COST STRUCTURE OF TRAWL FISHERIES IN NIGERIA

J.A.L. EFFIONG
Department of Agricultural Technology,
Federal Polytechnic Nekede, Owerri,
Nigeria.

J.O. ALIGBE
Federal Ministry of Agriculture,
Benin, Nigeria.

B.U. UZOHO
Department of Soil Science,
Federal University of Technology, Owerri,
Nigeria.

EZE E.U.
Department of Agricultural Technology,
Federal Polytechnic Nekede, Owerri,
Nigeria.
E-mail of corresponding author:effiongjale@gmail.com

ABSTRACT

The study examined the cost structure of trawling vessels operating in Nigeria. Multistage and random sampling techniques were used to select 60 vessels comprising large and small trawling vessels. Data were collected with the aid of pre-tested questionnaire and personal interview with the captains of vessels. Analysis of data was facilitated by means of the cost concepts and multiple regression techniques using the SPSS20.0 version. Empirical results from the study show that average annual operational costs of vessels has three components viz, running, vessel and labour cost. Running cost takes up about 60% of annual operational cost for large vessels and 59.2% for small vessels. Of these the cost of fuel alone takes about 81.9% of the total running cost for large and 80.5% for small vessels. Operational cost of vessels was significantly influenced by running and labour costs. The spiraling of these costs acts as a depressant on profits and could scare away investors. The study recommends abolition of uniform licensing and registration for vessels. Fees charged on vessels should be based on length overall (LOA) and gross registered tonnage (GRT). Direct allocation of fuel by relevant petroleum agency to trawling vessels is recommended as means of bringing down price of fuel per litre. Furthermore,

automation of operations onboard vessels will reduce crew size (labour) as well as cost incurred on food and supplies for crew members.

Keywords: trawling, operational, vessel, costs, fuel

INTRODUCTION

The contribution of fisheries to the Nigerian economy is very significant in terms of employment, income generation, poverty alleviation, foreign exchange earnings and provision of raw materials for the animal feed industry. It is estimated that over 10 million Nigerians are actively engaged in primary and secondary fishery operations. The importance of fisheries to the Nigerian economy is indicated by its contribution to the Gross Domestic Product being about 4.5% in the year 2007 (Amire,2009). The industrial fishery sub-sector generates non-oil foreign exchange of over $60 million per annum through the sales of shrimps and other fishery products. The extent to which a trawling vessel is able to make profit is critical to the survival of the industrial fishery sub-sector. According to a study by Effiong,Aligbe, Uzoho & Eze

(2015), it was observed that in 1995, there were a total of 315 trawling vessels operating in Nigeria (FDF, 2008), while in 2012 the number had reduced to 191. This reduction in the number of registered operational vessels and declining profitability is attributed to the prohibitive cost of fuel (Automotive Gas Oil) which constitutes the highest proportion of operational cost. In the analysis of economic performance of vessels Effiong *et al* (2015) observed that the cost of fuel alone takes about 47.7 per cent in total operating cost of small vessels, 47.8 per cent of large vessels, 42.2 per cent of fishing vessels and 40 per cent of shrimping vessels. If vessels are to operate profitably, their operational costs relative to revenue has to be within some reasonable limits as profitability is the major index that can attract or scare away would-be investors. This study examines the various cost components of operating trawling vessels and their effect on total operational cost. A study of this nature will highlight the proportion of each cost component in the total operational cost and could provide insight on measures that could bring down costs considerably so that trawling vessels can operate much more profitably.

LITERATURE REVIEW

Revenues and costs mainly determine the economics of fishing operations. FAO, (2000) and Tietze, (2005) pointed out that revenues depend on species and quantities caught and prices obtained which again depend on marketing channels and markets, seasonal fluctuations and other factors. The main cost factors are capital investments and operation costs and vessel costs. The major components of labour costs are wages and other labour charges such as insurance and employers contributions to pension funds. Running costs are principally composed of fuel, lubricants, costs of selling fish, harbour dues, cost of ice, food and supplies for the crew. The major elements of vessel costs are vessel and gear repair and maintenance expenses and vessel insurance. In addition, fishing operations also have external costs which are sometimes difficult to quantify. External costs are defined as costs which are created by a fishing enterprise for

others i.e. other enterprises or society for example through depletion of fish stocks or destruction of the coastal ecosystem (FAO, 1999 and Tietze, 2005).

Similarly Tietze observed that as far as the cost of operations is concerned, the cost structure of trawl fisheries differs significantly between developing and developed countries. The differences seem to be mainly related to differences in the remuneration of labour, which depend on the overall level of economic development. As could be expected, the cost of labour is the most important cost component in the developed countries studied. The second most important cost component is running costs, closely followed by vessel costs. In the developing countries studied, running costs and vessels costs account for the major share of the operating cost while labour costs are only of secondary importance. As countries develop and the level of remuneration increases, above differences in the cost structure can be expected to disappear. FAO (2004) in a summary of findings of studies carried out between 1995 and 1997, observed that in trawl fisheries, there are significant differences in the cost structure between developed and developing countries which are related to the higher cost of labour in developed countries. In trawl fisheries of developed countries, labour costs were the important element followed by running cost and vessel costs while in developing countries, labour costs were less important and running costs were the most important cost element. In view of higher labour costs in developed countries, the operating costs per unit of gross earnings were higher for trawlers in developing countries than for trawlers in developed countries.

Labour costs in trawl fisheries in Argentina, Peru (which have lower level of economic development) account for only between 34 and 40 per cent of total operating costs while it is as little as 11 percent in Trinidad while in developed developed European countries like France, Norway, Germany and Spain, cost of labour accounts for 38 to 60 per cent of the cost of operations. Peru experiences high running costs, where fuel costs account for up to 55 percent of total operating costs and up to47 per cent of total earnings. In Argentina and Peru running costs are the most important cost component and accounts for between 40 and 60 percent of the total operating costs of deep sea trawlers in Argentina and Peru. In Trinidad and Tobago like in other developing countries, running cost constitute 58 per cent while vessel cost constitute the second with 31 per cent operating costs.

In India, Thailand and People's Republic of China, running cost is the most important cost component with fuel constituting the highest. Labour cost is second and amounts to between 16 to 30 per cent of operating cost.Vessel cost are of minor importance as it is usually accounting for less than 20 per cent of operating cost. The reason for the differences in the total cost structure between trawlers in developed European countries and developing countries of South America and the Carribean is that the cost of fishing vessel construction and thus the cost of vessel replacement and depreciation are lower in developing countries, among other things, because of the lower cost of labour. The cost of interest is also lower in some cases as fishing vessels in developing countries are generally older and in many cases the actual value of many vessels is negligible as the vessels have already been written off (FAO, 2004)

METHODOLOGY

A multi-stage sampling procedure was used in selecting the sample for the study. First, the list of licensed vessels operating in Nigeria was obtained from the Federal Department of Fisheries (FDF) from which 60 vessels were randomly selected. The second stage involved the use of stratified sampling where the vessels were classified into large and small vessels. The third stage involved the random selection of 30 large and 30 small vessels. The size of large vessels in this study is taken as 18m length overall (LOA) and above while that of small vessels is taken as 10 – 17 LOA. A total of 60 copies of questionnaire was administered to captains of the trawling vessels using the above criteria. Hence n = 60.

This study made use of both primary and secondary sources for data collection.
Relevant information for this study was gathered through a combination of personal informal interviews, discussions and interview with a questionnaire. The structuring of the questionnaire allowed for both fixed alternative and open-ended questions for increased efficiency in data collection. The questionnaire was designed to obtain original information, which involved a direct field study of the trawlers. Secondary data for the study was obtained from Federal Department of Fisheries (FDF), Nigerian Trawler Owners Association(NITOA), Nigerian Maritime Administration and Safety Agency(NIMASA),

Analytical Framework

Cost function analysis was used in analyzing the cost structure of industrial trawl fisheries.

TC= TFC + TVC……1

Where:

TC = Total Cost

TFC = Total Fixed Cost

TVC = Total Variable Cost

In analyzing the cost structure portion of industrial fisheries, vessels are divided into different classes and studied in detail. This portion of analysis is aimed at studying operational cost in detail among the various classes of vessels to facilitate comparison between them and hence the proportion of each cost item and component in total operational cost. It is also to evaluate their relationship with earnings as a means of determining profitability. Operational cost of vessels which represents the total cost is made up of running costs (variable cost), vessel cost (fixed cost) and labour cost (fixed cost).

Multiple regression analysis was used to evaluate relationship between running, vessel and labour costs on operational costs.
The above functional relationship can be stated as follows:
Ct = f (Rn, Vs, Lr, ei) ……..2
Where

Ct = Operational Costs
Rn = Running costs
Vs = Vessel costs
Lr = Labour costs
ei = Error term
A multiple regression model with operational cost as dependent variable and running, vessel and labour costs as independent variables was estimated using the Ordinary Least Squares method of regression analysis. All the assumptions underlying the OLS method is assumed to hold in this study.

$Ct = ao+b_1R_n + b_2 V_s+ b_3L_1+ei$……3

Where
ao = constant term
bs = Unknown coefficients to be estimated

The Ordinary Least Squares (OLS) regression technique was used in deriving the relationships of the single equation model.The above independent variables were regressed on the dependent variable. Four functional forms were used. The models used were Linear, Semi-log, Double log and Exponential. The essence was to obtain the model of best fit. The model that provided the best fit was selected on the basis of the following : (a) magnitude of the coefficients of multiple determination R^2, (b) Magnitude and statistical significance of the regression coefficients and (c) the signs of regression coefficients as they conform to *a priori* expectations.
The functional forms are given as:

Linear: $Ct= \beta_0+ \beta_1Rn+ \beta_2Vs+ \beta_3Lr+ei$.....4

Exponential: $logCt= \beta_0+ \beta_1Rn+ \beta_2Vs+ \beta_3Lr+ ei$.....5

Semi-log: $Ct=\beta_0+\beta_1logRn+\beta_2logVs+\beta_3logLr+ei$.....6

Double Log: $logCt= \beta_0+ \beta_1logRn+ \beta_2logVs+ \beta_3logLr+ei$.....7

RESULTS AND DISCUSSION

Operational Cost of Trawling Vessels

Large Vessels

Table 1 shows the average annual operational cost of large vessels which has three components viz running, vessel and labour cost. From the table, running cost constitute the highest in the operational cost of trawlers. It is 59.4% of the total operational cost. Running cost consists of cost of fuel (Automotive Gas Oil or AGO) N36360000, lubricants (N24000), food supplies for crew (N640000), Miscellaneous expenses (N6400000) is more or less a statutory payment made to pirates/militants to be able to operate in a particular fishing ground; failure of which they will confiscate entire catch of a vessel with attendant loss of lives.This explains why vessel operators build this in their running cost. It is assumed in this study that large vessels make about 8 trips per year with 36 days as duration of an average fishing trip. This brings the total running cost to N43424000 per year. Of the various components of running cost, the cost of fuel (AGO) constitutes about 83.7 per cent of the total running cost. Vessel cost is made of vessel insurance

(N7500000), interest on loan (N13500000), vessel repair and maintenance (N400000). This depends on the age of vessel. Older vessels attract higher repair and maintenance costs. Gear repair and maintenance (N50,000), depreciation on vessel (N483333.33). Most of the vessels are aged with only few vessels being new.

Annual fishing license by FDF is N100,000 while Cabotage ship registration by NIMASA is N75000 for Nigerian vessels and N225000 for foreign vessels. Labour cost is the least among the average annual operational cost as it constitutes about 10.2 per cent of the total annual operational cost. This could be due to the fact that apart from the Captain and Engineer other crew members are poorly remunerated. Crew on board a large vessel consists of the Captain, Engineer and 11 crew members who are hired on casual basis. The captain earns N250000 per month while the Engineer earns N150000 per month. Other crew members merely earn about N20000 each per month. Such poor remuneration could make crew members resort to sharp practices as means of making ends meet. Essien (1982) stated that there have been serious complaints regarding the behavior of some crew on board some fishing vessels. The allegations are that part of the fish caught during the trip is sometimes sold to unauthorized persons.

From the above results it can be observed that cost of fuel alone accounts for 49.8 per cent of total average annual operational cost and therefore has great implications for vessels viability/ profitability. Fuel is therefore a major item of operational costs. Higher operational costs could result in poor economic/financial viability of vessels. To encourage industrial fishing industry to continue to thrive, there is an urgent need for a means of supplying fuel much more cheaply to vessel operators. Declining profits owing to high cost of fuel could be responsible for the decline in the number of fishing vessels currently operating in Nigeria. The implication is a shortfall in fish supply, higher fish prices and high import bill on fish importation. This also includes loss of jobs for those currently employed in the sub-sector. According to FDF (2008) estimated employment in the primary sector is 8.23 million while in the secondary sector is 18.27 million.

Payments to pirates/militant groups make up about 9.3 per cent of the total average annual operating cost. Such additional costs push up total cost occasioning decrease in profit margin. This is an unnecessary cost item. There are instances where pirates confiscate the entire catch from fishing trips and kill crew members who dare resist them. The present scenario does not augur well for investors as it renders investment climate in industrial fishing unfriendly and is capable of driving away present and would-be investors. This calls for an urgent and pragmatic action to checkmate the activities of pirates and other militant groups in our marine waters.

Table 1: Operational Cost of Large Vessels

S/N	Running Costs	Per Trip	Per Annum (8 Trips)
1	Fuel (AGO)	N4545000	N36360000
2	Lubricants	N3000	N24000
3	Food Supplies for crew	N80000	N6400000
4	Dues to Pirates (Miscellaneous)	N800000	N6400000
	Total	**N5428000**	**N43424000**

Vessel Costs (Annual)

1	Interest on loan 9% of N150 million	N13500000
2	Vessel insurance 5% of N120 million	N7500000
3	Vessel repair and maintenance	N400000
4	Gear repair and maintenance	N50000
5	Depreciation on vessel	N483333.33
6	Annual Fishing License (FDF)	N100000
7	Cabotage ship registration(NIMASA)	N75000(Nig) N225000(Foreign)
	Total Vessel costs	**N22220833.33**

Labour Costs (Annual)

1	Captain	N3000000
2	Engineer	N1800000
3	11 Crew	N2640000
	Total	**N7440000**

Table 2: Summary of Average Operational Cost for Large Vessels

1	Running Costs	N43424000
2	Vessel Costs	N22220833.33
3	Labour Costs	N7440000
	Total	**N73084833.33**

Average Operational Cost(Nigerian and Foreign Vessels) N73084833.33

Small Vessels

Table 3 indicate that the total average annual operational cost of small vessels is N49579133.33. Running cost totaled N29760800 and constituted the highest component of operational cost with 60 per cent. This is followed by vessel cost which totaled N14838333.33 and constituted about 29.9 per cent of total operational cost. Labour cost amounted to N4980000 and was the least being just 10 per cent of total operational cost for small vessels. The components of running, vessel and labour costs are similar to those of large vessels. Small vessels also undertake about 8 trips per year with 36 days as duration of an average fishing trip. Of the running cost components, cost of fuel otherwise known as Automotive Gas Oil (AGO) constitutes about 82.47 per cent. Average daily fuel consumption per small vessel at sea is 681.8 litres which is valued at N85225 when taking N125 as the price of AGO per litre. This finding is similar to Olawuyi (1992) and Amire (2009) who also identified high operational cost occasioned by prohibitive price of AGO. This phenomenon could be responsible for driving many operators out of business. For example, in 2003 there were about 48 fishing and 304 shrimping vessels, but in 2007 there were only 28 fishing and 161 shrimping vessels (FDF 2008).Cost of fuel alone takes up to 49.5 per cent of total operational cost of small vessels while payments to pirates represented 9.68 per cent of total average annual operating cost.

Table 3: Operational Cost of Small Vessels

S/N	Running Costs	Per Trip	Per Annum (8 Trips)
1	Fuel (AGO)	N3068100	N24544800
2	Lubricants	N2000	N16000
3	Food Supplies for crew	N50000	N400000
4	Dues to Pirates	N600000	N4800000
	Total	**N3720100**	**N29760800**
Vessel Costs	Interest on loan 9% of N120 million		N9000000

1		
2	Vessel insurance 5% of N120 million	N5000000
3	Vessel repair and maintenance	N270000
4	Gear repair and maintenance	N300000
5	Depreciation on vessel	N33333.33
6	Renewal of annual Fishing License (FDF)	N100000
7	Cabotage ship registration(NIMASA)	N75000(Nig) N225000(Foreign)
	Total Vessel costs	**N14838333.33**

Labour Costs (Annual)

1	Captain	N2400000
2	Engineer	N1560000
3	5 Crew	N1020000
	Total	**N4980000**

Table 4: Summary of Average Operational Cost of Small Vessels

1	Running Costs	**N29760800**
2	Vessel Costs	**N14838333.33**
3	Labour Costs	**N4980000**
	Total	**N49579133.33**

Source: Survey Data, 2015

Average Annual Operational Cost of Small Vessels is N49579133.33

Cost Structure of Trawl Fisheries

Data were fitted to four functional forms of Linear, Exponential, Semi-lig and Double –Log regression and analyzed using SPSS 20 Statistical Package. Out of the outputs of the four functional forms, the Linear output was the best in terms of signs, magnitudes and number of significant parameter estimates and was therefore chosen as the lead equation.

Out of the three regressors included in the model, two (Running cost and Labour cost) were positively signed and statistically significant on operational cost at 5% probability level.

The coefficient of running cost was positive and statistically significant at 5% probability level. The implication is that as the cost of fuel (Automotive Gas Oil otherwise called Diesel), lubricants, harbor dues, cost of ice, food and supplies for the crew rises, it will result in increase of overall operational costs.

The coefficient of labour cost was positive and statistically significant ($P<0.05$). This implies that as wages and labour charges such as insurance and employers contribution to pension funds increase, it correspondingly pushes up operational cost of vessels.

The estimated coefficient of vessel cost appeared with a negative sign. This implies a negative relationship with operational cost. This result strongly suggests that vessel operators may have discovered efficient ways of trimming down vessel and gear repair and maintenance expenses.

Further result of the multiple regression analysis (Table 5) revealed the coefficient of multiple determination (R^2) to be .904 (90.4%), implying that 90.4% of variation in operational cost of trawling vessels was explained by the independent variables, while the remaining 9.6% was due to error. The F- statistic value of 174.881 was significant and confirms the overall significance of the regression analysis.

The magnitude of the coefficient of running cost (13.674) relative to labour cost (4.052) shows that it is the dominant variable influencing operational cost. It suggests a great potential of bringing down operational costs of vessels through a measure that scales down the cost item which accounts for the highest percentage of operational cost (which in this case is fuel). In the light of these findings, it can be concluded that any measure at trimming down operational cost of trawling vessels must of necessity encompass reduction of particularly running cost. This underscores the need to evolve a means of cheaply supplying Automotive Gas Oil popularly called diesel which is used by vessels and checking the activities of pirates. A reduction in operational costs will significantly improve net profit and hence economic and financial viability of trawling vessels.

Table 5: Estimated Regression Parameters On Cost Structure Of Trawl Fisheries

Variable	Linear	Semi-log	Double-log	Exponential
Constant term	29066432.62 (23670025.48)	19.228 (0.41)	4.306 (.805)	-8806846833 (474139005.0)
Running Cost	13.674** (1.559)	2.584E-008** (.000)	.669** (.062)	363192926.2** (36722198.77)
Vessel Cost	-1.055 (1.955)	-2.654E-009 (.000)	-.003 (.005)	-2764774.346 (2936841.389)
Labour Cost	4.052** (.831)	5.052E-009** (.000)	.251** (.060)	182554711.8** (35487285.41)
Standard Error of Estimate	36353210.72	.06304	.06717	39584486.27
R^2	.904	.898	.885	.886
Adjusted R^2	.898	.893	.878	.880
F-value	174.881**	164.908**	143.002**	144.572**
N	60	60	60	60

Source: Survey Data, 2015

Note: Figures in parenthesis are standard errors

****means significant at the 5% level**

CONCLUSION AND RECOMMENDATIONS

Since the industrial fishery sub-sector occupies an important place in Nigeria's economy by boosting food security through the supply of fishery products, provision of employment and generation of foreign exchange through the export of shrimps, the need thus arises to strategically reposition it to play its role much more effectively

The present regime of adopting a uniform fee for licensing and registering vessels should be abolished. Licensing and registration should be based on length overall (LOA) and Gross Registered Tonnage of a vessel (size). In this way smaller vessels will not be compelled to pay the same fee as bigger vessels. This measure will also serve to reduce the operational cost of small vessels.

In view of high operational cost driven by the prohibitive price of fuel (AGO), there is the need by the relevant Petroleum agency to directly allocate fuel to trawling vessels. This will seriously bring down the price of fuel per litre and hence total operational cost of vessels.

Automation of operations on-board vessels could reduce the need for labour and its concomitant liabilities thereby reducing the labour cost component as well as food and supplies for crew members which will also reduce the running cost component.

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