PROFIT EFFICIENCY OF FISH FARMERS IN KWARA STATE NIGERIA

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ABSTRACT

The study examined profit efficiency among fish farmers in Kwara state, Nigeria. The specific objectives of the research were to examine the socio-economic characteristics of the fish farmers in the study area, estimate the cost and returns associated with fish farming, determine the profit efficiency of fish production in the study area, analyze the determinants of profit efficiency in fish production and to examine the constraints associated with fish production. Data were collected from randomly selected 60 farmers using questionnaire. Data were analyzed using descriptive statistics, farm budgeting technique and stochastic profit function. The results showed that the mean age, farming experience and household size of the fish farmers were 45 years, 18 years and 8 respectively. The gross margin and net farm income were ₦838,778.34 and ₦769,945.32 respectively. Stochastic profit frontier analysis revealed foundation stock cost, pond size and capital input had a significant and positive influence on fish output. Age and membership of cooperative had positive effect on the profit inefficiency Constraints faced by the farmers in the study area included lack of electricity, polluted water and lack of government support. It was concluded that fish production was a profitable venture in the study area. The study therefore recommended that farmers should form cooperative societies so as to pull their resources together and improve their finances to enhance their production. Also, policies made by the government to encourage local production of poultry and fish should be implemented by all the agencies concerned.

Keywords*: profitability, profit efficiency, fish, farmers, Kwara State*

INTRODUCTION

The Nigerian fishing industry consists of three major sub-sectors, namely the artisanal, industrial and aquaculture. The story of aquaculture in Nigeria is essentially the story of catfish culture and the hope of fish supply in Nigeria hang on its development and culture (Adewumi and Olaleye, 2010). The awareness on the potential of aquaculture to contribute to domestic fish production has continued to increase in the country. This stems from the need to meet the much needed fish for domestic consumption and export. Fish species which are commonly cultured include Tilapia spp, *Heterobranchus bidorsalis, Clarias gariepinus, Mugie spp, Chrysichthys nigrodigitatus, Heterotis niloticus, Ophio cephalus obscure, Cyprinus carpio and Megalo spp.* Fish culture is done in enclosures such as tanks. The aquaculture sub-sector contributes between 0.5% and 1% to Nigeria's domestic fish production.

One of the developmental challenges facing most developing countries is their inability to adequately feed their ever-increasing population with the right proportion of calories and protein (Apantaku, 2006). Since Nigeria's independence in 1960, evidenced from the provisions of the yearly national budgets, both at Federal and State levels, the fishery, forestry and even the livestock sub-sector have traditionally not been given as much priority as their crop counterpart. This notwithstanding, the country is benefitting from an emerging culture fish industry. Even though, successive governments had in the past made some efforts to leverage fish culturing as a viable business raising production to potential capacity appears low. The available culture fish farmers are still unable to meet the envisaged output levels; perhaps due to the inability to produce on a wider scale or problem of inefficiency in the production system. The production system is still characterized by small-scale holdings, low output, poor resource management, low application of technologies and the inadequacy of key professionals (FAO, 2010).The broad objective of this study was to carry out a comparative analysis of profit efficiency among fish farming enterprises in three Local Government Areas of Kwara State. The specific objectives were to: (i) describe the socio-economic characteristics of the respondents (ii) estimate the cost and the return of fish farmers in the study area, (iii) determine the profit efficiency in fish production in the study area, (iv) examine the determinants of profit efficiency in fish production in the study area, and (v) examine the constraints or limitations associated with fish production.

METHDOLOGY

Study area

Kwara State lies between Latitudes 7°45′N to 9°30′N and Longitudes 2°30′E to 6°2′E (Ojo, (2013). The State covers a total land area of 332,500 square kilometers or 8% of the land area of Nigeria (Fakayode *et al.*, 2008). According to the National Population Commission (NPC), (2006) the state has a population of 2,591,555 which is projected to be 3,317,409 by 2016 (Aruna, 2005) at annual population growth rate of 2.5%. It is located in the transition zone between deciduous woodland of the dry southern savannah of Nigeria (Jimoh, 2003) making it a good site for livestock production. The State climate is characterized by both dry and wet season each lasting for about 6 months. According to Kwara State Geographic Information System (KSGIS 2013), the raining season begins toward the end of April and last till October while dry season begins in November and ends in March. The annual rainfall ranges from 1,000 – 1,500mm, while the daily average temperature typical range is between 21°C to 33°C. The state is divided into four zones (zone A-D) by the Kwara State Agricultural Development Project (KWADP) based on the ecological and cultural characteristics, practices and administrative convenience of the State (KWADP 2004). The zones are: A (Baruteen and Kaima Local Government Area), B (Edu and Patigi Local Government Area), C : (Asa, Ilorin-East, Ilorin-South, Ilorin-West, Moro Local Government Area), D: (Irepodun, Isin, Ekiti, Ifelodun, Offa, Oke-Ero, Oyun Local Government Area). The mainstay of the economy is agriculture.

Sampling procedure

The primary data for this study was obtained using a multistage sampling technique. The first stage involved a random selection of three (3) Zones out of the four (4) existing zones in the study area namely Zone B, C and D. The second stage involved the random selection of one (1) Local Government from each of the selected zones, namely: (Patigi LGA, Asa LGA and Irepodun LGA), in stage three, two farming communities was randomly selected from each of the selected Local Government Area respectively, namely: (Kpada, Patigi, Lasoju, Eyenkorin, Sanmora and Ajasse-

ipo). The fourth stage involved the random selection of 10 fish farmers from each of the selected Communities to give a total of 60 respondents. The data were collected with the aid of structured questionnaire.

Method of data analysis

The data obtained were analyzed using descriptive statistics, farm budget technique and Cobb-Douglas Stochastic frontier model. Descriptive statistics such as mean, percentage, and frequency were used to examine the socio-economic characteristics of the fish farmers and to identify the constraints associated with fish production. Farm budget techniques such as Gross Margin and Net farm income (NFI) were used to estimate the costs and returns. Gross Margin per meter square (GM/m^2) which is the difference between the total revenue and the total variable cost of production is expressed in equation (1).

GM= TR – TVC …….(1).
GM= Gross Margin per meter square
TR=Total Revenue per meter square
TVC=Total Variable Cost per meter square.
On the other hand, Net Farm Income (NFI) which is the difference between the total revenue and total cost of production is expressed as:
NFI= GM –TFC……. (2)
Where
NFI= Net Farm Income per meter square.
GM=Gross Margin
TFC=Total Fixed Cost per meter square (interest on loan and depreciation on tools).
The stochastic frontier model was used to determine the profit efficiency of fish farmers in the study area. The Cobb-Douglas profit function in implicit form is expressed as follows (Sunday *et al*., 2012);

$\pi_i = \pi_i / P_y = f(X_i, Z) \exp(V_i - U_i)$ ……..(3)

Where:
π_i = normalized profit of the i^{th} farmer (Naira),
X_i = vector of variable inputs (Naira),
Z = vector of fixed inputs (Naira),
P_y = output price (Naira), and
$\exp(V_i - U_i)$ = composite error term

The explicit form is stated as
$ln\pi = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + \beta_7 lnX_7 + V_i - U_i$……. (4)

Where:
π = Normalized Profit (in ₦ per fish enterprise),
In = Natural Logarithm,
X_1= Normalized price of labour (in ₦),
X_2= Normalized price of feeds and feeds supplements (in ₦),
X_3 = Normalized price of medication (in ₦),
X_4 = Normalized price of foundation stock (fingerlings) (in ₦)

X_5 = Normalized pond size (m^2)
X_6 = Cost of capital inputs. These included depreciation cost of machines, equipments, rent on land and interest charges on borrowed capital (₦),
β_0 = Intercept/constant term,
β_i-β_7= Input parameters to be estimated.
V_i= Normal random errors assumed to be independently and identically distributed having N ~ (0, δv^2) and
U_i = Non-negative (zero mean and constants variance) random variables called profit inefficiency effect associated with profit efficiency of the i^{th} farmer.
U_{ijs} are the profit inefficiency effects which are assumed to be independent of V_{ijs} such that U_{ijs} is the non-negative truncation (at zero) of the normal distribution with mean U_i and variance δv^2. U_i is represented as:

$$\dot{U}_i = \delta_0 + \delta_{1i}Z_1 + \delta_{2i}Z_2 + \delta_{3i}Z_3 + \delta_{4i}Z_4 + \delta_{5i}Z_5 + \delta_{6i}Z_6 + \delta_{7i}Z_7 + \delta_{8i}Z_8 + \delta_{9i}Z_9 \ldots\ldots (5)$$

Where:
U_i = Profit inefficiency of the i^{th} farmer,
Z_1 = Age of the farmer (in years),
Z_2 = Level of education (in years),
Z_3 = Household size (number),
Z_4 = Farming experience (in years),
Z_5 = Contact with Extension Agents (1= if a farmer had contact with extension agents, 0= if a farmer have no contact with an extension agent)
Z_6 = Gender (male =1, female = 0)
Z_7 = Amount of credit received (in Naira),
Z_8 = Membership of co-operative society (1 if farmer is a member of any co-operative society, 0 if otherwise),
Z_9 = Location of farm (1 = urban, 0 = rural)
$\delta_1 - \delta_9$ = Unknown parameters to be estimated.

RESULTS AND DISCUSSIONS

Socio-economic Characteristics of Fish Farmers

The study found that 88.3% of the fish farmers were male, while 11.7% were female. It can therefore be concluded that male dominated fish production business in the study area. However, the involvement of women in fish farming was prominent among small scale fish farmers. This could be attributed to the fact that most of the women were part-time fish farmers. This is in consonance with the findings of Agboola (2012) and Olaoye *et al*. (2013) who reported that fish farming was dominated by male in Osun and Oyo States of Nigeria respectively. The result further showed that majority (85%) of the fish farmers were between the age of 31 and 50 years with a mean age of 45 years. This is an indication that fish farmers were in their productive age, energetic, can face challenges encountered in production and could accept and adopt innovations faster as well as invest more on production. This is because fish production requires both physical and mental skill with much time and energy required in the process. This is in consonance with the findings of Yahaya (2015) which states that youth are actively involved in fish farming. Furthermore, the results indicate that farmers have varying family sizes. About 85.0% of the fish farmers had household size of 1-10, and 15% of fish Farmers with household size of 11-15. This shows that fish farmers have relatively larger household size with the mean of 8 persons per

household. This average is relatively fair enough which perhaps necessitated the use of family labour by most of the respondents in the study area. Although, in some cases not all family members were strong enough to handle the tedious nature of farm work; indeed, availability of farm labour is not a function of the household size but rather the composition of the household. A farm household with too many aged people and children would have to hire labour as compared to a household with energetic persons. Labour demand increases during peak periods of accomplishing farm operations. The findings revealed that a larger proportion (31.7%) of the fish farmers attain primary education,23.9% of fish farmers attained tertiary education, and 26.7% of fish farmers attaining secondary education and 13.3% had no formal education. The result compares favourably with Aromolaran, (2000).The result presented in Table 1 indicates that an overwhelming majority of the fish farmers (95%) have farming experience of more than 10 years. This indicates that most of the farmers in the study area have adequate farming experience in fish production and know how to use resources efficiently. Experience enables the farmers set realistic targets.

Table 1: Socio-economic Characteristics of Fish Farmers

Variables	Frequency	Percentage	Mean
Gender			
Male	53	88.3	
Female	7	11.7	
Total	60	100	
Age			
31-40	13	21.7	
41-50	38	63.3	
51-60	8	13.3	
>61	1	1.7	45
Total	60	100	
Household size			
1-5	11	18.3	
6-10	40	66.7	
11-15	9	15	8
Total	60	100	
Educational Status			
Non-formal	8	13.3	
Primary education	19	31.7	
Secondary education	16	26.7	
Tertiary education	17	23.9	10
Total	60	100	
Farming experience			
1-10	17	28.3	
11-20	19	31.7	
21-30	21	35	
31-40	3	5	18
Total	60	100	

Source: Field Survey, 2017.

Cost and Returns of Fish Farmers

The result of the cost and return analysis of fish production in the study area is presented in Table 2. It shows that the total cost per meter square incurred on fish production was estimated to be ₦10,992.70k/m^2 of which the total variable cost accounted for the largest proportion, that is, 73.64%. Also, the cost incurred on feed and feeding accounted for 53.06% of the total cost which was the highest. Result also revealed that the revenue generated per meter square was estimated to be ₦36,024.12k. The estimated gross margin and net farm income were ₦27,929.53k and ₦25,031.42. The positive net farm income indicates that fish production in the study area was profitable. Gross ratio and operating ratio were estimated to be 0.3051 and 0.2247 respectively. The implication of this is that only 30.51% and 22.47% of the total revenue is required to cover the total cost and operating cost respectively, a further indication that fish production in the study area was profitable. This result agree with the findings of Musa *et al.* (2006), Onoja (2001) and Olukosi *et al.* (2006) who stated that the lower the gross and operating ratios, the higher the profitability of the farm enterprise and vice versa. The average rate of returns on investment was found to be ₦3.45k. This means that for every ₦1.00k invested in producing one meter square pond of fish, ₦3.45k was realized. Given the magnitudes of these ratios therefore, it can further be buttressed that fish production is a profitable venture in the study area.

Table 2 Estimated to cost and returns in fish farming

Variables	Average amount (₦/m^2)	% of total cost
Variable cost		
Cost of purchasing (fingerlings)	456.25	4.15
Cost of juveniles	388.75	3.56
Labour (Hired)	954.00	8.68
Labour (Family)	222.50	2.02
Medication cost	239.17	2.17
Feed and feeding cost	5,833.92	53.06
Sub-total	**8,094.59**	**73.64**
Fixed cost		
Depreciation (fixed inputs)	2,710.61	24.66
Interest (loan)	187.50	1.70
Sub- total	**2,898.11**	**26.36**
Total Cost	**10,992.70**	**100.00**
Revenue		
Receipts form sales	36,024.12	100.00
Total Revenue	**36,024.12**	**100.00**
Gross margin (TR-TVC)	**27,929.53**	
Net farm Income (GM-TFC)	**25,031.42**	
Gross ratio (TC/TR)	**0.3051**	
Operating ratio (TVC/TR)	**0.2247**	
Return on capital invested (GM/TVC)	**3.45**	

Source: Field survey, 2017.

Stochastic Profit Analysis for Fish Production

The result presented in Table 3 shows the maximum likelihood estimates of the stochastic profit frontier of the fish farmers in Kwara State, Nigeria. The diagnosis statistics for fish production have coefficient which are statistically significant at 99% confidence level. The coefficient of total

variance (δ^2) is 3.072 while the variance ratio ($_\gamma$) is 0.531 Variance ratio measures the ratio of the Variance of farm specific profit inefficiency to the total variance. This means 53.1% of the variations in output among the fish farmers were due to disparities in profit efficiency. The total variance (δ^2) of 3.072 is statistically significant and as such, indicates a good fit and the correctness of the specified distributional assumption of the composite error term. The estimated coefficient of the inefficiency function provides some explanation for the relative levels among individual farms.

The Table shows that the price of Foundation stock and the pond size were positive and significant at 1% level and Medication cost was significant at 10%. The estimated coefficient with respect to foundation stock was 1.638. This implies that every 1% increase in the price of foundation stock would lead to 1.638% increase in the profit of fish production. This result agrees with previous works of Effiong (2005) and Nwachukwu and Onyenweaku (2007) that the larger the stock size, the more efficient a farmer becomes. The estimated coefficient of pond size for fish production was 1.078. This implies that for every 1% increase in pond size, would lead to 1.078% increase in the profit of fish. This is in consonance with the findings of Amaza and Olayemi (2002) and Ojo *et al.* (2009). Price of medication for fish production with coefficient of -1.154 carried negative signs and is statistically significant at 10%. This implies that for every 1% increase in the price of medication would lead to -1.154% decrease in the profit of fish production. This does not conform to *a prior* expectation that the more the price of medication the more the profit. Feed price has a negative coefficient of -0.266. This means that an increase in the price of feed leads to decrease in the profit efficiency. This is in agreement with the findings of Adesiyan (2014) which asserted that the insignificant outcome for the cost of feed is surprising which could be that most of the farmers made use of other types of feeds, which was unaccounted for in their expenses. Capital inputs had a positive coefficient of 5.019. This implies that the fish producers in the study area are allocating and utilizing feed and capital input cost efficiently. This result is in agreement with that of Abdullahi *et al.* (2010) who observed that amount of capital inputs per farm determines the level of investment in such a farm.

According to Omotosho *et al.* (2008) and Ojo *et al.* (2009), since the dependent variable of the inefficiency function represents the model of inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency and a negative sign indicates the reverse. The result of analysis shows that farmers' age and membership of cooperative societies carried a negative signs of -0.170 and -8.621 respectively and were significant at the 10% and 1% level respectively. The farmers' age is significant at 10% and is positively related to profit efficiency. This implies that as the farmers age increases, the level of profit efficiency also increases. This implies that the farmer is in his active age and willing to take risk. This is in consonance with the work of Adebayo *et al.* (2015). The coefficient of membership of co-operative was found to be negative and significant at 1%. This implies that farmers' membership of associations affords them the opportunity of interacting with others and thereby exchanging information on improved technology in fish production. Co-operative societies provide benefits to members at all cost. On the other hand, access to credit and location of farm with the coefficient of 1.942 and 4.276 carried positive signs and are statistically significant at 5%. This implies that farmers who have access to credit tend to exhibit higher levels of profit inefficiency. This is against the *a priori* expectation and it might be as a result of credit received being misused (or diverted to other uses). The coefficient of location of farm was found to be

positive and significant at 5%. This implies that farther the distance of the farm from the farmers resident the lesser the profit efficiency.

Table 3: Stochastic Frontier Profit Efficiency in Fish Production in Kwara State

Variables	Parameters	Coefficient	t-ratio
Production Factors			
Constant	β_0	-3.282	-1.215
Labour(Family and hired) (X_1)	β_1	0.165	0.672
Feed cost (X_2)	β_2	-0.266	-1.805*
Medication cost (X_3)	β_3	-1.154	-1.833*
Foundation stock (X_4)	β_4	1.638	4.896***
Pond Size (m^2)(X_5)	β_5	1.078	3.299***
Capital input (X_6)	β_6	5.019	4.619***
Inefficiency Factors			
Constant	Z_0	2.051	1.408
Age	Z_1	-0.170	-1.939*
Level of education	Z_2	-0.243	-1.363
Household size	Z_3	-0.279	-1.166
Farming experience	Z_4	0.213	1.186
Contact with extension agent	Z_5	1.926	1.249
Gender of the farmer	Z_6	0.345	0.344
Credit access	Z_7	1.942	2.043**
Membership of cooperative society	Z_8	-8.621	-8.635***
Location of farm	Z_9	4.276	2.148**
Diagnosis statistics			
Total variance	δ^2	3.072	4.385
Variance ratio	γ	0.531	3.206
L R Test		9.070	
Log likelihood function		-100.411	

Source: Output of FRONTIER 4.1

*, ** and ***implies significance level at 10, 5 and 1% probability levels respectively

Profit Efficiency Scores Index for Fish Farmers in the Study Area

The scores in Table 4 showed that the mean profit efficiency of the fish farmers in the study area was less than one, that is, less than 100%). This implies that averagely the farmers in the study area were operating below the maximum efficiency frontier. The most profit efficient farmer had an efficiency score of 0.75, that is, 75%, while the least efficient farmer had a profit efficiency of 0.10, that is, 10% which indicates gross underutilization of resources. The mean profit efficiency was 0.39, implying that on the average; farmers in the study area were able to obtain a 39% of potential fish profit from a given mix of production inputs and the corresponding output. The estimation is skewed to the left, implying low level of profit efficiency. This further means that

the fish framers still have room to increase the profit efficiency as about 61% efficiency gap from optimum (100%) was yet to be attained by the farmers. Thus, in short run there is a scope for increasing profit in fish farming by 25% through adopting the technology used by best practice fish farm in the study area.

Table 4: Distribution of respondents according to the profit efficiency of fish production

Profit efficiency	Number	Percentage %
< 0.2	4	6.7
0.2 – 0.39	15	25
0.4 – 0.59	40	66.7
0.6 – 0.79	1	1.7
Total	60	100
Mean	0.39	
Maximum value	0.75	
Minimum value	0.10	

Source: Field survey, 2017.

Production constraints of Farmers

Table 5shows that lack of electricity (51.0), access to pollution-free water (15.6%) and lack of Government support for fish-input sourcing (11.5%) are the major constraints to fish production in the study area. Others shows that 7.3% of the respondents reported insufficient capital, 5.2% of the respondents reported lack of institutional education and lack of extension agent respectively, 4.2% of the respondents reported high cost of labour as constraints to fish production in the study area. This is in agreement with the findings of Akanbi, (2013) which asserted that some of the constraints militating against fish production are high cost of labour, lack of electricity, access to pollution-free water, lack of government support for fish-input sourcing.

Table 5: Distribution of fish producers according to production constraints

Constraints	Frequency	Percentage
Lack of electricity	49	51
Lack of institutional education	5	5.2
Access to pollution-free water	15	15.6
Lack of Government support for fish-input sourcing	11	11.5
High cost of labour	4	4.2
Lack of extension agent	5	5.2
Insufficient capital	7	7.3
Total	*96	100

Source: Field Survey, 2017.

* Multiple response

Hypothesis

Hypothesis which states that the explanatory variables in the model of inefficiency factors have zero coefficients is hereby rejected. This is because results in Table 3 show that the magnitude of

the explanatory variables is not equal to zero. This implies that inefficiency factors incorporated into the model significantly affected the level of profit efficiency of the respondents.

Conclusion and Recommendations

The study examined the profit efficiency among fish farmers in Kwara state, Nigeria. Data was collected from 60 fish farmers using questionnaire. It revealed that fish production in the study area is a profitable venture. Fish production was relatively efficient with mean profit efficiency of 0.39. Based on the findings of this work the following recommendations were made. The fish farmers should also acquire adequate skills necessary on compounding feeds and being formulating feeds to minimize cost. It is recommended that fish farmers in the study area should be encouraged to join better organized cooperative societies so as to enable them pool their resources in order to have access to inputs and knowledge on improved fish and poultry farming practices. This is very important as membership of cooperatives aids the adoption of improved technologies that enhance maximum production.

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