Profitability Analysis of Fish Farming in Niger State, Nigeria

Ahmed Gomna[*], Pawa, Dan-Azumi, Zakari Mamman

Department of Agricultural Education, Federal College of Education, P.M. B 39, Kontagora, Niger State, Nigeria.

Abstract

In the study of aquaculture, much attention has been focused on bio-technical aspects. Economic research is often neglected by researchers and fish farmers. This paper examined the profitability of fish farming in Niger State, Nigeria. Data was collected by means of semi-structured questionnaire administered to 90 fish farmers randomly selected from three Agricultural zones in Niger State. The study revealed that fish farming is profitable in Niger State as a result of positive net returns, high rate of incomes and benefit-cost ratios and, therefore capable of creating employment, generating income and improving the standard of living of the people. Fish farming should therefore be encouraged and supported. Support could be in the form of technical assistance or subsidies.

Keywords

Niger State, Aquaculture, Fish farming, Profitability, Cost-Return

1. Introduction

Fishermen in Nigeria have for generations practiced traditional methods of fish culturing in tidal pools and floodplains. The need to increase food supply especially animal protein gave rise to fish farming in the country. Fish farming (aquaculture) is a rational way of augmenting the dwindling fish supply from capture fisheries. However, the aquaculture sub sector has not been fully exploited in Niger State despite its high potentials. Despite the great potentials of low land (fadama) for the development of rice-cum-fish culture, only 0.37 ha out of 495,000 ha of available fadama is being cultured at experimental stage in Niger State [1].

One way of assessing aquaculture performance is to apply cost-benefit analysis. The analysis is essential to evaluate the viability of investment in aquaculture, determine the efficiency of resource allocation, improve existing management practices, evaluate new culture technology, assess market potential, and identify areas in which fish production would have high payoffs [2, 3]. The primary motivation of a commercial fish farm is profit making.

Profitability of a fish farm is dependent on level of yield, cost of production and farm price. The level of physical production is mainly dependent on stocking rate, survival rate and growth rate which are in turn affected by:

- bio-technical factors such as fertilization and feeding, mono or polyculture, different stocking and harvesting strategies;
- environmental factors such as water quality, diseases and predators; and
- physical facilities such as site selection, construction, soil condition and equipment used.

The cost of production relates to the level of input, the prices of inputs, the culture system, the size of operation, as well as the institutional factors such as costs of credit and marketing. The farm price of aquaculture products is usually affected by the size and quality of the product, the supply-demand situation for the product, the market structure and the existence of (if any) of governmental pricing policies [2]. Increases in yield, reductions in costs and increases in price,

therefore, are the major means of increasing profits.

Although fish farms exist in Niger State, Nigeria [4, 5, 6, 7], there is little information on the costs and returns of fish farming in the state. The few studies [8, 9, 10] on profitability in Niger State were conducted in some specific Local Government Areas of the state and did not cover the entire state. The current study was therefore undertaken to examine the profitability of fish farming in Niger State, Nigeria.

2. Materials and Methods

2.1 Study Area

Niger State is located between Latitudes 8° 20' N and 11° 30' N and Longitudes 3° 30' E and 7° 20' E. The state covers a total land area of 76,000 km^2 representing about 9% of Nigeria's total land area. This makes the state the largest in the country (Figure 1). According to 1991 census, Niger state has a population of 2,482,367 with a population density of 33 persons per sq km; the lowest in the country [11].

Niger state is an inland region that has abundant fresh water resources. The state has numerous, large, perennial water bodies which include major rivers like Niger, Kaduna and Gurara and, three giant man-made lakes—Kainji, Jebba, and Shiroro with an estimated water surface area of 436,196 ha [12].

The state is divided into three Agricultural zones as shown in Table 1, according to Agricultural zoning system of Niger State Agricultural Development Project (ADP). The three zones are made up of 25 Local Government Areas (LGAs) of Niger State.

Table 1. Agricultural zones with their LGAs

Zone	Local Government Areas (LGAs)
A	Agaie, Bida, Edati, Gbako, Katcha, Lapai, Lavun, Mokwa
B	Bosso, Chanchaga, Gurara, Paikoro, Munya, Rafi, Shiroro, Suleja, Tafa
C	Agwara, Borgu, Kontagora, Magama, Mariga, Mashegu, Rijau, Wushsishi

2.2 Sampling procedure and sample size

A multi-stage sampling procedure was adopted in the selection of the sample size. In the first stage, three LGAs were purposively selected on the basis of the availability of fish farms from each Agricultural zone for the study, making a total of nine Local Government Areas. The LGAs selected were Bosso, Shiroro, Chanchaga, Lavun, Mokwa, Bida, Borgu, Kontagora and Magama (Figure 2). In the second stage, 10 fish farmers were selected randomly from each of the nine LGA making a total of 90 fish farmers.

2.3 Method of Data Collection

Semi-structured questionnaire was used in collecting data from fish farmers. Rural Rapid Appraisal (RRA) technique was also adopted during the field visits. This method involves gathering of information through visual observations, measurements and oral interviews of individuals or groups. Data was collected with the help of extension agents of ADP in the State. Data was collected in November, 2019.

2.4 Profitability Analysis

Profitability was determined by the following criteria:
- Net return, defined as gross revenue minus total cost. The gross or total revenue is the total product or output multiplied by the market price of output. A positive net return means the activity is profitable.
- Benefit-cost ratio, defined as net return divided by the total cost. A ratio of greater than 1.0 is thus the indication of profitable activity.
- Rate of farm income, defined as net return divided by gross revenue, times 100. The larger the rate of farm income, the greater the production efficiency.

Opportunity cost of family labor was estimated from cost of hired labor in the area. Annual depreciation rates using the straight line method were used for fixed assets with salvage value assumed to be zero at the end of useful component life. Annual depreciation rate was therefore computed by dividing the cost of the asset by its expected years of economic life (useful life).

2.5 Statistical Analysis

Data was analyzed using descriptive statistics such as means, percentages, and frequency tables.

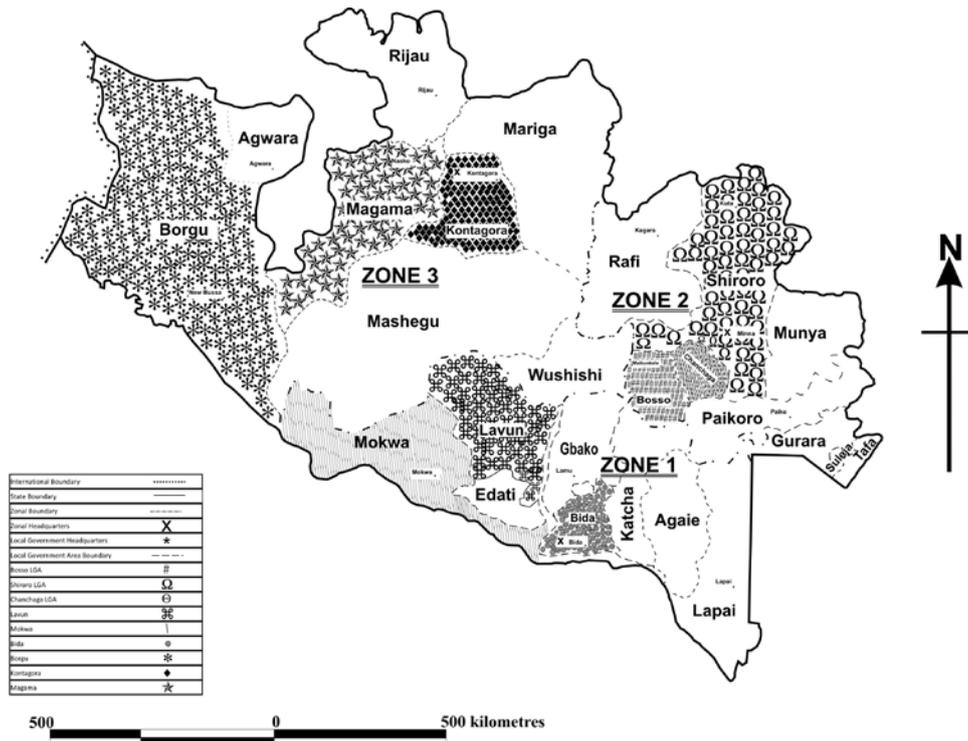**Figure 1. Map of Nigeria showing Niger state, the study area.**

Figure 2. Map of Niger State showing the study areas.

3. Results

3.1 Socioeconomic characteristics of the fish farmers

Socioeconomic characteristics of the fish farmers are presented in Table 2. Majority of the fish farmers (54%) were within the age bracket of 31-45 years and about 88% of the farmers were males. The results showed that large percentages of the fish farmers (89%) were married and about 43% of the farmers had family size of 6-10 persons. Large proportions (79%) of the farmers had tertiary education and were mostly civil servants. Majority of the fish farmers (70%) had less than six years experience in fish farming.

Table 2. Socioeconomic characteristics of the fish farmers

Variable	Frequency	Percentage
Age (years)		
Less than 31	12	13.3
31-45	49	54.4
Above 45	29	32.2
Gender		
Male	79	87.8
Female	11	12.2
Marital Status		
Single	9	10
Married	80	89
Separated	1	1
Household size		
1-5	37	41.1
6-10	39	43.3
More than 10	14	15.6
Education status		
No formal Education	10	11.1
Primary education	2	2.2
Secondary Education	7	7.8
Tertiary Education	71	78.9
Primary occupation		
Farming	31	34.4
Trading	17	18.9
Civil servants	40	44.4
Artisans	2	2.2
Farming experience (years)		
< 6	63	70
6-10	20	22.2
More than 10	7	7.8

Source: Field survey, 2019

3.2 Profitability of fish farming

3.2.1 Costs of fish production
Costs of various inputs used in the fish production by farmers are presented in Table 3. Feed accounted for the highest cost (49%) of fish production followed by cost of procuring (23%) fingerlings. Inorganic fertilizer accounted for the lowest cost (0.2%) of production.

3.2.2 Profitability
Total cost of N 227,453 was incurred in producing 1,065 kg of fish per hectare per year by farmers (Table 4). Gross revenue of N 984,060 was realized with a net return of N 756,607 per hectare per year. Rate of income and benefit-cost ratio were 77% and 3.3, respectively.

4. Discussion

4.1 Socioeconomic characteristics

In fish farming, proper management determines the profitability of the aquaculture. The ability to make proper management of ponds is, in turn, largely a function of the farmer's age and education as well as his experience and degree of involvement in fish farming [13].

Table 3. Costs of fish production

Cost item (N ha^{-1} yr^{-1})	Mean	% of Total cost
Lime	976±1,817	0.4
Organic Manure	586±1,143	0.3
Inorganic Fertilizer	500±1,832	0.2
Fingerlings	52,044±67,261	23
Feed	110,618±224,426	49
Labor	26,056±16,847	11
Medication	3,982±7,400	2
Total Variable Cost	194,762±96,325	**86**
Depreciation of equipment	1,009±128	0.4
Depreciation of Ponds	31,682±71	14
Total Fixed Cost	32,691±162	**14**
Total Cost	227,453±177	**100**

Data is presented as mean ± standard deviation. Nigerian Currency is Naira (N). 1 United States Dollar = 362 Nigerian Naira in November, 2019.

Table 4. Costs and returns of fish production

A. Mean production (kg ha^{-1} yr^{-1})	1,065
B. Average price (N kg^{-1})*	924
C. Gross revenue (N ha^{-1} yr^{-1}) (AxB)	984,060
D. Mean total cost (N ha^{-1} yr^{-1})	227,453
E. Net return (N ha^{-1} yr^{-1}) (C – D)	756,607
F. Rate of income (%) (E/C x 100)	77
G. Benefit - cost ratio (E/D)	3.3
H. Average cost (N kg^{-1}) (D/A)	214
I. Net return (N kg^{-1}) (B – H)	710

* Prevailing market price of fish. n = 90.

The current study showed that fish farmers were in the middle and economically active age group (Table 2) suggesting that training the farmers in fish farming may be effective. The result compares favorably with the findings of [14, 15].

Majority of Aquaculture farmers had attained tertiary level of education as indicated in (Table 2). A higher level of education is necessary for improved farm management and use of new production technologies [13, 16]. The willingness of farmers to take risks and innovate also may increase with level of education. Human resource development is largely a function of literacy and educational attainment. Amongst farmers, literacy and education attainments help develop conceptual skill and also facilitate the acquisition of technical skill, which can have direct bearing on income generation, expenditure and saving activities. Veerina *et al.* [17] noted that factors such as literacy have a role in influencing yields through production decisions. There is a general consensus that education has a positive effect on agricultural productivity [18, 19], a high rate of illiteracy resulting in low farm efficiency [20, 21]. Atapattu [22] stated that fish farmers should be properly educated with respect to the importance of management. The development of aquaculture is limited by technological and biological knowledge, and the level of education and experience in a society [3].

Most of the fish farmers were civil servants and majority had less than 10 years experience in fish farming. Primary occupation may not provide full time employment and the income derived from it may be insufficient to provide adequate means of livelihood, hence secondary occupation which was fish farming. Farmer's income is a key measure reflecting economic security. A household is economically secure when it has the capacity to generate sufficient income to satisfy the basic needs of the family and to maintain or increase the goods necessary for the stability of the household economy [23].

The study revealed dominance of men in fish farming. Women engage more in fish processing, preservation and marketing in the study area. Majority of the fish farmers were married and had large household size. This could be due to religion and geographic location. Niger state is in the Northern part of Nigeria where Muslims are concentrated [24]. The majority of the farmers in the study area had Islam as their religion, which allows polygamy that could lead to more children suggesting that they had labors to work on the farm.

4.2 Profitability of fish farming

The study revealed positive net return, high rate of income and benefit-cost ratios indicating that fish farming is profitable in Niger State, Nigeria. Various studies [25, 26, 14, 27, 28, 29, 30, 31, 32, 33, 34, 35] have also shown that fish farming is a profitable business.

Profitability of a farm is dependent on level of yield, cost of production and farm price. Increasing yield, reducing costs and increasing market price could increase the profitability of fish ponds. Increasing stocking rate, survival rate and growth rate are the primary means of increasing production [2]. In order to increase the yield of fish ponds, farmers paid more attention to management techniques such as mortality reduction, liming, fertilization, feeding, water quality monitoring, control of predators and poaching.

The cost of production relates to the level of input, the prices of inputs, the culture system, the size of operation, as well as the institutional factors such as costs of credit and marketing. Although the total cost of production is higher with fertilization and supplementary feeding than without, the production cost per kg may be lower and the additional revenue generated may be higher than the additional cost involved. Using domestic and farm wastes for fish culture helped in reducing the cost of feed and fertilizer. This practice also helped in recycling wastes, thereby protecting the environment and at the same time contributing to food production.

The farm price of aquaculture products is usually affected by the size and quality of the product, the supply-demand situation for the product, the market structure and the existence of (if any) of governmental pricing policies [2]. Farmers produced large fish at harvest in order to obtain higher prices. Phased stocking so that harvesting occurs at desirable times with respect to demand and price of fish can also increase the price of fish received. Low quality, spoilage, and waste reduce the average price that the farmers receive. However, the quality of fish can be improved through proper preservation during transport.

5. Conclusion

The study revealed that fish farming is profitable in Niger State as a result of positive net returns, high rate of incomes and benefit-cost ratios and, therefore capable of creating employment, generating income and improving the standard of living of the people.

Fish farming should therefore be encouraged and supported. Support could be in the form of technical assistance or subsidies.

6. Acknowledgement

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