

Full Length Research Paper

# A study of profitability and production determinants of fish farming in Umuahia Capital Territory of Abia State, Nigeria

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This study was conducted in Umuahia Capital Territory, of Abia state, Nigeria. Simple random sampling technique was used to select 72 respondents. Data were collected for a year from a panel group of fish farmers using semi structured questionnaire and interview sessions. Data were analyzed using descriptive statistics, net return analysis and multiple regression models. Results showed that mean age and mean farming experience of the fish farmers was 44 years and 8 years respectively, 63.9% of the respondents had no access to credit, 73.6% of them were males, 100.0% of them had acquired varied levels of formal education, 77.8% of them were married, 50.0% of the fish farmers were in civil service, 87.5% used purchased feed and 47.2% of them stocked their ponds with between 201 and 300 fingerlings per 10 m<sup>2</sup>. Annual gross margin and net return from fish production was ₦ 265,760.11 and ₦ 225, 791.98 respectively. Fish farming had a BCR of 2.20 and RORCI of 90%. Farming experience, access to credit, farm income and pond size were significant determinants of production level at 1, 5, 10 and 10% critical levels respectively. High cost of feed and inadequate storage facilities were two main problems constraining fish farmers. It is recommended that unemployed youths should be trained in fish farming methods and given soft loans to engage in fish farming business since it had a BCR of 2.20.

**Key words:** Profitability, output level, fish farming.

## INTRODUCTION

Due to the steady rise in world's population, considerable attention is being given to enhance the biological value of different food products and increase protein resource. Protein for human consumption comes from two main sources, namely: plants and animals. Plant proteins are deficient in certain essential amino acids notably methionine, tryptophan and lysine which are essential for

healthy growth while, animal proteins are rich in these amino acids and are therefore described as first class or good quality protein (Adeniyi et al., 2012; Dalhatu and Ala, 2010).

In recent years, increased knowledge and awareness of human nutritional requirements for healthy growth have focused increasing attention on the unique roles of fish farming in human development (CBN, 2004). Fish has been recognized to constitute 55% of animal protein intake of an average Nigerian (Adekoya and Miller, 2004). Apart from utilization as food, fish is used in

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medicinal preparation (fish oils), in fashion industry, recreation (fishing sport), fish meals, ornamental and decorations (Bolorunduro, 2004). The economic significance of fish in the life of every Nigerian family is obvious when it is considered that it is widely used in preparation of household meals. As a result considerable attention is being shifted towards fish farming as a means of increasing fish availability at affordable prices. Fish yields and the area under fish farming are increasing and fish farming is being generally accepted as a branch of agriculture.

Though fish farming has grown strongly in most regions of the world where the potential exists, it has not done so in Sub-Saharan Africa. In spite of various efforts since the 1950s, returns on government and international aquaculture investments appeared to be insignificant (FAO, 2004) with less than 5% of the suitable land area being used (Kapetsky, 2004). Sub-Saharan Africa contribution to world aquaculture production is less than 1% (Hecht 2006). Nigeria's local fish production has been below demand with imports accounting for about US\$48.8m in 2002 (CBN, 2004). According to Miller and Atanda (2004), Nigeria is one of the largest fish importers, importing about 700,000 tonnes of fish annually to augment domestic production of 700,000 tonnes, which constitutes 50% of the total demand. Hence, awareness on the potential of fish farming to contribute to domestic fish production has continued to increase in the country. Fish species which are commonly cultured include *Tilapia spp*, *Heterobranchus bodorsalis*, *Clarias gariepinus*, *Mugie spp*, *Chrysichthys nigrodigitatus*, *Heterotis niloticus*, *Ophiocephalus* obscure, *Cyprinus carpio* and *Megalo spp*. Fish culture is done in enclosures such as tanks, concrete and earthen ponds.

The development of the fish industry will increase local production of fish and save much of the foreign exchange being used for fish importation. Specifically, it has a special role of ensuring food security, alleviating poverty and provision of animal protein. This led to the idea of analyzing the profitability and factors influencing production of fishes in the study area. Specifically the study sought to: i) describe socio-economic profiles of the fish farmers; ii) estimate annual production costs, returns and net farm income of fish farmers in the study area; iii) determine factors that affect the production of fish farmers and iv) identify problems encountered by fish farmers in Umuahia Capital Territory of Abia state.

## METHODOLOGY

### Study area

The study was carried out in Umuahia Capital Territory of Abia State. Umuahia is the capital of Abia state located in the South East geo-political zone of Nigeria. The choice

of the study area is informed by the notable position of the area in small scale arable crop production. Umuahia capital territory which comprise Umuahia North and Umuahia South has a population of 426,803 (NPC, 2006) with a land mass of 423462 square kilometer. Umuahia capital territory is bounded in the North by Isiukwato L.G.A, South by Isialangwa North L.G.A and to the east by Ikwuano L.G.A and to the west by Obowo L.G.A in Imo state.

Umuahia Capital Territory has five notable clans, which are Ibeku, Ohuhu, Olokoru, Umuokpara and Ubakala, 84 autonomous communities and 33 political wards (Unleeds and Unsleeds, 2007). It lays between latitudes  $5^{\circ}30^1$  and  $5^{\circ}40^1$  North of equator and longitudes  $7^{\circ}25^1$  and  $7^{\circ}32^1$  East of the Greenwich meridian.

### Sampling techniques

The study adopted a simple random sampling technique based on a list of fish farmers that was collected from Abia State Ministry of Agriculture and Natural Resource (MANR) Aba. The information was used to select seventy two functional fish farms at random from eighty six fish farms giving all fish farms in the study area equal opportunity of being selected. From each fish farm one respondent (manager or owner) of the farm was selected. This gave a sample size of seventy two respondents for the study.

### Methods of data collection

Primary data was used for this research study. Primary data was collected from a panel group for a period of one year using a semi structured questionnaire as well as oral interview.

### Data analysis

Analysis of data collected was done quantitatively using some analytical techniques. Objectives (i) and (iv) were analyzed using descriptive statistical tools such as frequency distribution tables, mean and percentages. Objective (ii) was analyzed using net return analysis and objective (iii) was analyzed using Ordinary Least Square (OLS) multiple regression model.

### Model specification

The net farm income was estimated using the following model.

$$NFI = \sum Y_i Q_i - \sum P_x i X_j - \sum ZK \quad (1)$$

Where,

NFI = Net farm income from fish farming (N,,000)  
 $Y_i$  = ith farmer's price of fish (N,,000)  
 $Q_i$  = quantity of fish harvested (N,,000)  
 $P_{xi}$  = Unit purchase price of fish farming variable inputs (N,,000)  
 $X_j$  = Quantity of the jth variable inputs used (Hoes, cutlasses, wheel barrows, ...) used in rice production ( for  $j = 1, 2, 3, \dots, n$ )  
 $Z_k$  = Total cost of the kth fixed input used in fish farming (for  $k = 1, 2, 3, \dots, k$ ) (N,,000)  
 $\Sigma$  = Summation symbol.

The multiple regression model is specified implicitly as:

**For determinants of production among the fish farmers**

$$Y = F(x_1, x_2, x_3, x_4, x_5, x_6, e_i) \tag{2}$$

Where  $Y$  = Output of fish (Kg),  $X_1$  = Fish farming experience (years),  $X_2$  = Gender (male = 1, female = 0),  $X_3$  = Education level (schooling years),  $X_4$  = Access to credit (N),  $X_5$  = Primary occupation (farmer =1, otherwise =0),  $X_6$  = Farm income (N),  $X_7$  = Pond size (number of fishes),  $e_i$  = Stochastic term.

This was tried in four functional forms viz: linear, semi-logarithmic, double logarithmic and linear, exponential forms.

i. Linear function  
 $Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_6x_6 + e_i \tag{4}$

ii. Semi-log function  
 $Y = b_0 + b_1\ln x_1 + b_2\ln x_2 + b_3\ln x_3 + \dots + b_6\ln x_6 + e_i \tag{5}$

iii. Double log function  
 $\ln Y = b_0 + b_1\ln x_1 + b_2\ln x_2 + b_3\ln x_3 + \dots + b_6\ln x_6 + e_i \tag{6}$

iv. Exponential function  
 $\ln Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_6x_6 + e_i \tag{7}$

For Equations (4) to (7)  $b_1$  to  $b_6$  are regression coefficient. The choice of the lead functional form was based on the magnitude of the F-ratio and  $R^2$ , statistical significance of the regression coefficients as well as their conformity to *a priori* expectation.

**RESULT AND DISCUSSION**

**Socio-economic characteristics of fish farmers in Umuahia Capital Territory of Abia State, Nigeria**

The socio-economic profiles of pond fish farmers in the

study area are presented in Table 1. The table showed that 63.9% of the respondents had no access to credit, while 36.1% had access to credit. Low access to credit may constitute impediment to production because according to Adebayo and Adeola (2008) credit when properly allocated enhances output level and promotes standard of living by breaking vicious cycle of poverty of resource poor farmers. Thus, it acts as a catalyst that activates productivity growth and higher income. In terms of age, the table showed that the mean age of the farmers was 44 years. This is an indication that cassava farming is dominated by young people who are active and within the productive age group; this portends a bright future for the industry. However, Irokwe (1999), was of the opinion that fish farming is dominated by matured farmers, who have made some seasonal past savings and are prepared to invest them in capital intensive enterprise such as fish farming. The table also showed that 73.6% of the fish farmers in the study area were males and 26.4% of them were females. This result compares favourably with Njagi et al. (2013) who obtained a similar gender spread for fish farmers in Kenya ( 72.7% males and 27.3% females)In relation to education level the table shows that cumulatively, majority (77.8%) of the sampled population had acquired formal education at the stage of HND, B.Sc and M.Sc levels. A sizeable portion (16.7%) had acquired NCE and OND with only a small portion (5.5%) that acquired secondary education. This showed that all the pond fish farmers in Abia State had one level of formal education or another. Education enhances the acquisition and utilization of information on improved technology by farmers which tend to positively influence productivity (Osondu et al., 2014).

The marital status of the fish farmers is also presented in Table 1. The table shows that majority (77.8%) of the fish farmers were married while the remaining 22.2% were single. According to Nwaru (2003) family stability creates conducive environment for good citizenship training, development of self and entrepreneurship which are very important for efficient use of resources. This result is in tandem with Oputa (2005), who was of the opinion that fishing is a medium of sustaining the family. The table also showed that the mean household size of the fish farmers was 5 persons. This result is in accordance with Irokwe (1999), who emphasized that intensive nature of pond fish farming in Nigeria depends less on the number of households. The mean fish farming experience of respondents was 8 years. The more the number of years an individual have been in a particular business, the more he may have gained practical experience to handle the issues of productivity growth. Oputa (2005) was of the view that fish farmers will count more on experience for increased productivity than on their level of education.

The table further showed that the main source of income to a moderate proportion (50.0%) of the pond fish

**Table 1.** Socio-economic characteristics of fish farmers in Umuahia Capital Territory of Abia State, Nigeria.

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Access to credit</b>		
Yes	26	36.1
No	46	63.9
<b>Age of fish farmers</b>		
20-30	12	16.7
31-40	24	33.3
41-50	22	30.5
51-60	10	13.9
61 and above	4	5.6
Mean= 43.97		
<b>Gender</b>		
Male	53	73.6
Female	19	26.4
<b>Educational level</b>		
Primary school	0	0
Secondary school	4	5.5
OND, NCE	12	16.7
HND, B.Sc, M.Sc, Ph.D	56	77.8
<b>Marital status</b>		
Married	56	77.8
Single	16	22.2
<b>Household size</b>		
1 – 5	46	63.9
6 – 10	26	36.1
Mean = 4.56		
<b>Fish farming experience</b>		
1 – 5	18	25.0
6 – 10	44	61.1
11 – 15	10	13.9
Mean = 8.28		
<b>Primary occupation</b>		
Civil service	36	50.0
Artisan	4	5.56
Trading	6	8.3
Fish farming	10	13.9
Other Agricultural enterprises	16	22.2
<b>Sources of feed</b>		
Purchase from market	63	87.5
Household waste	9	12.5
<b>Stocking density (per 10 m<sup>2</sup>)</b>		
1 – 100	2	2.8

Table 1 Contd.

101 – 200	26	36.1
201 – 300	34	47.2
301 – 400	6	8.3
Above 400	4	5.6
Mean = 276.46		
<b>Contact with extension workers</b>		
Yes	21	29.2
No	51	70.8
<b>Number of ponds</b>		
1 – 3	57	79.2
4 - 6	11	15.3
7 – 9	4	5.5
Total	72	100.0

Source: Field survey, 2014.

farmers was civil service, while other aspects of agriculture (crop and animal enterprises) were the primary occupation of 22.2% of the respondents. Few of the respondents (5.56%) were artisans (fashion designing), 13.9% of the respondents' main source of income was fish farming and 8.3% of the respondents were primarily traders. The civil servants engaged in fish farming business as a secondary occupation to augment their salaries as a stop-gap measure to cushion the irregular payment of their salaries especially in this civilian era.

87.5% used feed purchased from the market and 12.5% used feed got from household waste. This second group minimized cost which could give a higher profit margin. In relation to stocking density, a fair proportion (47.2%) of the fish farmers stocked their ponds with between 201 and 300 fingerlings per 100 m<sup>2</sup>. Another fair proportion (36.1%) of the fish farmers stocked between 101 and 200 fingerlings per 10 m<sup>2</sup>. Few (8.3%) and (5.6%) of the respondents stocked between 301 and 400 fingerlings per 10 m<sup>2</sup> and above 400 fingerlings per 10 m<sup>2</sup> respectively, and 2.8% of the farmers stocked between 1 and 100 fingerlings per 10 m<sup>2</sup>. The average stocking density in the study area was 275 per 10 m<sup>2</sup>. Provided that rate of mortality is low or zero if stocking density is high the tendency of fish farmers to obtain higher productivity increases and vice versa. However, it should be noted that the above assertion holds true if the farm's carrying capacity is not over stretched *ceteris paribus*. The study also revealed poor extension visits to fish farmers who mostly operated on part-time basis. In relation to number of ponds owned by individual farmers the table showed that majority (79.2%) of the fish farmers had between 1 and 3 ponds, a fair percentage (15.3%) had between 4 and 6 fish ponds while few (5.5%) had between 7 and 9 fish ponds. According to Irokwe (1999),

large fish farms are farms with at least six ponds.

#### Cost and return analysis of fish farming in Umuahia Capital Territory of Abia State, Nigeria

Table 2 shows the average annual costs and returns of fish production in Abia State. The table posted annual total revenue of ₦308, 434.50 and total cost of ₦ 82, 642.52. The table also showed that the annual gross margin and net return from fish production in the area was ₦ 265,760.11 and ₦225, 791.98 respectively. The result revealed that cumulatively, fixed cost and variable cost accounted for 69.52% and 30.48% respectively of the total cost of producing fish. Among the variable costs the cost of feed accounted for the largest proportion (27.19%) and (57.34%) of the total cost and variable cost component of fish production. This was followed by cost of procuring fingerlings which accounted for (5.92%) and (19.44%) total cost and variable cost component of fish production. This clearly shows that large amount of money is spent by fish farmers in the area on purchase of feeds and fingerlings. The benefit cost ratio (BCR) of 2.20 showed that a fish farmer who invested ₦ 1 got ₦ 2.20 as revenue or gained ₦ 1.20K on each naira invested. The gross ratio of 0.454 indicated that for every ₦ 1 return there was a 0.149 Kobo expenses made. The rate of return per capital invested (RORCI) was 0.898. It indicates what is earned by the business by capital outlay Awotide and Adejobi (2007). The result revealed that the RORCI of 90% is greater than the prevailing bank lending rate, 22% implying that fish farming in the study area is profitable. If a farmer takes loan from the bank to finance fish farming, he will be 68k better off on every one naira spent after paying back the loan at the prevailing interest

**Table 2.** Average annual costs and returns analysis of pond fish production in Abia State, Nigeria.

Variable	Quantity (Kg/ Manday/)	Cost/unit	Amount N	K	% of total cost
<b>a. Revenue</b>					
Quantity of fish sold	610.72	450	274,824	00	
Quantity of fish consumed	57.08	450	25,686	00	
Quantity of fish given out as gift	17.61	450	7,924	50	
Total revenue			308, 434	50	
<b>b. Variable cost</b>					
Purchase of fingerlings	233	35.60	8,294	80	5.92(19.44)
Feed	224.50	109	24,470	50	17.47(57.34)
Lime	3.30	160.43	529	42	0.38(1.24)
Chicken dropping	10	98.0	980	00	0.70(2.29)
Inorganic fertilizer	15	227.6	3414	00	2.44(8.00)
Casual labour input	2.2	1200	2640	00	1.89(6.19)
Transportation cost on procuring fingerling and feed	-	-	2345	67	1.68(5.50)
Total variable cost			42,674	39	30.48 (100)
<b>C. Gross margin (a-b)</b>			265,760	11	
<b>D. Fixed cost</b>					
Depreciation cost of fixed inputs (water supply equipment, vehicle, wheel barrow, shovels, ponds, generator, cutlass)	-	-	75,871	37	54.19
Rent on owner occupied land for pond fish	-	-	21,456	76	15.33
Total fixed cost			97, 328	13	69.52
Total cost=(total variable cost+ total fixed cost)			140,002	52	
<b>Net returns (C –D)</b>			125,757	59	
<b>BCR =TR/TC</b>			2.20		
<b>Gross ratio = TC/TR</b>			0.454		
<b>Rate of return per capital invested = NR/TC</b>			0.898		

Source: Field survey, 2014.

rate.

### Factors influencing production of fishes in Umuahia Capital territory of Abia State, Nigeria

The regression result on the socio-economic factors that influence the production of fishes is shown in Table 3. Based on some econometric considerations such as number of significant variables, the magnitude of F – ratio and R<sup>2</sup> value, the semi logarithmic functional form was selected as the lead equation. The R<sup>2</sup> was 0.725 meaning that 72.5 percent of the variability in output was explained by the independent variables included in the model; while the F-ratio was 10.193.

Specifically, the coefficient (2037.800) of farming experience of the fish farmers was positive and

statistically significant at 1.0% probability level. The sign of the variable is consistent with *a priori* expectation. This result means that as the number of years in the business increases, so also the output level of the fish farmers would increase. Experience has been known to lead to perfection in production activities.

The coefficient (642.670) of access to credit was positive and statistically significant at 5.0% critical level. The sign of the variable is consistent with *a priori* expectation. This implies a direct relationship with output of the fish farmers. According to Alfred (2005), acquisition and proper utilization of credit for any agricultural purpose enhances the production capacity of a farmer.

The coefficient of farm income (326.272) was positive and statistically significant at 10.0% risk level. The sign of the variable is consistent with *a priori* expectation. This implies that an increase in farm income would lead to

**Table 3.** Estimates of factors that influence productivity of fish farmers in Umuahia Capital Territory of Abia State, Nigeria.

Independent Variables	Functional forms			
	Linear	Exponential	Double log	Semi-log+
Constant	527.324 (0.331)	6.140*** (6.291)	0.857 (0.306)	717.904 (0.166)
Farming experience (x <sub>1</sub> )	58.963*** (3.201)	0.008 (0.667)	0.272 (1.210)	2037.860*** (5.874)
Gender(x <sub>2</sub> )	111.002** (2.364)	0.062** (2.147)	0.125 (0.693)	307.603 (1.100)
Educational level (x <sub>3</sub> )	36.436 (0.493)	0.097 (0.888)	0.251 (0.384)	330.613 (0.327)
Access to credit(x <sub>4</sub> )	248.843* (1.867)	0.017 (0.203)	0.113 (0.583)	642.670** (2.142)
Primary occupation (x <sub>5</sub> )	405.502 (0.622)	-0.952 (-0.690)	-0.412 (-1.207)	-474.932 (-0.901)
Farm income (x <sub>6</sub> )	0.000 (0.780)	2.130** (2.591)	0.358*** (2.950)	326.272* (1.738)
Pond size (x <sub>7</sub> )	79.840 (1.470)	0.060* (1.771)	0.544** (2.227)	662.079* (1.755)
R <sup>2</sup>	0.558	0.421	0.607	0.725
-R <sup>2</sup>	0.443	0.270	0.505	0.654
F-ratio	4.861***	2.799***	5.950***	10.193***

Source: Field survey, 2014+ = lead equation. \*\*\*, \*\*, \* = indicates that the variables are statistically significant at 1.0% 5.0% and 10.0% risk levels respectively. Values in parenthesis are the t-ratios.

increase in the output level of fish farmers. The result agrees with Ezeh (2006) who posited that pond fish farmers would be more disposed to purchase and make use of more inputs when their income increases.

Fish pond size coefficient (662.079) was positive and statistically significant at 90.0% confidence level. The sign of the variable is in consonance with a *priori* expectation. The positive sign implies that increase in pond number and size of ponds increased stocking rate and this would influence the increased use of other inputs which would result to increased output and profit. The result is in tandem with Onwuka (2005), Oputa (2005) and Ezeh et al. (2008) who obtained similar results.

#### Problems encountered by fish farmers in Umuahia Capital territory of Abia State, Nigeria

Table 4 presents the problems encountered by fish

farmers. Majority of the fish farmers (77.8%) had problem of high cost of feeds. This could make the farmers turn to cheaper feeds with lower quality. Good proportion (69.4%) of the fish farmers encountered difficulties with inadequate storage facilities; this resulted from the incessant electric power shortage in the area which made it difficult to refrigerate the fishes adequately before transporting to distant market. Using generator to pump water in-order to replenish pond water increased total cost of production. Depending solely on electric power supply is unattainable due to incessant power outage in the study area. Moderate proportion (55.6%) of the pond fish farmers had the problems of lack of loan and unavailability of extension workers. These problems inhibit the ability of farmers to adopt profit enhancing innovations of fish production. 41.7% of the respondents encountered problems of pest attack and poaching and this militates against pond fish farming productivity. 38.9% of the farmers had problem of transportation. This

**Table 4.** Problems encountered by fish farmers in Abia State.

<b>Problems encountered</b>	<b>Frequency*</b>	<b>% of total population</b>
Transportation	28	36.9
Proximate distance to point of sale	10	13.9
Lack of credit facilities	40	55.6
Inadequate storage facilities	50	69.4
High cost of feeds	56	77.8
Pest attack and poaching	30	41.7
Unavailability of extension workers	40	55.6

Source: field survey, 2014. \* = Multiple responses.

is a result of bad roads and poor road networks in the study area. 13.9% of them encountered the problem of proximate distance to point of sales which reflected the high transportation costs incurred in the sale of produce.

## CONCLUSION AND RECOMMENDATION

Based on the findings of the study it can be concluded that fish production is profitable and is capable of improving the standard of living of the people. Farming experience, access to credit, farm income and pond size were significant determinants of output level at 1%, 5%, 10% and 10% respectively. The study identified high cost of feeds, inadequate storage facilities, lack of credit facilities and inadequate contact with extension workers as the main problems constraining the fish farmers in the study area. Based on findings the following recommendations are made:

1. Unemployed youths in the study area should be trained in fish farming production methods and given loans to engage in fish farming business which is a very profitable enterprise in the area with high rate of return per capital invested.
2. Government participation in fish farming in the area is important; policies that would facilitate provision of credit to the fish farmers as well as increase the number of contact of the fish farmers with extension personnel should be made to boost the quantity of fish available for consumption.
3. Fish farming in the area is dominated by males; females should be encouraged to participate in fish farming as a means of augmenting their income.

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