International Journal of Research Studies in Agricultural Sciences (IJRSAS)
Volume 2, Issue 8, 2016, PP 9-18
ISSN 2454-6224
http://dx.doi.org/10.20431/2454-6224.0208002
www.arcjournals.org

Production Efficiency of Fish Farming in Ibadan-Ibarapa Zone of Oyo State, Nigeria.

Sanusi W.A, Akinniran T.N, Akinyemi M.*, Ige, D.A

The Department Of Agricultural Economics, Ladoke Akintola ,University Of Technology, Ogbomoso, Oyo State.
*Federal University, Dutsi-Maa, Katsina State

Abstract: *This study investigates fish farming productivity by estimating the level of technical efficiency for a sample of fish farmers in Ido and Oluyole local government. Data was obtained from the respondents through a well structured questionnaires and interview schedule.*

In this study, a total of 60 fish farmers were selected using multistage sampling techniques. Descriptive statistical tools were used to analyze the socio economic characteristics of the farmers and constraints facing them. Gross margin analysis was used to analyze costs and return. DEA analysis was used to determine their efficiency, while tobit regression model was used to analyse determinants of efficiency.

The study revealed that about 68.3% chose fish farming as their minor occupation, 63.3% engaged in fish farming for family consumption, 86.7% did it for sales. 70% have 1-5 years of fish farming experience, 66.67% have 1-10 years of farming experience, 75% operated only 1 pond each. 40% of the respondents acquire their land through inheritance, 46.7% used earthen pond, 76.7% are members of cooperative society and 66.7% had no access to credit.

The finding shows that fish farming was profitable with net farm income of ₦374100.09 per fish farmers in the study area. Majority of the fish farmers are relatively technical efficient in their use of resources with mean technical efficiency of 84.9%, 89.0%, 95.5%, under CRS, VRS, and SE respectively. Farmers' sex and fish farming experience had inverse relationship with the efficiency of fish farming in the study areas, farmers' age had direct relationship under both CRS and VRS, while access to credit had direct relationship with efficiency under SE specification. The analysis shows a slack of 4.184kg, 2,972.091m^2,2,411.008kg, ₦112,119.49 and 2,284.597; in fish output, pond size, feed, labour and number of fingerlings respectively. Major problem facing the fish farmers were limited access to credit, marketing, transportation and access to quality feed.

The study therefore concluded that measures should be taken to improve technical efficiency, in order to bridge the gap between fish demand and supply, to bring about self sufficiency in fish production.

Keywords: *Production, Efficiency and Fish Farming.*

BACKGROUND OF THE STUDY

Fish existence is as old as human existence. Fishes have been consumed as food since the Paleolithic era, as a source of animal protein. The first appearance of fish on earth was recorded one million years ago. Fish naturally lives in water bodies e.g. river, ocean, and they can also be reared. Fish farming is the raising of fish for personal use or profit, with the aim of better use of land, water, source of food, income and employment to humans.

Nigeria fishing industry comprises of 3 major subsectors namely; the artisanal, industrial and aquaculture. 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 production and export. Fish species which are commonly cultured include Tilapia spp ,Heterobranchusniloticus, Clariasgariepinus, Mugiespp, Chrisichthysnigrodigitatus ,Hetero nitoticus, Ophiocephalus obscure, Cypinuscarpio and Megalo spp. Fish culture is done in enclosures such as tanks. The aquaculture subsector, contributes between 0.5% and 1% to Nigeria domestic fish production (Adewuyi et al., 2010).

Statistics indicated that Nigeria is the largest African aquaculture producer, with production output of over 15,489 tons per annum, this is closely followed by Egypt with output of about 5,645 tons. Only five other countries: Zambia, Madagascar, Togo, Kenya and Sudan: produce more than 1000 tons each. However Nigeria is among the largest fish consumers in the world, with over 1.5 million tons of fish, consumed annually. Yet today Nigeria has a big hole in her pocket, as the country imports over 900,000 metric tons of fish, while its domestic fish catch is estimated at 450,000 metric tons per year.

The large dependence on imported fish, has adversely affected her economy; and mostly foreign reserves (Davies et al 2008). Moreover the rapid increase in population of the world has resulted in a huge increase in demand, for animal protein. To solve the country's high demand for fish, Nigeria must turn to maximize the available resources (e.g. inland waters) and minimize constraints, including lack of seed and quality of feed. The challenge the efficiency on food production level in Nigeria appears to be more urgent now, than it has ever been in the history of the country. However, agricultural (food) problem needs much more concentration, because of its paramount importance. Apart from satisfying the inhabitants, it could also serve as source of income generation (tax), through marketing to other parts of the country and beyond (exports). The generated income could be used to solve other problems, mentioned aforetime. Moreover hunger and malnutrition remain amongst the most devastating problems facing the world poor and needy (FAO, 2002). About 80 to 90 million people have to be fed yearly and most of them are in developing countries. The most reliable source of protein for many is fish, yet millions of people who depend on fish are faced with the fear of food shortage (World Fish Centre, 2003).

With the population on the rise, there is a corresponding increase in the demand for fish consumption. To reduce the alarming increase in price of fish, there is a need for a suitable agricultural system, to meet the increasing demand for food. Also maximum utilization of the available limited resources is needed for this purpose. This is to increase supply, also to considerably reduce the price of fish, making it available to the masses, thus reducing malnutrition.

It is against this background that this study, intends to provide the answers to the following research questions:

1. What are the factors affecting the interest of farmers in fish farming?
2. What are the cost and returns to fish farming?
3. Are the fish farmers technically efficient?
4. What are the constraints to fish production in study area?

The general objective is to determine the technical efficiency and the profitability of fish farming in Ido and Oluyole local government, Ibadan.

The specific objectives include:

i. To estimate cost and return analysis of fish farming.

ii. To estimate technical efficiency of fish farmers in the study area

iii. To analyze factors affecting production efficiency of fish farming.

iv. To identify the constraint to fish production in study area.

HYPOTHESES OF THE STUDY

The hypothesis of the study are in null form

1. There is no significant relationship between the socio-economic characteristics of fish farmers and their production efficiency.

METHODOLOGY

Study Area

The study was carried out in Ido and Oluyole local government areas of Oyo state, Nigeria. The cardinal location of Ido local government is extremely within the tropics and bounded in the east by Akinyele, west by Ibarapa east local government, north by Ibadan south west and south by Egbeda local government. It has ten political wards with a land area of $1{,}010{,}950km^2$ .The annual rainfall is 1,480mm with peak from April to June, a July break and second peak from August to October. Agriculture is their predominant occupation of the people in Ido local government, though maingly cash crops and arable crops. They practice fisheries to an extent.

Oluyole local government is located in the tropic zone, lying between latitude 3^0E and 5^0E of the Greenwich meridian and between longitude 7^0N and 2^0N of the equator. It has the vegetation that is dominated with tropical rainforest region, due to its location in the southern part of the state. Oluyole local government area has annual rainfall of 1000-1400mm. They practice agriculture, predominated cash crops like cassava, Maize, Mango, Oil palm, Cocoa. Feed mills including fish feed mills could be seen as indication of aquaculture practice, as you travel along the area. It shares boundary with Ibadan southwest and east local government area, to the north, Ido local government area, to the northwest and Onaara local government area to the east. It also shares boundary with Ogun state, to the south.

It covers a land area of $629km^2$ and a population of 202,725 from 2006 population census. The residents are Yoruba and other tribes of Christianity, Islamic, and traditional religious backgrounds. It also has a well functioning Fadama program.

Population, Sampling Procedure and Sampling size

The population of the study includes all registered fish farmers of Fadama in Ido and Oluyole local government area of Oyo state.

Multistage random sampling was used. The two local government were purposively chosen because of higher concentration of fish farmers. 66.7% (40) respondents were randomly selected from Oluyole local government and 33.33% (20) were chosen from Ido local government making a total of 60 fish farmers. This is due to comparatively higher concentration of fish farmers in Ido local government.

Method of Data Analysis

Data was analyzed using descriptive statistics, Data Envelopment Analysis (DEA software) and Tobit regression model.

i. Descriptive statistics analysis

This entails the use of mean, frequency and percentages, Budgetary analysis was used to analyze profitability of fish farming in the area.

ii. Data Envelopment Analysis (DEA software) and Tobit regression model

DEA is a linear programming based technique for measuring the relative performance of Decision Making Units (DMUs) where the presence of multiple inputs and outputs make comparisons difficult. DEA is a relatively new approach for evaluating the performance of set of Decision Making Units (DMUs), which convert multiple outputs. The definition of DMUs is generic and in recent years has been a great variety of applications of DEA in evaluating the performance of many different kind engaged in different activities in many countries.DEA provide a means of calculating apparent efficiency levels within a group of DMUs. The efficiency of a DMU is calculated relative to the group's observed best practices (Ajao 2011).

It is used to determine the efficiency indices of the area. The models here will focus on the technical aspect of production.

U_1Y_1

V_1X_1…………………………………... (1)

Is obtained where U_1 is a Q_{X1} vector of output weight and V is a P_{X1} vector input weight. The optimal weights are obtained by solving

$$TE_{CRS} = \mathrm{Min}\,\theta\lambda\theta$$

$$-Y_i + Y\lambda \geq 0$$

$$-\lambda_{X1} + X\lambda \geq 0 \quad \text{………………………} \ (2)$$

Where θ is the scalar and λ is N_{Xi} vector of constant. The value θ will be efficiency score for the respondents. It will satisfy θ≤1, with a value of 1indicating point on the frontier, hence technical efficiency according to Farrell (1957) definition. Value of less than indicates technique inefficiency.

Equation (1) can be modified VRS assumption as the permits calculation of technical efficiency devoid of scale efficiency (SE) effect.

$$\mathbf{TE_{VRS} = Min\,\theta\lambda\theta}$$
$$-y_i + y\lambda \geq 0$$
$$-\theta_{X1} + X\lambda = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(3)}$$
$$N1'\lambda \leq 1$$
$$\lambda r \geq 0$$

Where N_i is anN_{Xi} vector of ones. A remaining aspect of DEA is that of scale efficiency (SE) which is a measure of whether or not, a producing unit is operating at an optimal scale of operation. To obtain SE, technical efficiency TE_{CRS} will be decomposed into pure technical and scale inefficiency. If there is difference between the TE_{CRS} andTE_{VRS} score for a particular respondent, this indicates there is scale inefficiency. According to Sharma et al. (1998), VRS is more flexible and envelope the data in a more tightly way than CRS analysis. The TE_{CRS} measures ($\theta_{\downarrow}$VRS) is equal to or greater than TE_{CRS} measure ($\theta_{\downarrow}$CRS) . This relationship is used to obtain a measure of scale efficiency (SE) of the respondent.

$$SE_i = \frac{\theta_{crs}}{\theta_{vrs}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(4)}$$

Where $SE = 1$ indicates scale inefficiency or CRS and $SE < 1$ indicates inefficiency. Eqn (2) did not indicate whether the firm is operating on the increasing or decreasing return to scale. The measure did not indicate whether or not scale inefficiency occur because a production activity is operating at too large or too small a scale, only requires solving another DEA problem, the non-increasing return to scale (NIRS) model. N↑λ=1 restriction in (2) will be replaced by $NI^1\lambda<1$ to have non increasing return to $TE_{nis} = Min$.

$$\mathbf{TE_{VRS} = Min\,\theta\lambda\theta}$$
$$y_i + v\lambda \geq y\lambda$$
$$\theta_{X1} + x\lambda \geq 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(5)}$$
$$NI^1\lambda=1$$
$$\lambda \geq 0$$

If the $TE_{VRS} = TE_{n1rs}$ denotes decreasing return to scale, if the $TE_{VRS} \neq TE_{n1rs}$ denotes increasing return to scale.

Ii (b) Determinants of Efficiency

Tobit regression Model

This was used to analyze the determinants of efficiencies among fish farmers. The model can be stated as

$$y^* = \beta z + e$$
$$y = y^*(\beta z + e) \text{ if } y* > 0$$
$$y = 0 \text{ if } y^* \leq 0$$

y = efficiency scores

Z = a vector of explanatory variables

β = vector of unknown variables

e = independently and normally distributed random error terms

Z_1 = Age of the farmer (years)

Z_2 = Gender (1 = male, 2 = female)

Z_3 = Years of schooling (years)

Z_4 = Farm experience (years)7

Z_5 = Membership of cooperative society (yes = 1, 0 = otherwise)

Z_6 = Access to credit (yes = 1, 0 = otherwise)

Z_7 = Fish farming experience (Years)

Z_8 = Household size (number)

RESULT AND DISCUSSIONS

Cost and Returns of fish farming

Cost is the expenditure that is involved in the production system while on the other hand, returns are referred to as the revenue generated on fish farming. The total cost (TC) and the total return can also be expressed in terms of their average cost and average return respectively. The total cost was divided into 2, namely: fixed cost and variable cost. Fixed costs are expenditure that do not vary as output changes while variable cost are expenditure incurred in production and vary as output changes.

Analysis of Variable Cost

Variable costs are costs which vary with output, that is, as output increases, cost of variable factor rises. Variable cost item in fish farming include labour, fingerlings and feed. From table 1, the average variable cost of fish farming was ₦164 468.34. Labour and feed accounted for 32.54% and 45.05%, while fingerlings accounted for 22.41%. This means that labour, fingerlings and feed are necessary in fish farming.

Table 1. *Analysis of variable cost*

Item	Cost (₦)	Percentage (%)
Labour	53526.67	32.54
Feed	74086.67	45.05
Fingerlings	36855.00	22.41
Total	164468.34	100

Source: Field survey 2014

Analysis of Fixed Cost

The fixed cost incurred by the farmers includes depreciated cost of land purchase and cost of pond construction, was estimated to be ₦62983.34.

Table 2. *Fixed cost*

Item	Cost (₦)	Percentage (%)
Land and pond construction	62983.34(dep)	100

Source: Field survey 2014

Analysis of Total Cost

Total cost is the sum of the fixed and variable cost. Table 2 shows that fixed cost is the lowest, which account for 27.69% of the total cost of fish farming in the study area, while variable cost account for the remaining 72.31%. This shows that variable cost is the most significant in fish production, in the study area.

Table 2. *Analysis of total cost*

Item	Cost (₦)	Percentage (%)
Fixed cost	62983.34	27.69
Variable cost	164468.34	72.31
Total cost	227451.68	100

Source: Field survey 2014

Gross Margin and Net Income Analysis

Table 3 shows the gross margin and net income analysis of fish farming in the study area. The total average revenue from fish farming was ₦549858.00 with average variable cost of ₦164468.34, which gives a gross margin of ₦385389.66. The average fixed cost was ₦62983.34 while the net farm income was ₦374100.09. Benefit cost ratio was 2.4. This implies that fish farming in the study area, was a profitable enterprise.

Table 3. *Gross margin and net farm income analysis*

Item	Value (₦)
Total revenue	549858.00
Average variable cost	164468.34
Gross margin	385389.66
Average fixed cost	62983.34
Net farm income	374100.09
Benefit cost ratio	2.4

Source: Field survey 2014

Production Efficiency Index of Fish Farmers

Table 4 revealed the frequency distribution of fish farmers' economic efficiency under constant return to scale (CRS), variable return to scale (VRS) and scale efficiency (SE) estimates.

The mean technical efficiencies are 0.849, 0.890, 0.955 for constant return to scale, variable return to scale and scale efficiency respectively. Substantial inefficiencies occurred in fish farming in the study area. Under the current circumstances, about 21.67%, 46.67%, and 25% were identified as fully economically efficient under CRS, VRS, and SE specification respectively. The observed differences between CRS, VRS, and SE measures indicated that some of the fish farmers do not operate at an efficient scale and improvement in the overall efficiency could be achieved, if the farmers adjusted their scales of operation. Under CRS, the group with the highest frequency of technical efficiency is 0.9-0.999 amounting to 35% of the sampled fish farmers. This was followed by group 1.0 with a percentage of 21.67% of the total respondents. Under VRS, the group with highest frequency of production efficiency is 1.0 amounting to 46.67% of the sampled fish farmers, followed by 0.9-0.999 with a percentage of 23.33%. The lowest production efficiency falls within 0.2-0.299 group. Under scale efficiency, the group with highest is 0.9-0.999 amounting to 60% of the sampled fish farmers, followed by group 1.0 amounting to 25% of the total respondent. The lowest frequency of production efficiency falls within 0.6-0.699 under scale efficiency. The minimum, maximum, standard deviation, mean of the distribution under CRS and VRS and scale efficiency are 0.283, 1.0, 0.2108,0.849 and 0.294, 1.0, 0.1860, 0.890 and 0.626,1.0,0.0698,0.955 respectively.

Table 4. *Frequency distributions of technical efficiency scores obtained with DEA model***.**

Economic efficiency	Constant return to scale	Variable return to scale	Scale efficiency
Frequency	Frequency	Frequency	Frequency
0.1-0.199	-	-	-
0.2-0.299	1 (1.67)	1 (1.67)	-
0.3-0.399	3 (5)	2 (3.33)	-
0.4-0.499	1(1.67)	2 (3.33)	-
0.5-0.599	4 (6.66)	3 (5)	-
0.6-0.699	1 (1.67)	-	-
0.7-0.799	5 (8.33)	2 (3.33)	1 (1.67)
0.8-0.899	11(18.33)	8 (13.34)	5 (8.3)

0.9-0.999	21 (35)	14 (23.33)	36 (60)
1	13 (21.67)	28 (46.67)	15 (25)
Total	60 (100)	60 (100)	60 (100)
Mean	0.849	0.890	0.955
Minimum	0.283	0.294	0.626
Maximum	1.000	1.000	1.000
Standard deviation	0.2108	0.1806	0.0698

Source: Field survey 2014

Figures in parentheses are percentage

Tobit Estimates of Determinants of Efficiencies

After calculating the efficiency scores, the second stage of the analysis is to identify the determinants of inefficiency using Tobit regression model. Various farm specific factors were regressed on the sub-vector efficiencies, the factors include sex, age, farm experience, fish farming experience, house size, access to credit, membership of cooperative society and year of schooling. The results shows that the log likelihood functions and sigma (Ϭ) values were 0.135 and 34.926, 39.738 and 0.1248, 76.758 and 0.6732 for constant return to scale (CRS), variable return to scale (VRS), and scale efficiency respectively. All values of sigma were statistically significant at 1% alpha level ($p<0.01$). This indicates that the model is good in explaining the determinants of production efficiencies.

In the analysis of CRS-efficiency, only three out of the eight included variables were significant. Farmers sex was negatively significant at 10%, implying that female fish farmers are more likely to be efficient than male fish farmers. Farmer's age was positively significant at 5% which shows that older fish farmers are more likely to be efficient than young fish farmers. Fish farming experience was also negatively significant at 1%, showing that inexperienced fish farmers are likely to be more efficient than experienced fish farmers. This may be due to the conservative nature of experienced farmers and reluctance in adopting new technologies.

For VRS –efficiency, three included variables were significant. Farmer's sex was negatively significant at 10%, which implies that female fish farmers are likely to be more efficient than male fish farmers. Farmer's age was positively significant at 1%, showing that older fish farmers are likely to be more efficient than young fish farmers. Fish farming experience was negatively significant at 1% implying that inexperienced fish farmers are likely to be more efficient than experienced fish farmers, which may be due to reluctance of farmers to use new ideas which could improve their efficiency.

Scale efficiency, only one variable was significant. Access to credit was negatively significant at 10%, implying that those who don't have access to credit are more likely to be efficient than those who have access to credit. This may be due to improper use of credit obtained by the fish farmers.

Table 5. *Tobit Estimates of Determinants of efficiency for all farmers*

Variable	CRS			VRS			SE		
	Coefficient	t-value	p-value	Coefficient	t-value	p-value	Coefficient	t-value	p-value
Constant	0.8584	9.262	0.000	0.8436	9.862	0.0000	1.0177	22.050	0.0000
Sex	-0.0688	-1.807*	0.0708	-0.06373	-1.813*	0.069	-0.00735	0.388	0.6982
Age of farmer	0.0054	2.511**	0.0121	0.00624	3.138***	0.0017	-0.00083	-0.776	0.4375
Farm experience	-0.0014	-0.595	0.5520	-0.00152	-0.678	0.4980	0.00005	0.042	0.9664
Fish experience	-0.034	-6.716***	0.0000	-0.03495	-7.392***	0.0000	0.00015	0.062	0.9504
House size	-0.0004	-0.081	0.9358	-0.0042	-0.761	0.4467	0.00398	1.333	0.1826
Access to credit	0.0207	0.507	0.6120	0.0558	1.477	0.1397	-0.03898	-1.912*	0.0559
Cooperative Society	0.0225	-0.488	0.6257	-0.01352	-0.317	0.7516	-0.01070	-0.465	0.6422
Year of schooling	-0.0022	-0.530	0.5961	0.00054	0.142	0.8874	-0.00298	-1.428	0.1532
Sigma	0.1351	10.954	0.0000	0.12477	10.954	0.0000	0.67324	10.954	0.0000
Likelihood function	34.926			39.7383					76.7582

***, ** and * indicates significance at 1%, 5% and 10% respectively

Source: Field survey 2014

Analysis of Output and Input Slacks

Table 6 gives the summary of output and input slacks under CRS specification for fish farmers in the study area.

Output slacks represent the amount by which farmers could increase production without necessarily increasing the level of input, while input slacks indicate the amount by which farmers could reduce input use without reducing the level of output, with existing technology. The result shows that there are opportunities for some of the farms to reduce their resources without reducing their output. Fish output displayed a mean slack of 0.08 kg in one farm. Pond size shows a mean slack of 49.535m^2 among 11 farms, 11 farms used an excess feed of 40.183 kg, 4 farms stocked 38 fingerlings in excess, while 11 farms spent an excess of ₦1868.66. This inefficient spending and over use of resources may be due to inadequate knowledge of appropriate production practices and non-reliance on prescriptions of extension agents.

Table 6. *Input Slacks and number of farms using Excess inputs*

Output/Input use	Number of farms	Mean slack	Mean Input use	Excess input use
Fish (kg)	1	0.080	1549.07	4.184
Pond size (m^2)	11	49.535	302.902	2972.091
Feed (kg)	11	40.183	428.76	2411.008
Fingerling (no)	4	38.038	2402.56	2284.597
Labour (₦)	11	1868.658	48311.67	112119.49

Source: Field survey 2014

Return to Scale Properties

Table 7 depicts the characteristics of optimal, sub-optimal and super optimal fish farms. Optimal farms are farms with constant return to scale, sub-optimal are farms with increasing return to scale while super optimal are farms with decreasing return to scale. Table 24 indicates that majority(56.7%) of the fish farms operate under sub-optimal condition, Optimal fish farmers had the highest yield per m^2 of about 2652.17 kg with least pond size of 172.25m^2

Table 7. *Characteristics of farms with respect to return to scale*

Variable	No of farms	Percentage (%)	Yield (kg)	Pond size (m^2)	Gross margin
Sub optima	34	56.7	836.82	217.52	182128.1
Optima	15	25.0	2652.47	172.25	766728.3
Super optima	11	18.3	2245.91	744.96	493645.5

Source: Field survey 2011

Output Target

Table 8 gives the summary of output target. The output target refers to the amount of output, the decision making unit should aim at producing, given the available unit of inputs. The minimum output target that some of the DMU should aim at producing fell within the range of 1-500 kilograms. Only about 33.4% of the total DMU in the study is applicable. The maximum output target range is 5000kilograms and above.

Table 8. *Frequency distribution of output target*

Target output	Frequency	Percentage (%)
1-500	20	33.4
501-1000	4	6.7
1001-1500	9	15.0
1501-2000	8	13.0
2001-2500	7	11.7
2501-3000	6	10.0
3001-3500	1	1.7
3501-4000	2	3.4
4001-4500	1	1.7
4501-5000	1	1.7
Above 5000	1	1.7
Total	60	100

Source: Field survey 2014

Major Constraints of Fish Farming in Study Area

Table 9 indicate the case of multiple responses of fish farmers. It reveals that 76.7% of the respondents agreed that there was limited credit, 31.7% of the respondents agreed that quality feed is a problem, 48.3% agreed there is marketing problem, while 50% of the respondents agreed signified there is problem of transportation. From the response given by fish farmers in Ido and Oluyole local government, it should be deduced that financial and transport problems are the major problem. The policy implication of this is that production would be low since farmers had no enough capital to start, also transportation cost would increase their cost of production. This would reduce their output at the end of production.

Table 9. *Distribution of farmers according to the constraints faced*

Constraints	Frequency	Percentage (%)
Limited credit	46	76.7
Quality feed	19	31.7
Marketing	31	51.7
Transport	30	50

Source: Field survey 2014. **Multiple Responses**

CONCLUSION

From the study, it can be concluded that there exist more potential that remained untapped in fish production, in the study areas. There is scope for increasing fish production efficiency by about 15%, 11%, 5% for technical efficiency under CRS, VRS and Scale efficiency specification respectively. The determinants of efficiency are farmers' sex, age, fish farming experience and access to credit. The result of cost and return analysis shows that fish enterprise is profitable with a gross margin of ₦385389.66 and a benefit-cost ratio of 2.4. It is also concluded that access to credit constitute major constraint, followed by transportation, quality feed (probably due to high cost) and marketing.

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