Resources Use and Efficiency of Artisanal Fishing in Oguta, Imo State, Nigeria

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Abstract: This study determined the cost-returns and the efficiency of resources used in artisanal fishing by fishers in Oguta Local Government Area of Imo State Nigeria. Data used for the study was obtained from primary and secondary sources using a multi-stage random sampling technique. In the first stage, 10 villages out of the 27 villages in Oguta were selected at random. In the second stage, 4 fishers were selected from each of the villages making a total of 40 respondents in Oguta Ameshi. Similarly, 60 respondents were selected from Ubi, which is made up of 27 farm settlements (Egwes). This brought the total sample size to 100. The result showed that the total revenue was ₦ 354, 530.00 with a total variable cost of ₦ 160, 677.23. The gross margin realized was ₦ 193, 852.77 with a net profit of 161,444.52. The study shows that the revenue from artisanal fishing was best estimated using the linear functions, which explained 51.5% of the total variations. The research identified that artisanal fishing is profitable and all the factors employed were inefficiently utilized. This suggests that higher profit and yields could be attained by efficient allocation of the employed resources which is vital to the sustainability of fishing in Nigeria. [Report and Opinion 2010;2(7):10-19]. (ISSN: 1553-9873).

Key Words: Resource use, efficiency, fishers.

1. Introduction

Fish production in Nigeria is either by capture fishers, artisanal fish farming (fish farming) or by importation. Capture fisheries involve the harvesting of naturally existing stocks of wild fish. This can be done either by small scale/artisanal fishers or by industrial/commercial trawlers. In artisanal fisheries, production is achieved by individual or by small groups by the use of labour intensive gears. Characteristically artisanal fishers operate from dug out, wooden canoes that are more often than not unmotorized (Coates, 2000).

At present, fish production by artisanal fishers dominates fish production in Nigeria. Between 1994 and 1998, the contribution of this sector to fish production ranged between 36 – 47% (Federal Office of Statistics, 1999). Several attempts were made over the years to boost the productivity of artisanal fishers through institutional reforms and the various fiscal and economic measures. Some of these measures involved tax exemption and input subsidy schemes for distribution to fishers to increase production. Despite all these forms of external intervention in the development plans, the fisheries sector still showed a deficit in the supply and demand of fish to Nigerians. The productivity of these fishers are being hampered by a litany of problems amongst which are, relative high cost of fishing gears, use of dangerous chemicals to kill fish, manpower shortage in the key areas, under capacity utilization, inadequate and faulty planning with attendant short lived policies by government, lack of finance, lack of storage facilities and marketing problems (Olayinde 1976).

Despite the significant contribution of artisanal fishers to local fish production in Nigeria, there are a few economic studies or financial analysis on the artisanal fisheries sub-sector of the Nigerian economy. For a meaningful development policy in artisanal fisheries in Nigeria, information is required on the allocation and utilization of all the resources or the resource use efficiency in addition to other economic data. This study is therefore generally aimed at determining the cost and returns of artisanal fishing and the efficiency of resources used in artisanal fishing.

2. Methodology

2.1 Study Area

The study was conducted in Oguta Ameshi and Ubi Oguta in Oguta Local Government Area of Imo State. Oguta is bounded between longitude $6^0 41'$ – $6^0 50'$ East and latitude $5^0 41'$ – $5^0 44'$ North of the equator. Oguta land mass is approximately 2,025.75km^2 (Nwadiaro, 1989).

This land mass is distributed as follows:

a. Ameshi Town: 63.75km^2
b. Ose-motor: 46.50km^2
c. K Beach: 30.50km^2
d. Ubi (Farmlands): 1885.99km^2

This region is located within the equatorial rain forest belt with an average annual rainfall of 3,100mm. Oguta is bounded on the north by Ogwu-Aniocha in Anambra State. It shares its northeastern border with Egbuoma, Mgbidi and Egwe in Imo State. On the south to the eastern flank, Oguta is limited at approximately latitudes $5^0 38^1$ to $5^0 39^1$ northwestern and southeastern boundaries of Oguta are defined by the Niger, from upstream of Okpai to beyond Abo, Kwale and Umuoru (River Niger) (Nwadiaro, 1989).

2.2 Sample Selection

Multi-stage random sampling technique was used in this study. First, 10 villages out of the 27 villages in Oguta were selected at random. In the second stage, 4 fishers were selected from each of the villages making a total of 40 respondents in Oguta Ameshi. Similarly, 60 respondents were selected from Ubi, which is made up of 27 farm settlements (Egwes) (Nwadiaro, 1989). This brought the total to 100 respondents. The reason for the 60/40 by proportion of the respondents is due to the fact that there are more artisanal fishers in Ubi than Oguta Ameshi, (Nwadiaro, 1989). The sample frame for each of the villages (Oguta Ameshi) and Egwes (Ubi) were supplied by the Chiefs (Okparas) of all the 10 villages in each case. The various analysis carried not include the use of means, gross, margin analysis, frequency counts and multiple regressions.

The gross margin analysis and Net profit were used as specified below

$$GM = \sum_{i=1}^{n} \rho_i Q_i - \sum_{j=1}^{n} P_j x_j \Big)$$

Where GM = gross margin

$P_i =$ Unit price of output

$Q_i =$ Quantity of each output

$P_j =$ Unit price of each input

$x_i =$ Quantity of each output

Net Returns = GM-TFC

TFC=Total Fixed Costs derived by depreciating fixed assets

The production response function model was expressed implicitly according to Oladunni (1996) and Mbanasor and Obioha (2003) thus:

$$Y = f\left(x_1, x_2, x_3, x_4, x_5, x_6, e\right)$$

Where $Y =$ Value of output in Naria

$x_1 =$ Fixed costs invested (₦)

$x_2 =$ Value of variable costs (₦)

$x_3 =$ Labour (Man days)

$x_4 =$ Depreciation value of assets (₦)

$x_5 =$ Area of lake fished (Ha)

$x_6 =$ Value of other inputs (₦)

$e =$ Error term

The following functional forms were evaluated

(a) Linear function

$$Y = b_0 + b_1 x_1 + b_2 x_2 + ...b_6 x_6 + ei$$

Here: Marginal Physical Production (MPP)
MPP = b (regression coefficients)
Elasticity = $bi\ x/y$

(b) Semi–log function

$$Y = \log b_0 + b_1 \log x_1 + b_2 \log x_2 + ...b_6 \log x_6 + ei$$

In this, MPP = b/x
Elasticity = b/y

(c) The Cobb Douglas (Double log) function

$$Log\ Y = \log b_0 + b_1 \log x_1 + b_2 \log x_2 ..b_6 \log x_6 + ei$$

Here: MPP = $b.y/x$
Elasticity = b

In all bi = b_6 are the regressions coefficients

The marginal value product (MVP) was used to determine the productivity of the resources which the ratio of MVP to the marginal factor cost (MFC) was used to determine efficiency use. MFC was either the purchased unit price of the input or the opportunity cost. Six percent interest rate was used to obtain the opportunity cost of fixed assets and other production inputs i.e. for every one Naira spent in artisanal fishing was therefore N1.06. Labour and water were valued at their current market price. However, MPP is taken as the MVP since

$$Log\ Y = \log b_0 + b_1 \log x_1 + b_2 \log x_2 \log + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6$$

iv. Exponentially Function

$$\ln Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6.$$

However, the choice of the best functional form was based on the statistical significance of the regression coefficients, the magnitude of the F-ratio, as well as their conformity to a prior expectation.

3. Results and Discussion

3.1 Gross Margin Analysis of Artisanal Fishing in the

A cost and returns analysis of cash flow of artisanal fishing in the study area is represented in Table 1. The table posted total revenue of ₦ 354, 530.00. It also showed that the total variable cost was ₦ 160, 677.23. This involves cost for the purchase of baits, partial fish processing and some miscellaneous costs. The gross margin realized was ₦ 193.852.77. It was revealed that out of the total fixed cost of ₦ 38, 408.25. The research revealed that nets were the most expensive single fixed cost components. Its depreciation and replacement value was ₦ 30, 276.25. Perhaps it may be as a result of the expensive nature of nets and the need to own different types of nets for different fishing seasons and different areas of water – rivers. However, the cash flow gave a net return of N161, 444.52. This figure is encouraging and plausible given the scale of fish output.

Table 1: Cost and Returns of Artisanal Fishing in Oguta Local Government Area, Imo State, Nigeria

Items	**Quantity (kg)**	**Price (₦)/kg**	**Total (₦)**
A: Revenue			
Sales of fishes	500.75	440.0	220,330.00
Quantity consumed	150.00	-	66,000.00
Quantity given as gift	100.00	-	44,000.00
Quantity processed and stored	55.00	-	24,200.00
Total			**354,530.00**
B. Variable cost/unit			Annual expenditure
Baits (soap, palm fruit, small fishes, ant and			68,769.00
Partial fish processing			39,516.00
Miscellaneous costs (foods eaten while fishing, mending of nets, repairs of canoe e.t.c).			52,392.00
Total variable cost			160,677.23
C. Gross Margin (**A-B**)			193,852.77
D: Fixed cost: Depreciation value of fixed			
Canoe			1502.43
Nets			30,276.25
Hooks			168.57
Spears/fishing arrows			421.00
Paddle			40.00
Total fixed cost			32,408.25
Net returns **(C-D)**			161,444.52

Source; Field survey, 2005

Table 2: Marginal physical production of artisanal fishers using three regression models

Variables	Linear	Semi-log	Cobb–Douglas
Constant	-140354.7	11.148	0.868
	(102540.44)	(0.318)***	(2.174)
Value of fixed cost invested (x_1)	4.872	1.266E^{-05}	0.794
	(1.331)***	(0.000)***	(0.258)***
Value of variable inputs (x_2)	0.146	8.061E^{-17}	-1.487E^{-02}
	(0.598)	(0.000)	(0.173)
Labour (x_3)	-9339.06	4.206E^{-06}	5.048E^{-02}
	(16543.62)	(0.051)	(0.111)
Depreciation value of fixed assets (x_4)	1.971	5.206E^{-06}	0.153
	(0.990)*	(0.000)*	(0.122)
Area of lake fished(x_5	3322.539	9.141E^{-03}	0.409
	(1741.27)*	(0.005)*	(0.218)
Value of other inputs(x_6)	1631.599	1.283E^{-02}	7.504E^{-02}
	(4237.882)	(0.013)	(0.097)
R^2	0.515***	0.483***	0.462
F-ratio	16.482***	14.490***	13.306***

*** Significant at 1% *Significant 10%, Figures in parenthesis are standard error

3.2 *Model Estimation and Resource use efficiency*

The model estimation of artisanal fishing is presented in Table 2. The result shows that value of output of artisanal fishing was best estimated using the linear function, which explained 51.5% of the total variation in the values of output of artisanal fishers. However, the linear regression functional form was chosen as the lead equation based on econometric and statistical reasons such as the number of regression coefficients that are significant, the value of R^2 and the significant level of the F-ratio.

The lead equation (Linear form) shows that values of fixed cost invested (X_1), depreciation value of fixed assets (X_4) and area of the lake fished (X_5) were significant while value of variable inputs, labour and value of other inputs were not. All the significant variables (value of fixed cost, depreciation and area of lake fished) and some variables that are not significant (value of variable inputs and value of other inputs) had positive relationship with the value of outputs. This implies that as their quantities used increased, the revenue accruing to the artisanal fishes would increase. It shows that the revenue of artisanal fishers would depend on the extent new fishing sites in the lake basin are identified and utilized, considering the constraints imposed by nature. It also indicates that the other inputs used had negative influence on the value of output, implying the more they were used, the less the revenue that would accrue to the artisanal fishers.

The non-significance of value of variable inputs, labour and value of other inputs may be attributed to the level of use. Most artisanal fishers use traps and cast nets instead of baited hooks. It is believed that encircling nets have the tendency to catch fishes than baited hooks.

3.3 *Marginal Productivities of Inputs*

The results of the estimated production functions were further used to compute the marginal productivities of the inputs in Table 3. The computed marginal value products (MPP) in the case are the marginal physical products (MPPs) since the outputs were measured in monetary terms (Mbanasor and Obioha, 2003). This implies that one unit increase in any of the inputs holding other constant, will change the monetary returns by value corresponding to the marginal value product of that input used were more productive than other resources.

The relative allocative efficiency of the artisanal fishers was based on the non-classical requirement that each factor be paid equal to its marginal value product (MVP). Based on this, the ratio of marginal factor cost to marginal factor cost (unit acquisition cost) were corrupted and the values were 4.59, 0.138, - 18.68, 1.859, 1.662.1539.24 for value of fixed cost invested value of variable inputs, labour, depreciation value of fixed assets, size of lake and value of other inputs respectively. Previous studies show that maximum or absolute allocative efficiency for a particular resource is confirmed if efficiency ratio is equal to one. But if efficiency ratio is greater than one, it means that less than the profit maximizing level of the input is in use. Also if efficiency ratio is less than one, it means that more than the profit maximizing level of that particular resource is in use (Onyenweaku and Fabiyi, 1991, Mbanasor and Obioha, 2003). But from the result obtained, it is evident that the values of variable inputs and labour were less than one indicating that more than the profits maximizing level of all the resources were employed by the artisanal fishers. This suggests that the resources were inefficiently allocated and were over utilized above their economic optimum levels. The result shows the need for the artisanal fishers to reduce the use of these resources employed in order to improve efficiency.

However, the results indicate that the value of fixed cost invested, depreciation value of fixed assets, size of lake and values of other inputs were greater than one indicating that less than their profit maximizing level of the resources were employed by the artisanal fishers. This suggests that these resources were inefficiently allocated and were under utilized below their economic optimum levels. The result shows the need for the artisanal fishers to increase the use of these resources employed in order to improve efficiency.

3.4 *Elasticity of Production*

The elasticity of production shows the change in output relative to a unit change in input (Mbanasor and Obioha, 2003). For the linear function which was our lead equation, the elasticity of production = $bi\, x / y$. From the result in Table 4, the production elasticity for each of the resources is less than unity indicating that the relationship between these resources and value of output is inelastic. Also the coefficient of returns to scale is 1.282 indicating increasing returns to scale. This implies that farmers were operating at the region of maximum technical efficiency, an irrational region of production. This finding is in conformity with the assertion of Mbanasor and Obioha (2003) that actual cases of increasing returns occur at relatively low levels of output that are characteristics of small scale farming and fishing. The implication of these results is that higher outputs are possible with an increase in the levels of aggregate input at the current level of technology.

Table 3: Marginal Value Products and Units Acquisition Cost of Inputs

Inputs	**MVP**	**MVP/MFC**	**Unit acquisition (N)**
Fixed cost invested (x_1)	4.872	4.59	1.06
Value of variable inputs (x_2)	0.146	0.138	106
Labour (man days) (x_3)	-9339.06	18.68	500.00
Depreciation value of fixed assets (x_4)	1.971	1.859	1.06
Size of lake (ha) (x_5)	33222.539	1.662	2000.00
Value of the inputs (x_6)	1631.599	153.24	1.06

Source: Filed survey 2005

Table 4: Elasticity of Production

Fixed cost invested (x_1)	0.825
Value of variable inputs (x_2)	0.031
Labour (man days) (x_3)	-0.53
Depreciation value of fixed assets (x_4)	0.169
Area of lake fished (ha) (x_5)	0.367
Value of other inputs (x_6)	0.043
Total	**1.282**

Source: Computed from Table 2

3.5 Problems of artisanal fishers

Table represents the problems encountered by artisanal fishers in Ogutal local government area of Imo state, Nigeria. The result shows that the entire fishers (100%) had problems of high cost of fishing gears while 68% encountered problems of in accessibility of fishing grounds as a result of the presence of vegetation invasion of fishing grounds. Fishing grounds are located in freshwater swamps forests which hinders navigation. The use of chemicals or other obnoxious methods (Gamalin 20, dynamite) in fishing constituted a problem to 60% of the fishers. Other problems encountered by the fishers are outlined in Table 5.

Table 5: distribution of problems encountered by artisanal fishers

Problems encountered	Frequency	% of Total Population
High Cost of fishing gears	100	100
Low water fluxes/irregular flood pulses	45	45
Vegetation cover	68	68
Obnoxious Fishing methods	60	60
Bad weather (harmattan, dew, rainfall etc)	21	21
Oil spillage	55	55
Inadequate finance and credit facilities	38	38
Inadequate Storage facility (Poor electricity supply)	12	12

4. Conclusion/Recommendations

The gross margin analysis of artisanal fishing revealed net returns of N161, 444.52 indicating that artisanal fishing is a lucrative venture. The hypothesis tested on the independent variables that influenced value of outputs in artisanal fishing using linear regression model showed that of all the variables hypothesized, only fixed cost invested was statistically significant at 1% level of probability ($P \leq 0.01$), size of lake was statistically significant at 10% level of probability ($P \leq 0.01$). However, the combined effects of all the variables explained 51.5% of the variations in the value of output of artisanal fishers. The result revealed that area of lake fished was more productive than other resources.

Meanwhile, the result of the elasticity of production indicated that each of the resources was less than unity indicating that the relationship between these resources and value of output were inelastic. In view of wide range of problems encountered by artisanal fishers high cost of fishing gears (100%), irregular flood pulse, use of toxic chemicals like Gamalin 20 and dynamites, oil spillage were reported as being very serious problems.

Based on these findings of this study the following recommendations have been put forward and are believed would help improve the efficiency of resources used in artisanal fishing in the study area.

- Government at all levels should subsidize the cost of fishing gears and other inputs used in fishing. This will help to address the problem of high cost of fishing gears.
- It is believed that the irregular flood pulses originated at the commissioning of Kanji dam. Consequently, the dam should be regulated to allow for higher inflow of water downstream.
- There is need for legislation against all forms of obnoxious fishing methods such as the use of chemicals in fishing. There is need to emphasis that law enforcement agents must ensure the enforcement of such laws.
- Industrial activities (especially exploration and production of oil) should be carried out in an environmentally friendly manner with a view of causing little or no damage to the aquatic resources and where damage it occurs it must be remediated as soon as possible and adequate compensation paid accordingly.
- The oil companies should pay commensurate compensation to fishers whose sources of

- income are adversely affected by oil spills in those aquatic systems where they fish.
- Loan facilities should be made available to the fishers especially through the agricultural cooperative and rural development banks, at a government subsidized interest rates. This will encourage the fishers into harvesting increased amount of fish.

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