



Assessment of the Constraints to Catfish Farming in Kogi State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author UO designed the study, supervised it and prepared the final draft of the manuscript. Author TAA wrote the protocol, performed the statistical analysis, wrote the first draft and managed the analyses of the study. Author OE managed the literature searches and assisted with statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

This study assessed the constraints to catfish production in Kogi state, Nigeria. The data collected were analyzed using frequency counts and exploratory factor analysis with varimax rotation method. Results show that 76.0% of the respondents were male with a mean age of 46 years and mostly educated, but little (5 years) of experience in catfish production. Three factors were extracted and the factor analysis indicate that the major problems confronting catfish production in the area are rooted in economic and climatic challenges. The challenges of finance, input costs and other economic factors faced by catfish farmers in Kogi state appear to be similar to those found elsewhere. Away from economic issues however, climatic factor and operational constraints exhibit some variations in presentations and seriousness. For instance, climatic issues appear to be priority issues in the area. Scarcity of viable fingerlings is also another issue that requires serious attention. Credit facilities at low rates or grants, should be made available to catfish farmers to enable them address input challenges. Also, research into local feeds and monitoring of local feed production will improve their qualities and minimize feed importation and its attendant high cost.

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Again, government support through capacity development, motivation and monitoring of extension personnel will assist in training the catfish farmers on climate change mitigating strategies. Finally, infrastructural development is canvassed in addition to availability of skilled manpower to encourage the establishment of certified hatcheries, aid in transportation and storage of output.

Keywords: Constraints; catfish; farming; Kogi State.

1. INTRODUCTION

Aquaculture is the fastest growing food production sector in the world, and it is growing faster than the capture fisheries [1]. This is helping to bridge the aquatic food demand-supply gap, especially as capture fisheries continue to shrink [2]. In Nigeria, it is the fastest growing subsector of the aquatic food production system [2]. Estimation from data obtained from miscellaneous publications of Nigeria's official statistical body- the National Bureau of Statistics (NBS), the Central Bank of Nigeria (CBN) and the FAO indicate that while the growth rate of aquaculture between 1960 and 2016 was 6.1%, that of the artisanal fisheries was 1.37 percent.

Although Nigeria occupies the second position in aquaculture on the continent next to Egypt, it is the highest producer of African catfish in the world (FAO 2016). As a subsector of aquaculture, catfish farming involves the rearing of catfish under controlled conditions for economic and social benefits. The favoured catfish for culture include, *Clarias gariepinus*, *Heterobranchus bidorsalis*, *Clarias heterobranchus*, hybrid (heteroclarias), with *Clarias gariepinus* and *H. bidorsalis* [3]. *Clarias gariepinus* is regarded as an excellent aquaculture species because it grows fast and feeds on a variety of agricultural by-products, and can therefore reduce the competition between man and livestock for food and nutrition. Catfish is also hardy and can tolerate extreme temperature [4]; easy to produce in captivity; has good feed conversion rate [5] and possess the ability to fetch high prices [6]. The ability of this species to fetch high prices places a premium on it in employment generation.

Catfish production serves as a ready source of income and employment both at the rural areas and urban centres. In 2012, 13 627 people were reported as employed in aquaculture; 2% of these were women [7]. It is also a viable source of protein nutrients in Nigerian households and contributes to improving national food security. The ability of this species to adapt well to culture environment and earlier enumerated qualities

makes it an easy source of the much needed animal protein, especially as rapid increase in human population [8] and the many challenges confronting livestock production [9,10] have constrained the adequacy of animal protein supply.

As nutrition, especially animal protein consumption level continues to remain a challenge, importation of aquatic food continues unabated with serious international trade consequences. For instance, available data in recent time, as before, indicate substantial foreign exchange loss. Data [2] indicate that of about 2.7 million metric tons demanded per annum and a domestic production estimated at 800,000 metric tons. This situation left Nigeria with the option of importing an estimated 1.9 million metric tons of fish valued at over 125 billion Naira per annum. Increased catfish production in the country, according to [11], can help improve the aquatic food balance sheet, and the attendant foreign exchange implications.

Development of the catfish subsector in Nigeria has been substantial in the past decades. According to [7] Catfish, which is typically grown in ponds and tanks and is the most farmed species in Nigeria, constituting over half of the total aquaculture production by volume. The influence of catfish production has therefore been responsible for the bulk of this progress. In 2016, Nigeria contributed 0.45% of the world total aquaculture output, progressing from 0.1% during the 1995 to 2005 period [12]. Also, the Nigerian aquaculture contribution to national fish sector total improved from 4.8% in the 1960-2007 period to 28.2% during the 2011 to 2015 period, leading to improvement in per capita consumption in recent times. Also, aquaculture in Nigeria is expected to grow from 307 mmt in 2016 to 418 by 36.2% against sector growth from 1041 mmt to 1231 mmt by 18.2% for the same period [12]. Hence, owing to catfish subsector which is responsible for major aquaculture output in Nigeria, there is great potential for Nigerian aquaculture [1].

These potentials however remain largely untapped, leading to low Capacity utilization. A

CBN report in 2011 [13] indicate that aquaculture can provide about 94% of the total national aquatic food demand. This estimation is hinged on Nigeria's natural and human resources. The country has large bodies of fresh water and dams with a combined storage capacity of 33 billion cubic meters of water. As regards human resources the population is about 200 million with high level of youth unemployment. Furthermore, all parts of the country are suitable for aquaculture.

Nigerian aquaculture is private sector driven and remains underdeveloped because it is plagued with a plethora of issues. Report by [14] states that despite the increase of aquaculture in Nigeria, production level is still very low and this has been attributed to high cost of input, lack of credit for fish farmers at low interest rate, lack of skilled man power and an ineffective aquaculture extension service system. To realize the potentials in the catfish subsector, constraints need to be identified, reviewed and placed in the context of problem areas [15]. Major constraints to catfish development suggested for sub Saharan Africa are feed and seed quality and availability, cost of design and construction, and financing [16,17,18,19].

However, these constraints are not exhaustive, as many more constraints present in different places. Moreover, constraints are not equally distributed in types and seriousness. Different studies on constraints to catfish production have been conducted in Nigeria. [20,21,22] identify specific constraints to aquaculture production in different parts of the country. Others related works include those of [23,24,25,26]. Outside Nigeria, [15] have also identified the constraints to Bangladeshi aquaculture. These studies found non uniformity in types and seriousness for most of the constraints associated with catfish production.

Catfish production in Kogi state is nascent. The state has just 1.2% of the fish farms in the country, although it occupies 3.23% of the total land mass and has a large bodies of water. In Kogi state, this venture is basically on small scales, owing to resource poverty, and has not enjoyed considerable growth [27]. For this nascent subsector to develop, it is expedient to identify the specific constraints to its progress on time, especially as studies of this nature have not been conducted in the area in recent times. Hence, this study was undertaken to assess the constraints encountered by catfish farmers in the study area. Findings from this study will guide

policy makers in formulating appropriate intervention measures for identified priority and peculiar areas.

2. METHODOLOGY

The study was carried out in Kogi State. The State has a population of about 4 million people projected from the 2006 National Census figures of 3,278,487 people. The State has a large expanse of low land suitable for any agricultural enterprise including artisanal fisheries, which is a way of live for those living by the coasts of rivers Niger and Benue.

Purposive sampling was used to select Ijumu, Okehi, Okene, Dekina, and Lokoja Local Government Areas based on prior knowledge of their active engagement in catfish farming. Simple random sampling technique was used to select 30% of the functional aquaculture firms for the study. This was done in order to have a fairly reliable sample size for analysis. A total of one hundred and sixty six (166) respondents were thus selected for questionnaire survey. Copies of the questionnaire were administered in English language by trained enumerators knowledgeable in local dialects, to obtain primary data for analysis. Test - pretest method was applied in the validation of the questionnaire. A correlation coefficient of 0.82 indicated that the questionnaire effectively served its purpose.

Frequency counts and percentages were used to present socio economic characteristics of catfish farmers while factor analysis (varimax rotation method) was employed to assess constraints to catfish production in the study area. Prior to the extraction of the factors, diagnostics tests were used to assess the suitability of the respondent data for factor analysis. These tests include Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, and Bartlett's Test of Sphericity. The KMO index, in particular, is recommended when the cases to variable ratio are less than 1:5. The KMO index ranges from 0 to 1, with 0.50 considered suitable for factor analysis. The Bartlett's Test of Sphericity should be significant ($p < .05$) for factor analysis to be suitable. The KMO index of 0.827 and the Bartlett's Sphericity of 0.0001 shows the suitability of the data for factor analysis.

3. FACTOR ANALYSIS MODEL SPECIFICATION

$$X_j = a_{j1}F_1 + a_{j2}F_2 + \dots + a_{jm}F_m + e_j$$

Where, $e_j = 1, 2, \dots, p$

In the classical factor analysis mathematical model, p denotes the number of variables (X_1, X_2, \dots, X_p) and m denotes the number of underlying factor (F_1, F_2, \dots, F_m). X_j is the variable represented in latent factors. Hence, this model assumes that they are m underlying factors whereby each observed variable is a linear function of these factors together with a residual variate.

The factor loadings are $a_{j1}, a_{j2}, \dots, a_{jm}$ which denotes that a_{j1} is the factor loading of j^{th} variable on the first (1^{st}) factor. The specific or unique factor is denoted by e_j . The factor loadings give us an idea about how much the variable has contributed to the factor; the larger the factor loading, the more the variable has contributed to that factor.

4. RESULTS AND DISCUSSION

Survey responses were obtained from 166 respondents, and same (166) were analyzed.

Although Catfish farming is undertaken by a good percentage of youth, the bulk of the respondents belong in the ageing population (Table 1). This is reflected in the mean age of 46 years. This is similar to the findings of [28]. Such scenario which may owe much to the difficulty in raising capital by the youths, portends serious challenge to the sustainability of catfish production [27].

Catfish farmers in the area consists more of men (76.0%) than women (24.0%). Men are more involved in catfish farming because of issues that borders on sociocultural and economic reasons [29,30]. However, the percentage of women in aquaculture in the state is higher than the National figure reported in [7]. Possibly, the need to diversify income sources as a results of poverty and incessant cases of nonpayment of salary in the largely civil service and agrarian state [31,32] has forced women to participate more in other ventures, including catfish production, in order to sustain their families.

Table 1. Socio economic characteristics of catfish farmers

Age	Frequency	%	Mean
21-30	42.0	25.3	
31-40	10.0	6.0	
41-50	30.0	18.0	
51-60	63.0	38.0	
61-70	21.0	12.7	
Total	166	100	46 years
Gender			
Male	126	76.0	
Female	40	24.0	
Total	166	100	
Marital status			
Single	26.0	15.7	
Married	134.0	80.7	
Divorced	4.0	2.4	
Widowed	2.0	1.2	
Total	166	100	
Level of education			
Primary	10	6.0	
Secondary	50	30.1	
Tertiary	106	64.0	
Total	166	100	
Fish farming experience			
0-6	82.0	49.3	
7-12	38.0	23.1	
13-16	37.0	22.2	
17-20	7.0	4.2	
21-30	2.0	1.2	
Total	166	100	5 years

Source: Field Survey, 2017

Furthermore, catfish famers in the area were educated and may be better positioned for greater productivity as well as the understanding and adoption of new production techniques [33,34]. Finally, the average years of catfish farming experience in the area (5 years) indicates its nascent nature and the need to have timely understanding of the challenges it faces. Experience also assists the farmers in handling certain production, climatic and economic problems in order to achieve greater efficiency [35].

5. FACTOR ANALYSIS OF FARMERS' CONSTRAINTS TO CATFISH PRODUCTION

Factor analysis of farmers' constraints to catfish production in the study area using varimax rotation method (Table 2) indicate that the estimated KMO index of 0.827 and Bartlett's Sphericity of 0.0001 supports the suitability of the data for factor analysis. Three factors were extracted based on the items loadings as constraints to catfish production. These were; economic, climatic and operational factors.

Specific constraints that loaded strongly on factor one (economic factor) include inadequate finance

(.857), high cost of fish feed (-.843), inadequate power supply (-.779), predators (.777), marketing challenges (.776), poor storage facility (.762), lack of encouragement from the government (.751), transportation cost (.703), disease (-.650), inadequate drug supply (-.647), and poor road network (-.595). Inadequate finance has the highest loading among the economic constraints implying that it is a major constraint to catfish production in the study area. Inadequacy of capital or credit resonates in [21,22] as the most profound of economics constraints but not in [20], were it is the second most pressing issue. Also [24,25] report lack of capital as a serious problem affecting aquaculture in the country.

High cost of feed also ranks among the most serious economic constraints to catfish production in Kogi state. High cost of feed and other inputs rank low in [21] but is a serious constraints in the other reports. [36] also report that high price of feed is a major problem in Bangladesh due to raw materials being imported from other countries. Quality fish feeds is also imported in Nigeria, where high exchange rates is affecting the prices of imports. Infrastructural challenges also rank high in Kogi state and in

Table 2. Factor analysis of constraints to catfish production in Kogi state

Constraints	Factor 1	Factor 2	Factor 3
Inadequate finance	.857	-.240	-.223
High cost of fish feed	-.843	.192	.343
Inadequate power supply	-.779	-.556	.111
Predators	.777	.114	-.022
Marketing challenges	.776	.097	-.010
Poor storage facility	.762	.552	-.158
Lack of government support	.751	.415	-.392
Transportation cost	.703	.369	-.326
Disease	-.650	-.177	.608
Inadequate drug supply	-.647	-.402	.164
Poor road network	-.595	-.434	.436
Challenges of water sources	.363	-.091	.232
High Temperature	.027	.896	.135
High rate of evaporation	.302	.807	-.214
Poor water quality	-.412	-.685	.210
Seasonal storms and flooding	-.071	.673	.073
Scarcity of viable seed	-.067	-.230	.776
Small pond size	.020	.519	.721
Cannibalism	.152	-.156	-.641
Lack of access to extension services	.361	-.395	.595
Lack of experience	.195	-.028	-.564
Poor expertise	-.312	-.139	.527

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization (loading at 0.50 and above).

Source: Authors' analysis of responses based on 2017 survey

other studies reviewed but do not belong among the profound problems suggested for the sub Saharan African region. Lack of government support is also a serious challenge in the area. [26] also indicate that lack of government assistance in form of implementing national aquaculture policies is a major constraints faced by fish farmers in the country. Government support might also be in the area of infrastructural development.

Factors that loaded high on factor two (climatic challenges) were high temperature (.896), high sun intensity (.807), challenges of water (-.685), as well as storms and flooding (.673). Analysis of the responses also indicate that the challenges posed by the vagaries of climatic factors to catfish production are very serious. Other studies in the country did not report these challenges as very serious ones. Challenges posed by vagaries of climatic factors vary in intensity and or mitigation strategies employed. Elsewhere, [15] indicate that climatic issues are serious in Bangladesh where annual cyclones, floods and monsoon rains pose major risks to aquaculture. In Bangladesh however, serious efforts are usually made to have the extension personnel intimate fish farmers on climate change mitigation strategies. Kogi extension services however leaves much to be desired in their contribution to aquaculture development. This may also be a fall out of the poor government support identified as an economic constraints.

Scarcity of viable seeds (.776), small pond size (.721), cannibalism (-.641), lack of access to extension services (.595), lack of experiences (-.564), and Poor expertise (.527) loaded on factor three (operational constraints). Scarcity of viable fingerlings in the area is a serious operational challenge. Financial challenge and distance to certified hatcheries, partly due to the dearth of skilled manpower in the state, sometimes constrain catfish farmers to seek fingerlings from the wild or patronize uncertified hatcheries [37]. Also [22] identify this as a major challenge to catfish production in Kaduna state. In another study [23] report that scarcity of fish viable fingerlings is a serious constraint to aquaculture development in Nigeria. They attributed this challenge partly to energy and water quality related problems. Finally, the challenge of pond size indicated could be related to inadequacy of finance since the sizes of ponds, whatever the type, vary with their costs.

6. CONCLUSION AND RECOMMENDATIONS

The challenges of finance, input costs, infrastructural challenges and other economic factors faced by catfish farmers in Kogi state appear to be similar to those found elsewhere. Away from economic challenges however, climate related constraints and operational constraints exhibit some variations in presentations and serious. For instance, climatic issues appear to be major problems in Kogi compared to most of the studies cited. Scarcity of viable fingerlings and small pond sizes are also operational challenges that require serious attention in the area. It is therefore imperative to address this issues, focusing on the peculiarity of some, in order to promote catfish production in the area.

To this end, credit facility or grants should be made available by financial institutions to the catfish farmers at low interest rates to address the issue of inadequacy of capital. Such empowerment will assist in the acquisition/construction of larger pond, in addition to the procurement of other inputs. Furthermore, research into local feeds and monitoring of local feeds production to improve their qualities, will minimize the need to import feeds at high cost. This will reduce the total cost of production. Also, government support, through viable extension service will to help train catfish farmers on climate change mitigating strategies. This will have to be achieved through training, motivation and monitoring of extension personnel. Finally, government support may also be in the form of addressing infrastructural challenges like those of power and water as well as training. For instance, improved power supply and water quality, in addition to availability of skilled manpower will improve access to viable fingerlings as this may encourage the establishment of certified hatcheries in the area. It will also aid in transportation as well as processing and storage of products.

CONSENT

As per International standard informed and written consent were obtained from the participants and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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