PATTERN AND DETERMINANTS OF INVESTMENT AMONG CATFISH ENTREPRENEURS IN ABIA STATE, NIGERIA

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ABSTRACT

This study analyzed the determinants of investment among catfish entrepreneurs in Abia State, Nigeria. Specifically, the study described the socio-economic and demographic characteristics of the catfish entrepreneurs, ascertained the pattern and the determinants of investment in catfish enterprises in the study area. Data were collected from 112 respondents through structured questionnaire which were analyzed using both descriptive and inferential statistical tools. The result showed that that majority of the respondents (64.29%) were male and the mean age of the entrepreneurs was 36 years. About 51.79% of the respondents were married while 48.21% were single. The mean farming experience was approximately 5 years and majority (51.79 %) having secondary form of education. The mean household size of farmers was 6 persons per household. The location of the business is mostly in the rural area. Result revealed that the catfish entrepreneurs invested majorly on land (₦ 592,946.40k), this was followed by borehole (₦249,830.40k), pond expansion (₦242,714.30k), generator (₦161,785.70k) and pumping machine (₦64,160.71k). The significant determinants of investment on catfish enterprises were age ($p<0.01$), sex ($p<0.01$), education ($p<0.01$), experience ($p<0.01$), cooperative ($p<0.01$), extension visit ($p<0.05$) and income ($p<0.01$). It could be concluded that the major operating cost is the cost of feed and the major investments by catfish entrepreneurs were on land, borehole, pond expansion, generator and pumping machine. It was recommended that since feed cost constitute a major operating cost in production, there is the need to formulate feed locally in order to reduce costs associated with the business as this would enhance commercial catfish production in the study area and Nigeria in general. Variables such as age, sex, education, experience, cooperative, extension visit and income should also be taken into consideration in policy formulation.

Keywords: Pattern, Investment, Catfish

1. INTRODUCTION

The importance of agriculture in the economic development of a nation cannot be overstated (Afolabi, 2017). According to the World Bank (2024). agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and feed a projected 10 billion people by 2050. It noted that it is also crucial to economic growth: accounting for 4% of global gross domestic product (GDP) and in some least developing countries, it can account for more than 25% of GDP. As noted by Sasu (2023), agricultural activities provide livelihood for many Nigerians. FAO (2022) reported that between January and March 2021, the agricultural sector contributed 22.35 percent to the Gross Domestic Product (GDP) in Nigeria, with over 70 percent of the population of Nigerians engaged in the agricultural sector mainly at subsistence level. Hence, the sector has high potential for employment generation, food security and poverty reduction.

Aquaculture is the fastest growing food production sector in the world and it is growing faster than the capture fisheries (Dauda *et al.,* 2018). Aquaculture is the part of agriculture that is involved in the production of fish and other aquatic organisms. The fishery sector contributed 1.09% of the

national GDP in 2020 and 0.97% in the Q3 of 2021 (NBS, 2021 in Odioko and Becer, 2022). Fish makes a vital contribution to the food and nutritional security of about 200 million people. Fish farming provides income for over 10 million people in Africa, majority of which are small-scale fish farmers and entrepreneurs (Inter Press Service, 2016).

Fish remains an important dietary element for Nigeria, especially in the southern part of the country where fish is highly valued and one of the cheapest sources of animal protein available to many Nigerians (FAO, 2020). DARD-ECOWAS Commission report (2020) on the Nigeria fishery sectors shows that between 2015 and 2020, 6,861,700 tonnes of fish had been produced. As a sub-sector of aquaculture, catfish farming involves the rearing of catfish under controlled condition for economic and social benefits. The favoured or common catfish species in Nigeria aquaculture include *Clarias gariepinus, Heterobranchus bidorsalis*, Clarias X Heterobranchus hybrid (Heteroclarias) and *Clarias nigrodigitatus.* (Adewumi and Olaleye, 2015). Increasing population created a large market for catfish which led to an intensification of culture with high growth in small-to-medium-sized farms and the establishment of large scale intensively managed catfish farms. An annual growth rate of 20% was reported by Miller and Atanda (2019). This growth, though considered to be market-driven (Muir *et al.,* 2015), also coincided with a period of increased availability and usage of commercial protein-rich catfish feeds.

According to Ogunji and Wuertz (2023), fish farming has become one of the fastest-growing farming businesses, turning Nigeria into the second biggest aquaculture producer in Africa. Also, Nigeria is the leading country in the production of African catfish (*Clarias gariepinus*) and African bonytongue (*Heterotis niloticus*). Unfortunately, Nigeria is far from self-sufficiency in its fish supply, with a deficit of about 2.5 million tons being imported. Like in many of the world's fisheries, the Nigerian fishery subsector are at grave risk from human pressures, including overexploitation, pollution and habitat change. Climate change is intensifying these pressures, posing very serious challenges and limiting livelihoods opportunities. Despite the potential of aquaculture in Nigeria, recent data show a decline in aquaculture production from 2015 to 2017, with reports of increasing withdrawal of farmers from fish farming in favour of other agricultural ventures (PIND, 2017; Digun-Aweto and Oladele, 2017). Some of the reasons attributed to this include poor quality of fish feed and seed and reduced profitability of fish farming. However, national initiatives envision an expansion in the future to increase the supply of the population with high-quality protein and the prevention of malnutrition. This therefore, call for increased investment in the sector for increased productivity.

Investment is one of the fundamental variables in financial improvement of a country. Investment is needed to reproduce and develop production capacity and improve the profitability and competitiveness of Nigeria agriculture. The driving force behind investment is the projected income earned from the realized investments (Szyman´ska *et al*., 2021). It is the availability of capital (equity capital and credit) that determines the level of investment, which is turned into new technologies, thereby providing multiplication of income, and this in turn gives rise to new investments. The importance of investment capital as a driving force for the development and expansion of agricultural holdings cannot be overemphasized (Greenwald *et al.,* 2018).

From the foregoing, it has become necessary and indeed imperative to examine the determinants of investment among catfish entrepreneurs in Abia State, Nigeria. The specific objectives of the study were to describe the socio-economic and demographic characteristics of the catfish entrepreneurs and ascertain the pattern and the determinants of investment in catfish enterprises in the study area.

2. RESEARCH METHODOLOGY

This study was conducted in Abia State, Nigeria. The State has a land mass of 6,320 square kilometer with 17 Local Government Areas (LGA). Abia State was created out of Imo State on August 27, 1991. The state lies between longitudes 7^{o} 23^{1} and 8^{0} 02^{1} East of Greenwich meridian and latitudes 5^{o} 25^{1} and 7^{o} 30^{1} North of the equator. Abia State is bounded on the East by Cross River and Akwa Ibom States, on the North by Ebonyi and Enugu States, on the West by Imo State and on the South by Rivers State. The State consists of three agricultural zones, namely Aba, Umuahia and Bende. The State has a population projection of 4,143,100 people, which is 2.4% annual population change (2006-2022), NBS (2022).

The annual rainfall ranges from 2122 mm – 3050 mm while the temperature ranges between 20^{0}C and 36^{0}C. There are two seasons; the rainy season (April - October) and the dry season (Mid October - March). Farming is done majorly at subsistence level. The women only farm on their husband's land as they do not have direct title to land (Agba *et al*., 2014). The State is endowed with a rich fertile soil that supports the growth of crops such as yam, cassava, cocoyam, melon, maize, oil palm, garden egg, cocoa, to mention but a few. Poultry, goat, pigs and sheep are the major livestock kept. A lot of catfish farming activities are carried out in the study area as the area is suitable for catfish production.

There are over 80 catfish enterprise existing within the State, they include 7^{th} Option Farms,Ag Healthy Farm, Amamey Fish Farms Nigeria, Amazing Fisheries and Farms, Eteicon Farm, Great Fish Farming, Large Fish Farm and Smarchris Farms Ind. Ltd etc. within the State.

A multi-stage sampling technique comprising purposive, proportionate and random sampling procedures was adopted in the selection of respondents for the study. In the first stage, three (3) agricultural zones were used for the study to ensure an adequate representation of different catfish entrepreneurs in the State. They are Umuahia, Aba and Ohafia agricultural zones. The second stage involves purposive selection of one LGA from each agricultural zone. The local governments selected were Ikwuano for Umuahia agricultural zone, Ohafia for Ohafia agricultural zone and Osisioma Ngwa for Aba agricultural zone giving a total of six (6) LGAs. These LGAs were selected because of dominant activities in catfish enterprise in the area. The third stage is random selection of four villages from the selected LGAs. The fourth stage involved a random selection of 10 catfish entrepreneursthis gave a total of one hundred and twenty (120) respondents which constituted the sample size for the study.

Data for this study was collected with the use of structured questionnaire administered to the respondents. The questionnaire was designed to capture the relevant variables necessary for achieving the objectives of the study. The collected data were analyzed using both descriptive and inferential statistics. To analyze major determinants of investment, the Tobit model was estimated. This model was chosen because it has advantages over other models in that it reveals both probability of willingness and intensity of capital use which is tend to be censored at the lower limit of Zero. The Tobit model specification is given as follows:

$$Y^{*}_{i} = X_i\beta + \mu, \qquad i = 1,2,\ldots..n \quad - \quad - \quad - \quad - \qquad (1)$$

$$Y_i = Y_i^{*} \; if \; Y_i^{*} > 0$$

$$= 0, \quad \text{if } Y_i^{*} \leq 0 \qquad - \quad - \quad - \qquad (2)$$

where,

Y_i: the observe annual investment

Y_i^{*} = is the latent variable which is not observed

β = vector of unknown parameters
μ = error term that are assumed to be independently and normally distributed with mean zero and constant variance ∂^2 (i = 1,2…n)

X_i= vector of independent variable affecting investment

The explanatory variables specified as factors influencing the level of investment were defined as follows: X1 = Age (years), X2 = Sex (male =1, female = 0), X3 = Education (years), X4 = Farming experience (number of years), X5 = Cooperative society (number), X6 = Household size (number), X7 = Transportation Cost (₦), Extension service (number), Credit use (₦) and Income(₦).

The threshold value in the above model is zero. The model parameters are estimated by maximizing the tobit likelihood function to the following form:

$$L = \prod_{Y_i^*} \frac{I}{\partial} f\left(\frac{Y_i - \beta_i X_i}{\partial}\right) \prod_{Y_i^*, \leq 0} F\left(\frac{\beta_i X_i}{\partial}\right) \quad - - - - - - \quad (3)$$

where,

f and F are density probability function and cumulative distribution function of Y_i^*, respectively, $\prod_{Y_i^*}$ means the product over j for which $\prod_{Y_i^*, \leq 0}$ and $\prod_{Y_i^*, \leq 0}$ means the product over those 1 for which $Y_i^* > 0$,

Decomposition techniques will be used to analyze the effect of explanatory variables

1. Change in the probability of gain in independent variable X_i change is

$$\frac{\partial F(z)}{\partial X_i} = f(z) \frac{\beta_i}{\partial} \quad - - - - - \quad (4)$$

2. The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\frac{\partial E(Y_i)}{\partial X_i} = f(z)\beta_i \quad - - - - - \quad (5)$$

where,

$$Z = \frac{\beta_i X_i}{\partial} \quad - - - - \quad (6)$$

The change in intensity of dependent variable with respect to a change in an explanatory variable among the investors category:

$$\frac{\partial E\left(\frac{Y_i}{Y_i^*} > 0\right)}{\partial X_i} = \beta_i \left[1 - Z\frac{f(z)}{f(z)} - \left(\frac{f(z)}{f(z)}\right)^2\right] \quad - - - - \quad (7)$$

F(z) is a cumulative normal distribution of z, F(z) is the value of the derivative of the normal curve at a given point (i.e. unit normal density). Z is the zero score for the area under the normal curve, β is a vector of the Tobit maximum likelihood estimate and ∂ is the standard deviation of the error term. Prior to running the above specified models, all dependent variables will be checked for the existence of data problems mainly multicollinearity problem, heteroscedasticity problem and endogeneity problem.

3. RESULTS AND DISCUSSION

3.1 Socio-economic and Demographic Characteristics of the Catfish Entrepreneurs

The distribution of the catfish entrepreneurs which is based on their socio-economic and demographic characteristics is presented in Table 1. The result in Table 1 showed that majority (64.29%) of the respondents were males while 35.71% were females. This shows that males

dominates fish farming activities in the study area. This could be due to the fact that fish farming requires acquisition of fixed assets/high level of investment, constant supervision and monitoring, adoption of new technology as opined by Brummett *et al.* (2010), Olaoye *et al.* (2013) and Kumar *et al.* (2018). Furthermore, women's role in aquaculture is not widely acknowledged due to the fact of being at home most of the time, which eventually made their involvement in fish farming to be viewed as an extension of domestic activities and as such are not recognized and rewarded as opined by Ndanga *et al.* (2013). However, this result proves positive as women are faced with socially conditioned inequalities in the access, use and control of resources although they form big portion of the population undertaken farming activities. Removing these barriers will increase their involvement as well as enhance their performance in catfish farming.

The age distribution showed that 41.96% of the catfish entrepreneurs were within the age range of 21 – 30 years. Those between 31 and 40 were 26.79 %. The mean age of the entrepreneurs is 36 years. This implies that the entrepreneurs involved in fish farming activities in the study area were in their economically active and productive age. This conforms to the findings of Maina *et al*. (2014). It is obvious that people within a certain age range would have acquired some good level of experience; other people belonging to different age group might not have the experience but instead enough strength or energy which could be gainfully employed in the farm. However, according to Bassey (2017), age is considered to have a remarkable influence on the ability to invest in agriculture.

Table 1 showed that 51.79% of the respondents were married, while 48.21% were single. This result corroborates the findings of earlier studies of Adelaja *et al*. (2018) who reported that being married is a highly cherished value among farming households in Nigeria, not only because of the need for children and the continuation of the family, but due to the fact that the spouses and children form a vital source of unpaid family labour which can improve and boost fish production. This is typical of Nigeria rural setting because family members often serve as a source of additional labour together with cultural value attached to marriage.

About 68.75% of the respondents had spent 1 – 5 years of experience in catfish production, 25% had spent 6 – 10 years of experience while 3.57% had spent 16 - 20 years of experience in catfish production, respectively. The mean farming experience was approximately 5 years. This suggests that a considerable portion of the farmers have average experience in the business. Nwaru (2004) noted that the number of years spent in the farming business may give an indication of the practical knowledge he has acquired. This implies that the experience gained enables the entrepreneurs to use their resources prudently and consequently enhance their production status.

Table 1. Distribution of the respondents based on Sex

Sex	**Frequency (n= 112)**	**Percentage (%)**
Male	72	64.29
Female	40	35.71
Age (years)		
21 – 30	47	41.96
31 - 40	30	26.79
41 – 50	13	11.61
51 – 60	18	16.07
61 – 70	4	3.57
Mean	36.4	
Marital status		
Married	58	51.79

Single	54	48.21
Experience		
1 – 5	77	68.75
6 – 10	28	25.00
11 – 15	3	2.68
16 – 20	4	3.57
Total	112	100.00
Mean	5.1	
Level of education		
Primary	7	6.25
Secondary	58	51.79
Tertiary	47	41.96
Household size		
1 – 3	7	6.25
4 – 6	56	50.00
7 – 9	42	37.50
10 – 12	7	6.25
Mean	6	
Cooperative		
No	96	85.71
Yes	16	14.29
Extension contact		
No	94	83.93
Yes	18	16.07
Training		
No	72	64.29
Yes	40	31.71
Total	112	100.00
Location of business		
Rural area	61	54.46
Semi urban	29	25.89
Urban area	22	19.64

Source: Field survey, 2024

The distribution based on the level of education showed that literacy level was high among the catfish entrepreneurs with majority (51.79 %) having secondary form of education whereas 41.96% and 6.25% had secondary and primary education, respectively. High educational status of the entrepreneurs will also enable them acquire knowledge and skills for budgeting, saving, adoption of innovations and resources usage. Education plays a vital role in agricultural production as it promotes better exposure and access to vital information This means that they can be easily convinced to accept better practices of their farming operations. It is in conformity with Okezie *et al.* (2021) that a greater deal of change has occurred within the rural communities in recent times due to the introduction of education. This has implications on their involvement in agricultural development activities, since they can access information through print, electronic and professional associations meeting and workshop. Their high literacy level is an asset as the farmers would be exposed to many information sources, embrace innovations and analyze farm situations objectively. Undoubtedly, the high level of literacy predisposes some level of managerial ability in the farm business.

The distribution of the respondents according to household size showed that the mean household size of entrepreneurs was 6 persons. This corresponds with the findings of Nnamerenwa *et al*. (2017) as they noted that household size between 6 and 10 persons could likely participate in farming in order to improve sustainability of food production. Furthermore, according to Onwumere *et al*. (2017), this is desirable, consistence and of great importance as entrepreneurs may rely more on their family members than hired workers for labour on their farm. The economic implication is that it will provide the catfish entrepreneurs with family labour at reduce cost of farming.

From Table 1, 85.71% indicated that do not belong to cooperative society or farmers association. However, on the contrary, 14.29% indicated that they belong to an association. Membership of association satisfies the social needs of entrepreneurs in additions to serving as an avenue for access to information on agricultural technology. This corroborates with the findings of Okezie e*t al.* (2021). They noted that farmers by virtue of their membership has obvious advantages in terms of agricultural technology adoption and their doubts and misconceptions of technology and its adoption are clarified.

Majority of the catfish entrepreneurs (83.93%) did not encounter extension visitors. This suggests that greater numbers of the sampled fish farmers were not exposed to technical services and innovations in catfish production. According to Belton *et al*. (2017), extension services enhance farmers knowledge on agricultural technology and improved farm practices which would lead to increase productivity.

Majority of the catfish entrepreneurs (64.29%) did not have training in catfish production. The interpretation of 64.29% of catfish farmers reporting that they do not have any training in catfish production indicates that a significant majority of these farmers lack professional training specific to catfish aquaculture. This suggests that they might be relying on traditional knowledge, informal learning, or trial-and-error methods to manage their farming operations. Without proper training, entrepreneurs may not be using the most efficient or productive methods to raise catfish, which can lead to lower yields and higher costs. Lack of training can affect the quality of the catfish produced, as farmers might not be aware of the best practices for feeding, breeding, and disease management. Therefore, untrained farmers may inadvertently engage in practices that are unsustainable or harmful to the environment, such as overfeeding, improper use of chemicals, or poor waste management.

The result in Table 1 showed that majority (54.46%) of the catfish enterprises were located in rural areas, this was followed by semi-urban area (25.89%), and urban area (19.64%). The interpretation indicates that a significant majority of catfish farming takes place outside of urban centres. This could be due to various factors such as the availability of land, water resources, and the traditional location of agriculture in less densely populated areas. Rural areas often provide the space and water resources necessary for aquaculture, which may not be as readily available or affordable in urban settings. Catfish farming in rural areas can contribute to the local economy by creating jobs and supporting ancillary businesses such as feed suppliers, equipment retailers, and processing facilities. The concentration of catfish farms in rural areas may highlight the need for improved infrastructure, such as roads for transportation, electricity for farm operations, and access to markets.

3.2 Operating Cost in Catfish Business

The summary statistics of operating costs in catfish business is summarized and presented in Table 2.

Table 2. Summary statistics of operating costs in catfish business

Variable	Mean	Std. Dev.	Min	Max
Fingerling	335,479.50	692,883.30	2,400.00	3,300,000.00
Fertilizer	4,808.04	15,005.20	0	60,000.00
Liming	2,675.89	5,022.14	0	20,000.00
Feed	765,205.40	758,519.40	72,000.00	2,600,000.00
Drugs	3,068.75	2,974.25	0	10,000.00
Labour	6,616.07	8,503.57	0	40,000.00
Energy	16,588.39	13,212.67	0	45,000.00

Source: Field Survey, 2024

The result in Table 2 shows that the cost of feed accounted for the highest proportion (₦765,205.40k) this was followed by fingerlings (₦335,479.50k). Others include energy (₦16,588.39k), labour (₦6,616.07k), drugs (₦3,068.75k), fertilizer (₦4,808.04k) and liming (₦2,675.89k). This reveals that feed constitutes the most significant operational cost, followed by fingerlings and then various other inputs like energy, labour, drugs, fertilizer, and liming. This reveals that large amount of money was spent by fish farmers for the purchase of feed (₦765,205.40k). This can be attributed to the high cost of imported feed by farmers. Feed has the dominant cost factor, accounting for over 60% of the total. This suggests a significant investment in fish feed, likely for intensive production systems or high-value fish species. Fingerlings (₦335,479.50k) the second-highest cost, serves as one of the most important inputs in catfish production. Farmers should ensure that fingerlings are purchased from reliable sources. Olasunkanmi and Yusuf (2014) reported that an average catfish farmer spent majority of the operational costs on feed. The cost breakdown can be used to justify further investments in feed production and storage facilities to improve efficiency and reduce reliance on external suppliers.

3.3 Pattern of Investment in Catfish Enterprises

The pattern of investment in catfish enterprises in the study area is summarized and presented in Table 3. Result in Table 3 reveal that catfish entrepreneurs in the study area invested majorly on land (₦592,946.40k). This was followed by borehole (₦249,830.40k), pond expansion (₦242,714.30k), generator (₦161,785.70k) and pumping machine (₦64,160.71k).

Table 3. Pattern of investment in catfish enterprises in the study area

Variable	Mean	Std. Dev.	Min	Max
Borehole	249,830.40	272,975.00	0	830,000.00
Pumping machine	64,160.71	10,780.90	0	123,500.00
Generator	161,785.70	93,478.47	0	350,000.00
Pond expansion	242,714.30	112,390.80	75,000.00	600,000.00
Land	592,946.40	680,130.70	0	3,000,000.00

Source: Field Survey, 2024

Land (₦592,946.40k): The highest average investment by catfish entrepreneurs is in land acquisition. This indicates that securing a physical and permanent location for their operations is the primary cost concern for these entrepreneurs. Borehole (₦249,830.40k): The second highest investment is in boreholes. This suggests that a reliable and clean water supply is crucial for maintaining the health and growth of the catfish. Pond Expansion (₦242,714.30k): The third largest investment is in pond expansion. This indicates that farmers are looking to increase their production capacity by enlarging their existing pond systems. Generator (₦161,785.70k): The fourth investment priority is in generators. Reliable power sources are essential for operations such as aeration, lighting, and running water pumps, especially in areas with unstable electricity supply. Pumping

machine (₦64,160.71k): The smallest average investment among the listed items is in pumping machines. These are necessary for water circulation and management within the ponds.

This investment pattern suggests that catfish entrepreneurs prioritize the foundational elements of their operations, such as securing the land for ponds and ensuring a steady supply of both water and young fish to grow. The investments in boreholes and generators also indicate that these farmers may be operating in areas with limited infrastructure, necessitating self-sufficiency in water and power supply. The data reflects the capital-intensive nature of catfish farming, with significant upfront costs required for land and infrastructure before production can begin. It also highlights the areas where entrepreneurs may need financial support or loans to cover these substantial initial investments. According to Szyman´ska *et al.* (2021), investment is needed to reproduce and develop production capacity and improve the profitability and competitiveness of Nigeria agriculture. Productive investment decides the development opportunities of aquatic enterprise. It indicates the expansion of fixed asset inventory or an increase in its quality, which contribute to the growth of the enterprise's potential in the future.

3.4 Determinants of Investment in Catfish Enterprises in the Study Area

Tobit regression model result on determinants of investment in catfish enterprises is presented in Table 4.

The result in Table 4 showed that Chi-square value, capturing the goodness-of-fit, indicates that the model is significant at 1 percent (1%) probability level. Seven, out of the ten explanatory variables that were hypothesized to affect potential investors‟ decision to invest were statistically significant. Age, sex, education, experience, cooperative, extension visit and income were found to significantly affect the level of investment. Among the seven variables that were found to significantly affect the level of investment, the coefficients of sex, education, experience, cooperative, extension visit and income were positive, implying that these variables had a significant investment-enhancing impact. Whereas the coefficient of age had negative sign, implying that this variable had a significant investment deterring impact.

Table 4. Determinants of investment in catfish enterprises

Variables	Coefficients	Std. Error	z-value	Marginal effect dy/dx
X_1 = Age	-0.013	0.003	-4.02***	-0.003
X_2 = Sex	0.269	0.053	5.07***	0.269
X_3 = Education	0.034	0.008	3.96***	0.034
X_4 = Household size	0.003	0.014	0.18	0.003
X_5 = Experience	0.052	0.009	5.89***	0.052
X_6 = Cooperative	0.065	0.021	3.14***	-2.111
X_7 = Transport	0.075	0.049	1.51	0.075
X_8 = Extension visit	0.163	0.077	2.11**	-0.163
X_9 = Credit use	2.05e-08	1.16e-07	0.18	-2.05e-08
X_{10} = Income	3.339	0.462	7.23***	-4.65e06
Constant	.39266	0.075	5.20***	
LR chi^2 (10)	108.95			
Prob> chi^2	0.0000			
Pseudo R^2	0.8510			
log likelihood	-9.5368			
Number of observation	112			

*, **, *** denotes 10%, 5% and 1% significant respectively

Source: Field Survey, 2024

The coefficient of age was negative and significantly ($p<0.01$) affect the propensity to invest. The marginal effect of age on the level of investment was -0.003. The negative coefficient for age suggests that as catfish entrepreneurs get older, their propensity to invest decreases. The significance level ($p<0.01$) indicates that this is a statistically robust finding. Marginal effect of -0.003 implies that for each additional year of age, the level of investment decreases by 0.003 units on the scale used in the study. This marginal effect quantifies the change in the expected level of investment associated with a one-unit change in age. The implication is that older farmers may be less likely to invest due to factors such as approaching retirement, aversion to change, or satisfaction with the status quo. This could have implications for the transfer of knowledge to younger farmers and the adoption of new technologies or practices in the industry. Awoyemi (2011) obtained a negative relationship between age and level of investment.

The coefficient of sex was positive and significantly ($p<0.01$) affect the propensity to invest. The marginal effect of sex on the level of investment was 0.269. The positive coefficient for sex indicates that being of a particular sex (usually coded as male = 1, female = 0 in models) is associated with a higher propensity to invest in respect to male catfish farmers. The marginal effect of 0.269 suggests that the sex associated with the value of 1 (likely male) has a higher level of investment by 0.269 units compared to the female sex. The Implications is gender-related differences in access to resources, risk-taking behavior, or opportunities that influence investment decisions.

Accordingly, as expected, the coefficient of years of education was positively and significantly ($p<0.01$) related to the likelihood that the investor chooses to proceed with the investment. The marginal effect of education level of the sample investor on the level of investment was 0.034 and education increased the probability of investment. A higher education level among catfish entrepreneurs is positively associated with the likelihood of investing. The statistical significance indicates a strong relationship between education and investment behavior. The marginal effect of 0.034 means that for each additional level of education (however it is measured in the study), the level of investment increases by 0.034 units. Education also increases the probability of making an investment. The implications is that catfish entrepreneurs may have better access to information, be more aware of the benefits of investment, or be more capable of implementing sophisticated farming techniques. This finding is in agreement with the study of Uvaneswaran and Wollo (2019). This suggests that increasing educational opportunities for farmers could lead to higher levels of investment in the industry.

The coefficient of years of experience was positively and significantly ($p<0.01$) related to the likelihood that the investor chooses to proceed with the investment. The marginal effect of experience of the sample investor on the level of investment was 0.052. The positive coefficient for experience indicates that as the experience of the sample investor increases, the likelihood of proceeding with the investment also increases. The significance level ($p<0.01$) suggests a strong statistical relationship. The marginal effect of 0.052 implies that each additional unit of experience, the level of investment increases by 0.052 units. Uvaneswaran and Wollo (2019) noted that experienced farmers are more likely to invest and may do so at a higher level. The implications is that experienced farmers may have a better understanding of the industry, improved risk assessment skills, and more confidence in making investment decisions.

The coefficient of membership of cooperative society was positive and significantly ($p<0.01$) affect the propensity to invest. The marginal effect of cooperative on the level of investment was -2.111. The positive coefficient for cooperative suggests that entrepreneurs who are part of a cooperative are more likely to invest. The significance level ($p<0.01$) indicates a robust relationship. The implications is that catfish entrepreneurs who were part of a cooperative may provide access to shared resources, collective decision-making, or support networks that encourage investment.

However, the negative marginal is not in line with *a prior* expectation. In the study undertaken by Kareem *et al.* (2013), they noted that there is a positive interaction between cooperative membership and level of investment.

The coefficient of extension visit was positive and significantly ($p<0.05$) affect the propensity to invest. The marginal effect of extension on the level of investment was -4.65e06. The positive coefficient for extension visits suggest that entrepreneurs who receive extension services are more likely to invest. The significance level ($p<0.01$) indicates a strong relationship. The extremely large negative marginal effect here is unusual. Extension services can provide valuable information, training, and technical support to entrepreneurs, which can positively influence their investment decisions. This agrees with the findings of Aphunu and Nwabueze (2013) that showed that farmers who had contact with extension agent will investment more in production.

The coefficient of income was positive and significantly ($p<0.01$) affect the propensity to invest. The marginal effect of income on the level of investment was -1.163. The positive coefficient for income indicates that higher income is associated with a greater propensity to invest. The significance level ($p<0.01$) suggests a strong relationship. The marginal effect of-1.163 means that for each unit increase in income, the level of investment decreases by 1.163 units. The implication is that the higher income level may provide entrepreneurs with the financial capacity to invest, expand their operations, or take on new ventures. The volume of investment has been found to depend on income, cost of procuring investible fund and entrepreneurs' expectations on the trend of the industry in future (Shitu, 2012).

4. CONCLUSION AND RECOMMENDATIONS

Based on the results, it could be concluded that the major operating cost is the cost of feed and the major investments by catfish entrepreneurs were on land, borehole, pond expansion, generator and pumping machine. The significant determinants of investment in catfish business were age, sex, education, experience, cooperative, extension visit and income. It was recommended that since feed cost constitute a major operating cost in production, there is the need to formulate feed locally in order to reduce costs associated with the business as this would enhance commercial catfish production in the study area and Nigeria in general. Variables such as age, sex, education, experience, cooperative, extension visit and income should be taken into consideration in policy formulation.

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