

ADOPTION OF POND FISHERY TECHNOLOGIES BY FARMERS IN IMO STATE, NIGERIA

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ABSTRACT

The study was on the adoption of pond fishery technologies by farmers in Imo State, Nigeria. Multi-stage random sampling technique was used in selecting the respondents. The sample size was eighty (80) pond fish farmers. Data were collected through a well structured questionnaire. Descriptive and inferential statistical methods were used to achieve the objectives. The technological packages include pond site selection, fish fertilization/hatching, fish stocking, method of fish transportation, fish feeding, fish harvesting / preservation. The result showed that the mean age of the farmers was 40 years, while 72.5% of them were males. However, 91.3% of the pond fish farmers were married and had 7 persons as the mean household size. The result also showed that majority (42.5%) of the pond fish farmers had post primary education. The respondents had 14 years as the mean farming experience. Multiple regression analysis indicated that the significant factors influencing the adoption of pond fishery technologies were age, education, income and experience. The coefficient of age is significant at 1% level and negatively related to pond fishery technologies adoption. The coefficient of education and income were significant at 1% level of significance and positively related to fishery technologies adoption. The coefficient of farming experience was significant at 1% level and positively related to adoption of fishery technologies. Some factors that constrained adoption of pond fishery technologies included inadequate fishery information, unavailability of fingerlings, cost of construction/ preparation, years of experience and educational background of the fish farmers among others. Based on the findings, it was recommended that farmers should be given expert advice by extension workers on how to prepare quality fish feed from locally available ingredients. ADP should invest in training extension agents and

pond fish farmers to enhance acceptance of good technologies transferred. Technologies that are at the trial stages of adoption need to be properly demonstrated and intensified by extension agents. In addition, formation of cooperative societies is advocated to encourage access to credit and farm inputs at reduced cost. Finally, care should be taken in the choice of site for ponds to ensure suitability in terms of water supply, security of fish and protection against pond leakage.

Keywords: Adoption, Pond Fishery Technologies, Imo State.

INTRODUCTION

Nigeria among other developing countries, is facing problem of insufficient dietary protein. Protein deficiency has led to incidents of malnutrition, diseases and deaths over the years in most of these developing countries. Animal protein intake in Nigeria (4.4kg/year per capita) is below the FAO recommendation of 35kg/year per capita consumption (Anibueze, 2005). Increase in fish production is a major solution to this problem of dietary protein deficiency. Past studies have shown that fish is rich in major essential amino acids and so is classified as first class or good quality protein source (Njoku *et al*, 2014, and Anozie, 2007). Fish in addition is recognized as being nutritionally superior to other animal protein sources like beef, pork and chicken (FDF and FISON, 2007). Apart from containing essential amino acids such as lysine, leucine and arginine, it is a good source of sulphur (Nwaobiala, 2014). The demand for fish in Nigeria is high and is expected to increase even as the population increases (Nwaneri, 2015). In order to address this problem, there is the need to explore all avenues of increasing fish production not only at the national level but also at state and rural farmer level.

Pond fishery is the most viable option to make up the short fall in the supply of fish which plays a vital role in the nutritional diet of man as well as serving as a source of employment and income (FAO, 2002). Fish consumption is gaining wide prominence particularly in developing countries where 40% or more of their protein comes from fish (Amaefula *et al.*, 2010). It is estimated that aquaculture or homestead fishery is capable of giving up to 50,000 metric tonnes or more of fish supply in Nigeria (Amaefula *et al.*, 2010). This lead to this study to assess the extent by which fish farmers in Imo State have adopted pond fishery technologies since embarking on massive adoption would contribute in increasing fish production and meet up with the high rate of fish demand. The specific objectives of this study were to: describe socio-economic characteristics of pond fish farmers in the study area; identify sources of pond fishery technologies information to fish farmers in the area; identify pond fishery technologies extended to aquaculturists in the study area; ascertain level of adoption of pond fishery technologies by farmers in the study area; determine factors that influence adoption of pond fishery technologies by the farmers in the study area.

METHODOLOGY

The study was conducted in Imo State, Nigeria. The land area of the state is estimated at 5,100 square kilometers. Imo State lies within Latitudes 4° 45' and 7° 15' North of the equator and Longitudes 6° 50' and 7° 25' East of the Greenwich meridian. It has an annual rainfall of 1,500mm to 2,200mm and temperature of 20°C which creates an annual relative humidity of 75%, with relative humidity reaching 90% in the rainy season. The three agricultural zones of the State is broken down into blocks and circles. Multi-stage random sampling technique was adopted in the selection of blocks, circles and fish farmers. First, 8 blocks were selected randomly from the three zones, 4 blocks from Owerri zone and 2 blocks each from Orlu and Okigwe zones, because these constitute 20.0% each of the blocks in the various zones. With the list of circles in each of the blocks selected, 2 circles were randomly selected from each block while five (5) contact fish farmers were selected randomly from each circle, giving a total of 80 respondents. The data used for the research were obtained by means of a structured questionnaire

and interview schedule. Data generated in the study were analyzed using descriptive and inferential statistics. Objectives i, ii and iii were analyzed using descriptive statistics such as means, percentages and frequency distribution. Adoption scale analysis was used to determine objective iv. Objective v that dealt with determining factors influencing adoption of fishery technologies by the farmers in the area of study was analyzed using Ordinary Least Square (OLS) Multiple Regression Model. There functional forms were specified in explicit forms as follows:

Linear:

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + e \text{-----}(1)$$

Cobb-Douglas (Double Log):

$$\log Y = b_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 + b_8 \log x_8 + b_9 \log x_9 + e \text{-----}(2)$$

Semi-Log:

$$Y = b_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 + b_8 \log x_8 + b_9 \log x_9 + e \text{-----}(3)$$

Exponential:

$$\log Y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8 + b_9 x_9 + e \text{-----}(4)$$

Where Y = Number of Fishery Technologies Adopted

X₁ = Age of the pond fish farmer (years)

X₂ = Gender of the pond fish farmer (a dummy: 1 = male, 0 = female)

X₃ = Years of formal education of the pond fish farmer

X₄ = Income of the pond fish farmer (Naira)

X₅ = Household size of the pond fish farmer

X₆ = Years of fish farming experience

e = Error

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Pond Fish Farmers in the Study Area.

Table 1 shows the socio-economic characteristics of the farmers. The result indicates that majority (72.5%) of the pond fish farmers were males. This is in line with the generally held view and common practice in the developing countries to direct training services primarily towards men because they are more likely to adopt technologies faster than the females (Iheke and Nwaru, 2014). The study

also revealed that the mean age of the farmers was 40 years. This implies that most of the pond fish farmers were energetic and still able to do work. Farmers in this age bracket appear willing to try out new technologies. Majority (91.3%) of the pond fish farmers were married. Thus, according to Nwaneri, *et al.*; (2013), getting married is a highly cherished value among rural dwellers in Nigeria, not only because of the need for children and the continuation of the family

but also, because the women and children form a ready source of unpaid labour. The table also shows that 42.5% of them had post primary education. Okoronkwo and Ume (2013), observed that the more educated a farmer is the better he can adopt innovations. The mean household size of the farmers was Seven. According to Iwueke (1987), household size of seven is large.

Table 1: Distribution of Pond Fish Farmers According to Socio-economic Characteristics in Imo State, Nigeria (N=80).

Characteristics	Frequency	Percentage
Gender		
Male	58	72.5
Female	22	27.5
Age		
20 – 29	5	6.3
30 – 39	35	43.7
40 – 49	28	35.0
50 – 59	9	11.3
60 – 69	3	3.7
Mean age	40	
Educational level		
No Formal Education	4	5.0
Primary education	15	18.7
Secondary level	34	42.5
Tertiary education	27	33.8
Household Size		
1 – 4	13	16.2
5 – 8	51	63.8
9 – 12	12	15.0
13 – 16	4	5.0
Mean	7	
Marital status		
Widow	4	5.0
Single	3	3.8

Nwachukwu and Onuegbu (2005), who averred that inadequate funding constitutes major setback in the usage of fishery technologies.

Source: Field survey, 2016

Large size of household might compel decisions to adopting good technologies to be able to provide adequate food for all members. The mean score for farming experience of the pond fish farmers was 14 years. Nwaru (2004) observed that the number of years a farmer has spent in the farming business may give an indication of the practical knowledge he has acquired. The longer the years of farming experience, the more efficient a farmer is presumed to be. In other words, the experience gained all through the years in active farming will enable the farmer to make profitable decision and put him/her in a much better position to accept or reject innovation. Most (61.3%) of the pond fish farmers had between ^51,000 and ^150,000 as their annual income. This amount appears small but could be attributed to the small farm holdings. The small income may negatively affect adoption of pond fishery technologies on account of it's expensive nature. This finding is in tandem with

Sources of Pond Fishery Technology Information to Fish Farmers

The main sources of pond fishery technology information to fish farmers is shown in Table 2. Majority (72.5%) of the farmers received information from Agricultural Extension agents. However 37.5% of them got information from Radio, 22.5% others received information through interaction with fellow farmers. This findings revealed that Journals, Friends/neighbours, Newspapers and Agricultural shows were not common channels in the dissemination of information to the pond fish farmers. This suggests that the pond fish farmers do not have the resources to obtain these materials or they may be too preoccupied in their farming activities to have time to read newspapers and magazines.

Table 2. Distribution of Pond Fish Farmers Based on Sources of Information on Pond Fishery Technology.

Source of information	Frequency *	Percentage (%)
Extension Agent	58	72.5
Fellow farmers	18	22.5
Radio	30	37.5
Television	10	1.2
Friends/Neighbours	0	0.0
Newspapers/Magazines	0	0.0
Journals	2	2.5
Agricultural shows	2	2.5

Source: *Field survey data, 2016*

* Multiple responses recorded

Pond Fishery Technologies Extended to Fish Farmers In The Study Area

Table 3 presents the distribution of the pond fishery technologies extended to aquaculturists in Imo State. It revealed that Pond site selection, pond maintenance and fish harvesting methods were rated 70%, and pond preparation/construction were rated 80%. Other pond fishery technologies extended to them include fish stocking and method of transportation of fingerlings (56.3%), fish feeding (52.5) and fish preservation (60%) are the pond fishery technologies accepted by the farmers as being available in the area. It is one thing for an innovation to be available and a

different thing for the technology to be propagated by extension services (Nwachukwu and Onuegbu, 2005).

Table 3 Percentage Distribution of Fish Farmers Perception Based on Pond Fishery Technologies Extended in the area.

Pond Fishery Technologies	Yes (%)	No (%)
Pond site selection	56 (70.0)	24 (30.0)
Fish fertilization	3 (3.8)	77 (96.3)
Egg hatching	3 (3.8)	77 (96.3)
Pond preparation/ construction	64 (80.0)	16 (20.0)
Fish stocking	45 (56.3)	35 (43.8)
Transportation of fingerlings	45 (56.3)	35 (43.8)
Fish feeding	42 (52.5)	38 (47.5)
Pond maintenance	56 (70.0)	24 (30.0)
Fish harvest method	56 (70.0)	24 (30.0)
Fish preservation	48 (60.0)	32 (40.0)

Source: *Field survey data, 2016*
 Values in Parentheses are percentages

Mean Level of Adoption of Pond Fishery Technologies Among the Fish Farmers in Imo State

The level of adoption of the various practices in pond fishery technological packages and the mean adoption scores is shown in Table 4. The table shows that transportation of the fingerlings recorded the highest level of adoption with mean score of 3.9. Transportation of fingerlings is very important because any mistake made in the

process of transporting the fingerlings often lead to serious loss. Pond installation, pond maintenance, fish harvesting and feeding had mean scores of 3.5, 3.4, 3.2 and 3.1 respectively. Since the mean adoption scores of these packages were above 3.0, it shows that these technologies were fully adopted by the fish farmers. However, pond site selection, pond construction, pond preparation, pond stocking and preservation of fish scored below the adoption mean score and therefore mean that these technologies were least adopted.

Table 4. Level of Adoption of Pond Fishery Technologies Among the Fish Farmers in Imo State (Threshold Mean = 3.0).

Technology Packages	Mean	Adoption Level
Pond site selection	1.7	Awareness
pond construction	2.7	Trial
Pond installation	3.5	Adoption
Pond preparation	2.3	Trial
Pond stocking	2.7	Trial
Transportation of fingerlings	3.9	Adoption
Feeding of fish	3.1	Adoption
Pond maintenance	3.4	Adoption
Harvesting	3.2	Adoption
Preservation of fish	2.7	Trial

Source: *Field survey data, 2016.*

Decision Rule

- Below 1.0 = Unaware.
- 1.0 - 1.49 = Aware.
- 1.50 - 1.99 = Interest.
- 2.0 - 2.49 = Evaluation.
- 2.50 - 2.99 = Trial.
- 3.0 and Above = Adoption.

Factors influencing the adoption of Pond Fishery Technologies by Fish Farmers in the Study Area.

The regression estimates of the factors influencing the adoption of fishery technologies is presented in Table 5. The linear functional form gave the best fit and was subsequently chosen as the lead equation. This choice was premised on it having the highest magnitude of

the coefficient of multiple determination (R^2), the number of significant variables, the conformity of the coefficients of the variables to *a priori* expectation and the significance of the F-ratio. The coefficient of multiple determination was 0.8936 which implies that 89.36% of the variations in fishery technologies adoption was explained by the variables in the model. The F-ratio was statistically significant at 1% level of significance which attests to the goodness-of-fit of the model. Apart from experience in fish farming, the coefficients of the other variables were all significant.

The coefficient of age of fish farmer was significant at 1% level of significance and negatively related to fishery technologies adoption. This implies that adoption of fishery technologies decreased with age of the farmer. This conforms to *a priori* expectation. Iheke and Nwaru (2014) noted that the older a farmer becomes, the greater he/she becomes risk averse

(adoption of new technology). The coefficient of gender of fish farmer was significant at 5% level of significance and positively related to adoption of fishery technology. This implies that male pond fish farmers adopted technologies more than their female counterparts. This could be because women are more constrained by resource ownership than male farmers

The coefficients of education and income were significant at 1% level of significance and positively related to fishery technologies adoption. This implies that adoption of these technologies increases with higher educational attainment and increase in income respectively. The coefficient of fish farming experience was significant at 1% level of significance and positively related to adoption of fishery technology. This implies that adoption of fishery technologies increases with farming experience.

Table 5 Ordinary Least Square Estimates of Factors influencing the adoption of Pond Fishery Technologies by Farmers in the Area.

Functional forms				
Variables	Linear+	Exponential	Double log	Semi log
Intercept	6364.657	11.107	7.669	-79724.00
Age of farmer	(3.61)*** -788.497	(15.57)*** -0.064	(2.92)*** -0.405	(-0.73) -4433.173
Gender	(-7.30)*** 369.803	(-4.07)*** 0.079	(-2.62)** 0.7534	(-2.42)** 29657.610
Education	(2.47)** 268.968	(2.04)** 0.225	(1.96)* 0.618	(1.86)* 35826.340
Income	(4.35)*** 731.920	(3.88)*** 0.050	(2.41)** 0.557	(3.37)*** 25621.950
Household size	(5.51)*** 211.535	(3.52)*** 0.360	(3.07)*** 0.286	(3.36)*** 12621.950
Fishing Experience	(1.03) 1.812	(1.32) 0.059	(0.92) 0.384	(1.90)* 45292.260
	(2.49)***	(0.37)	(1.25)	(3.84)***
R^2	0.8936	0.6658	0.7449	0.8118
Adjusted R^2	0.8267	0.5931	0.6701	0.7545
F-ratio	19.32***	7.02***	9.75***	19.18***

Source: Field survey data, 2016

*** = significant at 1%

** = significant at 5%

* = significant at 10%

(...) = t-ratios

+ = lead equation

CONCLUSION AND RECOMMENDATIONS

Adoption of pond fishery technologies by farmers in Imo State was studied. The study revealed that the fish farmers adopted many of the technology packages (pond installation, transportation of fingerlings, feeding rate of fish, pond maintenance and harvesting) extended to them in the study area. It also revealed that majority of the fish farmers

received their information from extension agents. Many factors critically determined pond fishery technologies' adoption which included age of farmers, educational level, income and farming experience.

Inadequate fishery information, availability and cost of fish feed and cost of construction/preparation among others were the major problems encountered by the fish farmers in the study area. The following Recommendations were proffered;

i. Agricultural Development Programme (ADP) should invest in training the extension agents and fish farmers to enhance the acceptance of good technologies transferred.

ii. Deliberate policy should be enacted to strengthen access to education to fish farmers. In order to achieve this, adult education centres should be located in the rural areas to stimulate farmers to learning thus improving their educational levels.

iii. Technologies that are at the trial stages of adoption need to be properly demonstrated by and intensified by the extension agents. Trainings and re-trainings on such technology components and exposing farmers to specialized field trips would facilitate the adoption of the technologies.

vi. Care should be taken in the choice of sites for ponds to ensure their suitability in terms of nearness to supply of water or its readily availability, security of fish, protection against pond leakage.

iv. Formation of Cooperative Societies is advocated. This will encourage access to credit and farm inputs such as fingerlings and fish feed at reduced costs.

v. There is need to encourage the production of fish feed in high commercial scale to alleviate the farmers' problems of lack of fish feeds. Farmers should be given expert advice by the extension workers on how to prepare good quality fish feed from locally available ingredients.

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