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Investigation of the Personal, Social and Economic Factors Influencing Catfish Farmers Utility in Choosing Pond Types: Implications for Profitability

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ABSTRACT

The use of wrong pond types in fish farms has affected profit and this kind of widespread impression could make people quit fish farming if it is not addressed. In this study, investigation of the contributing factors of farmers choice of pond types and profitability in Delta State Nigeria were examined. A multi-stage sampling method was used to carefully choose 180 fish farmers. Data were collected from June to July 2019 using structured questionnaire. The collected data were analyzed by using descriptive statistics, multinomial logit model, regression model and one way Anova. The findings showed that majority of respondents were males and were married. The mean age was 44years with household of 5 people. High proportion of the respondents had secondary education with 9 years' experience in fish farming. The mean pond size was 148.44m². Majority of them employed earthen ponds in their fishing business. The major reasons for pond type selection were land availability and scale of production. The result further shows that farmers choice of pond types was influenced by cost of feed, labor cost, pond size, output, stocking density and cost of pond construction. The profit of catfish operators has been positively influenced by education of the respondent, experience of the respondent, stocking capacity, pond size and pond types of the respondent. The average profit realized from earthen pond was ₦61092.55 while average profit of concrete pond and tarpaulin pond operators are ₦38394.68 and ₦29753.19 respectively showing that earthen ponds are more profitable than concrete and tarpaulin ponds. Further results of Anova revealed that at 5% level of probability, there was statistically significant profit difference between the different pond types as a whole. There is need to enhance credit accessibility and to subsidize improved production inputs for effective utilization of pond types.

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INTRODUCTION

Nigeria has the opportunity to develop an energy-efficient economy that provides the population with rich natural resources to meet their basic needs. This incredibly well-managed resource base will sustain a vibrant farming industry capable of providing raw materials for industrialization, generating income for the growing population (Nnamocha and Eke 2015). In many parts of the world, fish has played a key role for human diet over the centuries. The uncontrolled practice of artisanal fishing activities continue to increase indiscriminately for fish catches with the use of heavy fishing engines and equipment leading to decrease in wild stocks and this scenario led to importation of fish and fisheries products to meet the demand and supply gap.

Statistical survey has revealed that demand exceeds supply in fish production implying that the domestic production is very low. The condition has caused a widening demand-supply gap which has led to huge import of fish to augment local demand. Nigeria's fish import increased from 246,850 tons in 2000 to 2,027,797 tons in 2011, resulting to mean import of 738,308.69 tons between 2000 and 2012 (FAO, 2014). Nigeria is the biggest importer of fish in the developing world with 2.03 billion US dollars in 2011 (FAO, 2016).

Fish farming was suggested by Carballo et al. (2008) to ameliorate the short fall and sustain the fish production sector. Nigeria's fish and fish products market is the biggest in Africa. Fish farming is the practice in a controlled water system to rear, grow and harvest fish. Fish fanning has turn out to be imperative for food security and eradication of malnutrition especially among infants (Awotide, 2012). Fish, no doubt has substantial nutritional, social and economic importance. Fish occupies a distinctive position because it is the cheapest source of animal protein consumed by average Nigerians which account for 50% of the total animal protein intake (Cai et al 2017). As in most parts of Africa, the mostly cultured species of fish in Nigeria include cat fish (*Clarias gariepinus*), the imported tilapia and carp (*Clarias lazera* and heterobrachus spp) as they accounted for 75.5 % of total production of aquaculture in 2014 (FAO, 2016).

Catfish, being a popular fresh fish in Nigeria is thereby given much attention for filling the demand gap given its prolificacy and fast growth potential. Clarias's high resistance to disease, relatively cheap cost of' production and omnivorous mode of feeding has made it a very easy source of' income with high yield of return. . Given the present development, catfish farming still clutches the paramount potentials to promptly enhance domestic fish production towards self-sufficiency (Inoni, 2007).

Ukeje (2002) observed the principal constraints to the growth of the Nigerian fishery sub-sector as that of structural and technological changes which have retarded substantial growth in the sub-sector for over the years. The preference of farmers to culture catfish may be due to their better growth performance and survival (Dunham and Elaswad 2018), and a higher market value which is 2-3 times the tilapia value (Olagunju et. al., 2007). Despite the attractiveness of catfish farming in Nigeria, it is still at the infant phase when compared to the large market potentials for its production and marketing (Nwiro, 2012). However, the capability of catfish farming to reach optimal level has been on the decline in the last three decades.

In recent times, Nigeria has observed an exceptional attention by industrialists in fish farming. Fish farming is a foremost constituent of the agricultural production system in Delta State due to copious land and water resources availability for fish production. The dominant hydrographic environment made fish farming a blossoming agricultural business investment for smallholder fish farmers in the State and notwithstanding the potential capability to produce enough catfish for local consumption as well export abroad, the situation has not significantly improved. Fish importation is yet to be greatly reduced in Nigeria. What then are the factors influencing choice of pond types at the farmers level militating against their profitability?

Although various research studies have been undertaken Inoni et al (2017) studied influencing factors of catfish production in Delta State. Vihi et al (2015) also studied catfish production in Bayelsa State. Oyinbo et al (2013) studied technical efficiency of catfish farming in Lagos State and similarly Ologbon et al (2013) studied profitability and efficiency of concrete based catfish farming in Ogun State and Esu et al (2009) examined costs and revenues from fish production in Akwa Ibom State using earthen ponds but no known research into factors affecting the selection of pond types and profitability in catfish production was available.

The use of wrong pond types has affected their profit and they concluded that the business is not profitable. This kind of widespread impression could make people quit fish farming if it is not addressed. Now the purpose of this study is therefore to address the aforementioned problem that tend to bedevil the fish farming business. This presents an important limitation since farmers responses to catfish production and their choice of pond types are affected by a swarm of socioeconomic factors which invariably reduces their profit. A knowledge of these socioeconomic factors will assist policy makers to strengthen production efforts through investing on the factors. The individuals that will benefit include all stakeholders in catfish fishing sub-sector of the economy. This research presented missing data for policy making which was deficient before now. The broad objective of the study is to determine the factors influencing catfish farmers choice of pond types on profitability in Delta State Nigeria.

MATERIALS and METHODS

This study covered Delta Central Agricultural zone of Delta State, Nigeria. Multi-stage sampling procedure was applied in the study. Seven local government areas were randomly selected from the ten local government areas that constitute the study area due to high level of cat fish farming. Three villages were accidentally selected from each of the LGAs. Nine fish farmers were then proportionally and randomly selected from the list of duly registered contact fish farmers with the Ministry of Agriculture and Natural Resources. But due to non-response and inadequate information, nine copies of the questionnaire were discarded, and data from 180 respondents were used for the analysis. This study was approved by the ethics committee of Faculty of Agriculture, Delta State University (Approval No: 2010/052).

Primary data were collected from June to July 2019 with questionnaire. The collected data were treated with descriptive statistics and inferential statistics.

The multinomial logit regression model was used following Hassan and Nhemachena (2008) to express the probability of a farmer being in a particular category. The farmers were categorized into four based on the type of pond type chosen. MLM requires basic normality assumptions and continuous data, including independent or dependent variables. The advantage of MLM is that it permits the analysis of decisions across more than two categories, allowing the determination of choice probabilities for different categories (Woolddridge, 2002 cited in Deressa et al., 2009). Tabanick et al (2001) argued that a number of advantages are provided by the technique of MLM, i) it is robust in violations of multivariate normality and equal variance and covariance matrices between classes, ii) diagnostic statistics which can be readily understood. iii) MLM primarily does not accept a linear relationship between dependent and independent variables, iv) independent variables do not need an interval, (v) independent variables do not actually have to be unbounded and lastly (v) the errors usually distributed are not assumed (Chan 2005; Jemal and al 2011).

The probability of different outcomes of a categorically distributed dependent variable can be estimated in this model based on a set of independent variables. If the dependent variable involved is nominal and has more than two categories, the model can be used.

The multinomial logit model assumes that the data is case-specific: in other words, each variable has a fixed value for each event, and it is never possible to accurately predict the dependent variable from the independent variables.

Generalized Multinomial Model is given as;

$$Pij = \frac{exp^{\beta jXi}}{1+\Sigma\, j\text{k}=jexp^{\beta jXi}} \qquad \text{for j =1, 2..........n .... (1)}$$

The probability of being in the reference group is given a

$$Pi0 = \frac{exp^{\beta jXi}}{1+\Sigma\, j\text{k}=jexp^{\beta jXi}} \qquad \text{for j =0 .... (2)}$$

Where: Pij = is the likelihood that the farmer selects j from the dependent variables ' options. X_1= an explanatory vector; and β = the unknown parameter to be estimated:. P, is the chance to be in the reference group = 0. Practically, the reference coefficients are set to zero when evaluating the model. The explanation for this is that the probabilities for all choices must be summed up to unity (Greene 1993).The natural logarithm is the odd ratio of equations (1) and (2) give the estimating equation (Greene 1993) as:

$$In \frac{Pij}{PI0} = \beta jXi \text{ .... (3)}$$

This refers to the relative probability of each of the other groups to the probability of the reference group. The estimated coefficients for each choice thus reflect Xi's impact on farmers ' probability of choosing that alternative in relation to the reference group. The explicit form of the functions is given as follows:

$Y= b_o + b_1COFEED + b_2COLBR + b_3PONDSZ + b4PERSAV + b5OUTPUT + b_6STODEN + b_7COPDC + e$

Where:

Y= pond types or categories, which included: (i) use of plastic tanks (ii) use of earthen ponds (iii) use of concrete ponds and (iv) tarpaulin ponds
COFEED= cost of feed (₦)
COLBR=cost of labour (₦)
PONDSZ=pond size (m^2)
OUTPUT=output of fish (kg)
PERSAV=personal savings (₦)
STODEN=stocking density (number)
COPDC= cost of pond construction (₦)

Model for determinants of profits of catfish farmers

In order to analyse the factors influencing profit of catfish farmers the following econometric model was used. This model is presented as follows:

$Yi= \beta 0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ei$

Where,
βi = coefficient of associated variable
β0 = constant
Yi= Profit of catfish farmers (₦)
X_1 = educational level of respondents
X_2 = experience of the respondents
X_3 = stocking capacity
X_4 = Age of catfish farmers
X_5= pond size (m^2)
X_6= pond types
b_1–b_6 = coefficients of explanatory variables
e= error term

For further analysis, analyses of variance (ANOVA) with post hoc test for multiple comparison were used to observe the profitability of the pond types used and to know whether there is significant difference in the profit of those catfish farmers or not.

Budgetary technique is a very popular method applied for analyzing the cost and return. It was used to determine the profitability of catfish operators in the study area.

Profit (π) = TR –TC
Where:
Π = profit
TR =Total revenue
TC= Total cost (total variable cost + total fixed cost)

RESULTS and DISCUSSIONS

Socioeconomic characteristics of fish farmers are presented in Table 1. The result shows that most fish farmers (56.7%) were males. This shows the dominance of men in fish farming industry in the study area, which can be as a result of risk involved in venturing into the business. This indicates that males are mostly risk-takers and also have a higher chance of getting land than the females. The findings supports Aphunu and Agwu (2014) that catfish production is dominated by males in Delta State. Majority of fish farmers (61.1%) were married. Thus it can be inferred that marriage in a way provides access to the use of family labor in fish farming. This is in agreement with

Adebayo (2012) that family size can serve as source of free and cheap labour in Oyo State. This is indicative of the fact that marriage is highly cherished among the respondents in the study area (Asa et al, 2012). The mean age fish farmers was 44 years. This suggests that most of the farmers were within their productive ages and could contribute meaningfully to catfish production. This is in agreement with Omobepade et al (2015) report that catfish farmers in Ekiti State had a mean age of 50-69 years. The mean household size was 5 persons indicating that they had moderate household sizes. Result suggest that more family labour would be available and provided for catfish production due to the abundance of household members. The result is congruent with Osondu and Ijioma (2014) findings that average household size was 5 persons among the fish farmers in Abia State. Most of them (72.2%) had more than primary education. This agrees with the view of Adebayo and Adeyemi (2000) that education is important to understand and evaluate information on new techniques of fish farming. This result also support the findings of Osondu et al (2014).

The mean experience of catfish farmers in the business was 9 years. This means that most of them had acquired the necessary skills to operate their farms efficiently. Experience has taught most of the farmers on the various pond types that can be used in the face of foreseen production risks on output. This has really helped farmers in the study area to switch from one pond type to another based on the expected returns. The result agrees with Okpeze (2007) that the level of farming experience one has in a particular occupation could contribute meaningfully to his/her level of managerial ability and quality of decision in farm operations. This supports Williams et al (2012) that the ability to manage fish pond efficiently depends on the years of experience.

Table 1. Socioeconomic characteristics of catfish farmers (N= 180)

Variable	Frequency	Percentage %
Gender		
Male	102	56.7
Female	78	43.3
Marital status		
Married	110	61.1
Single	46	25.6
Widower	18	10.0
Divorced	6	3.3
Age (years) Average: 44 years		
21-30	7	3.9
31-40	49	27.2
41-50	84	46.7
51-60	32	17.2
Above 60	9	5.0
Household size Average: 5 persons		
1-5 persons	108	60.0
6-10	58	32.2
Above 10	14	7.8
Educational level		
No formal education	12	6.7
Primary education	38	21.1
Secondary education	74	41.1
Tertiary education	56	31.1
Fishing experience Average: 9 years		
Less than 5 years	25	13.9
5-10 years	104	57.8
Above 10 years	51	28.3

Pond Size of Respondents

Majority(58.9%) of fish farmers had land area ranging between 100-200m^2 for pond construction, 25.0% had pond size of 201-300m^2 while 13.9% had pond size less than 100m^2. only 2.2% of the respondents had above 300m^2 in the study area. . The mean pond size was 148.44m^2. This agrees with Inoni et al (2017) that Land area available for pond construction is a very cardinal factor for the involvement in catfish farming with an average of 104.35 m^2.

Different pond types used by the cat fish farmers

Table 3 portrays different pond types used by the farmers in the study area. The result discloses that 37.8% of the cat fish farmers employed earthen ponds in their farms. This was followed closely by 28.3% who preferred concrete ponds for cat fish farming. However, 21.7% of the respondents selected tarpaulin ponds while 12.2% of cat fish farmers used plastic tanks respectively. This is in line with Asa et al (2012) findings that high proportion of catfish farmers in the

Niger Delta area used earthen ponds for catfish production. This result contradicts the findings of Olaoye, et al (2014) that fish farmers prefer more of concrete tanks as against earthen ponds in Oyo State.

Table 2. Pond Size of Respondents

Pond size (m²) Average: 148.44m²	Frequency	Percentage %
Less than 100	25	13.9
100-200	106	58.9
201-300	45	25.0
301-400	4	2.2

Table 3. Different pond types used by the cat fish farmers

Pond types	Frequency	Percentage %
Earthen pond	68	37.8
Concrete pond	51	28.3
Tarpaulin pond	39	21.7
Plastic pond	22	12.2

Reasons for the choice of pond types

Land availability was the major (36.1%) reason for choice of pond types as presented (Table 4). Scale of production (30.6%) is another reason for engagement in preferred pond type. The purpose of raising fish stimulate the choice of pond type to use (11.7%). About 9.4%, 7.8% and 4.4% were of the view that topography of land, convenience and water resources greatly contribute to making choice on a given pond type to enhance their production level.

Table 4. Reasons for the choice of pond types

Selection reasons	Frequency	Percentage %
Land availability	65	36.1
Convenience	14	7.8
Purpose of raising fish	21	11.7
Water resources	8	4.4
Scale of production	55	30.6
Topography	17	9.4

Summary of the descriptive statistics of the variables used in the multinomial logistic regression model

Table 5 below presents some of the descriptive statistics of the variables included in the model. It specifically focuses on the profit, value of feed cost, cost of labour, pond size, personal savings, output, stocking density and cost of pond construction. The result showed that the farmers realized a mean profit of ₦241705.56. The mean feed cost of the respondents was ₦51,880.83. The average labor cost was ₦50,875.22 with a minimum N10,600 and a maximum of ₦142,000. The pond size of respondents ranged between 38m² and 400m² with a mean of 148.44m². The result also showed that the respondents personal savings ranged between ₦10,000 and ₦500,000 with a mean of ₦83,309. The average value of output generated by the households amounted to 5197.09kg. Mean stocking density was 4793.44 fingerlings with a minimum and maximum of 1000 and 10,000 respectively. The average cost of pond construction was ₦23,518.33 with a minimum of ₦8000 and a maximum of ₦94500.

Table 5. Summary of the descriptive statistics of the variables used in the multinomial logistic regression model

Variable	Definition of variables	Mean	Std. Dev	Min	Max
COFEED	cost of feed (₦)	51880.83	19625.22	5600	91900
COLBR	cost of labor (₦)	50875.22	20496.90	10600	142000
PONDSZ	pond size (m²)	148.44	61.34	38	400
PERSAV	personal savings (₦)	83309.17	61878.54	10000	500000
OUTPUT	output of fish (kg)	5197.09	2214.32	500	12000
STODEN	stocking density(number)	4793.44	2461.95	1000	10000
COPDC	cost of pond construction (₦)	23518.33	15781.46	8000	94500

1USD=₦360 local currency

Factors Influencing the Choice of pond types

Table 6 shows the study of the impact of socio-economic characteristics on the choice of different types of ponds. The pond types options set in the multinomial logit regression model include plastic tanks, earthen ponds, concrete ponds and tarpaulin ponds. A standardized category, usually the base category, was applied for the estimate of the multinomial logit regression model. In this analysis, the primary category was (plastic tanks). The likelihood ratio statistics of 70.164 and a chi-square value of 285.86 which was highly significant at 1% probability level. This indicates the strong explanatory power of the model.

Cost of feed

The coefficient of cost of feed had negative and significant relationship with choice of pond types at 5% level of probability. The implication is that an increase in cost of feed would most likely lead to a unit increase in the decision of farmer to make choice on the pond types such as earthen ponds, concrete ponds and tarpaulin ponds. This is aligned with earlier studies (Okwu and Acheneje 2011) that the largest proportion of fish farmers ' production costs is the cost of fish seeds and feeds.

Cost of labor

The coefficient of cost of labour was negative and had significant effect on choice of pond types at 5%

probability level. This infers that a unit increase in cost of labour incurred by the farmer could results in a decrease in the probability of using concrete ponds and had direct relationship with choice of earthen ponds and tarpaulin ponds to improve fish sufficiency. This means that a drop in labor costs would increase farmers ' option of concrete ponds. This is in agreement with Adebayo (2012) that family size can serve as source of free and cheap labor in Oyo State.

Pond size

The coefficient on pond size is significant and positively correlated with the likelihood of choosing earthen ponds for fish farming. A unit rise in land area could results in an increase in the likelihood of choosing earthen ponds but the coefficient of land area was significant but bore a negative sign with concrete ponds and tarpaulin ponds. This means that a unit decrease in land area would most likely lead to a unit increase in the choice of concrete ponds and tarpaulin ponds. Indeed, large-scale farmers are more likely to adapt because they have more capital and resources. Therefore, they can easily invest in concrete ponds and tarpaulin ponds, which demand high investment costs.

Personal savings

Personal savings also had significant positive relationship with earthen tarpaulin ponds. A higher level of personal savings increases the chance of choosing tarpaulin ponds. This finding was confirmed by the findings of Omobepade et al (2015) that fish farmers sourced finances for fish farming activities through their personal savings. The result is also in line with Ozor and Cynthia (2009) that with resource limitations, farmers fail to meet transaction costs necessary to adopt pond types and at times farmers could not make beneficial use of the available information they might have. So those farmers who have credit will be opportune to choose the one that he/she has comparative advantage.

Output of fish

The fish output had a significant and positive relationship with concrete ponds and tarpaulin ponds. This means that a unit increase would most likely increase the choice of pond types. The individual farmer, in the quest for increased output will always seek for the best alternative even when they are costly to apply.

Stocking density

Stocking density was statistically significant at 5% and positively related to choice of pond types. The result showed that an upsurge in stocking density will lead to more likely preferences for earthen ponds and concrete ponds as against plastic tanks which was the base outcome. This can be due to the farmers ' purchasing power.

Pond construction cost

The variable cost of pond construction had negative and significant relationship with choice of pond types at 5% and 10% level of probability. The implication is that an increase in cost of pond construction would most likely lead to a unit increase in the decision of farmer to make choice on the pond types such as earthen ponds, concrete ponds and tarpaulin ponds because this scenario will affect the income generated.

Table 6. Result of Multinomial Logistic Regression

Variable	Earthen ponds	Concrete ponds	Tarpaulin ponds
Cost of feed	-0.0006(3.02)**	-0.552(2.85)**	-0.225(2.34)**
Cost of labour	-0.0002(1.54)	-0.0004(2.13)**	-0.0001(0.80)
Pond size (m^2)	0.814(2.78)**	-0.027(2.42)**	-0.744(3.68)***
Personal saving	0.046(1.06)	0.005(1.49)	0.568(2.17)**
Output	0.002(0.86)	0.001(2.98)**	0.534(3.72)***
Stocking density	0.586(3.29)**	0.009(3.12)**	0.004(0.73)
Pond construction (₦)	-0.037(1.92)*	-0.738(2.12)**	-0.043(2.70)**
Constant	21.621(3.63)***	22.657(3.81)***	138.556(34.35)***

Numbers in parenthesis are the t-values *, ** and *** implies significant at 10%, 5% and 1% respectively.

Summary of the descriptive statistics of the variables used in the regression model

The summary statistics of the variables used for the regression model is shown in the Table 7. It specifically focuses on the educational level of the respondents, experience of the respondents, age of respondents, pond types, stocking density and pond size. The mean educational level of the respondents was about 3 and it ranged between 1 and 4, an indication that the majority of respondents had at least secondary education. The result reveals that the fish farmers had a mean experience of 9 years. Mean stocking density was 4793.44 fingerlings. The age of the respondents ranged between 25 and 65 years with a mean of 44 years. The pond size of respondent ranged between 38m^2 and 400m^2 with a mean of 148.44m^2. The pond types of respondent ranged between earthen ponds and plastic tanks with a mean of earthen ponds mostly used.

Determinants of profitability

The results of the linear regression analysis of determinants' of profitability are presented in Table 8. The coefficient of determination, R-Square, is 0.5641 which implies that explanatory variables accounted for 56.4% of the variation in the dependent variable (profitability). The Adjusted R-Square of 0.5490 is reasonably close to the value of the R-Square (0.5641), implying that the correlation between independent variables included in the regression and the dependent variable Y was quite good. The F-value is 37.32, and is statistically significant ($p<0.01$). This is an indication that the combined effect of independent variables on the dependent variable is very significant. The results of the regression analysis in Table 8 showed that 5 variables had a significant influence on the profitability of the respondents. These variables were education, experience, stocking capacity and pond size. The result discovered that education of respondents had a positive and statistically significant influence (β =44537.43, $p<0.05$) on profitability with all other factors held constant. The implication is that a unit increase in educational level of the respondents will correspond to the same increase in profitability.

Table 7. Summary of the descriptive statistics of the variables used in the regression model

Variable	definition of variables	Mean	Std. Dev
Y	Profit from fish farming (₦)	*241705.56*	*237692.39*
X_1	Education level (years)	3.29	0.82
X_2	Experience in fish farming (years)	9.31	2.38
X_3	Stocking capacity (number)	4793.44	2461.95
X_4	Age of farmer(years)	44	8.85
X_5	Pond size(m^2)	148.44	61.34
X_6	Pond types (categorical)	2.16	1.12

The coefficient of experience had a positive and statistically significant effect on profitability (β = 23884.34, $p<0.05$) with all other factors held constant. This implies that a unit increase in the years of catfish farming by the respondents would result in a 23884.34 units increase in their profitability, all other factors held constant.

The coefficient of stocking capacity of the respondents had a positive and statistically significant effect on profitability (β = 54.97, $p<0.01$) with all other factors held constant. The results revealed that a unit increase in the number of fish stock will increase profitability by 54.97 units with all other factors held constant.

The results further shows that pond size used by respondents also had a positive and statistically significant effect on their profitability (β = 545.04, $p<0.05$) with all other factors held constant. The results implies that a unit increase in the pond size will increase profitability by 545.04 units with all other factors held constant.

The coefficient of pond types of the respondents had a positive and statistically significant effect on profitability (β = 40425.42, $p<0.05$) with all other factors held constant. The results revealed that a unit increase in the choice of appropriate pond type for use will increase profitability by 40425.42 units with all other factors held constant.

Table 8: Regression result for estimation of profitability

Variables	Coefficients	Standard error	t-test	p-value
Constant	119777.6	99620.68	1.20	0.231
Education	44537.43	17116.89	2.60	0.010**
Experience	23884.34	6985.97	3.42	0.001**
Stocking capacity	54.97	7.07	7.77	.000***
Age of farmer	653.27	1520.33	0.43	0.668
Pond size	545.04	228.01	2.39	0.018**
Pond types	40425.42	13589.94	2.97	0.003**

Dependent variable: Profit, Adj. R^2 = 0.5490, F = 37.32, ***Significant at 1%. **Significant at 5%

Profit per Pond Types of Respondents

In comparison of the profit of various pond types it was observed that the average profit realized from earthen pond was ₦61092.55 while average profit of concrete pond and tarpaulin pond operators are ₦38394.68 and ₦29753.19 respectively. The profit realized from plastic was ₦21712.82. The result indicate that the highest profit earned by the operators of catfish was earthen pond (Table 9). To check statistically whether profit is same in the different pond types or not, one way ANOVA test was used. The results showed that at 5% significance level, there was statistically significant difference in profit level between the different pond types as determined which led to a post-hoc test in other to select the most profitable pond. Value within the same column with similar letter(s) are not significantly different at 5% level of probability. The result of the LSD post-hoc showed that the profits are significantly different from each other, hence the different alphabet a, b, c, d. are presented in superscript. Hence, the null hypothesis was rejected and the alternate hypothesis was accepted that profit is different in the different pond types in the study area

Table 9: Profit per Pond Types

Operators	Total	Mean	Min	Maximum
Earthen pond	2871350	61092.55[a]	31000.00	103500.00
Concrete pond	1804550	38394.68[b]	20650.00	76000.00
Tarpaulin pond	1398400	29753.19[c]	20000.00	87000.00
Plastic pond	846800	21712.82[d]	20000.00	53000.00

1USD=₦360 local currency significant at ($p < 0.05$)

CONCLUSION

The result shows that farmers' choice of pond types was influenced by cost of feed, labor cost, pond size, output, stocking density and cost of pond construction. The profit of catfish operators has been positively influenced by education of the respondent, experience of the respondent, stocking capacity, pond size and pond types of the respondent. The most common pond types in the study area were earthen ponds, concrete ponds, tarpaulin ponds and plastic ponds. The reasons adduced for the choice of pond types was due to land availability and scale of production. The findings further indicates that earthen ponds operators made more profit. It was recommended that policy makers should enlighten the fish farmers on the potentials embedded in the different alternatives of pond types available to sustain them in the farm business. There is also need to enhance credit accessibility and to subsidize improved production inputs for effective utilization of pond types. Finally, in order to protect respondents against the possibility of incorrect pond types deciding to influence their profit level, government policies and investment plans need to concentrate on many of the factors underlying this.

Statement of Conflict of Interest

Author has declared no conflict of interest.

Author's Contributions

The contribution of the authors is equal.

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