises are moderately labour-intensive, particularly at medium scales, which aligns with the labour requirements of both aquaculture and capture fisheries as reported by Akanni (2008).

Investment in the enterprises increased with labour size. Enterprises with 11–15 workers had the highest average investment (₦782,516.44), followed by those with 6–10 workers (₦760,620.46), and 1–5 workers (₦648,293.17). This relationship indicates that enterprises employing more workers require more capital for wages, input procurement, and operational equipment. Anene *et al.* (2010) emphasized that higher labour intensity is associated with increased capital requirements, particularly when enterprises aim to sustain productivity and ensure efficient resource utilization. The finding also underscores the importance of skilled labour in fishery operations, as investment in human resources directly influences productivity and profitability.

Enterprises operating two production cycles per year constituted the majority (62.9%), followed by those operating a single cycle (22.9%) and more than three cycles (14.3%). This indicates that most enterprises adopt a moderate frequency of production, reflecting seasonal resource availability, capital limitations, and operational capacity (Agnishwaran *et al.*, 2024). Investment levels correlated with production frequency, with more than three -cycle enterprises recording the highest average investment (₦772,681.15), followed by enterprises with two cycles (₦759,401.40), and one-cycle enterprises (₦659,347.52). This finding highlights that enterprises with more intensive production cycles require greater financial commitment to support feed, labour, and operational expenses. It aligns with the findings of Akinsorotan *et al.* (2019), who reported that production intensity is a major determinant of capital investment in aquaculture and capture fisheries. Enterprises operating multiple cycles are more likely to adopt modern technologies, feed management practices, and efficient production methods, all of which necessitate higher investment.

The majority of enterprises (97.1%) were registered, while a small proportion (2.9%) were non-registered. This indicates a high level of formalization, which is essential for accessing credit, extension services, and regulatory support (Akinsorotan *et al.*, 2019; AU-IBAR, 2018). Registered enterprises exhibited substantially higher investment levels (₦942,369.56) compared to non-registered enterprises (₦518,583.82). This suggests that formalization encourages capital accumulation and operational expansion. Registration provides enterprises with legitimacy, enabling them to access financial institutions, grants, and government programs, which in turn facilitates higher investment in technology, infrastructure, and workforce development (Amosu *et al.*, 2012; Anene *et al.*, 2010). These findings underscore the critical role of formalization in promoting investment and long-term sustainability of fishery enterprises.

The results in Table 2 provide an in-depth view of the sources of financial investment accessed by fishery entrepreneurs in the study area, revealing how fish farmers mobilize capital to sustain, expand, and diversify their enterprises. The study identified multiple sources of finance, with microfinance institutions, personal savings, cooperatives, and family/friends emerging as the most prominent, highlighting a diversified approach to capital acquisition. Microfinance institutions were the most accessed source of finance, utilized by 96.19% of respondents. This indicates a strong dependency on small-scale, flexible loans tailored to meet the needs of fishery enterprises. The dominance of microfinance reflects the capacity of these institutions to provide relatively low-interest loans with flexible repayment structures, making them more suitable for small and medium-scale fishers who often face irregular incomes due to seasonal production and environmental shocks (Akinsorotan *et al.*, 2019; Chikaire *et al.*, 2016). Microfinance capital enables fishery entrepreneurs to invest in critical infrastructure, such as fish ponds, storage facilities, and aeration systems, which directly influence productivity and enterprise sustainability (Clark & Munro, 2017). The prevalence of microfinance as a major source underscores the role of structured financial support in reducing production constraints and improving operational efficiency in the sector, while also facilitating the adoption of climate-smart interventions to mitigate the effects of changing environmental conditions (Chikaire *et al.*, 2026).

Personal savings were the second most accessed source, reported by 83.81% of respondents. Reliance on personal savings reflects a strategy of self-reliance and prudent financial management, which allows fishery entrepreneurs to retain control over their investment decisions and reduces dependency on external credit that may carry high interest or stringent repayment conditions (Aminu *et al.*, 2017; Chikaire *et al.*, 2016). Investments from personal savings are often directed toward both short-term operational needs and long-

term capital improvements, including the expansion of aquaculture ponds, purchase of high-quality fingerlings, and adoption of improved feed and technology. This financial strategy has implications for enterprise sustainability, as it provides liquidity to absorb shocks from adverse weather events, disease outbreaks, and fluctuating market prices, all of which are prevalent challenges in Nigerian fisheries (Agnishwaran *et al.*, 2024; Chikaire *et al.*, 2026). The use of personal savings ensures that investment levels are maintained without the risk of over-indebtedness, promoting resilience and steady enterprise growth.

Cooperatives were accessed by 69.52% of respondents, highlighting the importance of organized social networks in mobilizing financial and technical resources. Cooperatives provide a platform for group-based lending, pooled resources, and mutual support, allowing members to access larger amounts of capital than would be possible individually (Akanni, 2008; Chikaire *et al.*, 2016). Beyond financial support, cooperatives also facilitate knowledge exchange, training, and adoption of improved technologies, which can directly enhance productivity and sustainability. For instance, cooperative members are often able to invest collectively in shared facilities such as ice-making plants, hatcheries, or feed storage systems, which improve the overall efficiency and profitability of their enterprises (Akinsorotan *et al.*, 2019; Chikaire *et al.*, 2026). This form of collective investment not only increases the capital base but also provides a mechanism for risk-sharing, allowing fishery entrepreneurs to better withstand environmental and economic shocks, including those arising from climate change.

Family and friends were reported as a source of finance by 68.57% of respondents, emphasizing the importance of informal financial networks in fishery investment. Support from family and friends provides flexible, often interest-free capital that can be accessed quickly to meet urgent operational needs, respond to unexpected challenges, or exploit time-sensitive market opportunities (Aminu *et al.*, 2017; Chikaire *et al.*, 2026). This informal financing mechanism is particularly important in rural and peri-urban settings, where access to formal banking is limited or where stringent collateral requirements make institutional credit inaccessible. Investments sourced from family and friends often complement personal savings and cooperative loans, providing additional liquidity for purchasing inputs, expanding production capacity, or adopting modern aquaculture practices (Chikaire *et al.*, 2016; Clark & Munro, 2017).

Commercial banks were accessed by 58.10% of respondents, making them a moderately utilized source of finance for fishery enterprises in the study area. Unlike microfinance institutions, commercial banks often require formal collateral, detailed business plans, and credit histories, which may limit their accessibility to small-scale and medium-scale fishers (Akinsorotan *et al.*, 2019; Clark & Munro, 2017). However, where accessible, loans from commercial banks tend to be larger and can support significant capital investments, such as construction of large ponds, mechanized harvesting equipment, or cold storage facilities. The relatively lower utilization rate suggests that many fishery entrepreneurs rely more on flexible, smaller-scale financing sources for their day-to-day and seasonal operational needs. Despite this limitation, commercial bank loans are crucial for medium and large-scale enterprises seeking to expand production capacity, invest in technology, and enhance competitiveness in the fishery market (Chikaire *et al.*, 2026). Their contribution to current investment is significant but constrained by the formalities of access and the risk-averse nature of banks in lending to smallholder fishers exposed to climate and market uncertainties.

NGOs and development partners were accessed by 35.24% of respondents, reflecting their role as supplementary financiers and capacity-building agents in the fishery sector. NGOs often provide a combination of financial assistance, technical training, and input support, such as fingerlings, feed, or equipment, aimed at improving productivity and sustainability (Chikaire *et al.*, 2016; Chikaire *et al.*, 2026). While their coverage is limited geographically and by project scope, NGOs play an important role in bridging financing gaps for smallholders and promoting adoption of best practices in aquaculture and fisheries management. Investment from NGOs often serves as seed capital for innovation, allowing fishery enterprises to experiment with improved management systems, diversified production methods, and climate adaptation strategies (Chikaire *et al.*, 2026). Although less widespread than microfinance or personal savings, NGO support enhances enterprise resilience, particularly in rural areas with limited access to formal credit and cooperative networks.

Government grants were the least accessed source of financial investment, with only 7.62% of respondents reporting use. This finding underscores the limited reach of government interventions in supporting fishery enterprises, despite the sector's strategic importance for food security, employment, and economic growth

(Agnishwaran *et al.*, 2024; Chikaire *et al.*, 2016). Government grants are typically targeted, project-based, and require compliance with stringent application procedures, which may discourage many fishers from applying. Nonetheless, where available, these grants can have a transformative impact on enterprise investment, allowing recipients to implement modern aquaculture practices, adopt climate-resilient technologies, and expand operations without incurring debt. The low utilization rate suggests that many fishery entrepreneurs remain dependent on informal and semi-formal financing sources, highlighting the need for more accessible, transparent, and responsive government support programs to enhance capital investment and sector sustainability (Clark & Munro, 2017; Chikaire *et al.*, 2026).

The distribution of initial capital investment among fishery enterprises in the study area, as presented in Table 3, shows considerable variation, ranging from less than ₦200,000 to over ₦2,000,000, with a mean initial investment of ₦795,238.60. A substantial proportion of fishers (27.6%) started their enterprises with less than ₦200,000, indicating a large presence of small-scale operations that likely rely on personal savings, family support, and cooperative assistance to finance basic fishery activities. These low-capital investments are consistent with findings by Akanni (2008) and Aminu *et al.* (2017), who noted that small-scale artisanal fishers in Nigeria often commence operations with minimal capital due to limited access to formal credit and high-risk exposure in fisheries. Despite their low starting capital, such enterprises are often agile and capable of incremental growth through reinvestment of profits, though their capacity for adopting advanced aquaculture technologies may be constrained.

On the other hand, 35.2% of respondents reported initial investments between ₦800,001 and ₦1,000,000, representing the largest single group of investors. This suggests that medium-scale enterprises dominate the sector in terms of capital deployment, likely positioning these operators to adopt improved aquaculture systems, mechanized equipment, and higher stocking densities. Such capital levels provide flexibility to absorb operational shocks and pursue diversification in production methods, which aligns with the findings of Chikaire *et al.* (2026) that adequate initial capital enhances fishery enterprise sustainability and resilience to climate and market variability.

A smaller proportion of fishers (9.5%) invested more than ₦2,000,000, reflecting the presence of large-scale or highly specialized operations that may engage in intensive aquaculture or integrated capture and culture systems. These high-capital enterprises are likely to access formal financial channels such as commercial banks or government support, which offer larger loans or grants to support expansion, in line with observations by Clark and Munro (2017) on capital-intensive fishery enterprises. Investments in the ₦1,400,001 – ₦2,000,000 range were reported by only 12 respondents, highlighting that very high initial capital is relatively uncommon among fishers in the study area, possibly due to barriers in accessing substantial credit, high perceived risks, and limited market infrastructure.

Interestingly, there is a noticeable gap in the ₦1,200,001 – ₦1,400,000 range, with no respondents reporting initial investment within this bracket. This may reflect local financing patterns where incremental capital accumulation occurs in smaller or larger steps, influenced by available personal savings, cooperative support, or microfinance accessibility. It also suggests that fishers either start very modestly or scale directly to larger investments when resources permit.

Overall, the mean initial capital of ₦795,238.60 indicates that fishery enterprises in the study area are largely medium-scale in financial capacity, which provides a foundation for moderate technological adoption, operational stability, and potential expansion. This investment pattern underscores the importance of accessible and flexible financing mechanisms to support enterprise growth, particularly for small-scale operators who face constraints in scaling their operations. Enhancing access to structured credit, cooperative funding, and government grants could help bridge capital gaps, enabling fishers to invest in better production systems, climate-resilient practices, and sustainable enterprise growth (Chikaire *et al.*, 2016; Chikaire *et al.*, 2026).

The distribution of current capital investment in the fishery enterprise, as presented in Table 4.4, reveals considerable variation in working capital among fishery operators in the study area. The largest proportion of respondents (29.5%) maintained current capital between ₦200,001 and ₦400,000, reflecting moderate financial capacity sufficient for routine operational needs such as purchasing feed, paying labor, and maintaining equipment.

Conversely, 12.4% of enterprises operated with less than ₦200,000, indicating that some small-scale operators have limited liquidity, which may constrain production efficiency and the ability to scale operations. This aligns with findings by Egwenomhe *et al.* (2022), who noted that limited working capital among small-scale fish farmers in Delta State negatively affected operational growth and adoption of improved aquaculture technologies.

Higher current capital levels were observed among a significant proportion of respondents: 14.3% had ₦800,001–₦1,000,000, 9.5% had ₦1,800,001–₦2,000,000, and 8.6% had more than ₦2,000,000. These higher investments were generally associated with medium- to large-scale enterprises or operations engaged in both aquaculture and capture fisheries, which require substantial inputs and labor. This finding corroborates Elezuo *et al.* (2024), who highlighted that larger or integrated fishery enterprises in Nigeria often sustain higher working capital levels, enabling them to adopt modern technologies, maintain regular production cycles, and respond more effectively to environmental and market fluctuations.

The mean current capital of ₦730,476.69 indicates that, on average, fishery enterprises have a moderate level of liquidity to sustain production activities. Adequate working capital is critical for mitigating risks associated with climate variation, feed shortages, or operational disruptions, which have been reported to impact fishery productivity and health in Rivers and Imo States (Chikaire *et al.*, 2016; Esiobu & Onubuogu, 2014). The findings also suggest that enterprises with higher current capital are more likely to participate in growth-promoting initiatives, such as government empowerment programs or access to microfinance facilities, which have been shown to improve the growth and sustainability of aquaculture businesses in Nigeria (Egwenomhe *et al.*, 2022; EPA, 2011).

The distribution of annual investment in the fishery enterprise, as shown in Table 4.5, indicates considerable variation in the financial resources fish farmers allocate to sustain their operations each year. The largest proportion of respondents (35.2%) invested between ₦200,001 and ₦400,000 annually, suggesting that most operators maintain a moderate investment level sufficient for routine activities such as feed supply, labor, pond maintenance, and stocking of fingerlings. This is consistent with Elezuo *et al.* (2024), who noted that moderate financial inputs are common among small- and medium-scale fisheries and are critical for sustaining daily operations without overextending limited resources.

A significant proportion of farmers (21.9%) invested ₦600,001–₦800,000, while 15.2% invested ₦800,001–₦1,000,000, reflecting the higher financial demands of medium-scale or more intensive aquaculture practices. According to Egwenomhe *et al.* (2022), higher levels of investment enable farmers to adopt improved technologies and management practices, enhancing productivity, fish survival rates, and overall enterprise sustainability. This suggests that farmers in these investment brackets are better positioned to mitigate production risks, such as disease outbreaks and feed shortages, which are critical in Nigerian aquaculture.

A small proportion of farmers (2.9%) invested below ₦200,000, representing very small-scale operators whose limited financial capacity may restrict production efficiency and enterprise growth. Chikaire *et al.* (2016) observed that low investment in fish farming often limits the adoption of climate-adaptive and modern practices, increasing vulnerability to environmental fluctuations. On the other hand, a minority of respondents invested above ₦1,200,000, likely representing well-capitalized or commercially oriented operators who can sustain larger-scale production and benefit from economies of scale (Esiobu & Onubuogu, 2014).

The mean annual investment of ₦566,908.33 reflects a moderate average level of financial commitment in the sector. Sufficient annual investment is critical for maintaining fish health, mitigating production risks, and ensuring consistent yields (Falola & Heaton, 2022). Moreover, farmers with access to financial support from sources such as microfinance institutions, cooperative societies, and government empowerment schemes are more likely to maintain higher annual investment levels, which improves the adoption of modern inputs and climate-resilient practices (Egwenomhe *et al.*, 2022).

The largest group of respondents (41.0%) accessed loans between ₦200,001 and ₦400,000, indicating that most fish farmers depend on moderate loan levels to complement personal savings and other financial sources for operational costs, such as pond maintenance, feed, and labor. This observation aligns with

Kaleem and Sabi (2021), who noted that moderate access to credit enables small- and medium-scale aquaculture operators in Nigeria to sustain production and gradually adopt improved technologies.

Additionally, 17.1% of respondents obtained loans below ₦200,000, suggesting that a portion of farmers is either cautious about borrowing due to repayment concerns or has limited access to larger amounts. Limited loan access can restrict their ability to expand production, acquire improved feed, or invest in climate-resilient infrastructure. Ipinjolu *et al.* (2014) emphasized that financial constraints among fish farmers often hinder their capacity to adapt to climate variability, which can negatively affect productivity and sustainability.

Conversely, 13.3% of fish farmers secured loans exceeding ₦2,000,000, reflecting a subset of well-capitalized operators capable of undertaking large-scale or commercial operations. Access to substantial credit allows these farmers to invest in advanced aquaculture technologies, increase production capacity, and implement adaptive measures to climate stressors, consistent with insights from Iyeme *et al.* (2024), who highlighted the importance of financial capacity in enabling aquaculture stakeholders to respond effectively to environmental and climatic pressures.

The mean loan amount of ₦675,238.60 further demonstrates that, on average, fish farmers utilize moderate financial support from loans to sustain their enterprises. Such borrowing levels, when combined with personal savings and cooperative contributions, provide a critical foundation for operational stability and incremental growth. Le Quesne and Pinnegar (2011) suggested that adequate financial investment is essential for maintaining resilience in fisheries, especially given the challenges posed by environmental changes and resource variability.

A majority of respondents (53.3%) contributed between ₦200,001 and ₦400,000, indicating that moderate personal investment is the dominant form of capital among fishery operators. This finding aligns with Kaleem and Sabi (2021), who noted that in Nigeria and similar developing countries, aquaculture enterprises often depend on moderate personal equity to maintain daily operations and small-scale expansion.

Additionally, 30.5% of fish farmers invested less than ₦200,000 in equity, highlighting that a significant proportion of enterprises operate on minimal personal financial input. Such low equity contributions may constrain the adoption of improved production technologies, expansion plans, and resilience to environmental shocks. Ipinjolu *et al.* (2014) observed that limited internal funding in fishery enterprises can hinder operational efficiency and reduce the capacity to cope with climate variability, suggesting that low equity may increase dependence on external financial sources.

Only a small fraction of respondents contributed more than ₦800,000, with the highest bracket (>₦2,000,000) representing just 1.9% of the sample. This observation is consistent with Iyeme *et al.* (2024), who reported that higher personal investment facilitates the implementation of advanced management practices and improves the resilience of fishery enterprises to climatic and ecological challenges. Le Quesne and Pinnegar (2011) also highlighted that enterprises with substantial equity can invest in technologies that buffer against environmental stressors, enhancing productivity and sustainability.

The mean equity contribution of ₦368,571.93 indicates that fish farmers rely on moderate personal investment as a foundation for their enterprises, complementing other financial sources such as loans, cooperatives, and microfinance. Moss *et al.* (2021) emphasized that even moderate equity serves as a critical buffer, providing stability for routine operations and incremental growth. Jim (2001) and Li *et al.* (2021) further support this, noting that personal financial commitment strengthens access to external funding and underpins long-term enterprise sustainability.

Conclusion and Recommendations

The study on the dimension and pattern of financial investment in fishery enterprises in Southern Nigeria shows that the sector is dominated by small- and medium-scale sole proprietorships and partnerships, with aquaculture being the most common activity. Investment is higher in formalized, diversified, and larger enterprises, while microfinance, personal savings, cooperatives, and family support are the main sources of finance, and government grants are minimally accessed. Most enterprises operate with moderate capital, limiting technology adoption and expansion. It is strongly recommended that fishery entrepreneurs

formalize their businesses, actively engage in cooperatives, diversify production systems, and adopt modern technologies, while government and development partners should make credit and grants more accessible and provide training on financial management and modern aquaculture practices to boost investment, productivity, and sustainability in the sector.

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Appendix

Table 1: Economic profile of the fishery enterprise in the study area

Variable	Category	Frequency	Percentage	Current Investment (₦)
Ownership type	Sole proprietorship	45	42.9	698,512.74
	Partnership	43	41.0	671,588.13
	Cooperative	13	12.4	732,458.23
	Limited liability	4	3.8	819,347.66
Type of fishery	Capture fishery	34	32.4	642,938.57
	Aquaculture	63	60.0	664,817.18
	Both	8	7.6	883,674.32
Enterprise size	Small-scale	35	33.3	613,592.85
	Medium-scale	65	61.9	788,467.93
	Large-scale	5	4.8	789,369.29
Labour/workers	1–5	24	22.9	648,293.17
	6–10	66	62.9	760,620.46
	11–15	15	14.3	782,516.44
Production cycle	1 cycle	24	22.9	659,347.52
	2 cycles	66	62.9	759,401.40
	>3 cycles	15	14.3	772,681.15
Enterprise registration	Non-registered	3	2.9	518,583.82
	Registered	102	97.1	942,369.56
	Total	105	100.0	

Source: Field survey, 2025

Table 2: Sources Financial Investment in the fishery Enterprise

Sources Financial Investment	*Frequency	Percentage
Personal savings	88	83.81
Family/friends	72	68.57
Cooperatives	73	69.52
Microfinance institutions	101	96.19
Commercial banks	61	58.10
Government grants	8	7.62
NGOs/Development partners	37	35.24

Source: Field survey (2025) *multiple response recorded

Table 3: Level of Initial capital investment in the fishery enterprise

Initial capital	Frequency	Percentages
< 200,000	29	27.6
200,001 – 400,000	6	5.7
400,001 – 600,000	7	6.7
600,001 – 800,000	2	1.9
800,001 – 1,000,000	37	35.2
1,200,001 – 1,400,000	0	0.00
1,400,001 – 1,600,000	4	3.8
1,600,001 – 1,800,000	3	2.9
1,800,001 – 2,000,000	7	6.7
>2,000,000	10	9.5
Total	105	100.0
Mean	795,238.60	

Source: Field survey (2025)

Table 4: Level of Current capital investment in the fishery enterprise

Current capital	Frequency	Percentages
< 200,000	13	12.4
200,001 – 400,000	31	29.5
400,001 – 600,000	13	12.4
600,001 –800,000	10	9.5
800,001 – 1,000,000	15	14.3
1,200,001 – 1,400,000	2	1.9
1,400,001 – 1,600,000	1	1.0
1,600,001 – 1,800,000	1	1.0
1,800,001 – 2,000,000	10	9.5
>2,000,000	9	8.6
Total	105	100.0
Mean	730,476.69	

Source: Field Survey data (2025)

Table 5: Level of Annual investment in the fishery enterprise

Annual investment	Frequency	Percentages
< 200,000	3	2.9
200,001 – 400,000	37	35.2
400,001 – 600,000	12	11.4
600,001 –800,000	23	21.9
800,001 – 1,000,000	16	15.2
1,200,001 – 1,400,000	3	2.9
1,400,001 – 1,600,000	3	2.9
1,600,001 – 1,800,000	3	2.9
1,800,001 – 2,000,000	3	2.9
>2,000,000	2	1.9
Total	105	100.0
Mean	566,908.33	

Source: Field Survey data (2025)

Table 6: Level of Loan amount invested in the fishery enterprise

Loan amount	Frequency	Percentages
< 200,000	18	17.1
200,001 – 400,000	43	41.0
400,001 – 600,000	10	9.5
600,001 –800,000	2	1.9
800,001 – 1,000,000	3	2.9
1,200,001 – 1,400,000	3	2.9
1,400,001 – 1,600,000	6	5.7
1,600,001 – 1,800,000	4	3.8
1,800,001 – 2,000,000	2	1.9
>2,000,000	14	13.3
Total	105	100.0
Mean	675,238.60	

Source: Field Survey data (2025)

Table 7: Level of Equity contribution in the fishery enterprise

Equity contribution	Frequency	Percentages
< 200,000	32	30.5
200,001 – 400,000	56	53.3
400,001 – 600,000	3	2.9
600,001 –800,000	1	1.0
800,001 – 1,000,000	4	3.8
1,200,001 – 1,400,000	3	2.9
1,400,001 – 1,600,000	2	1.9
1,600,001 – 1,800,000	1	1.0
1,800,001 – 2,000,000	1	1.0
>2,000,000	2	1.9
Total	105	100.0
Mean	368,571.93	

Source: Field Survey data (2025)