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Economics of Fish Farming in Concrete Ponds, Private Ownership of Fish Farms in Developing Countries: The Case of Nigeria

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ABSTRACT

The setting up of concrete ponds fish farm in a full plot of land with N10,000,000 capital needed as cash on interest free loan basis payable in five (5) years period with the sole aim of making profit was projected. The management was based on polyculture of catfishes (*Clarias gariepinus*). Data for the study was collected through face to face interview and the use of checklist from the 22nd of May to 27th of July, 2019. Based on financial analysis an interest free loan of N10,000,000 was required, payable within a period of 5 years, a good return on investment was realized. In addition, the state government was encouraged to empower the populace to engage in aquaculture fish production system. Government fish farms that are no longer operational were recommended for privatization and or commercialization on revival for the provision of more employment, income generation and poverty reduction, especially among the internally displaced person (IDP) in Nigeria.

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Introduction

Among the different food production systems around the world, fish farming is widely seen as an important weapon in the global fight against poverty, malnutrition and food insecurity, particularly within developing Countries like Nigeria. Fish farming is regarded as an important domestic provider of the much needed high-quality animal protein and other essential nutrients (generally at affordable prices to the poorer segments of the community) and or a provider of employment opportunities and cash income. In view of these positive characteristics, it is perhaps not surprising that fish farming has been among the world's fastest-growing food production sectors for nearly two decades [1].

Fish remains among the most traded food commodities worldwide. The fishery sector is especially important for developing nations, in some cases accounting for more than half of the total value of traded commodities. In 2012, it represented about 10 percent of total agricultural exports and 1 percent of world merchandise trade in value terms (Food and Agriculture Organization, 2014). Fishery exports reached a peak of \$129.8 billion in 2011 up by 17% from 2010 but declined slightly to \$129.2 billion in 2012 following downward pressure on international prices of selected fish and fishery products (FAO, 2014).

Africa as a Continent increased its contribution to global fish production from 1.2 percent to 2.2 percent in the past ten years,

albeit from a very low base. The share of freshwater aquaculture in the region also fell from 55.2 percent to 21.8 percent in the 1990s. The potential for fish farming to compete at the economic level on the African continent is very limited compared with the situation in China for example. In Southeast Asia in general, fish farming is widely practiced and it is strictly an economic enterprise through private investment. Aquaculture is still developing in Africa and is mostly concentrated in a few Countries like Egypt, Morocco and Nigeria [2].

In Nigeria, aquaculture expansion has been a slow process as private sector fish farmers have faced major constraints including lack of seed and quality feed. Fish farming as an economic activity was first introduced into Nigeria about 66 years ago with the establishment of a small experimental station at Onikan in Lagos State, Agodi in Ibadan, Oyo State, and an industrial farm (20 hectares) at Panyam in Plateau State by the Federal Government of Nigeria. Since the establishment of fish farms was spear-headed by the Federal Government of Nigeria, fish farming had received some attention from the government through her programs on agriculture such as the establishment of Aquaculture and Inland Fisheries Project and the Presidential Initiative on Aquaculture in 2005 [3].

Borno state of Nigeria has a great potential for fish production both from capture and culture fisheries. The potentials of the culture fisheries have not been adequately developed, this can be attributed to the enormous fisheries resources of the state inland water particularly the Lake Chad, whose fisheries is entirely

artisanal, having sustainable yield estimated at 100,000 to 180,000 tons annually under normal condition [4].

Generally, most of the environmental requirements of fish farming could be attributed to water, temperature and soil. These factors play critical roles in determining the possibilities of fish farming activities. Borno state of Nigeria possess abundant water resources which can be categorized in to seasonal rivers, pools and flood plains, small perennial rivers, reservoirs and lakes, major rivers and major lake. The temperature regime of the state is suitable for fish production throughout the year, more so the nature of the soil does not constitute problem for fish farming in the state [5].

Fundamentally, the establishment of private individual ownership of aquaculture form of fish farm enterprises requires pre-feasibility and feasibility studies. Carried out based on the guidelines in conducting Feasibility studies:

Site selection and land acquisition should be based on the availability of water, good quality soil and the topography of the soil. On the basis of these the prospective investor goes to land acquisition. The influenced of these factors varies from one location to the other depending on the usefulness of land and its relative usefulness to agriculture.

In the site survey and farm design the clearance and survey of the acquired land is necessary to enable provide basic data on the topography of the area for easy design of the farm. The essence of the design in simplest form is to be able to show the layout of the farm, position of the reservoir, the ponds, drainage systems, drainage canals and spill ways. Office complex is also required which involved offices, warehouse and stores for feed and other inputs. The cost of survey and design should not exceed 5% of the total cost of pond construction depending on the locality.

Under the cost of pond construction, the cost implication for the excavation volume of the earth can be computed from the design and the desired depth of the ponds. The desired site should be cleared and well pegged out to the desired size. The depth of the pond should not exceed 1.5 meters; most concrete ponds are constructed with blocks. The perimeter length should be dig up to accommodate 1 to 2 coaches of blocks and ensuring that the floor is adequately concreted and when setting-out all hollow part of the block must be filled with concrete (sand concrete). 4 to 5 coaches of blocks above ground level are ideal for fish rearing, using cement, sand and gravel mix in the ratio 1:2:4 respectively with water, the pond floor should be well concreted to a thickness between 7.5cm – 10cm. The wall should be plastered to about 5cm thickness using cement – sand mix in the ratio of 1 bag of cement to six tubs of sand. The four corners of the pond must be well reinforced (pillar may be built) as these are likely area where leaks can develop. Pipe for draining and overflow should be installed to drain and prevent overflow after a heavy rainfall. Market survey is necessary for the inputs for construction of the concrete pond.

Preparation of operational plan is necessary for private fish farms especially when financial firms are involved in loan acquisition. This shows the financial analysis, cash flow statement, production targets and loan repayment schedule.

Problem Setting and Research Objective

Aquaculture was incepted over 60 years ago in Nigeria was believed to bridge the gap between fish demand and supply but has not been able to substantially contribute to the domestic fish

production in Nigeria and Borno as a state in spite meeting environmental requirement for aquaculture fish production. Private ownership of fish farm has been shown to have positive impact for aquaculture to substantially contribute to domestic fish production which is in turn catalytic to food security, hunger reduction and poverty alleviation subsequently employment generation and economic growth [6].

Borno state fish production from capture fisheries has reached its assured maximum sustainable yield in the Lake Chad Basin area, since the number of catch from capture fisheries is declining [7]. Aquaculture production in the state has been very slow as a result of high cost of feed in spite the economic constraints of the fish farmers, inadequate high quality seed (fingerling), inadequate access to credit facilities, high level of illiteracy of fish farmers, lack of technical know-how of aquaculture production system by fish farmers, lack of awareness on the aquaculture production system, lack of government support in developing aquaculture, inadequate research on aspect of aquaculture and lack of economic viability studies. There is the need for serious research work on fish species that are suitable for Borno state aquaculture production. The existing government fish farms, hatcheries, and other facilities are limited and the contribution of these projects have not significantly solves the problems facing fish farmers towards improved fish production in the state due to ineffective management and I don't care attitudes of the previous administration couples with sorry state of insecurity of the state.

Fish is very much consumed by Nigerians and more so in Borno state, the country's total demand was estimated at 3.2 million tons, while it depends on only 1.12 million tons of domestic production from aquaculture, artisanal and industrial fisheries. The output of wild sources of fish species has drastically declined as such cannot keep up with the demand of the growing human population and particularly the Boko Haram insurgency in Nigeria continues to disrupt the fish supply from the Lake Chad basin area, an area known for its high productivity worldwide (FDF,2018). The deficit has to be made up through private ownership of aquaculture. Therefore, this study was undertaken in 303 housing estate community of jere Local Government Area of Borno State of Nigeria within the period of three months from 22nd May to 27th July, 2019 in consideration of the end of the production period of most farmers in the study area to determine the economic profitability of private operation of aquaculture and improve the operation of private ownership of aquaculture in the state and identification of relevant policy strategy to empower youth in aquaculture fish production in the state.

Methodology

The study area Borno State of Nigeria is situated between Latitudes 100 15' N and 130 40'N and Longitude 110 30'E and 140 45'E. The climate is of semi-arid and arid type with wide seasonal and diurnal temperature ranges. A long dry season is followed by a single wet season. Practically all rainfalls in a three to four months' period from June to September. From November to May it remains very dry. The amount of rainfall recorded in difference observation points in the State is highly variable. For example, the mean annual rainfall of Bama, Biu, Damboa, Gwoza, Maiduguri and Baga for 59 years up to 1974 was 698mm, 951mm, 869mm, 647mm and 300mm respectively. In essence Borno State falls in to the Sudano-Sahelian vegetation classified under the tropical continental climate with rainfall of 250-1000mm. The temperature regime of the State is relatively more constant than that of rainfall pattern. The hottest months of the year are March, April and May with mean monthly temperature of 29.5, 32.8 and 34.5°C respectively [4].



Figure 1: Map showing the Study Area (Borno State of Nigeria)
Source: Google Map, 2019

Data for this study was obtained from a primary and secondary source. Both the primary and the secondary data were obtained through a face to face interview and the use of check-list to elicit information from both the respondents and personal observation of the respondents (fish farmer and an employee of financial institution) on profitability of fish farming in concrete ponds in the study area.

A multi-stage sampling procedure was adopted for this study. In the first stage, Jere Local Government Area was purposively selected out of the twenty-seven Local Government Areas in Borno State of Nigeria for this study because of the environmental suitability of the area for aquaculture system of production [4].

The second stage was the selection of aquaculture fish farmers in all houses in 303 housing estate of Jere local Government Area of the State and finally an aquaculture fish farmer house hold was selected in the study area considering its uninterrupted large scale of production.

Data obtained from the study were analyzed using descriptive statistics to determine the profitability of aquaculture in the study area using net farm income analysis. Net farm income analysis is a measure of profitability and is determined based on information derived from a business or farm operations income statement. The term “profitability” is the difference between the value of what is produced or service provided and the cost of producing that product or providing that service. Net farm income analysis will be used to determine how profitable fish farming business is in Borno State of Nigeria. This analytical technique will be used to estimate the profit or the net income which is the difference between the gross farm income and the total costs of production [8].

The model is specified as follows:

$$NFI = TR - TC \dots\dots\dots (4)$$

Where;

NFI = Net Farm Income,

TR = Total Revenue and

TC = Total Cost (Total Variable Cost + Total Fixed Cost).

Results and Discussion

Fish Farm Financial Analysis for the Development of Cash Flow Statement

Table 4.1 shows the total estimated cost of one million naira(N10,000000) for setting up of fish farm in a60 × 120ft plot of land using two, 2m depth of 20 × 15m concrete Ponds with a stocking density of 3000 fingerlings per Pond. The N10,000000 capital investment involves; fixed capital investment cost of N7380,000 and operation expenses of N 2620,000.

Table 4.1: Fish Farm Cash Flow Statement

Particulars	Period (Years)				
	1	2	3	4	5
A. Details of Cash Receipts:					
1. Sales “Table Size Fish” Pond 1	₦3,000000	₦3,000000	₦3,000000	₦3,000000	₦3,000000
Sales “Table Size Fish” Pond 2	₦3,000000	₦3,000000	₦3,000000	₦3,000000	₦3,000000
2. Bank loan (Interest Free)	₦10,000000				
Subtotal	₦16,000000	₦16,000000	₦6,000000	₦66,000000	₦6,600000
B. Details of Cash Payments:					
Fixed Capital					
Land Acquisition	₦1,100,000				
Farm House	₦1,400,000				
Pond Development	₦1,200,000				
Farm Equipment	₦3,500,000				
Survey and Design	₦1,30,000				
Clearing	₦50,000				
Subtotal	₦7,380,000				
C. Details of Operating Cost:					
Recurrent Input					

Fingerlings (Catfish)					
Pond A: 3,000 @ N45.00	₦135,000	₦135,000	₦135,000	₦135,000	₦135,000
Pond B: 3,000 @ N45.00	₦135,000	₦135,000	₦135,000	₦135,000	₦135,000
Personnel	₦420,000	₦420,000	₦480,000	₦560,000	₦560,000
Feeds / Fertilizer	₦1500,000	₦1520,000	₦1540,000	₦1560,000	₦1580,000
Vehicle/Pump Running Cost	₦200,000	₦240,000	₦280,000	₦320,000	₦360,000
Miscellaneous Expenses	₦230,000	₦200,000	₦220,000	₦220,000	₦230,000
Subtotal	₦2620,000	₦2650,000	₦2790,000	₦2930,000	₦3000,000
D. Loan Repayment	₦200,000	₦200,000	₦200,000	₦200,000	₦200,000
E. Total Cash Outflow:					
(B+C+D)	₦12000,000	₦4650,000	₦4790,000	₦4930,000	₦5000,000
F. Total Cash Inflow					
(A-E)	₦4000,000	₦1350,000	₦1210,000	₦1670,000	₦1600,000

The operating cost gradually increased up to ₦3,000,000 within the five years' period. The increased in the operating cost was as a result of anticipated expansion of the aquaculture production system in the state which resulted in high demand of fish production inputs both material and otherwise. The cash flow statement shows positive result as indicated by the attractiveness of the market price of the cultured fish throughout the production period.

Loan Repayment

Table 4.2 shows loan repayment schedule. The loan repayment was apportioned to be paid equally at the rate of ₦2,000,000 per annum over a period of five years. However, based on the projection, the loan was paid easily within the five years' period considering the profitability of the venture as well as the interest free based of the loan.

Table 4.2: Loan Repayment Schedule (Interest Free)

Year	Capital ₦	Annual Repayment ₦	Outstanding Balance ₦
0	-	-	10,000,000
1.	2000,000	2000,000	8,000,000
2.	2000,000	2000,000	6,000,000
3.	2000,000	2000,000	4,000,000
4.	2000,000	2000,000	2,000,000
5.	2000,000	2000,000	Nil

The repayment terminated at the end of the 5th year as indicated “zero outstanding balance” on the 5th row of the table under outstanding balance column.

Depreciation of Fixed Assets

Table 4.3 shows the total value of depreciation of the fixed assets of the business at the rate of 10% per annum spread over 5years. Some of the assets may last for over fifty years.

Table 4.3: The Rate of Depreciation for 5years Period

Year	Annual Depreciation at 10% ₦	Assets Value at the End of the Year ₦
0.		7,380,000
1.	738,000	6,642,000
2.	664,200	5,977,800
3.	597,780	5,380,020
4.	538,002	4,842,018
5.	484,202	4,357,816

The total value of the fixed assets of the fishing business on the commencement year was ₦7,380,000 and valued at ₦4,357,816 at the end of the 5th year.

Profit and Loss Account

Table 4.4 shows that aquaculture production system was profitable as indicated in the projection that throughout the 5 years business life no loss was recorded except gain in the business. The highest profit gained within the 5 years' period of the projected production was in the 4th year; operating profit of ₦ 3,670,000, gross profit of ₦ 3,131,998 and net profit of ₦ 1,722,599.

Table 4.4: Projected Profit and Loss Account

Particulars	Period (Years)				
	1	2	3	4	5
Revenue from Sales of Fish	₦6,000,000	₦6,000,000	₦6,000,000	₦6,600,000	₦ 6,600,000
Less Operating Cost	₦2,620,000	₦2,650,000	₦2,790,000	₦ 2,930,000	₦ 3,000,000
Operating Profit	₦3,380,000	₦3,350,000	₦3,210,000	₦ 3,670,000	₦ 3,600,000
Less Depreciation	₦738,000	₦664,200	₦597,780	₦ 538,002	₦ 484,202
Gross Profit	₦2,642,000	₦2,685,800	₦2,612,220	₦ 3,131,998	₦ 3,115,798
Less Company Tax	₦1,188,900	₦1,208,610	₦1,175,499	₦ 1,409,399	₦ 1,402,109
Net Profit	₦1,453,100	₦1,477,190	₦1,436,721	₦ 1,722,599	₦ 1,713,689

The least profit was recorded in the 3rd year as projected; operating profit ₦ 3,210,000 gross profit ₦2,612,220 and net profit ₦1,436,721.

Conclusions and Recommendations

As projected, the project has shown to be viable. Government and finance houses are therefore encouraged to support aquaculture production system aggressively for youth empowerments, poverty reduction, rural development and economic growth. Although the projected work was on the basis of interest free loan, however banks should be encouraged to charge low interest rate where inevitably applicable, especially commercial banks so that the venture would be more lucrative [9, 10].

The following recommendations are made:

1. Government farms should be made to be productive and as well run as a profitable venture and those farms that failed should be revived or privatized so that such farms could be used in poverty reduction.
2. Government should make effort to ensure that aquaculture production system inputs are easily accessible to farmers at affordable rate.
3. Government should set up fish feed mill, hatcheries, fish processing, preservation and packaging industries in the state.
4. Responsible authorities should ensure that consultancy and extension services should be within the easy reach of the fish farmers.
5. Government and other non-governmental organizations should prioritize skill acquisition program in fish farming backed up with capital support and other material requirements for smooth operation and subsequent expansion.

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