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Original Research

Profitability of Aquaculture by Gender in Delta State, Nigeria

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ABSTRACT: This study examined the profitability of aquaculture by gender in Delta State, Nigeria. The study population consisted of 3,295 aquaculture farms from 32 identified clusters in Delta State. A total of 991 aquaculture farms formed the sample for the study. Data were collected through questionnaires and unstructured interviews using enumerators. The data collected were analyzed using Statistical Package for Social Scientists (SPSS) version 24. Gross margin analysis model, Likert scale and z-test were used for data analysis. The results showed that the majority of aquaculture farmers in the study area were male and their average age was 42 years. Most of the aquaculture farms were married, had a moderate household size and had a relatively high level of education. In terms of profitability, male aquaculture producers had higher net incomes and a better benefit-cost ratio than their female counterparts. However, female aquaculture marketers generated greater profits than male marketers in this area. Male input suppliers were found to be more profitable than female input suppliers in a study on the profitability of aquaculture input suppliers. This study, therefore, recommends that efforts should be made to encourage and support more female participation in aquaculture activities. This can be achieved through training programs, access to finance and resources, and addressing social and cultural barriers that limit female involvement.

Keywords: Aquaculture profitability; gender; delta state; fish farming, gross margin analysis
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INTRODUCTION

According to the Food and Agriculture Organization (FAO, 2020), aquaculture and fisheries value chains are critical to food security, improved nutrition, and poverty reduction in developing countries. Aquaculture, the farming of aquatic organisms such as fish, crustaceans, mollusks, and aquatic plants, has gained significant attention worldwide as a means of sustainable food production and economic development (FAO, 2020). In Nigeria, aquaculture has emerged as a vital sector, contributing to food security, employment generation, and foreign exchange earnings (Litwack et al., 2017). Nigeria, the second-largest aquaculture producer in Africa (Adam and Njogu, 2023), has a lot of untapped potential in the aquaculture sector, but gender inequities in the sector could hinder aquaculture's growth and profitability.

Gender is an important social construct that influences the roles, responsibilities, and access to resources within a given society. In the context of aquaculture, gender can play a crucial role in determining the profitability and sustainability of fish farming operations. Gendered differences in access to resources, decision-making power, and knowledge can result in differential outcomes for male and female aquaculture farmers (Adam and Njogu, 2023). For instance, women are more involved in post-harvest activities such as processing and marketing, while men tend to dominate in fish farming activities such as fingerling production and pond management (Ayeloja et al., 2022; Okwuokenye, 2020). Moreover, women often face challenges such as limited access to credit, land, inputs, extension services, and markets that can affect their productivity and income (Omitoyin et al., 2020).

Gender disparities in the sector cannot be ignored, as women play a significant role in the aquaculture value chain, yet their efforts are often unrecognized and

underpaid (Adam et al., 2021). This leads to lower profits and higher risks for women, as well as limited access to resources, training, and decision-making power (Adam and Njogu, 2023). To address these challenges, there is a need for pro-equality gender policies and interventions that promote women's empowerment and transformation in the aquaculture sector. This would not only benefit women, but also enhance the productivity, sustainability, and resilience of the sector as a whole.

Previous studies have highlighted the importance of gender analysis in the agriculture and aquaculture sectors, emphasizing the need to address gender disparities to promote sustainable development and social equity. Research by Maja et al. (2023) in Ethiopia demonstrated that gender-sensitive interventions can significantly improve the profitability and productivity of smallholder farming systems. Similarly, Morgan et al. (2016) emphasized the need for gender-responsive policies and programs to enhance women's participation and profitability in aquaculture.

By shedding light on the profitability of aquaculture by gender in Delta State, this research aims to contribute empirical evidence that can inform policy and practice. Findings from this study will provide valuable insights into the specific challenges faced by female fish farmers and help identify strategies to enhance their profitability and economic empowerment. Furthermore, the research outcomes will contribute to the broader literature on gender and agriculture, offering a case study that can inform future research in the field.

Objectives of the study

The main objective of this study is to examine the profitability of aquaculture by gender in Delta State, Nigeria. The specific objectives are to:

(a) Examine the profitability of aquaculture by gender.
(b) Identify the challenges faced by aquaculture producers.

Research hypothesis

This study was guided by the following hypothesis
Ho_1: There is no significant difference in the profitability of aquaculture between male and female aqua farmers.

MATERIALS AND METHODS

Area of the study

The study area is Delta State. Delta State was created out of the defunct Bendel State on August 27, 1991. The state has a land mass of 17.698 square kilometers and lies roughly between latitude $5^{0}00^{1}$ and 6^{0} 30^{1} North and longitude $5^{0}00^{0}$ and 6^{0} 45^{1} East of the equator. With a coastline of about 160 km and an extensive network of rivers and wetlands, Delta State has abundant resources for aquaculture production (Forum for Agricultural Research in Africa (FARA), 2017).

The population of the study

The 32 identified aqua farmer clusters and 3,295 aqua farmer comprises in Delta State comprise the population. This population was obtained from the Delta State Ministry of Agriculture, Asaba, and the job creation office at Asaba.

Sampling procedure and sample size

The study covered the fish farmers that are registered under clusters in the various agricultural zones of Delta State. Thirty (30) percent of the aqua farmers were purposively selected from each location to sample at least one aqua farmer from the various clusters. This gave a total of 991 aqua farmers which were used for the study.

Methods of data collection

Primary data were collected from the sample of aqua farmers and value chain actors using a Questionnaire and unstructured interviews with the assistance of enumerators who were rapidly trained by the researcher on the area of interest.

Methods of data analysis

Data were analyzed using the statistical package for Social Scientists (SPSS) version 24.

Gross margin analysis model

The Gross Margin Analysis model was used to estimate the profitability of aquaculture and it is stated as follows;

$$GM = TR - TVC \quad \ldots\ldots(1)$$
$$TC = TVC + TFC \quad \ldots\ldots(2)$$
$$NR = GM - TFC \quad \ldots\ldots(3)$$
$$BCR = \frac{TR}{TC} \quad \ldots\ldots(4)$$

Where:
GM = Gross margin
TVC = Total variables cost
TC = Total cost
TFC = Total fixed cost
NR = Net Returns

BCR = Benefit-cost ratio

Likert type scale

The seriousness of the various types of challenges faced by aquaculture farmers was measured by making a list of the types of challenges faced by the farmers in the study area. Respondents were requested to indicate their level of agreement with the seriousness. A four-point Likert-type scale of Not Serious =1; Fairly Serious = 2; Serious = 3 and Very Serious = 4 was used to ascertain their responses.

Determination of cut-off point

Cut-off point (x) = $\frac{\sum f}{n} = \frac{4+3+2+1}{4} = \frac{10}{4} = 2.50$

The mean of the response value which is 2.50 was taken as the cut-off point. This implies that types of challenges with a score of 2.50 and above are those that respondents agreed to be serious.

Z-test

The null hypothesis which stated that there is no significant difference in the profitability of aquaculture between the male and female aqua farmers was tested using a z-test. The formula for z-test is given as:

$$Z = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where;
X_1 and X_2 represent the means of both samples
S_1 and S_2 represent the standard deviations of the two populations while
n_1, and n_2 are the two sample sizes.

RESULTS AND DISCUSSION

Socioeconomic characteristics of aqua farmers

The sex distribution of aqua farmers in the study area revealed that the majority (57.1%) were male while 42.9% were female, as shown in (Table 1). This aligns with the study of Adebayo et al. (2016); and Ayanwuyi et al. (2010) who in their respective research conducted in Adamawa and Oyo States reported that fish production was dominated by the male more than their female counterparts.

The age distribution of the respondents as shown in (Table 1) revealed that the mean age of the aqua farmers was 42 years. In addition, 10.8% of the aqua farmers were less than 20 years of age, while 1.8% were above 67 years of age. It was further revealed that 36.2% of the aqua farmers were within the age range of 36 – 51 years. This implies that a good number of aqua farmers in the study area are still in their active and productive economic age. The findings of this research, therefore, agree with the findings of Okeke and Nwoye (2019) whose research took place in Anambra State and stated that a majority of fresh catfish farmers were in their productive age and could withstand any stress arising from fresh catfish farming.

The research result showed that the majority (53.2%) of the aqua farmers were married, revealing that most of the aqua farmers have stable homes, as indicated in (Table 1). From the result, married people are dominant and it is an apriori expectation that there exists a positive correlation between marriage and venture. This finding is in agreement with Njoku and Offor (2016), who found that the majority of the catfish marketers in Aba South Local Government Area of Abia State were married.

The distribution of the educational level of the respondents revealed that the respondents were literate, given that about 31% had primary education, 33% had secondary education and about 22% had tertiary education, as indicated in (Table 1). This shows the high literacy level of the respondents in the study area. Education plays a major role in enlightening farmers in the area of the adoption of improved technologies and effective mitigation practices. This finding is corroborated by the finding of Esiobu and Onubuofu (2014) who researched on socioeconomic analysis of frozen fish marketing in the Owerri municipal council area of Imo State, and found that the majority of the Marketers had secondary education and were thus literate. Omananyi (2021) working on the involvement of small and medium-scale enterprises in the culture fish value chain in Niger State, Nigeria found that educational enlightenment was positively related to the ability to access information from extension agents and other sources and thus led to better adoption of best practices.

The distribution of the respondents by aquaculture experience is presented in (Table 1). The result shows that 35.4% of the respondents had less than 10 years of aquaculture experience while 7.7% had above 30 years of experience, with a mean aquaculture experience of 16 years. This indicates that the respondents in the study area are old in business because the area is riverine and most of the people perceive aquaculture as a source of livelihood. This indicates that a greater percentage of the

Table 1: Socioeconomic characteristic of aqua farmers.

Variable	Frequency	Percent	Mean/Mode
Sex			
Male	566	57.1	Male
Female	425	42.9	
Age			
Less than 20 years	107	10.8	
20 – 35 years	347	35.0	
36 – 51 years	359	36.2	
52 – 67 years	160	16.1	42 years
Above 67 years	18	1.8	
Marital status			
Single	324	32.7	
Married	527	53.2	Married
Divorced	56	5.7	
Widowed	84	8.5	
Educational level			
No formal	141	14.2	
Primary	310	31.3	
Secondary	323	32.6	Secondary
Tertiary	217	21.9	
Household size			
1 – 4 persons	502	50.7	
5 – 8 persons	354	35.7	6 persons
9 – 12 persons	107	10.8	
Above 12 persons	28	2.8	
Aquaculture experience			
1 – 10 years	351	35.4	
11 – 20 years	309	31.2	16 years
21 – 30 years	255	25.7	
Above 30 years	76	7.7	
Monthly income from aquaculture			
Less than ₦50,000	92	9.3	
₦51,000 – ₦100,000	131	13.2	₦137,492.93
₦101,000 – ₦150,000	287	29.0	
₦151,000 - ₦200,000	424	42.8	

Source: Field Survey, 2023

respondents have been in the business for a long time and have gathered significant years of experience in the business. Hence, they can identify possible problems and are likely to proffer solutions for the sustainability of the enterprise in the area. The result corroborates the findings of Babalola et al., (2015), who studied the potential of fish marketing and women empowerment in Nigeria, evidence from Ogun State, and noted that a majority of the fish marketers had above 10 years of experience.

The average monthly income of the respondents in the study area was ₦137,492.93, as shown in Table 1. This income when compared with the official minimum wage in Nigeria of ₦30,000 is relatively high. The implication is that aqua farmers in the study area earn far above the minimum wage. The result further revealed that 42.8% of the respondents earned ₦151,000- ₦200,000 monthly while 5.8% earn above ₦200,000 every month.

Profitability of aquaculture value chain actors by gender

Profitability of aquaculture production per production cycle

The profitability analysis of aquaculture production includes variable cost, fixed cost, and total revenue and is presented in (Table 2). The analysis presented revealed that on average a total revenue of ₦760,330.98 was realized by the male producers. The female producers had a total revenue of ₦580,510.75 at the end of a production cycle. The variable costs that were incurred for both the male and female fish producers include; the cost of fingerlings, feeds, water, fuel, labor, medication, and veterinary services while the fixed cost components were: rent, pond construction, and depreciation. The total variable cost incurred by the male

Table 2: Profitability of Aquaculture Production per Production Cycle.

Items	Males			Females		
Variable cost	**Quantity**	**Price**	**Amount (₦)**	**Quantity**	**Price**	**Amount (₦)**
Fingerlings/ juveniles	628	55	34,540.82	367	55	20,276.66
Feeds	13.5 bags	11,000	148,890.04	11.8 bags	11,000	130,011.30
Water			38,633.77			30,847.55
Fuel			62,023.91			60,034.12
Labour			27,034.53			40,080.33
Medication			70,572.42			40,437.01
Veterinary services			62,090.12			9,625.14
Miscellaneous			20,116.60			5,550.99
Total variable cost			463,902.21			336,863.10
Fixed cost						
Rent	1 year		64,200.92	1 year		50,750.17
Pond construction	2 ponds	52,155	104,310.10	2 ponds	67,515	135,030.55
Depreciation			5215.51			6751.53
Total fixed cost			173,726.53			192,532.25
Total cost			637,628.74			529,395.35
Revenue	422 fishes	1,800	760,330.98	323 fishes	1,800	580,510.75
Gross margin			296,428.77			243,647.65
Net revenue			122,702.25			51,115.40
Benefit Cost Ratio			1.19			1.10

Source: Field Survey, 2023

producers was ₦463,902.21 per production cycle while the total fixed cost was ₦173,726.53. On the other hand, the total variable cost incurred by the female fish producers was ₦336,863.10 per production cycle while the total fixed cost was ₦192,532.25. It was found that the cost of fish feeds made up more than half of the variable cost component of both the male and female fish producers which is in line with the study of Adebayo et al. (2016) who in their research at Yola, Adamawa State reported that fish feeds generally account for approximately 60% of the variable production cost in intensive systems in Nigeria. The result in (Table 2) also revealed the average gross margin realized by male aquaculture producers in the study area to be ₦296,428.77 while that of the female aquaculture producers was found to be ₦243,647.65. The net revenue (profit) for the male aquaculture producers was ₦122,702.25 while the Benefit- Cost Ratio (BCR) was calculated to be 1.19, implying that for every ₦1.00 invested by the male aquaculture producers, there was a yield return of ₦1.19 and therefore a gain of ₦0.19. The net revenue (profit) for the female aquaculture producers was ₦51,115.40 while the Benefit-Cost Ratio (BCR) was calculated to be 1.10, implying that every ₦1.00 invested by the female aquaculture producers yielded a return of ₦1.10 and therefore a gain of ₦0.10. This result, therefore, implies that aquaculture production in the study area is profitable. The result further noted that although the male producers incurred higher costs of production, they generated higher net revenue and benefit-cost ratio than their female counterparts. This finding supports that of Adebayo and Daramola (2013) who investigated the economic analysis of catfish production in the Ibadan metropolis and found that sex in favour of male farmers significantly influenced the total revenue of catfish farming.

Profitability of aquaculture marketing per month

The result in (Table 3) shows the profitability analysis of aquaculture marketing in the study area. The analysis revealed that total revenue of ₦164,480.22 was realized by the male aquaculture marketers. The female aquaculture marketers had a total revenue of ₦183,711.38 at the end of the month. The variable costs incurred for both the male and female aquaculture marketers include; the cost of fish, transportation, packaging, fees/levies, storage, handling, personal expenses, processing cost, and miscellaneous. The total variable cost incurred by the male aquaculture marketers was ₦136,788.78 per month. On the other hand, the total variable cost incurred by female aquaculture marketers was ₦148,676.59 per month. The net revenue (profit) for the male aquaculture marketers was ₦27,691.44 while the Benefit- Cost Ratio (BCR) was calculated to be 1.20, implying that every ₦1.00 invested by the male aquaculture marketers yielded ₦1.20 and therefore a gain of ₦0.20. The net revenue (profit) for the female aquaculture marketers was ₦35,034.79 while the Benefit-Cost Ratio (BCR) was calculated to be 1.24, implying that every ₦1.00 invested by the female aquaculture marketers yielded ₦1.24 and therefore a gain of ₦0.24. This result indicated that female aquaculture marketers realized more profit than male marketers. In collaboration with the study by Omoregbee et al. (2019) at Edo State, it

Table 3: Profitability of aquaculture marketing per month.

Items		Males			Females	
Variable cost	**Quantity**	**Price**	**Amount (₦)**	**Quantity**	**Price**	**Amount (₦)**
Cost of fish	55 fishes	1,100	60,022.11	87	1,100	95,920.01
Transportation			22,950.65			19,011.87
Packaging			7,311.37			1,030.02
Fees/levies			5,920.20			3,750.83
Storage			6,659.94			4,110.52
Handling			8,011.24			5,025.17
Personal expenses			6,302.20			9,066.86
Processing cost			12,600.46			8,200.32
Miscellaneous			7,010.61			2,560.99
Total cost			136,788.78			148,676.59
Revenue	55 fishes	2,990	164,480.22	87	2,111	183,711.38
Net revenue			27,691.44			35,034.79
Benefit Cost Ratio			1.20			1.24

Source: Field Survey, 2023

Table 4: Profitability of aquaculture input suppliers per month.

Items		Males			Females	
Variable cost	**Quantity**	**Price**	**Amount (₦)**	**Quantity**	**Price**	**Amount (₦)**
Feeds	41 bags	9,000	366,160.77	31 bags	9,000	280,103.44
Transportation			17,225.90			9,201.76
Multivitamins			59,180.28			20,230.45
Labour			30,054.02			17,141.21
Medication			55,101.30			15,150.66
Miscellaneous			7,540.43			5,401.28
Total cost			535,262.70			347,228.80
Revenue			677,413.14			410,330.93
Net revenue			142,150.44			63,102.13
Benefit Cost Ratio			1.27			1.18

Source: Field Survey, 2023

revealed that women created value addition through processing, preservation, and packaging of catfish and location and time value addition through storage of dried catfish and hawking along the road. The outcome indicated that women played a vital role in catfish marketing value addition in the studied area. This finding, therefore, implies that aquaculture marketing in the study area is profitable. The finding is also in agreement with the works of Nwabueze and Nwabueze (2010), Iliyasu *et al.* (2011), Olubunmi and Bankole (2012), and Okeoghene (2013), who also noted that marketing of fish was profitable if carefully managed.

Profitability of aquaculture input suppliers per month

The profitability analysis of aquaculture input suppliers consists of variable cost, fixed cost total cost, and total revenue incurred within one month. The analysis is presented in (Table 4). The analysis showed a total revenue of ₦677,413.14 was realized by the male aquaculture input suppliers while the female input suppliers had a total revenue of ₦410,330.93 at the end of the month. The variable costs incurred for both the male and female aquaculture input suppliers include; feeds, transportation, multivitamins, labor, medication, and miscellaneous expenses as shown in (Table 4). The total variable cost incurred by the male aquaculture input suppliers was ₦535,262.70 per month. On the other hand, the total variable cost incurred by the female aquaculture input suppliers was ₦347,228.80 per month. The net revenue (profit) for the male aquaculture input suppliers was ₦142,150.44 while the Benefit- Cost Ratio (BCR)) was calculated to be 1.27, implying that every ₦1.00 invested by the male aquaculture input suppliers yielded ₦1.27 and therefore a gain of ₦0.27. The net revenue (profit) for the female aquaculture input suppliers was ₦63,102.13 while the Benefit- Cost Ratio (BCR)) was calculated to be 1.18, implying that every ₦1.00 invested by the female aquaculture input suppliers yielded ₦1.18 and therefore a gain of ₦0.18. This result, therefore, implies that the aquaculture input supplier in the study area is profitable. The study further revealed that male input suppliers were more profitable than female input suppliers in the study area.

Table 5: Difference in the profitability between the male and female aquaculture producers.

z-Test: Two Sample for Means	Male profitability	Female profitability
Mean	122702.25	51115.40
Known Variance	34045610974	1585289609
Observations	330	248
Hypothesized Mean Difference	0	
Z	20.6700135	
P(Z<=z) one-tail	0***	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0***	
z Critical two-tail	1.959963985	

*** = Significance at 1% probability level
Source: Field Survey, 2023

Table 6: Difference in the profitability between the male and female aquaculture marketers.

z-Test: Two Sample for Means	Male profitability	Female profitability
Mean	27,695.03	35,039.99
Known Variance	3547541138	46690731178
Observations	59	44
Hypothesized Mean Difference	0	
Z	1.225838651	
P(Z<=z) one-tail	0.1101297	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0.220259399	
z Critical two-tail	1.959963985	

*** = Significance at 1% probability level
Source: Field Survey, 2023.

Test of hypothesis

The test of the hypothesis was done using the z-test. The result in (Table 5) shows that there was a statistically significant difference in the profitability levels between the male and female aquaculture producers (z = 20.6700; p<1%) at a 1% level of probability. Also, there was a positive significant difference between male and female aquaculture input suppliers as depicted in (Table 7). The result between male and female aquaculture input suppliers was (z = 10.5634; p<1%) at a 1% level of probability. However, the result in (Table 6) showed no significant difference between the profit levels of the male and female aquaculture marketers (z = 1.2258; p>1%). Hence since two out of three actors were significant, it is empirical to conclude that there was a significant difference in the profitability level between the male and female aqua farmers, therefore, the null hypothesis which stated that there is no significant difference in the profitability of aquaculture between the male and female aqua farmers is hereby rejected.

Challenges Faced by aquaculture producers in the study area

The noted challenges encountered by the aquaculture producers include flooding, lack of capital, high cost of feed, unavailability of water, poaching, lack of trained extension officers, and others. The result in (Table 8) shows the various challenges faced by aquaculture producers in the study area. Among these challenges include; lack of capital ($\bar{x}$ = 3.1), high cost of feed ($\bar{x}$= 3.0), long distance to a water source ($\bar{x}$ = 2.9), unauthorized harvesting ($\bar{x}$ = 2.9), lack of trained extension officers ($\bar{x}$= 2.9), seasonal patronage ($\bar{x}$ = 2.8), poaching ($\bar{x}$ = 2.8), distance from farm to market $\bar{x}$= 2.7), shortage of fingerling/fry to stock ponds ($\bar{x}$ = 2.7) and flooding ($\bar{x}$ = 2.5). All the challenges identified in the study were perceived to be serious by the aquaculture producers in the study area but lack of capital ($\bar{x}$= 3.1) and poaching ($\bar{x}$ = 3.0) were seen as the most serious challenges to aquaculture producers. Some of the respondents during the interview revealed that poaches invade their fish farms at night and harvest large numbers of fish thereby affecting their motivation and revenue. Other respondents also complain that the huge capital required to set up the fish pond was due to the high cost

Table 7: Difference in the profitability between the male and female aquaculture input suppliers.

z-Test: Two Sample for Means	Male profitability	Female profitability
Mean	142150.44	63102.13
Known Variance	3547541138	46690731178
Observations	63	47
Hypothesized Mean Difference	0	
Z	10.563412856	
P(Z<=z) one-tail	0***	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0***	
z Critical two-tail	1.959963985	

*** = Significance at 1% probability level
Source: Field Survey, 2023

Table 8: Challenges Faced by Aquaculture Producers (n = 578).

Challenges Faced by fish producers	VS	S	FS	NS	Score	Mean	Rank
Lack of capital	277 (48.0)	167 (28.9)	53 (9.1)	81 (14.0)	1797	3.1	1st
High cost of feed	212 (36.7)	251 (43.5)	11 (1.9)	103 (17.9)	1728	3.0	2nd
Long distance to a water source	208 (36.0)	212 (36.6)	44 (7.6)	114 (19.8)	1669	2.9	3rd
Unauthorized harvesting	197 (34.0)	243 (42.0)	14 (2.4)	125 (21.6)	1667	2.9	3rd
Lack of trained extension officers	221 (38.3)	157 (27.2)	96 (16.6)	103 (17.9)	1653	2.9	3rd
Seasonal patronage	148 (25.6)	275 (47.5)	62 (10.8)	93 (16.1)	1633	2.8	4th
Poaching	132 (22.8)	282 (48.8)	62 (10.8)	102 (17.6)	1600	2.8	4th
Distance from farm to market	179 (30.9)	186 (32.2)	89 (15.4)	124 (21.5)	1575	2.7	5th
Shortage of fingerling/fry to stock ponds	150 (25.9)	210 (36.4)	103 (17.9)	114 (19.8)	1551	2.7	5th
Flooding	143 (24.7)	118 (20.4)	194 (33.6)	123 (21.3)	1436	2.5	6th

Where; VS = Very Serious; S = Serious; FS = Fairly Serious; NS = Not Serious
Source: Field Survey, 2023

of materials which is a major challenge as well. In line with the work of Adebayo et al. (2016) it was made known that high cost of feed and lack of capital were the major limiting factors to fish production in Nigeria. If the associated problems of production, especially the twin issue of high cost of feed and lack of capital are tackled, then Nigeria will soon become an exporter of fish in no distant time.

Conclusion

The investigation looked into the profitability of aquaculture producers in Delta State, Nigeria. Based on the findings, the study finds that aquaculture farmers in the study area were mostly males, married people, and those with small households. They also had a comparatively high level of education, indicating a higher level of literacy and the capacity to adopt improved aquaculture technologies and best practices. The majority of the aquaculture farmers in the study region were seasoned veterans of the industry with many years of expertise. As a result of their experience, they are better able to recognize possible issues and locate workable solutions, enhancing the viability of the local aquaculture industry. In the study region, it was discovered that aquaculture production, marketing, and input supply were lucrative. In comparison to their female counterparts, male aquaculture producers achieved higher net revenues and benefit-cost ratios. Male input suppliers were more profitable than female suppliers, whereas female input suppliers made more money than male input suppliers. Based on the findings of this study, the following recommendations can be made:

(a) Efforts should be made to encourage and support more female participation in aquaculture activities. This can be achieved through training programs, access to finance and resources, and addressing social and cultural barriers that limit female involvement.

(b) Given that lack of capital and high cost of feed were identified as significant challenges for aqua farmers, it is crucial to provide financial support and access to affordable inputs.

This can be done through microfinance schemes, government subsidies, and collaborations with financial institutions.

(c) The presence of trained extension officers was identified as a challenge in the study area. It is important to enhance extension services to provide technical advice, training, and information dissemination to aqua farmers. This can improve their knowledge and adoption of best practices, ultimately leading to increased productivity and profitability.

REFERENCES

Adam RI, Byrd K, Siriwardena S, Subasinghe R and McDougall C. (2021). Gender in Nigeria's aquaculture and small-scale sheries value chains. Penang, Malaysia: WorldFish. Poster.

Adam, R., Njogu, L. (2023). A review of gender inequality and women's empowerment in aquaculture using the reach-benefit-empower-transform framework approach: A case study of Nigeria. *Frontiers in Aquaculture*, *1*, 2.

Adebayo, E., Polycarp, M., Anyanwu, S. (2016). Analysis of Fish Value Chain in Yola area of Adamawa State, Nigeria. IIFET 2016 Scotland Conference Proceedings.

Adebayo, O. O., Daramola, O. A. (2013). Economic analysis of catfish (Clarias gariepinus) production in Ibadan metropolis. *Discourse Journal of Agriculture and food sciences*, *1*(7), 128-134.

Ayanwuyi, E., Kuponiyi, F. A., Ogunlade, I., Oyetoro, J. O. (2010). Farmers' perception of the impact of climate changes on food crop production in Ogbomosho agricultural zone of Oyo State, Nigeria. *Global Journal of Human Social Science*, *10*(7), 33-39.

Ayeloja, A. A., Jimoh, W. A., Adebisi, G. L., Amusat, M. A. (2022). Gender Differentia Among Fish Farmers Within Ilorin Metropolis, Kwara State, Nigeria. *Momona Ethiopian Journal of Science*, *14*(2).

Babalola, D. A., Bajimi, O., Isitor, S. U. (2015). Economic potentials of fish marketing and women empowerment in Nigeria: Evidence from Ogun State. *African Journal of Food, Agriculture, Nutrition and Development*, *15*(2), 9922-9934.

Esiobu, N. S., Onubuogu, G. C. (2014). Socio-economic analysis of frozen fish marketing in Owerri municipal council area, Imo State, Nigeria: An econometric model approach. *Scholarly Journal of Agricultural Science*, *4*(8), 449-459.

FAO. (2020). The State of World Fisheries and Aquaculture. Rome, Italy: Food and Agriculture Organisation.

FARA (2017). Opportunities for aquaculture in Nigeria: An investment guide. Forum for Agricultural Research in Africa (FARA).

Iliyasu, A. H., Onu, J. I., Midau, A., Fintan, J. S. (2011). Economics of smoked and dried fish marketing in Yola North and South local Government areas of Adamawa State, Nigeria. *J. Agric. Soc. Sci*, *7*, 13-16.

Litwack, J., Nthara, K. L., Kojima, M., Dabalen, A. L., Hoffman, J., Joseph-Raji, G. A., Babalola, O. O. (2015). Nigeria economic report. *Washington, DC: World Bank Group*.

Maja, M. M., Idiris, A. A., Terefe, A. T., Fashe, M. M. (2023). Gendered vulnerability, perception, and adaptation options of smallholder farmers to climate change in eastern Ethiopia. *Earth Systems and Environment*, *7*(1), 189-209.

Morgan, M., Choudhury, A., Braun, M., Beare, D., Benedict, J., Kantor, P. (2016). *Understanding the gender dimensions of adopting climate-smart smallholder aquaculture innovations*. WorldFish.

Njoku, M. E., Offor, E. I. (2016). Cost and returns analysis of catfish marketing in Aba South local government area of Abia state, Nigeria. *Agro-Science*, *15*(2), 9-14.

Nwabueze, A. A., Nwabueze, E. O. (2010). An investigation into the problems of fresh fish marketing in Oshimili South Local Government Area of Delta State, Nigeria. *Agriculture and Biology Journal of North America, 1 (4): 690-693. http://www. sci-hub. org/ABJNA*.

Okeke, M. N., Nwoye, I. I. (2019). Analysis of Fresh Catfish Marketing among Natural Fishpond Users in Ogbaru Local Government Area of Anambra State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology,* 36(3), 1-7.

Okeoghene, E. S. (2013). Assessment of the marketing of frozen fish (iced fish) in Edo State, Nigeria. *Asian Journal of Business Management*, *5*(4), 353-357.

Okwuokenye G.F.A. (2020). Gender roles along the aquaculture value chain: A case study of catfish production in Delta State Nigeria. Journal of Agricultural Extension 24(2): 1-13.

Olubunmi, A., Bankole, A. F. (2012). Determinants of income from fish marketing in Ibarapa Area of Oyo State, Nigeria. *Science Journal of Agricultural Research and Management*, *2012*.

Omananyi, M. (2021). Involvement of small and medium scale enterprises in culture fish value chain in Niger State, Nigeria (Doctoral dissertation).

Omitoyin, S. A., Fawehinmi, O. A.,Pomary, A. B. (2020). Gender participation in aquaculture in Lagos State, Nigeria.Ibadan Journal of Gender Studies, 3(4), 22-33

Omoregbee, F. E., Okogba, G. A., Adeyeye, J. A., Abiola, M. O. A. (2019). The role of women in catfish marketing value addition in Egor Local Government area of Edo State. *Gender and Behaviour*, *17*(2), 13193-13200.