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Research Paper

Estimating farm level technical efficiency and elasticity of production among small scale catfish farmers in Epe local government area, Lagos state, Nigeria

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This research work broadly estimated farm level technical efficiency and elasticity of production among small scale catfish farmers in Epe Local Government Areas of Lagos State, Nigeria. The study in its specific objectives described the socio-economic characteristics of the catfish farmers in the study area; and analysed the technical efficiency and elasticity of production of the catfish farmers in the study area. A total of 65 small scale catfish farmers were purposively selected for the study. The data collected with the aid of structured questionnaire were analysed using Descriptive Analysis and Inferential Statistics like the Stochastic Frontier Analysis. The mean age of the farmers in the study area was 44 years. Majority of the catfish farmers are married and were well educated. The catfish farmers in the study have a relative large household with an average household size of 7 persons. In the preferred model (model 2), the variables that significant influence catfish production in the study were feed quantity (at 1%), labour quantity (at 1%), fingerling quantity (at 1%) and pond size (at 1%) respectively. The estimated sigma square (σ^2) of the catfish farmers was 0.02515 and highly significant at 1% level of significance. The estimated gamma (γ) parameter of the catfish farmers was 0.0061.The RTS for the catfish farmers was 1.147 in the study area. The catfish farmers are were experiencing increasing returns to scale and were operating in the irrational zone of production (stage 1). The catfish farmers were not fully technically efficient in the use of production resources. The predicted catfish farm specific technical efficiency (TE) for the catfish farmers' indices ranged from a minimum of 71.62% to a maximum of 91.87% for the farms, with a mean of 82.15%. Family size was the only significant inefficiency variable with a positive coefficient, meaning it was positively related to inefficiency but negatively influence the technical efficiency of the catfish farmers in the study area. The policy implications and recommendations of this study based on the major findings include: the extension services should be directed towards training and teaching the farmers recent agricultural practices that are fish specific. The use of labour-saving device should be developed and farmers should be made to have access to such at affordable prices.

Keywords: Technical Efficiency, Stochastic Frontier Analysis, Elasticity, Catfish Farmers, Return to Scale.

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INTRODUCTION

Nigeria has aquaculture potential which constitutes 75% of 923,768km^2 of the land mass and 14 million hectares of inland freshwater, but less than 1% is utilized for fish production; and despite the popularity of farming in Nigeria, the fish farming industry can be best described as being at the infant stage when compare to the large market potential for its production and marketing (FAO, 2005; Nwiro, 2012). Aquaculture in Nigeria encompasses both the extensive and intensive system of farming and with different kinds of spices in stock. The domination of catfish among the most commonly cultured species of fish in Nigeria is very apparent even at the local fish markets (Oyakhilomen and Zibah, 2013; Issa *et al*., 2014).

In Nigeria, there is wide gap between food production and population growth, hence the rising wave of food insecurity. While food production increases at the rate of 2.5%, food demand increases at a rate of more than 3.5% due to high rate of population growth of 2.83% (FAO, 2014). The apparent disparity between the rate of food production and demand for food in Nigeria has led to rising food importation and soaring food prices. The demand and supply gap for animal protein intake is very high. The recommended minimum intake of protein by an average person should be 65 g per day; of this, 36 g (i.e. 40%) should come from animal sources. Nigeria is presently unable to meet this requirement. The animal protein consumption in Nigeria is less than 8 g per person per day, which is a far cry from the FAO minimum recommendation (FAO, 2018).

Generally, fish farming as an industry in Nigeria is faced with some problems which include inadequate supply of fishing inputs (fingerlings and feed), rising cost of trawling operation, insufficient production of fingerlings of cultivable fish species, lack of sufficient least cost-effective feed for fish culture among others. Despite the present fish demand of about 2.66 million metric tonnes and estimated domestic production of about 800,000 metric tonnes in Nigeria, there is still a shortfall of 1.2 million metric tonnes in domestic fish production (Agbo, 2015). This inability of the fish farming industry to expand fast enough in the supply of the required quantities of fish being demanded for has been linked to low or inadequate intake of protein among the Nigeria households (FAO, 2018).In order to meet demand and keep sustaining the animal protein markets in the country, fish importation in Nigeria is to the tune of over 900,000 metric tonnes making Nigeria one of the largest importers of fish and fish products among the developing countries. With the present frowns of successive governments at importation of food items in Nigeria, it is obvious that the supply-demand gap will keep widening if domestic growth of the livestock industry is not stimulated. The fish farming subsector is yet at the infant stage when compare to the large market potential for its production and marketing (Olagunju *et al*., 2007; Nwiro, 2012; Ozigbo *et al*., 2014).

The crucial role of efficiency in increasing agricultural output has been widely recognized by researchers and policy makers alike. It is no surprise; therefore, that considerable effort has been devoted to the analysis of farm level efficiency in developing countries(Bifarin et al., 2010).Efficiency studies help countries to determine the extent to which they can raise productivity by improving efficiency with the existing resource base and available technology (Jarzebowski, 2013).An underlying premise behind much of this work is that if farmers are not making efficient use of the existing technology, their efforts designed to improve efficiency would be more cost-effective than introducing new technologies as a means of increasing agricultural outputs (Battese, 1992; Bravo-ureta and Pinheiro, 1997).

The attainment of economic optimum output and thus profitability of any farm enterprise is premised on the optimal and efficient utilization of available farm resources, for it is the efficiency of input utilization in the enterprise that enhances the profitability of such an enterprise. The ability of the farmers to adopt new technology and achieve sustainable production depends on their level of technical efficiency. Measuring technical efficiency at the farm level, identifying important factors associated with the efficient production systems would serve as a panacea to assessing potential for developing sustainable aquaculture (Kareem et al., 2008).The analysis of efficiency is generally associated with the possibility of farms producing a certain optimal level of output from a given level of resources or certain level of output at least cost (Battese and Coelli, 1995; Yao and Liu (1998; Ohajianya, et. al, 2006). The efficiency of input utilization in any agricultural enterprise enhances the profitability of such enterprise. The ability of catfish producers to adopt new technology and achieve sustainable production depends on their level of technical efficiency (Oluwatayoand Adedeji , 2019).

Technical efficiency refers to the ability of firms to employ the “best practice” in an industry so that not more than the necessary amount of a given set of inputs is used in producing the “best” level of output (Ajibefun, et. al, 2002; Mijindadi, 1980; Ohajianya, 2006; Onyenweaku and Nwaru (2005); Anyanwu and Ezedinma, 2006). Criticisms have been raised about the interpretation of efficiency measures. To avoid many of these criticisms levied upon efficiency concepts, Ellis (1988) advised that the producers’ performance should be estimated only in terms of technical efficiency. This according to him is because measures of technical efficiency rely less heavily on assumptions of perfect knowledge, perfectly competitive markets and the profit maximization objective.

Sarker, et. al, (1999) reported that efficiency can be estimated by separately estimating technical and allocative efficiencies from a production frontier using farm survey data. Technical efficiency is defined as the ratio of farmer’s actual output to the technically maximum possible output, at given level of resources. Allocative efficiency is expressed as the ratio of the technically maximum output, at the farmer's level of resources to the output obtainable at the optimum level of resources (NPC, 2006). This study will therefore investigate the technical efficiency and elasticity of production among small scale catfish farmers in Epe Local Government Areas of Lagos State.

METHODOLOGY

The Study Area

This study was carried out in Epe Local Government area of Lagos state. The study area is located on a little island 30 to 60 meters high above the sea level. The economy of Epe since the earlier period expends on three factors, which are, agricultural production, fishing and some manufacturing industries. 70% of people in Epe are either farmers or fishermen.

Sampling Technique and Sample Size

The study used a multi-stage random sampling technique. The first stage involved purposive selection of EpeLocal Government Areas in Lagos State. The second stage involved random selection of political wards from which the list of catfish producing areas obtained from the information units of each LGA. A total of 65 catfish farmers were interviewed with the aid of a structured questionnaire.

Data Collection and Data Analysis

The primary data collected for this study include socio-economic characteristics of the catfish farmers (such as age, gender, years of formal education or educational level, marital status, household size, years of experience in farming, income level, off-farm activities, income sources and amount of farm credit and loans, expenditure and problems encountered in agricultural production). Input-output data of the catfish farmers as pertained to the production season were also collected. Output data included quantity and values of catfish output, market prices, while input data include quantity and cost of inputs.

Analytical Techniques

The analytical techniques employed in this study include: the descriptive statistics, and stochastic frontier production model. The descriptive statistics was used to discuss the socio- economic characteristics of the catfish farmers in the study area; and Stochastic Frontier Production Function (Cobb Douglas functional form) was used to analyze the technical inefficiency and elasticity of production of the catfish farmers in the study area. Congruent with the works of several scholars where the Cobb-Douglas stochastic frontiers was used in estimating the technical efficiency and productivity of maize farmers within and outside the Sasakawa –Global 2000 project in Ethiopia. Therefore, for the sake of this study, the stochastic frontier production functions in which Cobb-Douglas as proposed by Battese and Coelli (1995) represents the best functional form of the production frontier and also as confirmed by Yao and Liu (1998) was applied in the data analysis in order to better estimate the efficiency of catfish farmers.

The model of the stochastic frontier production for the estimation of the TE is specified as:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + V_i - U_i \quad \text{.........................(.1.)}$$

Where subscript i refers to the observation of the ith farmer, and

Y = output of catfish (Kg)
X_1 = feed quantity (kg)
X_2 = labour quantity (man day)
X_3 = fingerling Quantity (kg)
X_4 = pond size (m^2)
β_i's = the parameters to be estimated
ln's = natural logarithms
V_i = the two-sided, normally distributed random error
U_i = the one-sided inefficiency component with a half-normal distribution.

For this study, it is assumed that the technical inefficiency measured by the mode of the truncated normal distribution (i.e. U_i) is a function of socio-economic factors (Yao and Liu, 1998). Thus, the technical efficiency was simultaneously estimated with the determinant of technical efficiency defined by:

$$U_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Where:

- U_i = technical inefficiency of the ith farmer
- Z_1 = Age of farmer (years)
- Z_2 = Marital status
- Z_3 = Educational level
- Z_4 =Family size
- Z_5 = Farming experience

The above equation was used to examine the influence of some of the catfish farmers' socio-economic variables on their technical efficiency. Therefore, the socio-economic variables in equation above were included in the model to indicate their possible influence on the technical efficiencies of the catfish farmers. In the presentation of estimates for the parameters of the above frontier production, two basic models were considered. Model 1 is the traditional response function in which the inefficiency effects (U_i) are not present. It is a special case of the stochastic frontier production function model in which the parameter γ = 0. Model 2 is the general frontier model where there is no restriction in which γ, $\sigma^2 s$ are present. The estimates of the stochastic frontier production function were appraised using the generalized likelihood ratio test, and the T-ratio for significant econometric relevance.

Results and Discussion

Results of Descriptive Analysis

The results of the socioeconomic characteristics of the respondents are disused in this section

Sex: most (78.46%) of the catfish farmers were male while the rest 21.54% were female. By implication, fish farming enterprise is male dominated and this may be due to easy access to land and other inputs, as well as loans from micro-finance banks.
Age: Most (77.47%) of the catfish farmers were about 50 years of age. The productive age of the catfish farmers is between 41-50 years of age. Most of the catfish farmers were still in their productive age, they will be able to dissipate their human energies on their catfish farms, hence better supervision of their catfish enterprises as well as better outputs.
Marital status: Majority (69.23%) of the catfish farmers in the study area were married; 7.69% were singles; 15.38% were divorced; 7.69% were widowed. Most of the households will enjoy the luxury of family labour and reduce costs incurred on hired labour hence better profit margin.
Family size: Most (81.54%) of the catfish farmers had household size of more than 5 members; hence there will be adequate supply of family labour and efficiency of farm operations over those with smaller household sizes.
Primary occupation: majority (98.46%) of the catfish farmers were primarily into other activities apart from catfish farming, this could be as a result of economic situations and government policies that does not encourage small scale fish farming.
Educational level: Most (93.84%) of the catfish farmers had one form of education or the other, It can be seen that the literacy level of the farmers in the study area is very high. Hence they will be able to understand and adopt innovations as well as viable agricultural practices.
Fish farming experience: Most of the catfish farmers (56.93%) had farming experience of more than 6 years. This revealed that most of the farmers in the area are well experienced in fish farming and as such they will be able to manage the items of risks and uncertainties that may attend their ways while in production.
Source of water: 32.31% of the catfish farmers sourced water from boreholes while the majority (67.69) sourced from natural sources. This may be due to the fact that Lagos State is a city surrounded with water and Epe especially has natural water sources in abundance.
Labour utilization: 50.77% of the catfish farmers make use of family labour, 23.08% employed hired labour on the farm while 26.15% use both family and hired labour. This could be due to the fact that family labour is cheaper when

compared to hired labour.

Pond size: Most of the catfish farmers have pond sizes of more than 100 sqm. This depends on the stocking rate of each farmer.

The Stochastic Frontier Production Function Analysis

The ordinary least square (OLS) (Model 1) and the maximum likelihood parameter estimates (MLE) (Model 2) of the stochastic production frontier models which were specified as Cobb-Douglas frontier production function for catfish farmers are presented in Table 2. The coefficients of the variables are very important in discussing the results of the analysis of data. These coefficients represent percentage change in the dependent variables as a result of percentage change in the respective independent variables.

In model 1, the significant variable among the catfish farmers in the study area include: feed quantity (at 1%), labour quantity (at 1%), fingerling quantity (at 1%) and pond size (at 1%) respectively. While the feed quantity had an inverse (negative) significant relationship with the output of catfish, other variables like labour quantity, fingerling quantity, and pond size, all had a direct (positive) significant relationship with the output of catfish in the study area. The implication of the above findings is that in the study area, the major limiting factors of the catfish enterprise are feed quantity, labour quantity, fingerling quantity and pond size. In the preferred model (model 2), the significant variables include: feed quantity (at 1%), labour quantity (at 1%), fingerling quantity (at 1%) and pond size (at 1%) respectively. While the feed quantity had an inverse (negative) significant relationship with the output of catfish, other variables like labour quantity, fingerling quantity, and pond size, all had a direct (positive) significant relationship with the output of catfish, indicating that they greatly impart positively on catfish output in the study area. Of the four major significant inputs, fingerling quantity has the highest coefficient with a value of 0.6994 (Table 2) in the preferred models (model 2) and therefore, it exists as the most limiting factor, and as such greatly determine what catfish output would be like among the catfish farmers. The variables with positive coefficient imply that any increase in such variables would lead to an increase in catfish output of the farmers.

The estimated sigma square (σ^2) of the catfish farmers was 0.02515 and highly significant at 1% level of significance. The estimated gamma (γ) parameter of the catfish farmers was 0.0061, and it was not significant at all known levels of significance. The value was not large and not significantly different from zero. This means that 0.61% of the variations in the output of catfish in the study area were due to the differences in the technical efficiencies of the catfish farmers. This result is incongruent with the findings of Yao and Liu (1998); Ajibefunet al., (2002)).

The analysis of the inefficiency model shows that the signs and significance of the estimated coefficients in the inefficiency model have important policy implications on the technical efficiency (TE) of the catfish farmers. Among the catfish farmers in the study area, only family size was significant, and its coefficient was positive thereby non-conforming to *a priori* expectation with the implications that they are positively with inefficiency but negatively influence the technical efficiency of the catfish farmers in the study area. The estimated productivity parameters such as elasticities of production and returns to scale as presented in Table are discussed below. Among the catfish farmers, the estimated elasticities of the explanatory variables of the preferred model (Model 2) show that labour quantity, fingerling quantity and pond size were all positive (increasing) to catfish output indicating that the use and allocation of these variables was profitable, and as such a unit increase in these inputs will eventually result in an increase in the catfish output of the farmers. While feed quantity is negative (decreasing) to catfish output indicating that the use and allocation of this variable was not profitable, and as such a unit increase in this input when the catfish are well advanced in age (growth) will eventually result in a decrease in the catfish output of the farmers. The elasticity of catfish output with respect to fingerling quantity has the highest value among the catfish farmers. These findings indicated that fingerling quantity was the most important variable factor of production among the catfish farmers in the study area, and should be readily attended to. The analysis of result of the Return to Scale showed that the RTS for the catfish farmers was 1.147 in the study area. Thus, the catfish farmers are experiencing increasing returns to scale and are operating in the irrational zone of production (stage 1).

The predicted technical efficiency estimates obtained using the estimated stochastic frontier models for the individual catfish farmers in the study area as presented in Table 4 are discussed below. The predicted catfish farm specific technical efficiency (TE) for the catfish farmers' indices ranged from a minimum of 71.62% to a maximum of 91.87% for the farms, with a mean of 82.15%. Thus, in the short run, an average catfish farmer has the scope of increasing his/her catfish production by about 17.85% (i.e.100% – 82.15%) by adopting the technology and techniques used by the best practiced (most efficient) catfish farmers. Such catfish farmers could also realize 10.58% cost savings (i.e.1 – [82.15/91.87]) in order to achieve the TE level of his/her most efficient counterpart (Bravo-Ureta and Evenson, 1994; Bravo-Ureta and Pinheiro, 1997).

The above findings unfolds the capacity of an average catfish farmers to increase his/her technical efficiency level to a tune of 17.85% and in turn attain a cost-saving status of about 10.58% that the most technically efficient catfish farmer had enjoyed in his/her catfish production enterprise using the available production techniques and technology in the study area. A similar calculation for the most technically inefficient catfish farmer reveals cost saving of about 22.04% (i.e., 1 – [71.62/91.87] as shown in Table 5.

The decile range of the frequency distribution of the TE as presented in Table 4 indicated that about 40% of the catfish farmers had TE ranging between 71% -80%, 50.77% of them TE ranging between 81% - 90%, and the rest 9.23% had TE of over 90% respectively. The above findings from the analyses of the most technically inefficient catfish farmer revealed that he/she has an untapped ability to realize a cost-saving of about 22.04%. To realize this latter cost-saving status, the catfish farmers would have to employ the right amount of the various production inputs, maximize the use of available technology as well as proper supervision of their catfish farms to the activities of thieves and intruders on their farms.

Table 1: Descriptive Statistics of Socio-Economic Characteristics of the Catfish Farmers.

Characteristics	Frequency	%
Sex		
Male	51	78.46
Female	14	21.54
Age		
20-40	31	47.69
41-50	20	30.78
51-60	12	18.48
≥61	2	3.08
Marital status		
Single	5	7.69
Married	45	69.23
Divorced	10	15.38
Widower	5	7.69
Household size		
≤5	11	16.93
6-10	53	81.54
≥11	1	1.54
Primary occupation		
Fishing	1	1.54
Civil servant	21	32.31
Trading	15	23.08
Others	28	43.08
Farming experience		
≤10	50	76.93
11-15	11	16.92
≥16	4	6.16
Educational level		
No formal education	4	6.15
Primary education	12	18.46
Secondary education	30	46.15
Tertiary education	19	29.23
Labour source		
Family	33	50.77
Hired	15	23.08
Both	17	26.15

Table 1: CONTINUATION

Pond size(sqm)		
≤100	21	32.30
≥101	44	67.70

Source: Computed from Field Survey Data, 2020

Table 2: Maximum Likelihood Estimates for the Parameters of the Stochastic Frontier Production Function for Catfish Farmers in Epe Local Government Area of Lagos State, Nigeria.

Variables	**Parameters**	**Model 1**	**Model 2**
General Model (Production Function)			
Constant	β_0	0.9247	0.9186
Feed quantity	β_1	-0.1766 (-2.559)*	-0.1620 (-2.8448)*
Labour quantity	β_2	0.4301 (4.0280)*	0.4142 (3.9330)*
Fingerling Quantity	β_3	0.6823 (7.9552)*	0.6994 (8.3393)*
Pond Size	β_4	0.1885 (3.6791)*	0.1957 (4.1518)*
Inefficiency Model			
Constant	δ_0	-	0.0556 (0.1842)
Age	δ_1	-	-0.0047 (-1.4994)
Marital Status	δ_2	-	-0.0042 (-0.1274)
Educational Level	δ_3	-	0.0423(1.6414)
Family size	δ_4	-	0.0268(2.2062)**
Farming experience	δ_5	-	0.0048(1.1316)
Variance Parameters			
Sigma Squared	σ^2	-	0.0252 (5.7309)*
Gamma	γ	-	0.0061 (0.0011)
Log Likelihood Function		-	27.45
LRTest 7.6367			

Notes: * =1% level; ** = 5%; *** = 10% (Figures in parentheses are t- values).
Source: Computed from Field Survey Data, 2020

Table 3: Elasticities (εP) and Returns-to-Scale (RTS) of the catfish farmers in Epe Local Government Area of Lagos State.

Variables	**Elasticity Coefficient**
Feed quantity	-0.1620
Labour quantity	0.4142
Fingerling Quantity	0.6994
Pond Size	0.1957
RTS	1.147

Source: Computed from Field Survey Data, 2020

Table 4: Decile Range of Frequency Distribution of Technical Efficiencies of the Catfish Farmers in Epe Local Government Area of Lagos State.

Decile Range (%)	Technical Efficiency	
	No	%
>90	6	9.23
81-90	33	50.77
71-80	26	40.00
61-70	-	-
51-60	-	-
41-50	-	-
31-40	-	-
21-30	-	-
Minimum	71.62%	
Maximum	91.87%	
Mean	82.15%	

Source: Computed from Field Survey Data, 2020

Table 5: Summary of Cost Savings According to Efficiency Indicator by Catfish Farmers in Epe Local Government Areas of Lagos State.

Efficiency Indicator	**Value of Savings (%)**
Most Technically Efficient	10.58
Most Technically Inefficient	22.04%

Source: Computed from Field Survey Data, 2020

Summary, Conclusions and Recommendation

This research work broadly estimated the farm level technical efficiency and elasticity of catfish farmers in Epe Local Government Areas of Lagos State, Nigeria. The study in its specific objectives described the socio-economic characteristics of the catfish farmers in the study area; and analyzed of the technical efficiency of the catfish farmers in the study area. The study employed the use of cross-sectional data from household survey conducted on a sample of 65 catfish farmers in the study areas. The data were collected with the aid of structured questionnaire and were later analyzed. The study employed the following analytical tools in order to analyze the data collected from the field: Descriptive Statistics like frequency counts and percentages as well as Inferential Statistical Model such as Stochastic Frontier Approach.

The mean age of the farmers in the study area was 44 years, and this revealed that they were still in their active productive age group. Majority of the catfish farmers are married. The catfish farmers in the study have a relative large household with an average household size of 7 persons. The mean year of farming experience was 9 years for the catfish farmers. This research revealed that about 70 % of the male catfish farmers were married in the study area.

In model 1, the significant variable among the catfish farmers in the study area include: feed quantity (at 1%), labour quantity (at 1%), fingerling quantity (at 1%) and pond size (at 1%) respectively. In the preferred model (model 2), the significant variables include: feed quantity (at 1%), labour quantity (at 1%), fingerling quantity (at 1%) and pond size (at 1%) respectively. Of the four major significant inputs, fingerling quantity has the highest coefficient with a value of 0.6994 in the preferred models (model 2) and therefore, it exists as the most limiting factor, and as such greatly determine what catfish output would be like among the catfish farmers. The variables with positive coefficient imply that any increase in such variables would lead to an increase in catfish output of the farmers.

The estimated sigma square (σ^2) of the catfish farmers was 0.02515 and highly significant at 1% level of significance. The estimated gamma (γ) parameter of the catfish farmers was 0.0061, and it was not significant at all known levels of significance. The estimated elasticities of the explanatory variables of the preferred model (Model 2) showed that labour quantity, fingerling quantity and pond size were all positive (increasing) to catfish output; and only feed quantity is negative (decreasing) to catfish output indicating that the use and allocation of this variable was not profitable, and as such a unit increase in this input when the catfish are well advanced in age (growth) will eventually result in a decrease in the catfish output of the farmers. The fingerling quantity was the most important variable factor of production among the catfish farmers in the study area, and should be readily attended to. The analysis of result of the Return To Scale showed that the RTS for the catfish farmers was 1.147 in the study area. Thus, the catfish farmers are experiencing increasing returns to scale and are operating in the irrational zone of production (stage 1).

The catfish farmers were not fully technically efficient in the use of production resources. The predicted catfish farm specific technical efficiency (TE) for the catfish farmers' indices ranged from a minimum of 71.62% to a maximum of 91.87% for the farms, with a mean of 82.15%. Among the catfish farmers in the study area, only family size was significant, and its coefficient was positive thereby non-conforming to *a priori* expectation with the implications that they are positively with inefficiency but negatively influence the technical efficiency of the catfish farmers in the study area.

The policy implications and recommendations of this study based on the major findings include: the extension services should be directed towards training and teaching the farmers recent agricultural practices that are fish specific. The use of labour-saving device should be developed and farmers should be made to have access to such at affordable prices. Further studies on this research area should investigate the differentials in the technical efficiency of the farmers based on certain risks inherent and peculiar to their production system.

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