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ECONOMIC VIABILITY AND PROFITABILITY OF INVESTING IN LOCALLY PELLETIZED FISH FEED PRODUCTION IN NIGER STATE, NIGERIA.

[1]Umar. J. K, [2]Ewugi. M.S. and [3]Muktar. B.

[1]Research Outreach Department, National Institute for Freshwater Fisheries Research
P.M.B 6006 New-Bussa Niger State Nigeria.

[2&3]Department of Economic, Ibrahim Babagida Badamasi University Lapai Niger State Nigeria.
Department of Economic, Ibrahim Babagida Badamasi University Lapai Niger State Nigeria.

Corresponding Author; Umar.J. K
umarjummaikhadijah@gmail.com
07060452957.

ABSTRACT

The study assessed the profitability and economic viability of investing in locally pelletized fish feed production in Niger State, Nigeria. The research was motivated by the rising cost of fish feed, which significantly affects the profitability of fish farmers and limits the growth of aquaculture in the country. Primary data were collected from 215 locally pelletized fish feed producers using structured questionnaires and analysed using farm budgeting techniques, including net farm income, gross margin, and profitability ratios. The findings revealed that total variable costs accounted for 70.48% of the total production cost, while fixed costs constituted 29.52%. The estimated gross margin and net farm income were ₦233,425 and ₦122,425 respectively, indicating strong profitability. The rate of return on investment (RRI) was 0.33, the operating ratio 0.84, and the gross ratio 0.75, all of which confirm the economic viability of local feed production. The study concludes that locally pelletized fish feed production offers a profitable and sustainable agribusiness opportunity capable of enhancing rural employment, reducing production costs for fish farmers and supporting Nigeria's food security goals. Therefore, it is recommended that government and development agencies promote the establishment of small and medium-scale local fish feed enterprises through targeted credit schemes, subsidized equipment, and technical training for producers

KEYWORDS: Aquaculture, Pelletized Fish Feed, Profitability, Marketability, Employment creation, Niger state.

JEL Classification: : ***E31, I32, H53***

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1. INTRODUCTION

Aquaculture is broadly recognized for its essential contribution to providing food and income for many developing countries. It encompasses the controlled cultivation of fish and other aquatic species in environments like pens, ponds, tanks, cages, and raceways, a practice commonly known as fish farming. Aquaculture is rapidly expanding worldwide, offering significant potential to supply a substantial portion of the proteins needed for human consumption (Boyd, McNevin, & Davis, 2022). Global fish production increased from 184.6 million metric tons in 2022 to 186.6 million metric tons in 2023 (Al-Wakeel et al 2024). In Africa, freshwater fish production has steadily risen and has grown more significantly compared to previous years.

Projected global fish production is expected to continue its upward trend, with estimates suggesting an increase to approximately 189.0 million metric tons in 2025 and reaching around 192.5 million metric tons in 2026 (FAO, 2022). Similarly, freshwater fish production in Africa is anticipated to grow significantly, with projections indicating an increase of about 5% annually, resulting in a notable rise during this period (FAO, 2022; World Bank, 2023). In the North Africa for instance, the most raised production levels are found in Egypt, Morocco, Algeria and Libya (Mehrim & Refaey, 2023). Egypt's aquaculture production grew significantly from 139,389 tons in 1998 to 1,561,457 tons in 2018, representing approximately 71% of Africa's total aquaculture output (Elsheikh et al 2024).

Egypt ranks first among African countries and ninth globally in fish farming production. This achievement seeks to address the gap between fish production and consumption in Egypt (Mohammed et al 2024). Fish farming in South Africa has experienced substantial growth over the years, with production increasing from 2,819 tons in 2000 to approximately 3,500 tons in 2020. The industry continued to expand in subsequent years, reaching around 4,200 tons in 2021, 5,000 tons in 2022, 6,000 tons in 2023, 7,200 tons in 2024, 8,600 tons in 2025, and an estimated 9,753 tons in 2026 (Life & Potgieter, 2024) the country was the 12th largest fish producer in Africa.

Similarly, fish farming in East Africa grew significantly from 68,351 tons in 2000 to approximately 105,000 tons in 2020. The industry continued its upward route, reaching around 120,000 tons in 2021, 135,000 tons in 2022, 150,000 tons in 2023, 180,000 tons in 2024, 210,000 tons in 2025, and an estimated 379,778 tons in 2026.Tanzania is the major fish producing country of the region with a production of close to 400000 tons. In value terms and based on ex vessel price, the total fish production is estimated at close to US 400million. Similarly, In West Africa, fish production surged from 32146 tons in 2000 to 388375 tons in 2021, with a remarkable annual growth rate of 2.37 percent, surpassing regional and global averages.

Aquaculture production in Nigeria has seen a significant increase, rising from approximately 2000 tons in 1960 to more than 300,000 tons in 2015. The industry has continued its upward trend, with production reaching around 320,000 tons in 2016, 350,000 tons in 2017, 380,000 tons in 2018. This rate dropped in 2019 to 290,000 tons and 260,000 tons in 2020 because of the COVID-19 impact (Ogunji & Wuertz 2023). The last production figures revealed 275,645 tons. According to the Central Bank of Nigeria (CBN) and the Food and Agriculture Organization (FAO), the average Nigerian eats less than 2kg of beef a year. The figures also show that the average Nigerian receives a paltry 4kg of eggs a year. This has resulted in a flow of interest in fish farming; thereby creating a thriving market for fish feed producers in Nigeria. Nigeria's fish farming industry is expanding, leading to increased demand for fish feed. However, the high cost of feed impacts the

profitability of fish farmers, causing some, especially small-scale farmers, to exit the industry. The high cost of fish feed also influences the price of fish products, thereby undermining the welfare of Nigerians.

Therefore, it is important to assess the costs and benefits of investing in locally pelletized fish feed, aiming to offer affordable feed to fish farmers while also creating employment opportunities and income for fish feed producers. Fish culture is becoming increasingly significant in Nigeria, as locally available raw materials are regarded as potential ingredients for fish feed (Audu & Yola, 2021).

The global increase in fish demand has sharpened the need for sustainable and affordable feed solutions. However, in Nigeria, challenges such as inconsistency in feed quality, the absence of standardized quality controls, and logistical issues like inadequate infrastructure impede widespread adoption (Nwachukwu et al 2017). Farmers' skepticism about local feeds leads to greater dependence on imported feeds, causing economic issues and market instability. (Ogunleye et al 2018: Dada et al 2019). Increasing interest is emerging in producing local feeds from readily available raw materials such as maize and soybeans, potentially reducing costs and creating employment opportunities (Adewumi et al, 2019: Eze et al 2019). To promote the use of locally pelletized fish feed, it is essential to focus on meeting quality standards, enhancing distribution channels, and understanding farmers' preferences.

Several studies on local fish feeds in Nigeria and developing countries offer important insights for this research. Dada and Olaleye (2019) examined distribution networks for aquaculture inputs and reported that inadequate transportation infrastructure and limited market linkages restricted access to local feeds, especially in rural areas. These logistical challenges increased costs and reduced availability, limiting adoption among smallholder farmers.

Ogunleye et al (2018) surveyed fish farmers in Ogun State, revealing that while farmers valued the low cost of local feeds, concerns about their quality and nutritional effectiveness hindered widespread adoption. Farmers preferred feeds with proven nutritional content and consistent pellet quality, emphasizing the importance of quality assurance and farmer education.

Ogunleye and Ayodele (2020) conducted a survey of small-scale feed producers in southwestern Nigeria, revealing their primary reliance on easily accessible raw materials like maize, soybean, and rice bran. The study also emphasized the lack of standardized processing methods, which affected the uniformity and nutritional quality of the feeds. Similarly, Ibrahim and Musa (2020) noted that restricted access to advanced pelletizing equipment caused inconsistency in the quality and weight of pellets produced by local producers. While Adegbite et al (2021) observed the nutritional analysis of locally produced fish feeds in Nigeria revealed that many samples did not meet the recommended protein and energy levels, mainly as a result of inadequate ingredient mixing and suboptimal processing techniques. This inconsistency negatively impacted fish growth and feed efficiency, underscoring the need for establishing quality control protocols.

Recent growth in Nigeria's aquaculture industry, especially in Niger State, highlights its potential for economic development and food security due to abundant natural resources. However, the sector faces significant challenges, mainly the heavy reliance on expensive imported fish feed, over 80% of Nigeria's feed costing around $600 million annually which raises operational costs and limits industry expansion. Developing local fish feed production could reduce costs, create jobs, and support rural development, but obstacles such as high investment requirements, quality control, raw material fluctuations, and weak distribution networks hinder progress. Existing research lacks region-specific data for Niger State, making it

difficult for policymakers to expertise targeted strategies. Addressing this gap through focused studies on cost benefit analysis could promote sustainable growth, attract investment, and enhance food security by establishing a competitive local fish feed industry modified to Niger State's unique socio-economic environment.

Historically reliant on costly imports feeding, Nigeria and other African countries have shifted toward locally producing fish feed using available raw materials like maize and soybean. This approach aims to reduce costs, improve feed availability, and support local economies. Today, pelletized fish feed is seen as essential for making aquaculture more sustainable and profitable, despite challenges in scaling up, ensuring quality, and establishing distribution. Largely, it is a transformative solution, especially in resource-rich regions like Niger State.

However, the sector faces significant challenges, mainly the heavy reliance on expensive imported fish feed, over 80% of Nigeria's feed costing around $600 million annually which raises operational costs and limits industry expansion. Developing local fish feed production using raw materials like maize and soybean could reduce costs, create jobs, and support rural development, but obstacles such as high investment, quality control, raw material fluctuations, and weak distribution networks remain. A lack of region-specific data for Niger State hampers targeted policymaking; focused studies could promote sustainable growth, attract investment, and enhance food security. Transitioning to local, pelletized fish feed is a transformative move toward more sustainable and profitable aquaculture, especially in resource-rich areas like Niger State, despite existing scaling and quality challenges.

Nigeria's pelletized fish feed industry is growing due to government policies and expanding aquaculture. Advances in technology and increased use of local ingredients have reduced dependence on imports. Investment from SMEs and larger firms has boosted production capacity, supported by government and NGO backing, meeting rising demand with diverse feed options.

Currently, there is limited scholarly work that focuses exclusively on locally pelletized fish feed production in Niger. However, relevant insights and conceptual frameworks can be obtained from broader research on aquaculture feed production in West Africa, small-scale fish farming, and local feed manufacturing practices. The main conceptual framework related to locally pelletized fish feed production in Niger center on fostering sustainable aquaculture through the development of affordable, locally sourced feed options that decrease dependence on imports. These frameworks highlight the adaptation of cost-effective pelletization technologies adapted for small-scale producers, utilizing readily available raw materials such as maize bran, millet, sorghum, and fish waste to create nutritionally balanced feeds customized for regional fish species. The approach seeks to enhance fish growth performance, reduce production costs, and strengthen food security. It also acknowledges existing challenges such as limited technical expertise and market access, while identifying opportunities for technology transfer, capacity building, and supportive policies to promote industry growth.

Fish feed remains a major challenge for small-scale farmers, costing over 70% of production expenses. However, recent advancements in local Pelleted feed technologies have improved cost-efficiency and profitability. The use of hand mixing has been replaced with a well-modernized model of indigenous machinery comprising a crusher, pelletizer, mixer and the like. Omeje et al (2023). This technology can be

installed directly at fish farm sites, allowing for flexible adjustments to the composition of mixed ingredients and the size of the pelleted feed based on the age and species of the farmed fish.

In light of these considerations, this study focuses on Niger State to explore the economic viability and profitability of investing in locally pelletize fish feed production. Related empirical and literature reviews such as: Nwabeze et al (2017) examined information needs of fish-feed entrepreneurs in the Kainji Lake Basin, Nigeria. On the other hand, Oppong et al (2017) studies found that producing fish feed from Black Soldier Fly Larvae is a financially viable and promising alternative to traditional fishmeal, which is expected to become scarce. It's assessed the profitability using Net Present Value (NPV), Benefit Cost Ratio (BCR), and Internal Rate of Return (IRR), finding that both BSFL meal and BSFL-based fish feed are financially attractive. Ajani et al (2020) examined the differences in quality between locally pelletized fish feed and the imported one. The study found that local diet if well formulated has the potential for being profitable.

More so, Ifegika et al (2020) analysed the economic return among different low-cost feed types while, Adeoti et al (2021) found that fish feed enterprises in Osun State, Nigeria, are highly profitable, but farmers face challenges like limited funding, high equipment costs, market instability, and poor feed quality. Similarly, Sogbesan, et al (2021) investigated the hike in the price of fishmeal, which is the major source of animal protein in fish diet, and suggested the need for alternative sources. Their study found that fresh chicken intestine could be used as an alternative for fishmeal in order to reduce the cost of raw materials for making fish feed. Hence, Studies on the marketability of the locally pelletized fish feed point the price of the feed, its aroma and quality as its barriers in the market place (Adeoti et al., 2021).

The cost of raw materials often makes the price of locally pelletized fish feed to be high and put it at a competitive disadvantage (Audu, et al 2021). Furthermore, Omeje et al (2023) Stated that fish feed production profitability depends on factors like stable electricity, affordable equipment, demand, and ingredient availability, and they advise regular maintenance and timely machine replacement to boost productivity and profits. Therefore, this research seeks to provide focused insights into the economic and social effects of establishing a regionally adapted fish feed industry. In doing so, the study intends to guide local policy-making, attract investment, and support the development of a sustainable and competitive aquaculture sector that can foster economic growth, enhance food security, and generate livelihoods for communities within Niger State. Specifically, the study aims to:

- Determine the profitability of investing in locally pelletized fish feed in Niger State.
- Examine the marketability of locally pelletized fish feed in Niger State
- Examine the employment creation of the locally pelletized fish feed production

2. 0. METHODOLOGY

2.1. Study Area

The research was carried out in Niger State, Nigeria, located geographically between latitudes 8°22'N and 11°30'N, and longitudes 3°30'E and 7°20'E. It shares borders with several states: Zamfara, Kebbi, Kogi, Kwara, Kaduna, and Abuja (FCT) and has an international boundary with the Republic of Benin at Babanna in Borgu Local Government Area. Spanning approximately 76,470 square kilometers, which accounts for about 9.3% of Nigeria's total land area, Niger State has an estimated population of around 3.95 million. Its

favorable environment for studying locally produced fish feed is attributed to its high fish production levels, ample raw materials such as fishmeal, soybeans, maize, and other agricultural product. These resources help lower transportation costs and improve operational efficiency. Moreover, the presence of existing fish feed manufacturing facilities provides a solid infrastructure foundation to support further research and development initiatives in the region.

2.2. Population of the study

The population for this comprised locally pelletized fish feed producers in Niger State, who play a crucial role in the region's Aquaculture industry. A list of 450 producers was compiled with assistance from NAMDA, community leaders, and extension agents. Using a three-stage sampling approach across different zones and localities, 215 producers were selected to accurately reflect the diversity of fish feed production within the state.

2.3. Sampling techniques and sample size

The study focused on registered and active locally pelletized fish feed producers in Niger State. A three-stage sampling method was used to select participants within the study area. In the first stage, three (3) local government areas associated with pelletized fish feed production were purposively chosen from each of the three (3) Agricultural zones in Niger State: Bida in Zone I, Chanchaga in Zone II, and Borgu in Zone III. The second stage involved randomly selecting two (2) villages from each of these local government areas. In the final stage, 50% of the fish feed producers in each village were selected. Based on discussions with the Niger State Agricultural Mechanization and Development Authority (NAMDA), Community heads, and extension agents from each zone, a sampling frame of 450 registered and active pelletized fish feed producers was compiled. Ultimately, 215 respondents were selected for the study. This sampling approach was chosen because NAMDA, Community leaders, and extension agents are familiar with all registered and active producers within their jurisdictions, ensuring that the list was accurate and comprehensive. The sampling method was designed to accurately represent fish feed producers in Niger State by focusing on key regions and active, registered producers, reducing bias and

ensuring reliable results.

Table 2.3: Sampling outlay of the study.

Agricultural Zone	Local Govt Areas	Villages	Sample frame	Sampled size (50%)
Zone I	Bida	Kutigi	76	38
		Lemu	62	31
Zone II	Chanchaga	Lapaigwari	76	38
		Gbako	78	39
Zone III	Borgu	New Bussa	94	47
		(Agwara)Babanna	44	22
Total	**6**	**6**	**430**	**215**

2.4. Method of Data Collection

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Primary data were used for the study. A structured questionnaire complemented with interview schedule was used to obtain the necessary information from respondents in the study area. Data were collected on the socio-economic characteristics of the respondents; source and frequency of information; cost of input utilized and return was collected. More so, data on marketing margin and marketing efficiency of locally pelletized fish feed were collected.

2.5. Method of Data Analysis

Descriptive and inferential statistics were used in analyzing the collected data. Descriptive, Analytical techniques used compose of means, frequencies and percentages. However, budgetary technique and marketing margin were used to specify the model: The justification for using budgetary techniques and marketing margin analysis lies in their effectiveness for assessing the financial viability and profitability of fish feed production and marketing. Budgetary techniques help estimate costs and revenues, aiding in decision-making and resource planning. Market margin analysis evaluates the profitability at different distribution stages and the competitiveness of local feeds. Together, these methods provide a comprehensive financial overview; budgetary techniques specify costs and income, while market margins highlight economic efficiency and market sustainability.

Budgetary techniques:

The net farm income model is specified as equation 1:

NFI = GR – (TFC+TVC) (1)

Where:
NFI = Net farm income (₦);

GR = Gross revenue (₦);

TFC = Total fixed costs (₦); and

TVC = Total variable costs (₦).

GM = GFI – TVC (2)

$$RRI = \frac{GM}{TVC} \quad (3)$$

Where:
GM= Gross margin (₦);

TVC = Total variable cost (₦).

$$OR = \frac{TVC}{GI} \quad (4)$$

Where:

OR is the operating ratio;

TVC is total variable cost; and

GI is the gross income.

Gross ratio: It measures the ultimate solvency of the farm business. Equation 5:

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$$GR = \frac{TFE}{GI} \quad (5)$$

Where:

GR is the gross ratio;

TFE is the total farm expenses; and

GI is the gross income. A lower and less than one ratio are preferable.

$$\text{Marketing margin} = \frac{\text{selling price} - \text{purchasing price}}{\text{Selling price}} \times 100 \quad (6)$$

3. RESULT AND DISCUSSION

3.1 Socioeconomic characteristics of respondents

The finding on the age distribution of respondent in **Table 3.1** show that majority (60%) of the respondents are within 20-39 age bracket, with an average age of 37years, indicating that young and middle-aged individuals predominantly engage in locally pelletized fish feed production. Their openness to innovation and technological adaptation bodes well for the sector's sustainability. Additionally, most respondents (45.1%) have 21–30 years of fish farming experience, averaging 23 years, which provides them with substantial practical knowledge. This experience enhances their appreciation of locally produced feeds, especially for reducing costs compared to imported options. This aligns with findings by Oyesola et al (2022) and Boyd et al (2022), noted that experienced fish farmers are more likely to adopt cost-effective technologies and improve productivity, feed quality, input costs, and management practices.

Table 3.1: Socioeconomic characteristics of respondents

Variable	Frequency	Percentage (%)	Mean
Age			
20–39	129	60.0	37
40–59	75	34.9	
60 and above	11	5.1	
Years of experience			
1–10	32	14.9	
11 – 20	54	25.1	23
21 – 30	97	45.1	
31 – 40	32	14.9	
Gender			

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Female	50	23.3			
Male	165	76.7			
Marital Status					
Married	198	92.1			
Single	13	6.0			
Widowed	4	1.9			
Level of Formal Education					
Non-formal	95	44.2			
Primary	29	13.5			
Secondary	52	24.2			
Tertiary	39	18.1			
Contact with Extension Agent (Last Season)					
Yes	120	55.8			6
No	95	44.2			
Secondary occupation					
Fish farming			81	37.7	
Fish feed retailer			80	37.2	
Wage labourer			23	10.7	
Access to credit in the last farming season			77	35.8	
Belong to any association/cooperative societies			138	64.2	
Sources of information					
Family and friends			215	100.0	
Producers group			122	56.7	
Radio			174	80.9	
Television			34	15.8	
Newspaper			1	0.5	
Extension agent			118	54.9	
Social media			50	23.3	

The study area's respondents are predominantly male (76.7%), reflecting gender disparities in Nigerian aquaculture where women have limited access to land, credit, and training (Nwuba et al., 2022; Ogunji et al., 2023). Most are married (92.1%), supporting engagement through family labor (Audu et al., 2021).

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Educational levels vary, with 42.8% having no formal education, relying on indigenous knowledge, while some possess higher education for modern practices (Mehrim et al., 2023). About 55.8% have contact with extension agents, indicating moderate access to knowledge (Boyd et al., 2022; Ogunji et al., 2023). Fish farming and feed retailing serve as main secondary occupations, showing sector growth (Ashaolu et al., 2020; Olasunkanmi et al., 2023). However, only 35.8% recently accessed credit, mainly through informal sources (Osondu et al., 2021; Obasi et al., 2023). A majority (64.2%) are members of cooperatives, enhancing resource and market access (Adekoya et al., 2024). Information on feed production is mainly shared through family, friends, producer groups, and radio, which is the most accessible mass media in this rural context (Ajayi et al., 2023).

3.2 Profitability of investing in locally pelletized fish feed production

Most fish feed producers operate at small to medium scales, with 17.7% producing less than 500 kg per cycle and 32.1% producing between 1,000 and 1,499 kg, resulting in an average production of approximately 1,014 kg (Tiamiyu et al., 2023). They sell nearly as much as they produce, with 36.7% of producers selling between 800 and 1,099 kg, reflecting steady market demand. The small difference between production and sales suggests that some feed may be stored for future use or retained for personal consumption, a common practice among small fish feed producers in the area (Tiamiyu et al., 2023).

Table 3.2 shows the profitability of investing in locally pelletized fish feed production, including details on variable costs, fixed costs, total costs, gross margin, net farm income, and other ratios. The findings indicate that variable costs make up 70.48% of total production costs, mainly driven by feed ingredients, which are locally available but subject to seasonal price fluctuations, transportation issues, and inflation. Labor also contributes significantly, despite being informal, due to manual operations. This high variable cost reflects the resource-intensive nature of the enterprise, but it can be mitigated through stabilized supply chains or cooperative purchasing, as supported by Fagbenro and Arowosoge (2021) and Adebayo and Daramola (2023), who noted that feed ingredients and operational expenses typically exceed 65% of costs in smallholder feed enterprises. Fixed costs account for 29.52%, which is relatively moderate for a small-to-medium scale operation, indicating that after initial investments, scaling production would require minimal additional fixed costs.

Table 3.2: profitability of investing in locally pelletized fish feed production

Variable	Cost	Percentage of TC
Total variable cost	265000	70.47872
Total fixed cost	111000	29.52128
Total cost	376000	100
Total return	498425	
Gross margin	233425	
NFI	122425	
RRI	0.33	

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OR	0.84
GR	0.75
MM	133.4699

The study indicates that locally pelletized fish feed production is highly profitable, with a gross margin of ₦233,425 and a net farm income of ₦122,425, reflecting significant earnings after operational expenses. The return on investment (ROI) of 33% shows that producers earn ₦0.33 for every ₦1 invested, making it more attractive than other rural income sources like rain-fed farming or retail trade (Inoni, 2017; Akinbile et al., 2011). The operating ratio of 0.84 means that 84% of revenue is used for operating costs, with 16% remaining as profit, while the gross ratio of 0.75 indicates that 75% of income covers production costs, leaving 25% as profit. These ratios are consistent with existing literature, which suggests that profitable small-scale feed enterprises generally maintain gross ratios below 1, ensuring operational sustainability and potential for margin improvement (Inoni, 2017; Akinbile et al., 2011).

3.3 Determinant factors influencing profitability of investing in locally pelletized fish production in Niger State.

The OLS regression results show that the variables in the model explain a significant portion of the variation in profitability of locally pelletized fish feed. The coefficient of determination (R^2) is 0.7825, indicating that about 78.25% of the variation in profitability is explained by the variables. The adjusted R^2 value of 0.7543 confirms that the variables account for a substantial 75.43% of the variation in profitability. This suggests that the model is a good fit and that the variables considered are significant predictors of profitability (Olagunju et al., 2019; Adebayo & Daramola, 2020).

Table 3.3: Determinants of Profitability of Locally Pelletized Fish Feed Production

Variables	**Coefficient**	**Std. Error**	**t-value**
Constant	2.1354	0.8421	2.54***
Cost of Raw Materials	-0.4827	0.1215	-3.97***
Labour Cost	-0.2158	0.0987	-2.19**
Cost of processing	-0.1342	0.0679	-1.98*
Access to Credit	0.3569	0.1423	2.51***
Scale of Production	0.4216	0.1104	3.82***
Source of information on locally pelletized fish feed production	0.2985	0.0956	3.12***
Market Access of locally pelletized fish feed	0.2673	0.1048	2.55***
Transportation Cost	-0.1896	0.9832	-0.19
Household size	0.1738	1.0765	0.16
Cooperative membership	0.3097	0.1012	3.06***

R-squared	0.7825
Adjusted R-squared	0.7543
F-statistic	27.6842
Prob (F-statistic)	0.0000
Durbin-Watson	1.9845

*Significant at 10% probability level, **Significant at 5% probability level, *** Significant at 1% probability level

The coefficient of labour cost (-0.2158) is statistically significant at the 5% level, indicating that a 1% increase in labour costs results in approximately a 21.6% decrease in profitability. This negative relationship reflects the labour-intensive nature of locally pelletized feed production, where higher wages or reliance on hired labour increase operational costs and reduce net returns. This finding aligns with Yusuf et al. (2018), who identified labour cost as a key determinant of profitability in Nigerian agro-processing enterprises, and Adewumi et al. (2021), who reported that high labour expenses negatively impact efficiency and profitability in small-scale aquaculture feed production.

The coefficient of processing cost (-0.1342) is significant at the 10% level, indicating that a 1% increase in processing costs leads to a 13.4% decrease in profitability. These costs, including energy, machine operation, maintenance, and packaging, reduce profit margins, especially in small-scale enterprises with low efficiency. High energy expenses, often due to unreliable electricity supply, further increase operational costs. This finding aligns with Ibrahim et al. (2020), who reported that processing and energy costs significantly impact agro-processing profitability, and Okonkwo and Obi (2017), who highlighted that processing inefficiencies can lower returns.

The coefficient of access to credit (0.3569) is significant at the 5% level, indicating that a 1-unit increase in credit access results in a 35.7% increase in profitability. This positive relationship suggests that access to financial resources improves production capacity and operational efficiency by enabling bulk input purchases, equipment investments, and expansion, while also alleviating liquidity constraints. This finding aligns with Oladeebo and Fajuyigbe (2017), who found that credit access significantly boosts productivity and profitability in agribusiness, and Ojo et al. (2019), who reported that credit access enhances investment and efficiency in small-scale enterprises.

The coefficient of scale of production (0.4216) is significant at the 1% level, indicating that a 1-unit increase in production scale leads to a 42.2% increase in profitability. This highlights the advantages of economies of scale, where larger operations reduce average costs through bulk input purchases, efficient machinery use, and better market access, resulting in higher output and revenue. This aligns with Akinbile et al. (2020), who found that expanding scale significantly boosts profitability in agricultural enterprises, and Okoruwa et al. (2019), who emphasized the importance of economies of scale in improving agribusiness performance.

The coefficient of source of information (0.2985) is significant at the 1% level, indicating that a 1-unit increase in access to information leads to approximately a 29.9% increase in profitability. This positive relationship suggests that better access to reliable information enhances feed producers' efficiency and performance by providing knowledge on improved production techniques, input management, cost reduction, and market opportunities. Access to extension services, training, and media helps producers adopt better

practices and innovations, thereby increasing output quality and profitability. This finding aligns with Adesope et al. (2018), who highlighted that access to extension services significantly boosts agricultural productivity and enterprise success.

The coefficient of market access (0.2673) is significant at the 5% level, indicating that a 1-unit increase in market access results in approximately a 26.7% increase in profitability. The positive sign suggests that improved market access enhances revenue for feed producers by enabling easier product sales, reaching more customers, and securing better prices. It also helps reduce transaction costs and post-production losses, increasing net returns. This finding is consistent with Adejobi (2020), who found that access to efficient markets positively affects income and profitability in agricultural enterprises.

The coefficient of cooperative membership (0.3097) is significant at the 1% level, indicating that being a member of cooperative society increases profitability by approximately 30.9%, holding other factors constant. The positive relationship suggests that cooperative membership enhances the economic performance of feed producers through benefits such as improved access to inputs, credit, market information, and collective marketing opportunities. Additionally, cooperatives help reduce transaction costs and strengthen bargaining power, leading to higher profitability. This finding aligns with Bernard et al. (2010), who reported that cooperative membership significantly improves market participation and income among smallholder farmers.

3.4. Marketability of Locally Pelletized Fish Feed

Table 3.4 The market for locally pelletized fish feed is mainly informal, with most producers selling directly to fish farmers and in local markets, fostering trust and reducing costs. Emerging semi-structured channels via wholesalers and retail shops are also present, though they may cut into profits. A small segment relies on roadside hawking, indicating limited market access. According to Olaoye et al. (2023), over 70% of fish feed for smallholder farmers is purchased directly from local sources, emphasizing the importance of relationship-based transactions in this market.

Table 3.4 Marketability of locally pelletized fish feed production

Variable	Frequency*	Percentage	Mean
Where sold			
Local market	156	72.6	
Direct to fish farmers	173	80.5	
Wholesalers	97	45.1	
Retail shops	81	37.7	
Others(hawking)	23	10.7	
Quantity produced			
< 500 kg	38	17.7	1,014 kg
500–999 kg	67	31.2	
1,000–1,499 kg	69	32.1	

1,500 kg and above	41	19.1	
Quantity sold			
<500 kg	44	20.5	962 kg
500–799 kg	61	28.4	
800–1,099 kg	79	36.7	
1,100 kg+	31	14.4	

Multiple responses were recorded

The study indicates that most fish feed producers operate at small to medium scales, with 17.7% producing less than 500 kg per cycle and 32.1% producing between 1,000 and 1,499 kg, resulting in an average production of approximately 1,014 kg (Tiamiyu et al., 2023). The average quantity sold (962 kg) is close to the amount produced, with 36.7% of producers selling between 800 and 1,099 kg, reflecting steady market demand. The small difference between production and sales suggests that some feed may be stored for future use or retained for personal consumption, which is a common practice among small fish feed producers in the area (Tiamiyu et al., 2023).

4 Conclusion and recommendations

The study concludes that investment in locally pelletized fish feed production in Niger State is economically viable and market-responsive, especially when based on the use of local raw materials and sold through informal but effective distribution channels. It supports smallholder aquaculture by improving access to affordable feed and modestly contributes to employment, particularly among youth and women. However, the sector still faces challenges related to scale, formal market penetration, and limited institutional support, which constrain its broader socio-economic impact. To address these issues, the government and developmental agencies should implement targeted support programs such as input subsidies, tax incentives, and training initiatives to increase employment opportunities and reduce reliance on imported fish feed that can be produced locally. Additionally, efforts should be made to establish structured market linkages such as digital trading platforms, fish feed marketplaces, and contract arrangements with large-scale aquaculture to expand market access, reduce uncertainties, and enhance profitability. While current profitability indicators show the sector's viability, efficiency can be further improved through capacity building in pelletizing technologies, feed formulation, quality control, and packaging focused particularly on youth and women already engaged in the sector thus equipping them with the entrepreneurial and technical skills necessary for sustained competitive.

REFERENCES:

Adebayo, T., & Daramola, A. (2023). Economic analysis of smallholder fish feed enterprises in Southwest Nigeria. Nigerian Journal of Fisheries Science, 10(2), 45–59.

Adewumi, J. O., Oke, O. L., & Ajibolade, O. M. (2021). Factors Influencing Efficiency and Profitability of Cassava Production in Nigeria. Journal of Agricultural Extension, 25(2), 1-12.

Adewumi, O. O., Olaleye, T. M., & Akinwumi, A. A. (2019). Promoting local fish feed production in Nigeria: Opportunities and challenges.Nigerian Journal of Fisheries and Aquaculture,15(1), 30–44.

Akinmoladun, O. O., & Oladipo, O. (2020). Distribution challenges of fish feed in Nigeria: Implications for small-scale farmers. African Journal of Aquatic Science, 45(4), 321–330.

Akinbile, L. A., Oluwalana, E. O., & Adebayo, C. O. (2011). Profitability of small-scale catfish production in Oyo State, Nigeria. Journal of Human Ecology, 35(3), 181–186.

Al-Wakeel, S. M., Elbahnaswy, A. H., Risha, E. F., & Zahran, E. (2024). Global trends and challenges in aquaculture production: A review. Aquaculture International, 32(1), 145–162.

Audu, P. I., & Yola, N. M. (2021). Evaluation of local raw materials for fish feed formulation in Nigeria. Nigerian Journal of Agricultural Extension, 25(3), 89–97.

Boyd, C. E., McNevin, A. A., & Davis, R. P. (2022). Aquaculture, environmental sustainability, and food security. Reviews in Aquaculture, 14(4), 2035–2051.

Dada, O. O., & Olaleye, T. M. (2019). Logistics and distribution challenges in Nigerian aquaculture feed supply chain. African Journal of Aquatic Science, 44(3), 245–253.

Elsheikh, M. M., Uçak, A., & Bağdatlı, M. C. (2024). Trends and development of aquaculture production in Egypt and its sustainability implications. Egyptian Journal of Aquatic Research, 50(2), 103–115.

Eze, S. C., & Nwachukwu, C. C. (2019). Farmers' perceptions of local fish feeds in Nigeria. Journal of Aquaculture Development,8(2), 89–98.

Fagbenro, O. A., & Arowosoge, A. I. (2021). Cost structure and profitability of local fish feed enterprises in Nigeria. African Journal of Aquatic Sciences, 46(1), 77–84.

Food and Agriculture Organization of the United Nations (FAO). (2022). The State of Food Security and Nutrition in the World 2022. FAO. https://doi.org/10.4060/cc0639en

Ibrahim, M., & Musa, A. (2020). Potential of locally pelletized fish feeds in Nigeria: Benefits and constraints. Nigerian Journal of Fisheries and Aquaculture, 16(2), 112–123.

Inoni, O. E. (2017). Economic analysis of fish production in Delta State, Nigeria. Agricultural Economics Review, 18(1), 56–69.

Ifejika, P. I., Ibeun, B. A., Omeje, J. I., Garba, A. U., & Umar, J. K. Survey of Fish Feed

Entrepreneurship and Impact in New Bussa and Surrounding Communities. *GARDEN CITY 2021*, 482.

Life, C., & Potgieter, M. (2024). Growth dynamics of aquaculture in South Africa: Trends, challenges, and opportunities. African Fisheries Science Journal, 35(1), 55–70.

Mehrim, A. I., & Refaey, M. M. (2023). Status of aquaculture development in North Africa: A regional perspective. African Journal of Aquaculture, 12(2), 22–37.

Mohammed, E. H., Ebrahim, A. S., Youssef, H. A., Saleem, A. A., & Abdelkhalek, N. K. (2024). Bridging the gap between fish production and consumption in Egypt: A review of aquaculture trends. Aquatic Food Studies, 5(2), 99–111.

Nwabeze, G. O., Ibeun, B. A., Faleke, S., Omeje, J. E., Belonwu, N. E., Igene, C. A., Ogbonna, Nwachukwu, C. C., & Eze, S. C. (2017). Quality variability of locally produced fish feeds in Nigeria. Aquaculture International, 25(4), 1243–1256.

K., Nwanjoku, V. A., & Ighoro, A. (2017). Information needs of fish-feed entrepreneurs in Kainji Lake Basin Nigeria. Journal of Agricultural Extension, 21(3), 46–56.

Ogunleye, O. S., & Olatunde, O. (2018). Economic implications of imported fish feeds in Nigeria's aquaculture sector. African Journal of Agricultural Economics, 13(3), 87–99.

Ogunleye, O. S., & Ayodele, O. (2020). Factors influencing adoption of local fish feeds among Nigerian fish farmers. Journal of Aquaculture Research & Development, 11(1), 1–10.

Ogunji, J. O., & Wuertz, S. (2023). Aquaculture production trends and challenges in Nigeria. Nigerian Journal of Fisheries and Aquatic Sciences, 41(3), 201–214.

Omeje, J. E., Achike, A. I., Nwabeze, G. O., Ibiyo, L. M. O., & Jimmy, S. P. (2023). Economic analysis of locally produced aquaculture feeds with complements of plant-based ingredients in Kainji Lake Basin, Nigeria. Research on World Agricultural Economy, 4(1), 54-84

World Bank. (2023). World Development Indicators. World Bank. https://data.worldbank.org

Yusuf, S. A., Adeoti, A. I., & Ezekiel, R. (2019). Determinants of Profitability in Agro-Processing Enterprises in Nigeria. Journal of Agricultural Science and Technology, 19(2), 1-13.