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Extension Intensity and Productivity of Small-Scale Fish Farmers in Lagos State, Nigeria

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Abstract

Agricultural extension provides farmers with technical information and advisory support that can influence production decisions and resource use. This study examined the relationship between extension service intensity, production resources and fish output among 270 small-scale fish farmers in Ikorodu, Epe and Badagry, Lagos State, Nigeria. An Extension Service Intensity Index (ESII) was constructed from extension visits, training participation, demonstration participation and advisory consultations. A Cobb–Douglas production function was estimated to examine the determinants of fish output. The model explained 76.8% of the variation in output. Feed cost, farm size, labour, capital investment, farming experience and extension service intensity were positively and significantly associated with fish output. Feed cost had the largest estimated elasticity (0.421), while extension service intensity had an elasticity of 0.214. The sum of the estimated production elasticities was 1.274, indicating increasing returns to scale within the sampled production systems. The findings indicate that aquaculture productivity is associated with both conventional production resources and the intensity of farmers' engagement with extension services. Because the study is cross-sectional, the findings are interpreted as statistically significant associations rather than definitive causal effects.

Keywords: aquaculture; extension intensity; fish farmers; productivity; resource use; Lagos State; Cobb–Douglas.

1. INTRODUCTION

Aquaculture productivity depends on the effective combination of physical inputs and management knowledge. Small-scale fish farmers make repeated decisions concerning feeding, stocking, pond management, water quality, disease prevention, labour allocation and other production activities. Consequently, differences in output may reflect both conventional production resources and the information available to farmers. Recent Nigerian evidence further shows that digital agricultural innovation platforms can increase fish-farm output and income, underscoring the value of timely information and support mechanisms in production systems (Falola et al., 2024). At the global level, FAO identifies sustainable aquaculture expansion, knowledge transfer, capacity development and technological innovation as central to meeting rising demand for aquatic foods, while emphasizing that African aquaculture still requires stronger enabling systems and investment (FAO, 2024, 2025). Beyond

farm-level production, aquatic food systems also contribute to livelihoods, social identity and human well-being, underscoring the broader developmental importance of improving the performance of small-scale producers (Allison et al., 2020).

Agricultural extension is one institutional mechanism through which production information and technical advice reach farmers. Extension engagement may occur through farm visits, training, demonstrations and advisory consultations. Earlier work examined the impact of extension services on fish farming in Lagos State (Awolumat & Omosola, 2017), while other work examined aquaculture information sources and communication systems among fish farmers (Awolumat, 2018; Awolumat & Inyang, 2019). These studies provide a relevant context for examining extension as part of the production environment. In Lagos State, mobile phones have also been documented as important channels through which fish farmers obtain information on feed, drugs, fingerlings,

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equipment and harvesting, often from extension agents, input suppliers and fellow farmers (Komolafe et al., 2018). This emphasis is consistent with FAO guidance that farmer and extension-worker capacity, practical extension education and access to technical information are core elements of sustainable aquaculture development (FAO, 2025). In Nigeria, an FAO-supported rice-fish initiative used participatory training and demonstrations with farmers and extension workers and reported gains in yields and farm income, illustrating the practical value of repeated, field-based advisory engagement (FAO, 2024).

Production economics also requires attention to conventional resources. Feed, farm size, labour and capital are important components of fish production. Technical-efficiency research has further demonstrated the relevance of differences in resource-use performance among fish farms (Awolunate & Inyang, 2019). The present paper focuses on productivity rather than technical efficiency, using a production-function framework to examine whether extension intensity remains associated with fish output after accounting for major production inputs. At the wider aquatic-food-system level, digital innovations can strengthen information flows and support faster, more informed decision-making by fishers and farmers (Tilley et al., 2022). Sector-level evidence also points to management and resource-use constraints in Nigerian catfish production. FAO's value-chain assessment highlights the need to improve productivity and resilience in the national catfish sector (FAO, 2023), while farm-level studies show that scale, input quality, management and technical efficiency materially shape performance (Olagunju et al., 2022, 2024; Oluwatayo & Adediji, 2019).

A limitation of binary extension-access measures is that they do not distinguish between farmers who have occasional contact and those who receive repeated visits, training, demonstrations and consultations. The present study therefore uses an Extension Service Intensity Index (ESII) to capture the depth of extension engagement.

The objective was to estimate the relationship between fish output, major production resources and extension service intensity among small-scale fish farmers in Lagos State, Nigeria. Specifically, the study assessed extension intensity, estimated a Cobb–Douglas production function, and examined the returns-to-scale characteristics of the sampled production systems.

2. Materials and Methods

Variable	Operational meaning
Fish output	Fish production/output (kg)
Feed cost	Expenditure on feed
Farm size	Production area
Labour	Labour input used in production
Capital investment	Investment in production

	facilities/equipment
Farming experience	Years of fish-farming experience
ESII	Extension visits + training + demonstrations + advisory consultations

A cross-sectional survey design was used. Primary data were collected from 270 small-scale fish farmers in Ikorodu, Epe and Badagry, Lagos State, using a structured electronic questionnaire. The questionnaire covered socioeconomic characteristics, farm characteristics, production inputs and extension engagement.

The Extension Service Intensity Index was constructed as $ESII = EV + TP + DP + AC$, where EV is extension visits, TP is training participation, DP is demonstration participation and AC is advisory consultation. The four components were equally weighted.

The Cobb–Douglas production function was estimated in logarithmic form: $\ln Y = \beta_0 + \beta_1 \ln \text{Feed} + \beta_2 \ln \text{FarmSize} + \beta_3 \ln \text{Labour} + \beta_4 \ln \text{Capital} + \beta_5 \text{Experience} + \beta_6 \text{ESII} + \varepsilon$. The study also estimated a stochastic frontier model; those frontier results are reserved for a separate efficiency paper.

Data were analysed using descriptive statistics and regression procedures in STATA.

3. Results and Discussion

Indicator	Value
Sample size	270
Mean pond/farm area	≈1,245 m ²
Mean extension visits	4.7
Mean training participation	2.3
Mean demonstration participation	1.8
Mean advisory consultations	2.6
Mean ESII	11.4

Variable	Coefficient	p-value
Constant	2.184	—
Feed cost	0.421	<0.001
Farm size	0.286	<0.001
Labour	0.118	0.017
Capital investment	0.163	0.008
Farming experience	0.072	0.046
ESII	0.214	<0.001

The production model produced $R^2 = 0.768$, adjusted $R^2 = 0.759$ and $F = 144.82$ ($p < 0.001$). The model therefore explained a substantial proportion of the observed variation in fish output.

Feed cost had the largest estimated elasticity (0.421), indicating the importance of feed expenditure in the production relationship. The result concerns physical output and should not be interpreted as evidence that increasing feed expenditure necessarily increases profitability.

Farm size (0.286), labour (0.118) and capital investment (0.163) were all positive and statistically significant. These results indicate that conventional production resources remain important determinants of output among the sampled farms.

Farming experience had a positive coefficient of 0.072 ($p = 0.046$), indicating an association between experience and higher output after controlling for the other variables.

Extension service intensity had a positive coefficient of 0.214 ($p < 0.001$). Thus, greater extension engagement was statistically associated with higher fish output after accounting for feed cost, farm size, labour, capital and experience. The result extends the Lagos-focused extension literature by treating extension engagement as an intensity measure rather than simply an access condition. This association is also consistent with Nigerian evidence that better access to innovation and information channels can improve fish-farm performance, although the mechanisms and measures differ across studies (Falola et al., 2024; Komolafe et al., 2018). This interpretation is reinforced by recent FISH4ACP evidence from Nigeria, where training in best management practices and data-led farm management improved feed-use performance and farm value added among participating catfish producers (FAO, 2026).

The sum of the estimated production elasticities was 1.274. This indicates increasing returns to scale within the estimated production relationship. The result suggests that the sampled production systems retain scope for output expansion through coordinated use of the included resources, although the estimate should be interpreted within the observed range of the data.

4. Conclusion

Extension service intensity was positively and significantly associated with fish output alongside feed cost, farm size, labour, capital investment and farming experience. The findings indicate that aquaculture productivity is associated with both conventional production resources and the intensity of farmer engagement with extension systems. Because the study is cross-sectional, the relationships should be interpreted as associations rather than definitive causal effects.

5. Recommendations

Extension agencies should measure the frequency and depth of farmer-extension interaction rather than relying only on binary access measures.

Extension programmes should integrate feed management, production planning, farm records and resource-use advice.

Training and demonstration activities should be strengthened alongside routine extension visits.

Future research should connect extension intensity with profitability, technical efficiency and digital advisory variables using appropriately measured data.

6. Limitations

The study is cross-sectional and therefore cannot establish strong causal effects. Extension measures are based on farmer-reported information. The sample covers small-scale fish farmers in selected Lagos State locations and does not represent large commercial farms or marine capture fisheries. The productivity analysis does not directly estimate profitability.

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