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# Quantitative Analysis of Small Scale Catfish Enterprises in Oshimili South Local Government Area, Delta State

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***Abstract***
*The study examined the economics of small scale catfish enterprise Oshimili South local government area. The data were collected with the aid of questionnaire from 120 respondents. The tools of data analysis were descriptive statistics, cost and return analysis, ordinary least square and likert scale. The result revealed that the average age of catfish farmer was 45 years, 58.3% were males, 74.2% were married, average household size was found to be 6 persons, 98.3% were literate and average fish output per year was 5,080kg. Catfish production was profitable as showed by the Net Farm Income (NFI) of ₦ 488,617.00 and BCR of 1.30. The result of the ordinary least square (OLS) showed that pond size, fish feeds, labour, fingerlings, veterinary services and drugs, age, farming experience and educational level affected the output of catfish farmers. The constraints affecting catfish production were access to credit facility, theft, water management, and disease outbreak.*

***Keywords: catfish, small scale, farmer, enterprise, production***

## Introduction

Aquaculture, also known as aquafarming, is the farming of aquatic organisms such as fish, crustaceans, molluscs and aquatic plants. Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions and can be contrasted with commercial fishing, which is the harvesting of wild fish (Wikipedia). Fish farming is the sub-set of aquaculture that focuses on rearing of fish under controlled or semi controlled conditions for economic and social benefits (Anthonio and Akinwumi, 2002). According to Olagunju, *et al*., (2007), it requires less space, time, money and has a higher feed conserving rate. Fish is the major source of protein to the teeming Nigeria population (Ugwumba and Ugwumba 2003). Fish farming produces highly priced commodities for export as a source of foreign exchange, creates employment opportunity and utilizes large expense of land and water bodies not suitable for other agricultural activities (Akintola *et al*., 2009). Fish is a very crucial component of human diet that is very affordable and acceptable (Akinrotimi *et al.,* 2007). Over the years the demand for fish has been on the increase with supply not been able to meet the demand. Reducing this gap and boosting fish production has been the major concern of public and private agencies in fisheries sector all over the world (Akinrotimi, *et al*., 2010). The demand for fish in Nigeria mostly outstrip the local production (Ozigbo *et al*., 2013).

One of the major developmental challenges facing most developing countries is their inability to adequately feed their ever-increasing population with the right proportion of calories and protein (Oghoro 2007). The diet of the average Nigeria family is characterized by low protein intake which is not good for proper development of the body. Another challenge with protein availability is the attendant cost. The fisheries sub-sector has witnessed a steady rise in investment which has not translated to outcome though, fish farming is the fastest growing animal based production sector, particularly in the developing countries (Green Fact, 2004). The fishery industry is crucial to the world economy Tsue *et al.* (2013). Fishing like other hunting activities has been a major source of food for human race and has put an end to the unsavory outbreak of anemia, Kwashiokor etc. (Olagnuju *et al*., 2007). Every effort therefore should be geared towards increasing fish production through improved resources management and intensive aquaculture practices which should be matched with improved and modernized aquaculture technologies (Ibemere, *et al*., 2015).

Fish farming has become a full time job for many and is considered to be a commercially viable enterprise contributing significantly to Gross National Product (GNP). The arrays of environments to which fish farming thrive abound in Nigeria and Delta State in particular. The demand for catfish in Nigeria is unprecedented so much so that no matter the quantity supplied into the market, it would be consumed by ready buyers. This is because of its low caloric value, low carbohydrate content, high protein and low fat.

The problems associated with fish farming in Delta State are high cost of feed, poaching, poor feed conversion ratio, feeding, quality water management problems and lack of capital. The solutions to these myriad of problems can be found through appropriate research. Fisheries research, as with all other aspects of agriculture requires effective research approach to make meaningful impact on productivity and farmers level and standard of living.

The goal of any farmer is to make profit, and profit level depends on the ability of the farmer to reduce the cost of input and effective management procedures. In recent time, the cost of feed has soured this has led many small scale fish farmers to resort to selling their fish at less than table size with a view to reducing input, accelerating turnover of capital or increasing profitability. It is therefore necessary to examine and evaluate the economics of catfish production in view of the resource constraint faced by the farmers. The specific objectives include: describe the socio-economic characteristics of catfish farmers, estimate the level of profitability of catfish farming enterprise, determine the effects of the socio economic factors on the output of catfish farming enterprises and identify the problem militating against catfish production in the study area.

## Materials and Methods

### Study Area

Oshimili South Local Government Area is the home to Asaba the capital of Delta State, a developing city located on the bank of the River Niger. It has other area which are Oko, Okwe and Illah. The Local Government shares boundary in the Northern axis with Ndokwa East and Oshimili North, while on the Eastern axis it shares with the River Niger and at the Western axis it shares boundary with Oshimili North on the popular city called Ibusa. The Local Government has a land area of approximately 603km$^2$ and a population of about 149,603 People, who are mainly farmers and fishermen. It has latitude 6$^0$6'32'' North and Longitude 6$^0$41'54'' East of the equator. The vegetation falls mostly into rain forest belt with tropical climate marked by 2 distinct season- the dry season (November – April) and rainy season (April – October). The average annual rainfall is 195 cm. it has a temperature ranges between 30$^0$C and 39$^0$C. The study area boast of the popular Camp 74 fish estate amongst other fish farms.

### Sampling Procedure

During the preliminary survey, it was discovered that 267 fish farmers in Oshimili South were registered with the Delta State Department of Fisheries. For the purpose of this study 60% of the registered fish farmers were selected randomly with the use of the lottery technique. This result to the selection of 120 registered fish farmers.

### Data Collection

Primary data was used in this study. The primary data was obtained from the respondents using a well-structured questionnaire with the aid of personal interview during the field survey. The primary data collected include socio-economic characteristics of catfish farmers in the study area, inputs used for catfish production per annum, the output of catfish production per annum, costs and returns and other farming activities and challenges encountered.

**Methods of Data Analysis**
Descriptive statistics, cost and return analysis, ordinary least square model and 5 point likert scale were tools used for the analysis.

**Model Specification**
Net Income Analysis was determined using the following relationship:
NFI = GM – FC; GM = TR – VC; Where NFI = Net Farm Income; GM = Gross Margin
TR = Total Revenue; FC = Fixed Cost; VC = Variable Cost while Rate of return on equity was determined using; BCR = $TR/TC$.

**Production function Analysis**
The production function model is implicitly specified as follows:
$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}) + e$
Where:
Y = Quantity of fish output (kg); $X_1$ = Pond size ($m^2$); $X_2$ = Cost of fingerlings (₦)
$X_3$ = Cost of feeds used (₦); $X_4$ = Labour input (man-days); $X_5$ = Cost of drugs and veterinary care (₦); $X_6$ = Cost of fertilizer (₦); $X_7$ = Mortality rate; $X_8$ = Age of farmer (years); $X_9$ = Farming experience (years); $X_{10}$ = Level of Education; $X_{11}$ = Cost of fixed inputs (₦)
Where:
Y = Dependent variable; $b_0$ = Constant; $b_1$ - $b_{11}$ = Coefficient of regression for the independent variables; e = error term.

Three different functional forms namely; linear, semi-log and double log functional forms were tried. The functional form that have the best fit was chosen based on the statistical and econometric criteria such as the $R^2$, number of significant variables and the F-ratio.

**Results and Discussion**
**Socioeconomic Characteristics of the Respondents**
The result in Table 1 shows the distribution of catfish farmers with respect to socio-economic characteristics. Most (50.8%) farmers fall with the age bracket of 30-45years; while 2.5% were below 30 years. This age bracket is a productive stage which portend better future for catfish production, is also considered as economically active stage (Olowosegu *et al*, 2004). The mean age of the farmers was 45years. This indicate that high proportion of people involved in fish farming are still in their productive age. This is because fish farming requires adequate attention, hard work and a lot of sense of responsibility.
Majority (58.3%) of fish farmers are male while 41.7% were female. Fisheries activities are mostly dominated by men (Bummelt *et al*, 2010). It was discovered that majority (74.2%) of the farmers were married. 98.3% had primary, secondary and tertiary education, only 1.7% were not educated. This means that fish farming is dominated by educated people and this knowledge acquired can help in the adoption of modern technologies. The average mean for each farmer's household size was 6 persons. This indicates that most of the farmers has less family size.
However, the mean of fish farming experience is 8 years. As a result, the respondent with highest number of years' experience should have good skill and better approaches to catfish farming business. Majority of the respondent (70%) had output of 3000-5000kg/yr., 21.6% had 5100-7000kg/yr, while 8.4% of the farmers had fish output above 7,000kg/yr., the mean of fish output of catfish farmers in the study area was 5,080kg/yr.

**Table 1: Socio-economic characteristics of catfish farmers**

| | Variables | Frequency | Percentage (%) | Mean |
|---|---|---|---|---|
| Age (years) | Below 30 | 3 | 2.5 | |
| | 30-45 | 61 | 50.8 | |
| | 46-55 | 47 | 31.8 | |
| | 56 & above | 9 | 7.4 | |
| | **Total** | **120** | **100** | **45yr** |
| Gender | | | | |
| | Male | 70 | 58.3 | |
| | Female | 50 | 41.7 | |
| | **Total** | **120** | **100** | |
| Marital Status | Single | 21 | 17.5 | |
| | Married | 89 | 74.2 | |
| | Divorce | 6 | 5.0 | |
| | Widower | 4 | 3.3 | |
| | **Total** | **120** | **100** | |
| Household size | 3-5 | 48 | 37.6 | |
| | 6-8 | 75 | 62.5 | |
| | **Total** | **120** | **100** | **6persons** |
| Educational level | No Formal Education | 2 | 1.7 | |
| | Primary Education | 44 | 36.7 | |
| | Secondary Education | 64 | 53.3 | |
| | Tertiary Education | 10 | 8.3 | |
| | **Total** | **120** | **100** | |
| Experience (years) | 1-5 | 15 | 12.6 | |
| | 6-10 | 77 | 64.2 | |
| | 10 & above | 28 | 23.3 | |
| | **Total** | **120** | **100** | **8yr** |
| Fish Output (kg/year) | 3000-5000 | 84 | 70 | |
| | 5100-7000 | 26 | 21.6 | |
| | 7100-9000 | 8 | 6.7 | |
| | 9100 & above | 2 | 1.7 | |
| | **Total** | **120** | **100** | **5,080kg** |

**Profitability of Catfish Production**

Estimate of cost and return analysis were made from catfish production using average cost (fixed and variable) and yield data generated by each of the sampled fish farmers per farming season. The cost and return analysis in Table 2 reveals that the variable cost accounted for the largest proportion (58%) of the total cost of fish production. This means that large amount of money spent by fish farmers in the study area was for purchase of fish feed and labour.

The fixed cost of production accounted for 42% of the total cost. The result also shows that an average Total Cost (TC) of ₦1,658,233:00 was incurred by a respondent per farming season while Total Revenue (TR) of ₦2,146,850:00 was realized with a return gross margin of ₦1,183,350:00 and a Net Farm Income (NFI) of ₦488,617:00.

The analysis also revealed that Benefit Cost Ratio (BCR) was greater than 1. This ratio is one of the concepts of discount method of project evaluation. As a rule of thumb, any business with BCR greater than 1, indicate profitability. Since the ratio (BCR=1.30) it indicates that fish farming is profitable in the study area. This result is consistent with the findings of Ashaolu *et al.* (2006), who observed that fish farming is profitable.

**Table 2: Cost and Return Analysis for catfish farmers**

| Items | Amounts (₦) | Total Cost (%) |
|---|---|---|
| **Variable Cost** | | |
| Fingerlings | 121,500.00 | 12.6 |
| Fish Feeds | 431,000.00 | 44.8 |
| Hydrated Lime | 20,000.00 | 2.3 |
| Veterinary Service | 70,000.00 | 7.3 |
| Cost of drugs | 45,000.00 | 4.7 |
| Cost of Fertilizer (₦) | 36,000.00 | 3.7 |
| Labour (Land clearing, pond construction, pond maintenance and feeding of fishes) | 170,000.00 | 17.6 |
| Transportation | 68,000.00 | 7.1 |
| **Total Variable Cost** | **963,500.00** | |
| **Fixed Cost** | | |
| Land Cost | 338,333.00 | 48.7 |
| Farm House | 143,000.00 | 20.6 |
| Pumping Machine | 134,500.00 | 19.4 |
| Net | 19,900.00 | 2.9 |
| Weighing Scale | 14,000.00 | 2.0 |
| Storage tank | 45,000.00 | 6.5 |
| **Total Fixed Cost** | **694,733.00** | |
| **Total Cost** | **1,658,233.00** | |
| **Total Revenue** | **2,146,850.00** | |
| **Gross Margin** | **1,183,350.00** | |
| **Net Farm Income** | **488,617.00** | |
| **BCR** | **1.3** | |

**Socio-Economic Factors Affecting Catfish Output of Small Scale Farmers**

In determining the socio-economic factors affecting catfish output, the linear functional form was chosen as the lead equation because of a high $R^2$ value, the number of significant variables and agreement with *a priori* expectation.

The $R^2$ value of 0.705 indicates 71% variation in catfish output explained by the independent variables. The F-value was highly significant at 1% level of probability indicating a best fit. The result of linear regression analysis showed that the coefficient for pond size (0.068) was positive and significant at 5% level of probability. This implies that one percent increase in pond size will lead to a corresponding increase in catfish output. The coefficient of fish feeds (0.278) was positively signed and highly significant at 1% level of probability. This implies that one percent increase in fish feeds will lead to a corresponding increase in fish output. This is in agreement with *a priori* expectation. The coefficient for labour (0.011) was negatively signed and significant at 1% level of probability. This implies that one percent increase in labour will lead to a corresponding decrease in output of catfish output. This result is in disagreement with the findings of Nwaobiala (2013) found a positive relationship between labour and output. The coefficient of fingerlings (0.304) was positively signed and significant at 5% level of probability. This is in conformity *with a priori expectation* since the output of catfish is influenced by the number of fingerlings available and used for the given period. The coefficient of veterinary services & cost of drugs (0.837) was positive and highly significant at 1% level of probability. This means that one percent increase in veterinary services and drugs will lead to a corresponding increase of catfish output in the study area. The coefficient of age (0.214) was positive and significant at 1% level of probability, the result satisfied the *a priori expectation* because increase in the farmers age implies increase in exposure and probably experience. Fish farming experience had a positive coefficient (0.018) and significant at 5% level of probability. This implies that experience in catfish farming was a strong determinant of output. This result conforms to the findings of a priori expectation. The coefficient of educational level (0.032) was positive and significant at 5% level of

probability. This implies that an increase in educational level of catfish farmers will lead to increase in output because it exposes them to the environment of new innovations and better management techniques.

**Table 3: Regression Result on Determinants of Catfish Output of Small Scale Farmers**

| Variables | Coefficient | Standard Error | T | Sig |
|---|---|---|---|---|
| Pond size | 0.068** | 0.027 | 2.504 | 0.025 |
| Fish feeds | 0.278*** | 0.033 | 8.526 | 0.000 |
| Labour | -0.011*** | 0.002 | -4-519 | 0.000 |
| Fingerlings | 0.304** | 0.149 | 2.035 | 0.044 |
| Veterinary services & cost of drug | 0.837*** | 0.181 | 4.622 | 0.000 |
| Cost of fertilizer | 0.004 | 0.064 | 0.058 | 0.954 |
| Mortality rate | 26.306 | 27.793 | 0.947 | 0.346 |
| Age | 0.214*** | 0.053 | 4.038 | 0.000 |
| Fish farming experience | 0.018** | 0.007 | 2.492 | 0.014 |
| Educational level | 0.032** | 0.016 | 1.945 | 0.054 |
| Fixed inputs cost | -0.002 | 0.003 | -0.635 | 0.527 |
| constant | 5276.971*** | 1013.486 | 5.207 | 0.000 |
| R-square | 0.705 | | | |
| F-ratio | 21.321 | | | |

***, **, * = *Significant at 1%, 5% and 10% respectively*

**Problems Militating Against Catfish Production**

Information on catfish production constraints was elicited and presented in Table 4. Various factors which affect catfish production in the study area were rated according to the degree of severity. From the results in Table 4 access to credit facility (4.88), theft (4.23), water management (3.88) and disease outbreak (3.75) are above the cutoff mark at 3.00 which implies that they are found to be serious and thus should be addressed so as to improve catfish output and profit level. Ready market had a mean of 3.00 which implies that it is mild and as such the enterprise can be operated by small scale farmers.

**Table 4: Constraints to Catfish Production**

| S/N | Constraints | SA | A | UN | D | SD | Total Respondent | Total Score | Mean | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Access to Credit facility | 106 | 14 | 0 | 0 | | 120 | 586 | 4.88 | Serious |
| 2 | Theft | 56 | 36 | 28 | 0 | 0 | 120 | 508 | 4.23 | Serious |
| 3 | Water Management | 0 | 106 | 14 | 0 | 0 | 120 | 466 | 3.88 | Serious |
| 4 | Disease Outbreak | 0 | 91 | 28 | 1 | 0 | 120 | 450 | 3.75 | Serious |
| 5 | Ready Market | 28 | 0 | 36 | 56 | 0 | 120 | 360 | 3.00 | Not Serious |

**Conclusion**

The study showed that the socio-economic characteristics of the farmers was a strong determinant of output. Catfish enterprise if properly managed would be an income venture for many families as indicated by the profitability test of BCR, showing 1.30 that is greater than one as condition of determining project viability. The major constraints were access to credit facilities, theft, water management and disease outbreak.

**Recommendations**

Based on the finding from the study the following recommendations are made

- It is recommended that more farmers be encouraged to engage in production of catfish given its profit level by the Government through access to credit facilities.
- The Government should also intervene to reduce the militating effect of the constraints, such as access to credit facility, poaching, water management and disease outbreak as a matter of policy urgency.

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