Journal of Global Economics and Business **October 2022, Volume 3, Number 11, 95-111**
ISSN: Print 2735-9344, Online 2735-9352

DYNAMICS UPSETTING PROFITABILITY OF FISH FARMING IN NIGERIA: PERSPECTIVES FROM ETHIOPE EAST LOCAL GOVERNMENT AREA

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Abstract

The study examined the variables influencing the financial success of fish farming in Delta State's Ethiopia-East Local Government Area. The particular objectives were to describe *the socioeconomic traits of fish farmers, ascertain the economic viability of fish farming in the research area, and pinpoint the socioeconomic traits influencing that viability. 60 farmers were randomly picked as samples using multi-stage sampling approaches. Data were gathered using structured questionnaires, and descriptive statistics, gross margin analysis, and multiple regression models were utilized to analyze them. According to socioeconomic data, most fish farmers (68%) were male, married (71.7%), well-educated (53.4%), and between the ages of 31 and 50 (53.4%). Additionally, a whopping 60% of fish farming was done on a part-time basis. With a gross margin of $6,407,83 per production cycle and a return on investment of 0.73, fish farming was successful and worthwhile. Age, educational level, farming experience, and farming status were significant variables affecting the profitability of fish farming in the research area at a 1% significant level, according to the semi-log regression results. According to the report, farmers should receive training in feed formulation to lower production costs.*

Keywords: *Fish Farming, Aquaculture, Ethiope Local Government.*

DOI: 10.31039/jgeb.v3i11.92

1. Introduction

Fish farming is one of the significant sectors in certain parts of Nigeria. Almost 60% of fish farming was done on a part-time basis. With a gross margin of $6,407,83 per production cycle and a return on investment of 0.73, fish farming was successful and worthwhile. Age, educational level, farming experience, and farming status were significant variables affecting the profitability of fish farming in the research area at a 1% significant level, according to the semi-log regression results. According to the report, farmers should receive training in feed

formulation to lower production costs. Additionally, a whopping 60% of fish farming was done on a part-time basis. With a gross margin of $6,407,83 per production cycle and a return on investment of 0.73, fish farming was successful and worthwhile. Age, educational level, farming experience, and farming status were significant variables affecting the profitability of fish farming in the research area at a 1% significant level, according to the semi-log regression results. According to the report, farmers should receive training in feed formulation to lower production costs. Fish farming is a branch of aquaculture that involves the domestication and rearing of different types of fish such as catfish, salmon, tilapia and many others. With this method of farming, fish are encouraged to be fed, bred, grown, and harvested in a planned and regulated environment. Ekine et al. (2019) observed the common and straightforward methods for fish farming activities as earthen and concrete ponds, while Agyakwah et al. (2020) detailed the numerous locations where fish farming can take place including in tarpaulin and poly-tanks.

Fish production has the ability to meet the nation's demand for fish as well as generate surpluses for export and foreign exchange. Therefore, a coordinated effort is required to investigate the enterprise's potential for programs that promote food security and reduce poverty. With a population of over 160 million, a land area of 2,923,768 km2, and a network of inland water bodies such rivers, flood plains, natural and artificial lakes, and reservoirs, Nigeria has a tremendous potential for fish production (Kudi et al., 2008). However, the total annual fish production in the rivers and lakes ranges from 500,000 to 700,000 metric tons. To feed its population, Nigeria requires a minimum of one million metric tons of fish (Momoh, 2009; Dauda, 2010).

Nigeria is the largest consumer of fish and fish products in Africa, according to Sambo, Abdulaziz, and Bada (2021). With an estimated demand of 1.4 million metric tons of frozen fish annually, Nigeria is also the world's largest importer of frozen fish, with an annual foreign exchange loss of 35 billion. According to Adekoya and Miller (2005) and Sambo et al. (2021), 85% of artisanal fish farmers supply the domestic fish production, which is roughly 500 000 metric tons. While Kudi et al. (2008) indicated that there is a national demand-supply gap of at least 0.7 million metric tons, with imports filling the gap at a cost of roughly 0.5 billion US dollars per year, Sambo et al. (2021) found that. This suggests that the national fish demand in Nigeria has not been satisfied by either local fish output or fish imports (FAO, 1995). Therefore, the pressing problem is to close the enormous gap between the supply and demand for fish by encouraging farmers to acquire the basic methods of fish production in order to raise

their level of living and increase the supply of animal protein for local consumption. Fish farming has become more popular among entrepreneurs in Nigeria as a result of its ability to increase employment and income for small and medium farmers, improve owners' socioeconomic standing, and boost the nation's foreign exchange (Oluwasola & Ajayi, 2013; Olagunju, et al., 2007; Adekoya & Miller, 2004; Eyo, 2014).

In light of the above, this study is designed to examine the factors affecting the profitability of fish farming in the Ethiope East Local Government Area of Delta State.

The Problem

Although it has not been properly investigated as a solution to combat food scarcity and poverty, fish farming in Nigeria has numerous potentials to enhance the livelihoods of both rural and urban residents. Low production, astronomical startup costs, significant farm-level losses, and ineffective marketing are just a few of the issues faced by fish farmers. According to the study, inadequate product knowledge and abilities, suboptimal stocking and/or overstocking, as well as a subpar fish population control approach, are all causes of the low level of output. High startup costs for a fish farm provide challenges, particularly when it comes to digging, stocking fingerlings, and installing useful chain links Losses at the farm also result from predators like snakes, monitor lizards, and birds as well as from improper harvesting, post-harvesting and processing methods, and ineffective marketing because farmers don't invest in marketing activities, which may lower the income generated by farmers along the value chain of fish. Furthermore, according to a number of authors, the aquaculture industry in Nigeria faces a number of significant challenges, including poor infrastructure, low government funding, a lack of fishermen's cooperative societies, insufficient quality fish seed for stocking, a lack of information on modern aquaculture technologies due to subpar extension services, and a high cost of fish feed. However, the aforementioned issues can significantly lower the fish farmers' ability to generate income, which would have an impact on their ability to support themselves. With this in mind, the following research issues are addressed in this study:

1. What socioeconomic traits distinguish fish farmers in Delta State's Ethiope East Local Government area?

2. To what extent is fish farming profitable in the area under investigation?

3. What variables affect the fish farmers' bottom lines in the research area?

Learning Objectives

1 Analyze the elements determining the profitability of fish farming in the study region.

2. Examine the socioeconomic features of the fish farmers in the study area.

3. Examine the profitability of fish farming in the study area.

2. **Review of Related Literature**

Historical Perspectives of Fish Farming

Fish Farming (Aquaculture) in Egypt

Although there has been fish farming in Egypt for many centuries, modern management techniques have just lately been implemented to increase yield (Shaalan et al. 2018). The paradigm shift from traditional extensive to semi-intensive aquaculture systems and current intensive aquaculture systems has resulted in the Egyptian aquaculture industry's remarkable rise over the past 20 years (FAO, 2003-2020). Additionally, factors like the development of new technologies for the formulation and production of aquafeed (such as extruded feed), the adoption of best farm management practices, and the government's prioritization of the development of the aquaculture industry all significantly aided in the sector's rapid expansion (FAO 2003-2020; USDA 2016).

With an estimated market value of over USD 2 billion and annual production over 1.5 million tons, Egypt is the sixth-largest aquaculture producer in the world as of 2018. (FAO 2003-2020; Shaalan et al. 2018). More than 500,000 people are employed by Egypt's aquaculture industry, which produces 77% of the country's total fisheries production (FAO, 2016; Shaalam et al, 2018 as recorded by Adeleke et al, 2020)

Fish Farming (Aquaculture) in Nigeria

With an annual production output of roughly 300,000 tons, Nigeria is the second-largest aquaculture producer in Africa. Catfish culture predominates there (Ozigbo et al. 2014; FAO 2016,2018). Nigeria has been producing aquaculture for more than 50 years, but it has not been able to close the gap between domestic demand and production output (Olagunju et al. 2007).

(Ozigbo et al. 2014). Up until recently, socio-economic goals like creating jobs, supplemental income, and better nutrition in rural areas were the main drivers of aquaculture development in Nigeria. More recently, however, aquaculture has been adapted to address domestic fish supply shortages and cut down on fish imports (Ozigbo et al. 2014). With a 13.3 kg per capita fish consumption, fish makes up around 40% of the protein consumed by animals (WorldFish 2018).

Value and production of aquaculture Nigeria produced 370,000 metric tons of fish via aquaculture systems in 2016, with a market value of approximately USD 1.3 billion, according to the Catfish Association of Nigeria (CAFAN) (BusinessDay 2017). Production from aquaculture employs over 475,000 people, accounting for about 34% of all fisheries production in the country, and generates 4.5% of GDP (BusinessDay 2017; WorldFish 2018).

Cultured Fish Species in Nigeria

African catfish, tilapia, carp, and Heterotis niloticus culture is what defines Nigeria's aquaculture sector. 1829 G. Cuvier (Adeleke, et al 2020) Due to their hardiness, widespread acceptance, and high market value, African catfish species (Clarias spp. and Heterobranchus spp.) are the most widely cultivated species, according to Oyakhilomen and Zibah (2013) and Ozigbo et al. (2014). Depending on the production system used, the species are typically raised to an acceptable market size in a culture period of 4 to 9 months (Adewumi 2015). Catfish farming, which accounts for more than 80% of aquaculture production in Nigeria (Adewumi and Olaleye 2011), is largely responsible for the development of the country's aquaculture sector.

Since 1985, the production of catfish species has changed significantly in Nigeria, with the introduction of flow-through tank systems and RASs causing a notable increase in the production output of fish per unit area throughout the nation (Adewumi 2015).

Empirical Review of Literature

In Tigania East District, Meru County, Kenya, Kimathi, Ibuathu, and Guyo (2015) conducted an analysis of the factors influencing the profitability of fish farming under the Economic Stimulus Programme (ESP). The Kenyan government started the economic stimulus program to promote fish farming in the area. The study's objectives were to ascertain the impact of marketing on the financial success of fish farming in Tigania East, establish the significance of

related extension services for fish farming, identify the cultural practices of the host community that have an impact on fish farming, and investigate the ways in which pond management abilities have an impact on fish farming. 200 fish farmers who benefited from the ESP provided primary survey data, which was analyzed using the descriptive research approach.

According to the results, 80% of the fish farmers understood that their clients were primarily urban, meaning that markets in urban areas would yield higher profits. This implies that improved market accessibility will boost farmers' profitability. Therefore, it is evident that marketing has an impact on Tigania East district's fish farming industry's profitability. The farmers who had benefited from ESP differed significantly from those who had not; for instance, 78.9% of those who had attended a training session on fish farming in the Tigania East District stated that fish infections were not frequent in their farms. 65% of farmers who do not participate in these trainings, however, believe that infections are quite prevalent on their fields.

This implies a lack of knowledge about how to prevent certain illnesses, therefore extension programs would boost fish producers' profitability. However, the study came to the conclusion that the government needed to give market access and technical capacity building to the local fish farmers who were already in operation. if they need to boost their output.

In their 2010 study, Adewuyi, Phillip, Ayinde, and Akerele looked at the examination of fish farming's profitability in Ogun state, Nigeria. The study used primary data made up of 82 randomly chosen fish producers who were chosen with the aid of the state's extension agents. Multiple regression analysis, budgetary approach, and descriptive statistics were all used to analyze the data. According to socioeconomic data, 96.3% of fish farmers were under the age of 63, 7% were married, and 68% had higher education. This indicates that the bulk of the farmers were young, working-class farmers who supported their production from personal savings.

The results also showed that fish farmers spent an average of N 394,380 annually on costs while realizing N 715,030 in gross revenue, N 574,314 in gross margin, and N 320,650 in profit. According to the rate of return on investment of 0.55, farmers who invested one naira in the production of fish received a return of N1.55 and a profit of N0.55. The findings of the multiple regression analysis revealed that pond size, labor costs, feed costs, lime costs, and fingerling costs greatly influenced fish productivity.

According to the coefficient of determination, the R2 value of 0.462, the size of the pond, the amount of labor utilized, the cost of feed, the cost of lime, and the price of fingerlings each accounted for 46.2% of the variation in the value of fish output. According to the degree of responsiveness of the value of fish output to changes in the independent variables, a 1% increase in the values of labor, fingerlings, pond size, feeds, fertilizer, lime, fixed input, and fingerlings will result in 0.029%, 0.057%, 0.005%, 0.534%, 0.007%, and 0.001%, respectively, in the value of fish produced. The study found that fish production is economically satisfying and successful in the studied area.

It has the power to raise incomes, increase employment, and raise people's standards of living. In order to increase the amount of fish that is available for eating in Ogun State, it was advised that the government get involved in fish farming.

In Ibadan, Oyo state, Nigeria, Oluwasola and Ige (2015) studied the variables influencing the profitability of catfish production. The socioeconomic elements affecting the profitability of catfish farming in the city of Ibadan were assessed by the study. Data from one hundred and twenty (120) fish producers were collected using a multistage sampling technique, and the data was analyzed using descriptive statistics, budgetary analysis, and the multiple regression model.

While up to 78.3% of fish farmers had post-secondary education, the average age of fish farmers was 44.3 12.0 years. The average family size was 5.21.9, and the average farm size for fish farmers was 0.30.2 hectares. Since farmers only have a 6.9–6.5 year average farm experience, fish farming is fairly new. Eighty percent (80%) of fish farmers went into the business for financial gain. With a net profit of N182,573.04 (US$912.87) per ha, catfish farming had a gross margin of N197,520.25 (US$ 987.60) per ha. The budgetary research revealed that the primary cost component of catfish production was fish feed, which made up 79.18% of all operational costs.

Regression study revealed that net revenue in catfish production was significantly influenced by fish farming expertise, labor input, and feed input. The study found that in order to guarantee the use of an acceptable quantity and quality of feed in catfish production, fish producers must have access to feed inputs that are significantly less expensive. In catfish businesses, this will increase output, productivity, and net profits.

3. Tools and Methods

The study was conducted in Delta State, Nigeria's Ethiope East Local Government Area (LGA). Abraka, Agbon, and Isiokolo are the three districts that make up Ethiopia East LGA. Isiokolo is where its headquarters are situated. There are 200,942 people living in the LGA, with 101,596 men and 99,346 women (NPC, 2007). Approximately 100,000 people live in the semi-urban communities that make up the Ethiope East LGA of Delta State in Nigeria, which is situated between latitudes 5°N and 6°S and longitudes 5.5°E and 6.5°W. A tropical climate dominates the region, with the rainy season running from March to November. The vegetation includes mixed rain forest, grasslands, and extensive mangrove forests. Native farmers make up the vast majority of the population.

The soil is porous, moist, and has a temperature range of 28–32°C as a result of human activities and rainfall that occurs for eight to nine months out of the year. Three districts were specifically chosen at random for the investigation. To create a total of sixty (60) respondents for the study, twenty (20) rural farming households were randomly chosen from each of the three (3) districts. basic survey with structure. They were To accomplish its goals, the study used a multiple linear regression model, descriptive statistics, and gross margin analysis. As outlined below, descriptive statistics were employed;

GM = Gross Margin (₦/production cycle)
GI = Gross Income (₦/production cycle)
TVC = Total Variable Cost (₦/production cycle)
TVC = C1 +C2 +C3 +C4 +C5 ---------- (2)
C1 = Cost of feeds (₦/production cycle)
C2 = Cost of medication (₦/production cycle)
C3 = Water management cost (₦/production cycle)
C4 = Cost of fingerlings (₦/production cycle)
C5 = Labour cost (₦/production cycle)

Multiple Regression Model (four functional forms of the ordinary least square multiple regression model was used)
This model was used to determine the effects of socioeconomic characteristics of fish farmers on the profitability
The multiple regression model is specified as:

Y = f(X1, X2, X3, X4, X5, X6, X7, e)

Where:

Y = Output of fish in kg

X1= Age of the fish farmers in years

X2= Level of educational attainment (Number of years spent in school)

X3= Farming Experience in years

X4= Gender of the fish farmers(dummy variable :1 if female, 0 otherwise)

X5= Marital status (dummy variable: 1 if married, 0 otherwise)

X6= Mode of farming (dummy variable: 1 if full time, 0 otherwise)

X5= Household size

e = Stochastic error term

4. Result and Discussion

Socio-economic Characteristics of Fish Farmers

Table 1 summarizes the socioeconomic traits of the respondents (fish farmers) taken into account for the study. 53.4% of respondents, or a mean age of 47.2, are between the ages of 31 and 50, according to the results. Since men in this age range are more active and productive than older farmers, this is the economic prime of the male species. The age of a farmer has been found to be a significant factor in determining productivity in the literature. With 68.3% of the population being male, the gender distribution demonstrates the dominance of men in the local fish farming industry. This data is consistent with prior research by Ike and Okonta (2014), who found that fish farming was dominated by men in Burutu and Warri South LGA of Delta State, with 74.6% of men and 24.6% of women employed in the industry. Over 71% of respondents, according to an examination of their marital status, are married, while 13% are unmarried. The literature has noted that farmers typically require a spouse to raise children and support family labor. According to the findings, the majority of respondents (fish farmers) have households with one to eight members (83.2%). More over 40% of these people live in households with 5 to 8 people.

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A large household's impact on agriculture can be seen from two different perspectives. It serves as a low-cost source of labor because it may result in the usage of a small number of hired labor. However, it may also have a negative impact on the family if the majority of the residents are not of working age and cannot contribute to family labor in farming operations. One of the elements that predisposes to poverty in such a setting is the high food consumption expenditure.

According to the respondents' level of education, 75% of the fish farmers in the area who were included in the sample were literate with a college degree, 6.7% had a secondary education, and 18% had no formal education. This supports Ibemere and Ezeano's (2014) research, which found that a significant number of fish farmers in Rivers State, Nigeria, have tertiary education. This demonstrates that the study area's fish farmers are well-educated, making them ready to look for and implement new technology that will increase their production efficiencies and profit margins.

According to Table 1's findings, 60% of respondents in the study region work as part-time fish farmers, while 40% are full-time fish farmers. This suggests that the majority of fish farmers had jobs other than fish farming. This would increase their income and boost their tendency to save and invest. The outcomes in Table 1 also demonstrate the years of experience of fish farmers. According to the findings, 45% of respondents had experience in fish farming ranging from 1 to 5 years, and 31.7% had experience ranging from 6 to 10 years, with a mean of 8 years.

The outcome suggests that fish farmers in the study area have a lot of expertise raising fish. The ability of farmers to manage risks, properly allocate resources to maximize profit, and make other crucial farm management decisions that would raise their output and income levels is significantly influenced by their experience in agricultural production.

Table 1. Socio-economic Characteristics of Fish Farmers

Variable	Frequency (n=60)	Per cent	Mean
Age (years)			
21 – 30	9	15.0	
31 – 40	16	26.7	42.7
41 – 50	16	26.7	
51 – 60	12	20.0	
61 and above	7	11.7	
Gender			
Male	41	68.3	
Female	19	31.7	
Marital status			
Single	8	13.3	
Married	43	71.7	
Divorce	3	5.0	
Widow/widower	6	10.0	
Level of education			
Secondary education	4	6.7	
Tertiary education	45	75.0	
Informal education	11	18.3	
Household size			
1-4	7	11.7	
5-8	24	40.0	
9 and above	22	36.7	
Years of experience			
1 – 5	27	45.0	
6 – 10	19	31.7	8
11 – 15	14	23.3	
Mode of Farming			
Part-time	36	60.0	
Full time	24	40.0	

Source: Field survey, 2021

Costs and returns in small-scale fish production

This section presents the results of costs, returns and profitability of fish farming in Ethiope-East Local Government Area of Delta State

Table 2. Average costs and return of small-scale fish production (₦/Production Cycle)

Cost items and Revenue Variable cost	**Value (₦)**	**Percentage of Total Variable Cost**
Cost of feeds	52,848.33	59.20
Cost of medication	5,851.02	6.55
Water management cost	10,339.94	11.58
Cost of fingerlings	13,454.55	15.07
Labour cost	6,780.00	7.60
Total variable cost	**89,273.84**	**100**
Gross income	**154,681.67**	
Net income	**65,407.83**	
Return to Naira Invested	0.73	

Source Field Survey, 2021

The outcome reveals that fish farmers paid an average total variable cost of 89,273.84 per production cycle. Fish farming's greatest cost component was feeds, which averaged 52,848.33 per production cycle and accounted for 59.20% of all variable costs. The price of fingerlings, which amounted to $13,454.55 every production cycle and represented 15.07% of the overall variable cost, was another significant cost element in the production of fish. The outcome also reveals that the fish farmers' average gross margin per cycle of production was N65,407,83, and that their return on investment was N0.73, meaning they made a profit of N0.73 for every N spent.

These results are consistent with those of Ekine et al. (2019), who observed favorable gross margins for catfish production in Rivers State, Nigeria, employing concrete and earthen fish ponds.

Effect of Socioeconomic Characteristics of the Fish Farmers on Profitability

The findings of the analysis are shown in Table 3 for the variables influencing the profitability of fish farming in the research area using four functional versions of the ordinary least square multiple regression model. The regression analysis's findings demonstrate that the Semi log model surpassed all other models in terms of significant variables, coefficient of multiple determination (R2), and conformance to a priori expectations. The Semi Log model function

provided an excellent fit to the data, according to the test of significance of the R2's f-value, which was 19.059 and significant at 1%.

The coefficient of multiple determination was 0.982, indicating that the independent variables examined in the regression model together accounted for around 98.2% of the differences in the profitability of fish farming. Age, educational level, and farming experience all had multiple regression coefficients that were significant at 1%, suggesting that these variables have a considerable impact on how profitable fish farming is in the study area.

Table 3: Result of Multiple Regression on Effect of Socioeconomic Characteristics of Fish Farming on Profitability in Ethiope –East LGA of Delta State.

Explanatory variables and important statistics	Functional Forms			
	Linear	Semi-log	Double log	Exponential
Constant	4.51215	1.927864	17.5269	7.142414
	(2.5731)**	(9.5867)***	(3.1547)***	2.1674)**
Age (X_1)	1.44887	0.327629	0.11227	1.45E-05
	(1.34646)*	(6.34646)***	(2.94116)**	(1.65122)
Education (X_2)	0.540387	68158.66	0.050477	0.00018
	(0.299554)	(4.283192)***	(2.82636)**	(2.54686)**
Farming experience (X_3)	791.0466	30792.5	2.901915	0.007086
	(16.35268)***	(4.626796)***	(4.710015)***	(2.814662)**
Gender (X_4)	4007.797	50771.17	1.21963	0.075808
	(3.485045)*	(0.927274)	(2.405965)**	(1.716755)
Marital status (X_5)	-1.86872	-56746.6	-0.08522	-1.24E-05
	(-1.56984)	(-1.21476)	(-0.35927)	(-0.96295)
Mode of farming (X_6)	6.200085	3154.589	0.24217	5.5E-05
	(1.110404)	(2.10130)**	(0.83999)	(0.25665)
Household size	-18.8975	-732.309	-0.01675	-0.69683
	(-1.53017)	(-1.72184)	(-1.21223)	(-1.72184
R^2	0.962	0.982	0.859	0.815
F-value	15.621	19.059	17.278	12.114

T-values are shown in parenthesis; *** = significant at 1% Significant at 5%, **, and 10%, *

Age (X1) had a 1% significance level and was positively correlated with fish farming profitability. This demonstrates that age and fish farming are directly related, suggesting that older fish farmers have more expertise running the fish farming enterprise. The coefficient of educational level (X2) obtained a significant value of 1% and a positive sign. This suggests that a higher degree of educational attainment, as indicated by the number of years spent obtaining a formal education, increases fish output. The t-value for the coefficient of farming experience (X3) is 4.626796 and it is 30792.5.

With 1%, it is considerable. This suggests that as farmers' levels of experience in the aquaculture industry rise, so do their net returns and the quantity of fish produced. The X6

mode of farming coefficient, which indicates whether a farmer works full- or part-time, was positively signed and significant at the 5% level. This suggests that full-time operations in fish farming are more profitable than part-time operations because the full-time farmer will dedicate more time, attention, and energy to the administration of the food site.

5. Conclusion

The study was effective in analyzing the variables influencing the profitability of fish farming in Delta State's Ethiopia-East Local Government Area. The bulk of the fish farmers in the research area were men, married, educated, and between the ages of 31 and 50, when they were still economically active. The study also revealed that most fish farming was done on a part-time basis by individuals with an average level of business experience. Additionally, the production of fish in Ethiopia-East LGA was useful and profitable, with an average gross margin of 65,407.83 Naira per production cycle and a return on investment of 0.73 Naira.

The most delicate cost component in the production of fish for aquaculture was the cost of food. Adoption of steps that would lower the price of feed would raise maximum variable profit. Significant factors that affected the profitability of fish farming in the research area included the age of farmers, their degree of education, their level of farming experience, and their position as farmers.

Recommendations

i. The study made the following recommendations: i. extension services should focus on teaching farmers how to manufacture and make fish feed so they may do so on their own and reduce the cost of feed.

ii. ii. In order to reduce production, farmers should be rewarded with subsidies for their feed inputs.

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