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Factors Determining the Profitability of Catfish Production in Ibadan, Oyo State, Nigeria

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Abstract

This study evaluated the socioeconomic factors influencing the profitability of catfish production in the city of Ibadan. Multistage sampling method was used to collect data from 120 fish farmers. Descriptive statistics, budgetary analysis and the multiple regression model were used to analyse the data obtained. The results showed that catfish production in Ibadan was male dominated as 80% of the fish farmers were men. The mean age of fish farmers was 44.3±12.0 years while as many as 78.3% of the farmers had post-secondary education. The mean family size was 5.2±1.9 while fish farmers were small operators with a mean farm size of 0.3±0.2 hectares. Fish farming is very recent as farmers had a mean farm experience of 6.9±6.5 years. Eighty per cent of the fish farmers got involved in fish farming for commercial reasons. The gross margin to catfish farming was ₦197,520.25 (US$ 987.60)/ha with a net income of ₦182, 573.04 (US$912.87)/ha. The budgetary analysis revealed that fish feed which constituted 79.18% of the total operating cost was the major cost item in catfish production. The regression analysis showed that fish farming experience, amount of labour used and quantity of feed used were significant determinants of net income in catfish production. The study concluded that there is the need to access fish farmers to substantially cheaper feed inputs to ensure the use of adequate quantity and quality of feed in catfish production. This will enhance output, productivity and net income in catfish enterprises.

Keywords: Catfish, feed, unemployment, nutrition, policies, disincentive, subsistence, livelihood

1. Introduction

The enormous opportunities presented by increasing urbanization in Nigeria can be exploited by policy makers and agricultural sector operators to meet the challenges of unemployment, poverty and inadequate nutrition that pervades Nigerian cities. This is because the cities offer large markets, cosmopolitan and affluent population that demands more and better nutrition, and growing industrial and service sectors that depend on the agricultural sector for raw materials. Recent figures on the level of unemployment in Nigeria which stood at 23.9% in 2011(National Bureau of Statistics {NBS}, 2012; CIA, 2014) as well as urban unemployment estimated at 29.5% in 2013 (This Day, 2015) has been unacceptably high. Coupled with this is the challenge of poverty which also stood at 69% (112.5 million people) of the estimated national population of 163 million (NBS, 2014a). The NBS (2014b) also puts youth unemployment at 54% (with 48.1% male and 51.9% female). Furthermore, the average protein intake in Nigeria is about 19.38 grams/caput/day which is far below the Food and Agricultural Organization's (FAO) requirement of 75 g/caput/day (FAO, 1995).

Although the intensity of urban growth can pose a major challenge to the development and growth of large scale farming, fish production is an enterprise that requires small areas of land and which can make use of the several stream channels for the sustainability of the urban environment. In Nigeria where most of the cities have large agricultural resources and potentials relative to the industrial and service sectors, fish farming can generate significant employment, provide income earning potentials for the urban population, enhance the socio-economic status of the farmer as well as generate foreign exchange (Oluwasola & Ajayi, 2013; Olagunju, et al., 2007; Adekoya & Miller, 2004; Eyo, 1992). As succinctly put by Pretty et al. (2003), with dwindling food production, degrading agricultural environment, widespread poverty and insecurity in Africa, fish farming provides the poor and hungry with a low cost and readily available strategy to increase food production using less land and less water without further damage to the environment. Fish farming also has enormous potentials of improving the nutritional standard of the masses of the people. Fish contains higher percentage of protein than

meat and is important for its high nutritive value and significance in improving human health. Faced with increasing wealth, changing dietary patterns and urbanization, fish farming provides the key to meeting fish demand in the face of dwindling fish supply from captured sources. Fish farming is not just uniquely placed to reverse the declines in supplies experienced from capture fisheries but also has notable potentials for new livelihood opportunities, providing mechanism for lower priced fish, enhanced nutritional security and employment for poor communities (Jagger & Pender, 2001).

Prior to the 1990s, the development of fish farming in Nigeria was driven by socio-economic objectives including, nutrition improvement of rural communities, generation of additional family income, creation of employment and diversification of income generating activities. Fish farming was promoted by International Organizations and agencies as well as the governments of Nigeria at Federal, State and Local Government levels. In Nigeria, fish farming is predominantly an extensive land based system, practiced mainly at subsistence levels in fresh waters (Anyawu-Akeredolu, 2005). However, only a few species such as catfish and tilapia are cultured commercially (Komolafe and Arawomo, 2007) as commercial farming is yet to become widespread (Fagbenro, 2005). At present, most fish farmers operate small-scale farms ranging from homestead concrete ponds (25 - 40 meters) to small earthen ponds (0.02 - 0.2 hectares). The industry produced over 85,000 tonnes of fish in 2007 (FDF, 2008). FAO (2005b, 2006b) pointed out that Nigeria with extensive mangrove ecosystem and over 14 million hectares of inland water surface out of which 1.7 million are available and suitable for fish farming, should not have any major challenge in achieving sufficient and sustainable fish output to meet domestic demand. Yet, in spite of the nations enormous fish potentials and increasing interests in the subsector (Tobor, 1990; Shimang, 2005; Welcome, 1979; Kapetsky, 1981), the gap between the demand for fish in Nigeria (1.3 million metric tonnes annually) and its supply from domestic production (about 0.45 metric tonnes annually) has continued to widen (Oluwasola & Ajayi, 2013). This study thus seeks to evaluate the socioeconomic factors influencing the profitability of catfish production in the city of Ibadan with a view to determining its effects on employment generation, poverty alleviation and enhanced nutrition among the urban population. Specifically, the paper described the socioeconomic characteristics of fish farmers in the city of Ibadan, analyzed costs and returns to catfish farming and determined the factors affecting the profitability of catfish production.

2. Methodology

The study was carried out in the city of Ibadan, Oyo State in the in the southwestern geopolitical zone of Nigeria. The city is located on the coordinates of longitude $3^0$5 ' East of the Greenwich Meridian and latitude $7^0$23' North of the Equator. Administratively, the city is divided into eleven local government areas (LGAs) and has a population of 1,338,659 (NPC, 2006). Ibadan is the largest traditional city south of the Sahara (UN-Habitat, 2001) and is connected by road, rail and air transport to several cities in the southwestern geopolitical zone. The city enjoys two climatic seasons -the rainy season which lasts from April to October and the dry season which lasts from November to March. The city experiences a mean annual rainfall of 1,262mm and a temperature range of between 22.5 ^{o}C and 27.5 ^{o}C (Oguntoyinbo, 1994).

Primary data were used for the study. A multistage sampling procedure was used to select respondents for the study. In the first stage, the city of Ibadan was purposively selected because of the large and ready market for a burgeoning fish farming enterprise. At the second stage, six of the eleven LGAs including: Egbeda, Ido, Ibadan North-West, Ona-Ara, Ibadan North and Ibadan North East were randomly selected while from a list of catfish farmers obtained from the State Agricultural Development Programme (ADP), twenty catfish farmers were randomly selected from each LGA. In all, 120 catfish farmers were sampled for the study.

Data collected were analysed with descriptive statistics, budgetary techniques and the multiple regression model. Descriptive statistics including frequency counts, means and percentages were used to describe the socio-economic characteristics of the catfish farmers while the budgetary technique was used to determine the gross margin and profitability of catfish enterprises. The profit was estimated:

$$\pi_i = P_i Q_i - TCi \quad (1)$$

where,

π_i = net income (₦),

P_i = price per kg of fish produced (₦),

Q_i = Fish output (kg), and,

TCi = total costs of production (fixed cost {FC} plus variable cost {VC}) (₦).

Variable costs (VC) included in the analysis were expenditures on labour, feed, fingerlings, broodstock, fertilizer, lime, transportation, drugs and security. Items that could be used for more than a production cycle were classified as fixed costs (FC). These included nets, plastics and depreciation on pond construction, generator and pumping machines.

A multiple regression model was used to determine the factors affecting net income from catfish farming in the city of Ibadan. The model was implicitly specified as:

$$Y = f(X_{1,} X_{2,} X_{3,} X_{4,} X_{5,} X_{6,} X_{7,} \varepsilon_i) \quad (2)$$

where,

Y = Net income (₦/ha)
$X_{1,}$ = Age of farmer (Years)
X_2 = Family size
X_3 = Farming experience (Years)
X_4 = Size of fish pond (m^2)
X_5 = Labour (man days)
X_6 = Quantity of feed used (kg)
X_7 = Educational level of respondent (Years)
ε_i = Error term

The implicit function was linearized and specified in a log-linear form (Joshi & Jha, 1992; Idumah, 2006) as:

$$\text{Ln}Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_7 X_7 + \varepsilon_i \quad (3)$$

According to Greene (2005) and Gujarati (2003), the disturbance term is expected to fulfil all the assumptions of clssical regression model except that of homoscedasticity which breaks down when cross-sectional data are used (Ayanwale and Osotimehin, 2001). The technique of the ordinary least square (OLS) was then used to estimate the multiple regression equation. Rather than a straight line, geometric interpretation of the model involved a plane. The strength of the relationship between net income from catfish production and the specified explanatory variables was therefore measured by the R^2.

A priori expectations were for X_1, X_3, X_4, X_5, X_6 and X_7 to be positively associated with net income while X_2 could be positively or negatively associated with net income depending on whether the family is a production or consumption unit. The selection of the variables used in the regression model as well as the *a priori* expectations were based on the assumption that in traditional and near subsistent farming enterprises characterised by low resource inputs, age (X_1), family size (X_2), farming experience (X_3), labour (hired and family labour) (X_5) and educational level of respondents (X_7) are critical to output (Akinola & Adeyemo, 2008; Aihonsu, 2002; Oluwasola, 1996; Olayide et al., 1981) and the ability of farmers to take risks in adopting new innovations or technologies (Feder et al., 1985; Adesina & Zinnah, 1992;). Other studies on fish farming like (Olaoye et al., 2013; Ifejika et al., 2007; Olagunju et al., 2007) added other inputs such as feed (X_6) and pond size (X_4). The selection of these variables followed after these earlier studies. Three functional forms of the regression model - linear, semi-log and the double logarithm were fitted to the model but only the double logarithm model which provided the best fit and was in line with *a priori* expectation was selected and discussed.

3. Results and Discussions

3.1 Socio-economic Characteristics of Cat Fish Farmers

Table 1 shows that majority of the fish farmers (33.3%) aged between 41 and 50 years with an age range of between 23 and 65 years. The mean age of the farmers was 44.3±12.0 years. The fish farmers as indicated were in their prime age and hence, economically active (Aihonsu & Olatingiri, 2012; Fregene et al., 2011). Given necessary resources, these set of farmers could increase their productivity. They are also in the age where they could take risks that could increase output as well as income (Akinola & Adeyemo, 2008; Adesina & Zinnah, 1992; Feder et al., 1985). Eighty percent of the fish farmers were men while the remaining 20% were women. The dominance of men in fish production was also reported by Fregene et al. (2011). The dominance of the male gender could be due to a number of factors including the access to water points as access to land is through male lineage (Oluwasola, 1998) and is only by purchase that women can have access to such land resources. It could also be because of the drudgery of fish farming. However, the number of women involved is significant in a region where women are more involved in commerce than in production.

Table 1. Socio-economic characteristics of respondent farmers

Variable	Frequency	Percentage	Mean	Standard Deviation
Age (Years)				
≤	20	16.7		
31-40	29	24.2		
41-50	40	33.3	44.3	12
51-60	16	13.3		
≥61	15	12.5		
Gender				
Male	96	80.0		
Female	24	20.0		
Level of education				
Did not go to school	2	1.7		
Primary school education	1	0.8		
Secondary school education	23	19.2		
Tertiary education	94	78.3		
Marital Status				
Single	35	29.2		
Married	81	67.5		
Separated	4	3.3		
Family size				
≤5	59	49.2		
6 – 10	61	50.8	5.2	1.9
Farm Size (ha)				
≤ 0.5	110	91.7		
0.51 – 0.75	3	2.5		
0.76 - 1.00	6	5.0	0.3	0.2
≥ 1.01	1	0.8		
Farming experience of farmers (years)				
≤ 5.0	68	56.7		
5.1 – 10.0	35	29.2		
10.1 –15.0	5	4.2	6.9	6.5
15.1 - 20.0	7	5.8		
≥21	5	4.1		
Occupational status in fishing				
Primary occupation	53	44.2		
Secondary occupation	67	55.8		
Source of beginning capital				
Savings	69	57.5		
Family	30	25.0		
Friends	8	6.7		
Cooperatives	11	9.2		
Commercial bank	2	1.7		
Reasons for farming				
Subsistence	24	20.0		
Demand for fish	69	57.5		
Price	27	22.5		

Source: Field survey, 2014

As shown in Table 1, majority of the fish farmers were educated with as much as 78.3% having attended Universities, Polytechnics and Colleges of Education. Fregene et al. (2011), Fregene and Digun-Aweto (2008) also reported high levels of education among fish farmers in Oyo and Osun States of the country. Clearly, these set of farmers were educated farmers seeking to tap into the rich fish market to make financial gains. Only 1.7% of them did not go to school. Majority (67.5%) of them were married (Adewuyi et al., 2010) hence, could easily make use of family labour to perform critical farm tasks. It however also means that they will incur higher household expenditure that will reduce the quantum of income realizable from the enterprise. The mean family size was 5.2±1.9 while fish farmers were small operators with a mean farm size of 0.3±0.2 hectares. Fish farm sizes were small because most of the farmers had no access to credit funds to invest in the enterprise (Adeoti et al., 2011; Okorie, 1998; Olomola, 1990). Only 2.7% got loans from commercial banks while 9.2% got loans from cooperative societies to start the business. The remaining relied on their personal savings (57.5%), family members (25%) and friends (6.7%). About 86% of the farmers have been involved in fish farming for not more than 10 years with a mean farm experience of 6.9±6.5 years. Clearly, catfish farming is a recent phenomenon (Aihonsu & Olatingiri, 2012). Although all the respondents had other economic activities they were engaged in aside from fish farming, 55.8% were engaged in the business on part time basis as they saw it as a secondary occupation while the remaining said fish farming was their primary occupation even though they had other businesses. Clearly, fish farming provided opportunities for expanding livelihood choices in the city of Ibadan as fish farmers were also able to engage in other income earning activities after taking care of their fish farms. The push factors for engaging in fish farming as shown in Table 1 were threefold: the increasing demand for fish (57.5%); the high price catfish commands in the market (22.5%) and for subsistence (20%). Clearly, 80% of the fish farmers got involved for commercial reasons.

3.2 Profitability of Cat Fish Farming

The average income from cat fish enterprises in the city of Ibadan was ₦630,049(US$ 3,150.25) (Table 2) while the total average variable cost to enterprise was ₦432,528.75 (US$ 2,162.64) given a gross margin of ₦197,520.25 (US$ 987.60). The average total cost was ₦447,475.96 (US$2,237.38) giving a net income of ₦182, 573.04 (US$912.87). This amounts to a monthly income of about ₦15,214.42 which is less than the national minimum wage of ₦18,000; (US$76.07). Clearly, the high capital investment required and the low net income realizable is a disincentive to attracting young unemployed people. This is partly why in spite of the enormous opportunities in producing fish to meet the gap in supply, the fish subsector has not succeeded in attracting local investors. Only the employed with the necessary financial resources who needs to augment incomes from other economic activities to meet family expenditure are attracted. Table 2 clearly shows that the cost of feed for the fish constitute 79.2% of the total operating cost. Any policy and/or technical measure that substantially reduces the cost of feeding the fish will substantially increase farm income and hence profit. Labour cost constituted only 11.6% of operating cost. The low cost could have resulted from the use of family labour by majority of the fish farmers who were married with fairly large family sizes as shown in Table1.Other cost components were very low .

The financial ratios shows that the expense-structure ratio was 0.03 indicating that for every ₦100 spent on fish farms, ₦3 was incurred on fixed inputs while ₦97 was spent on variable inputs. This suggests that farmers can easily adjust to variations in market conditions as variable costs constitute the largest proportion of farm expenditure. However, it also implies that oscillations in the market price of variable inputs could impact gross margin realizable. Policies that will lead to a reduction in the costs of these inputs, particularly feed will significantly reduce the cost of production and make the enterprise profitable. The benefit - cost ratio of 1.41 suggests that every ₦100 invested in fish farming will yield an additional income of ₦41.

Table 2. Analysis of cost and returns to fish farming

Income/cost Items	Amount (₦)	Percentage in cost category
Revenue	***630,049.00***	
Variable Costs		
Labour	(50,141.67)	11.6
Feed	(342,250.00)	79.2
Fingerlings	(14,250.00)	3.3
Broodstock	(4,593.33)	1.1
Fertilizer	(2,139.17)	0.5
Lime	(758.33)	0.2
Drugs	(5,157.92)	1.2
Transportation	(11,475.00)	2.7
Security	(1,763.33)	0.4
Total variable costs	*(432,528.75)*	
Gross margin	***197,520.25***	
Fixed costs items		
Nets	(2,958.34)	19.8
Plastics	(1,108.42)	7.4
Depreciation	(10,880.45)	72.8
Total fixed cost	*(14,947.21)*	
Total Cost	*(447,475.96)*	
Net revenue	***182,573.04***	
Expense-Structure Ratio		0.03
Benefit-Cost Ratio		1.41

Source: Field Survey, 2014.

3.3 Factors Determining the Profitability of Cat Fish Farms

Equation 3 shows that all the independent variables with the exception of farming experience (X_3) were positively signed in conformity with *a priori* expectations. Farming experience (X_3) was not in conformity with *a priori* expectations as it was negatively signed. Three of the variables, farming experience of respondents (X_3), labour used (X_5) and quantity of feed used (X_6) were also statistically significant.

The experience of respondents in catfish farming (X_3) in contrast to *a priori* expectations was negatively signed although statistically significant. The coefficient of the variable indicates that a unit increase in the experience of catfish farmers will depress income by 13%. This result contradicts findings by Adesiyan and Idowu (2011) and Oluwasola, (2011). Three things could have accounted for this. First, as farmers age, their fish ponds also tend to become older and except remedial actions are taken to keep the fish dams from siltation, productivity could decrease as pond sizes also decrease. Secondly, as farmers age and their children are out of the homes for schools resulting in reduced family labour, the increasing need for labour decreases interest in fish farming. In addition reduced household size which also means a reduction in household expenditure all things being equal could lead to a reduction in efforts put into fish farming. Finally and more critically, when farmers do not find fish farming to be economically rewarding over time, their interest in the enterprise could wane thereby affecting output. The amount of labour used (X_5) was statistically significant with its coefficient indicating that an increase in labour used by a man-day will increase net income by 12.3% (Bamire et al., 2008). This is very important as labour is the most important input in smallholder farm business enterprises. The quantity of feed used (X_6) was also positively associated with net income from catfish farming (Oluwasola & Ajayi, 2013). The coefficient of the variable indicates that a kilogram increase in fish feed used will increase net income by 83.7%.

The adjusted coefficient of determination of R^2 value of 0.915 indicates that about 91.5% of the variability in the net income realized from cat fish farming in the city of Ibadan are determined by the explanatory variables specified in the model.

$$\begin{aligned} \ln Y = 4.799 &+ \underset{(0.079)}{0.089\ln X_1} + \underset{0.044)}{0.059\ln X_2} - \underset{(0.072)}{*0.133\ln X_3} + \underset{(0.024)}{0.022\ln X_4} + \underset{(0.050)}{**0.123\ln X_5} \\ &+ \underset{(0.028)}{***0.837\ln X_6} + \underset{(0.167)}{0.210\ln X_7} \end{aligned} \quad (4)$$

R^2 = 0.862

$\bar{R}^2$ = 0.854

F-value = 97.187

N.B. Figures in parenthesis are the standard errors

*significant at 10% level; ** significant at 5% level; ***significant at 1% level

4. Conclusion and Recommendation

The study has shown that catfish enterprises are recent means of livelihood among middle age and highly educated male urban dwellers who although have other means of livelihood, are engaged in catfish farming to augment household income and for subsistence. While supply of fish could enhance the nutrition of households engaged in catfish farming, it could also be targeted by policy to engage unemployed educated youths in the urban centres. Such farmers should be accessed to inputs of feed, credit and water points to enable them engage in the enterprise profitably. The net income realizable for engaging in catfish farming were however too low to attract the unemployed young, able bodied and educated urban dwellers to engage in the enterprise. A major way out of this challenge is to access potential farmers to cheaper feed to enhance the profitability of the enterprise. This could come in two main ways: stemming up research efforts to produce viable fish feed locally as a way out of the high costs of imported feeds or subsidizing fish feed. Nigeria produces only 13.4% of her fishmeal requirements and imports the remaining (Fagbenro & Adebayo, 2005). The major commercial fishmeal processing plant has since closed down because it cannot compete with imported fishmeal. In 2004, the cost of imported fishmeal ranged between US$870 and US$1, 350 per tonne, while the cost of locally produced fishmeal was US$1,500 per tonne (Fagbenro and Adebayo, 2005). Nigeria currently imports about 40,000 metric tonnes (44,444.44 tonnes) valued at US$ 60 million (Global Agricultural Information Network {GAIN}, 2011). Cheaper fish feed will also help retain experienced fish farmers as the net income realized from the enterprise will increase. It will also enhance the quantity as well as the quality of feeds given the fish for increased output and productivity.

The positive but significant association between labour used and net income shows the importance of labour to the production efforts of smallholder farmers. The low cost component of labour in catfish farm enterprises suggests that farmers depended more on family labour which is not sustainable in the long term as family members settle outside the family households. It also suggests that farming was on small scale and oriented mainly for subsistence with marketable surplus exchanged for cash. There is the need for policy measures to attract medium to large scale farmers into the catfish enterprise not only to increase output to bridge the supply gap but also to provide employment for the unemployed urban youths.

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