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PROFITABILITY AND ADOPTION POTENTIAL OF MAGGOT-BASED FEED IN CATFISH PRODUCTION IN SOUTHEAST NIGERIA

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ABSTRACT:

This study examined the profitability of catfish production using a 60:40 feed mix ratio of conventional feed to maggot-based feed in Southeast Nigeria. The research was motivated by the rising cost of conventional fishmeal, which has continued to threaten the profitability and sustainability of aquaculture enterprises in the region. Primary data were collected from 350 catfish farmers selected through a total sampling technique. The profitability analysis focused on a six-month production cycle involving 1000 catfish with a10% mortality, giving 900 catfish. Gross margin and net profit analyses were employed to evaluate the financial performance of the feed mix. Results revealed total revenue of ₦3,919,500 generated from both fresh and processed (dry) catfish sales. The total variable cost (TVC) amounted to ₦1,112,700 while the fixed cost (TFC), depreciated at 10% was ₦6,361. The gross margin was ₦2,806,800 and the net profit stood at ₦2,800,439, indicating a highly profitable enterprise. The contribution of maggot-based feed to total profit was estimated at 3.3%. The findings suggest that incorporating maggot-based feed in the production cycle improves overall cost efficiency and profitability, supporting its wider adoption in sustainable aquaculture systems. Despite these benefits, adoption remains low due to constraints such as inadequate technical knowledge, fear of disease transmission, poor access to credit facilities, and limited maggot supply. The study concludes that profitability remains a significant motivator for the adoption of maggot-based feed and recommends intensified awareness creation and capacity building to enhance adoption in the region.

Keywords: Maggot-based feed, profitability, catfish production, adoption, feed-mix, sustainable aquaculture, Southeast Nigeria

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Introduction:

One of the most significant challenges undermining profitability in aquaculture is the high cost of fish feed. Feed cost accounts for 60–70% of total fish production costs in aquaculture, making it a critical determinant of profitability (Ogunji *et al*., 2008; Akinbile *et al*., 2020; Adewolu *et al*., 2020; Tanga *et al*., 2022). The increasing cost of fish meal, a major protein source, has compelled fish farmers to explore alternative and affordable protein ingredients. Maggot meal derived from *Musca domestica* and *Hermetia illucens* has been identified as a viable substitute due to its high protein content, cost-effectiveness, and sustainability (Ogunji et al., 2022).

Previous studies (Tiamiyu et al., 2021; Ugwumba and Chukwuji, 2023) have shown that partial substitution of fish meal with maggot meal can improve feed efficiency and profitability. The integration of maggot meal into feed formulations has been shown to reduce dependence on conventional ingredients while maintaining comparable growth performance (Agbugba et al., 2023). However, economic analyses of production outcomes under mixed-feed regimes remain limited.

This study, therefore, assessed the profitability of catfish production using a 60:40 conventional–maggot feed mix ratio over a six-month production cycle in Southeast Nigeria; providing empirical evidence on its economic potential, adoption potentials and policy implications.

Understanding the economic viability and profitability of maggot-based feed, therefore, becomes critical to providing empirical evidence that can encourage wider acceptance and use among farmers. By quantifying profitability, this study provides insights necessary for promoting maggot-based feed as a sustainable innovation, capable of reducing production costs, improving profit margins, and enhancing food security in Nigeria. Specifically, the study seeks to:

1. Determine the profitability of maggot-based feed practices in catfish production; and
2. Asses the implication of the profitability on adoption of maggot-based feed.

This research contributes to ongoing efforts to diversify feed sources, improve aquaculture sustainability, and empower local farmers with affordable and environmentally responsible production strategies.

Methods:

Data Collection:

The study utilized cross-sectional data collected from 350 catfish farmers across Abia, Ebonyi, and Enugu States using a total sampling technique. Data on production inputs and outputs, focusing on a production batch of 900 catfish reared for six months were analyzed using gross margin and benefit–cost ratio (BCR) models. The fish attained an average harvest weight of 1.3 kg per fish, totaling 1,170 kg—comprising 500 kg of fresh fish and 650 kg of dry fish after processing.

Analytical Technique:

The profitability indicators of the maggot-based feed were computed using the following: relationships

Gross Margin (GM) = TR – TVC
Net Profit (NP) = TR – (TVC + TFC)
Profit Share of Maggot Feed (%) = (Profit from Maggot Feed / Total Net Profit) × 100
Benefit–Cost Ratio (BCR) = TR÷ TC

Where TR = Total Revenue; TVC = Total Variable Cost; TFC = Total Fixed Cost.

Result:

Revenue Structure:

The total revenue (TR) realized from the 60:40 feed mix was ₦3,919,500. ₦1,742,000 was derived from the sale of 500 kg of fresh fish at ₦2,800/kg and ₦2,177,500 was derived from dry fish equivalent of 167.5 kg at ₦13,000/kg. The results indicate that both product forms contributed substantially to total earnings, with dry fish offering higher income due to its higher market value and longer shelf life.

Cost Structure:

The total variable cost (TVC) amounted to ₦1,112,700, consisting of expenses on fingerlings (₦87,600), maggot feed (₦132,000), conventional feed (₦682,000), labour (₦48,000), transportation (₦90,000), and other minor inputs such as medications, packaging materials, and maggot production substrates. The fixed cost (TFC) depreciated at 10% was ₦6,361, covering ponds, aerator, oven, generator, borehole, wheelbarrow, and maggot hives.

Profitability Indicators:

The enterprise recorded a gross margin of ₦2,806,800 and a net profit of ₦2,800,439, confirming that catfish production under the 60:40 feed regimes is economically viable. Importantly, the maggot-based feed contributed ₦93,440, representing 3.3% of total net profit. This proportion, though modest, is significant considering that maggot feed replaced 40% of costly conventional ingredients and was locally sourced at minimal expense. The result reflects the efficiency gains associated with partial substitution—reducing feed cost while maintaining productivity. The benefit–cost ratio (BCR) was calculated as 3.5, implying that every ₦1.00 invested in the 60:40 feed production yields ₦3.50 in return.

Moreover, maggot feed supports circular bio-economy practices by converting organic waste into high-value protein, further enhancing system sustainability. This finding demonstrates that maggot-based feed is economically viable and capable of reducing production costs. The profit margin, though modest, indicates that maggot-based feed can enhance economic sustainability for small-scale fish farmers. Similar results were reported by Adesina *et al*. (2021) and Agboola *et al*. (2022)**,** who found that insect-based feeds significantly improve profitability and reduce feed costs in aquaculture enterprises. The 3.3% profit share from maggot-based feed is significant because feed costs dominate catfish

production. This shows that adopting maggot feed can sustainably improve margins, so policymakers should support farmers through training, technology access, and feed subsidies to encourage adoption.

Table: 1 Profitability Indicators

Profitability Indicator	**Amount (₦)**
Total Revenue (TR)	3,919,500
Total Variable Cost (TVC)	1,112,700
Total Fixed Cost (TFC)	6,361
Total Cost (TC = TVC + TFC)	1,119,061
Gross Margin (TR - TVC)	2,806,800
Net Profit (TR - TC)	2,800,439
Profit Share from Maggot Feed	93,440 (3.3%)
BCR = 3,919,500 ÷ 1,119,061 = 3.5	

Source: Survey; 2024

Implications for Adoption

The profitability outcome underscores the potential of maggot-based feed as an innovation worth adopting among catfish farmers in the study area. Economic return is a primary driver of adoption decisions (Rogers, 2003); thus, farmers perceiving tangible financial gains are more likely to adopt the innovation which can gradually improve farmers' profit margins and reduce dependence on expensive conventional feeds. In addition, maggot-based feed contributes to waste management and environmental sustainability. The finding that maggot-based feed contributed a 3.3% share of profit in catfish production underscores its potential as a cost-saving and profitability-enhancing innovation. Although modest in numerical terms, this margin is significant given that feed accounts for 60–70% of total production costs in aquaculture (Aniebo, Erondu, & Owen, 2009). Furthermore, the observed benefit–cost ratio of 3.5 suggests that increased awareness and training could strengthen adoption rates, as farmers tend to adopt innovations that demonstrate measurable financial and ecological benefits (Ogunji et al., 2017; Nwosu et al., 2020).

For policymakers, this highlights the need to promote maggot feed production through supportive interventions such as farmer training, access to low-cost maggot-rearing technology, and incentive-driven policies (e.g., input subsidies or credit schemes). Such measures would not only enhance adoption but also contribute to sustainable aquaculture development and food security in Southeast Nigeria.

Conclusion and recommendations:

The study establishes that catfish production using a 60:40 conventional–maggot feed mix is profitable and sustainable, yielding a net profit of ₦2,800,439 over a six-month cycle. The 3.3% profit share attributable to maggot feed underscores its economic contribution, validating its inclusion as a viable feed component in small- and medium-scale aquaculture enterprises.

The positive benefit–cost ratio (3.5) supports its economic feasibility, while its environmental advantages. The integration of maggot-based feed not only enhances profitability but also

promotes environmental sustainability through waste recycling. It is therefore recommended that farmers increase awareness and capacity for local maggot production to ensure regular supply. Government and research institutions should also facilitate training, demonstration projects, and quality standards for maggot-based feed to support large-scale adoption.

The recommendations were the following:

1. Support farmer training on maggot rearing
2. Provide access to low-cost maggot-production technology
3. Incentivize adoption through subsidies/credit schemes

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