PROFITABILITY ANALYSIS OF THE AQUACULTURE VALUE CHAIN IN ARGUNGU LOCAL GOVERNMENT AREA OF KEBBI STATE, NIGERIA

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ABSTRACT

The study examined the profitability of the aquaculture value chain in Argungu Local Government Areas of Kebbi State, Nigeria. It specifically described the socioeconomics of the actors along the value chain, determined the profitability of the enterprise along the value chain, and identified the constraints faced by actors along the chain. Data were collected randomly from 50 actors each along the value chain. Descriptive statistics and the Net Farm Income were for the data analysis. The results show that the fish producers along the value chain were more educated and had less family size compared to the processors and marketers. The women were more into the marketing aspect of the chain than the production and processing aspects. It was discovered that the production aspect of the chain was the most profitable with a profit margin of N551,270 per production cycle of 5 months. The major constraint highlighted by all the players in the value chain was the inadequacy of funds/credit facilities to support and expand their businesses. The study recommended that for both state and federal governments to have revolving credit facilities situated at the headquarters of the LGA.

Keywords: Profitability, constraint, aquaculture value chain,

INTRODUCTION

The fish sub-sector is a crucial agricultural industry that offers both revenue and vital nutritional requirements to the population. It is an important instrument for rural development in Nigeria since it provides income, high-quality protein, and social growth for fishing communities. The importance of the fisheries industry to the Nigerian economy, as well as the advantages gained by Nigerians from fish and other fish products, resulted in high consumption and, as a result, an increase in demand for fisheries goods. As opportunities are bound throughout the value chain of the subsector, it gives multiple work prospects to individuals. The fisheries subsector in Nigeria generates around 3-4 percent of the country's annual GDP (Central Bank of Nigeria [CBN] 2017) and is a key contributor to the populace's dietary needs, accounting for approximately 50 percent of animal protein intake. The subsector is an important instrument for rural development in Nigeria since it provides

money, high-quality protein, and socioeconomic development for fishing communities (Olaoye & Ojebiyi, 2018).

Furthermore, the subsector employs and benefits a large number of artisanal fishers and small dealers (Fisheries Society of Nigeria 2013). Even though capture fisheries are presently falling, Nigeria has a large potential in both marine and freshwater fisheries, including aquaculture. Despite this great potential, local fish output remains considerably behind overall demand, projected in 2008 at 2.2 million metric tons per year. As a result, the country imports over 60% of its seafood consumption. Fishing is the primary employment of inhabitants of riverine villages in Nigeria (Food and Agricultural Organization of the United Nations [FAO] 2010). In the past, the majority of individuals were involved in artisanal fishing, which involved fishing from lakes and rivers in the settlements. Aquaculture has recently been a source of income for communities in these riverine areas.

The National Bureau of Statistics [NBS] (2020) estimated Kebbi State's poverty rate to be 52% in 2019. Aquaculture may be utilized as a tool by governments at all levels to provide jobs, improve people's diets, and reduce poverty. Aquaculture in Nigeria started with non-commercial farms that had extremely modest material and labour inputs and were frequently coupled with other kinds of agricultural output. It was carried out to supplement other forms of farming undertaken by the inhabitants. Production was modest and was largely consumed at home and, to a lesser extent, at the farm gate (Oladimeji, 2017). To some extent and throughout time, average production grew, and many more farms were established. Improved output gradually led to commercialization, which was characterized by substantial capital expenditure, intensive material, and labour inputs, and aggressive marketing.

Market-driven and profit-oriented firms have inspired many fishermen to pursue the skill of fish farming. Fish farming (aquaculture) has gained popularity in the country, particularly in towns with bodies of water such as Argungu in Kebbi State. Most residents who used to fish in the wild now have reservoirs where they undertake aquaculture.

The notion of aquaculture product value addition provides a realistic chance for additional revenue generation, employment development, and effective post-harvest management. Fish farmers and fishmongers simply add value to fish to increase cash made from the fish business. This measure has resulted in a greater variety and variety of fish products that are well-accepted in the fish market. Not only can value additions increase the economic worth of the goods, resulting in increased revenue for fish farmers and mongers, but they also address market competitiveness, post-harvest, and food security (Olusola, 2017).

Several obstacles might restrict the profit potential of a fish farming firm. High feed costs, floods, poaching, illnesses, and marketing are just a few of the issues that farmers face (Tavares-Dias & Martins 2017; Kimathi et al., 2013; Olayiwola 2013). Many fish growers who began the enterprise with great hopes were frustrated with little or no return due to the hurdles and hazards involved.

Several studies on the profitability of fish production in Nigerian states such as Abia, Kwara, Ogun, Oyo, Imo, Osun, Kano, Delta, and Kaduna have been conducted (see Iheke & Nwagbara, 2014; Adewumi et al., 2012; Adewuyi et al., 2010; Anene et al., 2010), but there is a knowledge gap as regarding the profit the actors in the fish value chain stand to make and the challenges they face. Additionally, nothing has been done to identify the variables that work against maximizing the profit of the various stakeholders in the aquaculture value chain.

Furthermore, failing to recognize the limits that these actors experience in order to provide solutions to them may jeopardize the

advantages that the participants should derive from fish production, processing, and marketing. Thus, this study examined the profitability and constraints in the aquaculture value chain in Argungu Local Government Areas (LGA) of Kebbi State, Nigeria. It specifically, described the socioeconomic characteristics of actors in the aquaculture value chain in the study area, examined the profitability of enterprises along the aquaculture value chain in the study area, and identified the constraints faced by the value chain actors in the aquaculture value chain in the study area.

METHODOLOGY

Study Area

The study was conducted in Argungu LGA in Kebbi State, Nigeria. Kebbi State is situated in northwestern Nigeria. The State is located on latitude $11^{o}30'$ N and longitude $4^{o}0'$ E. It has overall averages of 787.53±24.03mm and 112.21 ±25.31mm respectively annual and monthly rainfall (Ismail & Oke, 2012). Kebbi borders the nations of Niger to the west and Benin to the southwest and it borders the Nigerian States of Sokoto and Zamfara to the north and east and Niger to the south. Agriculture is the most important economic activity, with riverine floodplains producing cash crops of groundnut, cotton, and rice. Subsistence crops include sorghum, millet, cowpeas, and onions. Much of the land in the State is used for grazing cattle, goats, and sheep. The state is also known for its fisheries activities because of the natural water bodies that abound in the State. Kebbi's vegetation consists of short-grass savannah that is drained southwestward by the Niger River and its tributary and the Sokoto (Kebbi) River. Most of the Kainji reservoir, formed by the Kainji Dam further downstream on the Niger River, lies in the southern portion of the State. Kebbi State consists of 21 Local Government Areas (LGAs), four emirate councils (Gwandu, Argungu, Yauri, and Zuru), and 35 districts.

Sampling Procedures and Sample Size

The sample frame consists of fish farmers, processors, and marketers in the aquaculture value chain in Argungu LGA. A multi-stage sampling technique was employed in selecting the respondents for the survey. The first stage was a purposive selection of Argungu LGA because of the peculiarity of the communities as a result of the fact that inhabitants of the communities were into fisheries activities due to the natural water bodies in the area. The second stage also involved a purposive sampling method of selecting a village from the LGA, this selection is based on the fact that the village is the center of fisheries activities because of the proximity to the bank of the river where the fish enterprise is predominant. Because of the common enterprise of the inhabitants of the communities (fishing), aquaculture activities have sprung up in those communities. The third stage is a random selection of players in the aquaculture value chain. Finally, 50 fish entrepreneurs each along the value chain were randomly selected for the study. The entrepreneurs captured along the aquaculture value chain for the studies are producers, processors, and marketers.

Method of Data Analysis

The study's data were examined using descriptive statistics such as tables, frequency, percentages, and gross margin analysis.

Net Farm Income

This evaluates the costs and returns of an individual enterprise. The gross margin per pond (p) was estimated using the following relationship:

GM = TR – TVC ....(1)

TR = $Y_m * P_m$

Where;

GM = Gross margin (₦/p)

TR = Total Revenue (₦/p)

TVC =Total Variable Cost (₦/p)

Y_m = Output of fish (kg/p)

P_m = Unit price of fish (₦)

and TVC = s $\sum_{i-j}^{n}$ P_iX_i ....(2)

Where;

P_i = unit price of the ith input (₦)

X_i = quantity of the ith input per pond

$\sum$ = summation sign.

Net Farm Income (NFI) is the income generated by a farm business after paying all expenses (operation & investment activities). The NFI can be computed thus:

NFI = TR – TC ....(3)

Where;

NFI = Net Farm Income (₦)

TR = Gross Margin (₦)

TC = Total Cost (₦)

RESULTS and DISCUSSION

Socioeconomic Characteristics of Actors in the Aquaculture value chain in the Study Area

The results on the socio-economic characteristics of the actors in the aquaculture value chain in the study area are presented in Table 1.

The socioeconomic characteristics of the aquaculture value chain actors in Argungu LGA as presented in table 1 above showed that 84 % of the fish producers in the study area were male and 16% were female. This implies that fish production in the study area is majorly practiced by male because culturally, married women are largely restricted from embarking on such economic activity. This result is consistent with the findings of Olasunkanmi (2013), who conducted a related study on the socioeconomics of fish farming in Ogun state and discovered that 88% of respondents were male and 12% were female.

The results also show that about 80% of fish processors in the study area were male, while 20% of them were women. In marketing, seventy-two percent (72%) of men were into fish marketing in the study area, while only 28% of the marketers were female. More women were involved in the processing and marketing aspect when compared to the production aspect because it is less cumbersome and the gestation periods for the processing and marketing are less compared to that of production and also because such activities can be done in or around their houses.

Table 1: The socioeconomic characteristics of aquaculture value chain actors in Argungu

	Producers		Processors		Marketers	
Variable	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Age						
<21	1	2	1	2	2	4
21 – 30	8	16	3	6	4	8
31 – 40	24	48	28	56	8	16
41 – 50	15	30	13	26	22	44
>50	2	4	5	10	14	28
Mean	**37.3**		**39.1**		**43.9**	
Sex						
Male	42	84	40	80	36	72
Female	8	16	10	20	14	28
Mean Household Size						
1-5	10	20	6	12	5	10
6-10	24	48	10	20	9	18
11 – 15	12	24	25	50	26	52
> 15	4	8	9	18	10	20
Mean	**9**		**12**		**12**	
Level of Education						
Formal Education	45	90	32	64	26	52
No Formal Education	05	10	18	36	24	48
Total	50	100	50	100	50	100

Source: Field survey, 2022.

The age distribution of the actors in the aquaculture value chain industry in Argungu LGA in Table 1 showed that the mean ages of the producers, processors and marketers were approximately 37 years, 39 years, and 44 years respectively. These results imply that fish production and processing in the study areas were majorly carried out by youth that are forty years and below, while fish marketing was mainly done by older people. This could be due to the fact that fish marketing is less tedious than production and processing and thus require little stress when compared to production and processing. More so, less capital is required to commence the enterprise (marketing) as compared to production and processing where the necessary inputs are required to be in place before production or processing. This finding is consistent with the findings of Olagunju, O., Dadi, M. K. & Alvin, S. J. (2019), who found that 46% of fish farmers in the Federal Capital Territory of Abuja were under the age of 40.

About 90%, 64%, and 52% of the fish producers, processors, and marketers in the study area, respectively had formal education.

This could be attributed to the fact that fish production and processing activities require technical skills that are being taught in school, while marketing is a less technical aspect of the value chain and requires little education to make an impact in the industry. The mean household size of the aquaculture value chain actors showed that on an average the fish producers, processors, and marketers in the study area had approximately 9 persons, 12 persons, and 12 persons in their households respectively. This is true to the fact that the marketers, being older and with less education tends to have larger household size when compared with the producers who were younger and more educated.

The Profitability of Enterprises along the Aquaculture Value Chain in the Study Area

The profitability of each enterprise (production, processors, and marketers) along the aquaculture value chain in Argungu LGA are presented and discussed under tables 2a, 2b and 2c.

Profitability Analysis of fish Production in the Study Areas

Table 2a: Profitability analysis of Fish Production in Argungu

Variables	Value (₦)	% of VC/FC	% of TC
Variable cost			
Feed	788,240	65.76	62.82
Seed	258,610	21.57	20.61
Labour	60,380	5.04	4.81
Transportation	45,000	3.75	3.59
Fuel	30,500	2.55	2.43
Drugs	16,000	1.33	1.28
I. Total Variable Cost	**1,198,730**	**100**	
Fixed cost			
Rent	18,000	32.14	1.43
Pond construction	20,000	35.72	1.59
Tax	4,000	7.14	0.32
Machines/implements	14,000	25.00	1.12
II. Total fixed Cost	**56,000**	**100**	**100**
III. Total Cost	**1,254,730**		
Farm Income			
Output (Kg)	2,150		
Price (N/kg)	840		
IV. Gross Farm Income	**1,806,000**		
V. Gross Margin (IV -I)	**607,270**		
VI. Net Farm Income (IV-III)	**551,270**		
VII. Return to Naira invested (VI/III)	**0.44**		

Source: Field survey, 2022.

The results in Table 2a show that the total variable cost for fish production, along the aquaculture value chain in Argungu LGA was N1,198,730. The variable cost consists of most of the expenditure used in the production process. Fish feed recorded the highest cost among the variable costs, recording 62.8% of the total variable cost in Argungu with an average pond size of 130ft^2 and an average depth of 12 feet, correlating with the findings of Zanna B. and Musa M. (2023), who found out that the cost of catfish feeds contributed about 65% of overall production costs. The cost of fingerlings represented the second highest variable cost after the feed. This was followed by labour (5%). Transportation formed about 5% of the total variable cost.

The total fixed cost of the fish farmers in the study area is N56,000. The tax paid by an average fish producer in Argungun was N4,000, representing 7% of the total fixed cost. The total cost of production is N1,254,730 with the total variable cost amounting to 96% (N1,198,730) of the total cost while the fixed cost represented 4% (N56,000) of the total cost of production. From the results, the gross income of a fish producer is N1,806,000. The gross margin computation shows a value of N607,270; while the net income is N551,270 for the fish farmers. This shows that fish production is profitable to the tune of N551,270 per fish farmer per production cycle of five months in Argungu LGA. The return to naira invested is 0.44, implying that for every N1 invested in fish production in Argungu, a farmer makes 44kobo as profit. This infers that fish farming is 44% profitable in Argungu. In a study of aquaculture in Oyo State, Nigeria, Ogundari et al. (2006) observed a return to scale of 0.841, showing that aquaculture has ample potential to bring about economic benefits.

Profitability Analysis of fish processing in the Study Area

Table 2b: Profitability analysis of Fish Processing in Argungu

Variables	Value (₦)	% of VC
Variable cost		
Fish	99,410	78.24
Fuel	7,520	5.92
Labour	8,120	6.39
Transportation	12,000	9.45
I. Total Variable Cost	**127,050**	**100.00**
Farm Income		
Output (Kg)	150	
Price (N/kg)	1,210	
II. Gross Farm Income	**181500**	
III. Gross Margin (II-I)	**54450**	
IV. Return to Naira invested (III/I)	**0.43**	

Source: Field survey, 2022.

Results in Table 2b revealed that the input for fish processing formed the bulk of the total variable cost in the processing enterprise amounting to 78% of the total variable cost in the study area. Fuel such as kerosene and firewood formed 6% of the total variable cost in the study area as processors used the mainly crude method of fish processing with a round metal container opened at both ends, with burning firewood at the base and wire gauze at the top of the container with fish on top of the wire gauze to smoke. Labour and transportation constitute about 6% and 9% of the total variable cost in the study area respectively. Labour is cheaper in Argungu compared to the cosmopolitan area of Kebbi state, thus labour can be acquired with less money. The gross income from fish processing is N181,500. The profit margin from fish processing is N54,450. This implies that fish processing is profitable in Argungu. The return on investment in fish processing in Argungu is 0.43. This implies that for every 1N invested in the enterprise in Argungu, 43kobo is made as profit. This demonstrates that aquaculture has a high potential for economic benefits. Emokaro, C. O., Ekunwe, P. A., & Achille, A. (2010) discovered that the gross revenue from catfish farming in Kogi State was 1.82 times the entire cost.

Profitability Analysis of fish Marketing in the Study Area

Table 2c: Profitability analysis of Fish Marketing in Argungu

Variables	Value (₦)	% of VC
Variable cost		
Fish	83,110	78.13
Labour	7,010	6.59
Transportation	16,250	15.28
I. Total Variable Cost	**106,370**	**100.00**
Farm Income		
Output (Kg)	120	
Price (N/kg)	1,250	
II. Gross Income	**150,000**	
III. Marketing Margin (II-I)	**43,630**	
IV. Return to Naira invested (III/I)	**0.41**	

Source: Field survey, 2022.

The marketing margin of the fish marketers in the study area is presented in Table 2c. The variable costs incurred in marketing fish in the study areas were recorded in fish, labour, and transportation. Labour accounted for 6% of the total cost of marketing, while transportation costs constituted 15% of the fish's total cost of marketing in the study area. The gross income from marketing fish in the study area is N150,000. The marketing margin (profit) for fish marketing in the study area is N43,630. The return to investment for fish marketing in the study area is 0.41. This implies that fish marketing along the value chain has a return to investment of 41% in Argungu. According to Business World (2011), fish farming in Nigeria is a gold mine that may ensure a 100% investment return with a three-month payback period.

Constraints Faced by the Value Chain Actors in the Aquaculture Value Chain

The constraints facing aquaculture value chain actors in the study area are presented in tables 3a, 3b, and 3c.

Constraints to the Fish Farming value chain in Argungu

Table 3a: Constraints to Fish Production in Argungu

Constraint	Frequency	Percentage	Ranking
Inadequate fund/credit facilities	22	44	1st
High cost of feed	18	36	2nd
Difficulty Accessing fingerlings	03	6	3rd
Bad roads	03	6	4th
Poor power supply	02	4	5th
Insecurity	01	2	6th
Difficulty Accessing market	01	2	7th
Total	**50**	**100**	

Source: Field survey, 2022.

The constraints to fish production activities in the study areas highlighted by the fish farmers were: inadequate fund/credit facilities, high cost of feed, difficulty accessing fingerlings, bad roads, poor power supply, insecurity, and difficulty accessing the market for the commodity (Table 3a). Inadequate fund/credit facilities were the major problem faced by fish farmers in the study areas as about 60% of fish farmers in Argungu complained of this constraint. Fund/credit is a major variable in agricultural production. This variable is important for farmers to acquire needed inputs to boost production. They complained of a lack of government support in terms of credit facilities for their businesses, thus making production limited to available funds and difficult.

The high cost of feed was ranked 2nd among the problems encountered by the fish farmers. The results show that 36% of the fish farmers said that the high cost of fish feed was their major problem faced in the enterprise. The high cost of the fish feed impelled some of the fish producers to compound their feed for the fish. According to them, the feed was of lower quality than the one in the open market, but it served the purpose of providing the required nutrients for the fish to grow. Difficulty accessing fingerlings and bad roads were constraints that were ranked 3rd and 4th among the fish producers. Six percent (6%) of the producers said having access to fingerlings for production was their main problem. Fingerlings were not produced in the study areas as producers sourced their fingerlings from Kainji in Niger State. Six percent (6%) of the producers also claimed bad roads as their major constraint to fish production.

Poor power supply, insecurity, and difficulty in accessing the market were ranked 5th, 6th, and 7th respectively. Four percent (4%) of the producers complained about a lack of power to drive production in the fingerling sector which is discouraging some of them to venture into the production of fingerlings. They also complained of a lack of power to illuminate the farm at night thereby limiting the rate of work around the

farm. Very few (2%) saw insecurity as a major constraint to their fish farming business. Most of the farmers said the insecurity in the North West area was not a threat to their business as the insecurity was not around their areas of business. Difficulty accessing the market for their produce was not a problem to many as the market was readily available according to the producers.

Constraints to Fish Processing and Marketing in Argungu

Table 3b: Constraints to fish processing in Argungu

Constraint	Frequency	Percentage	Ranking
Inadequate fund/credit facilities	21	42	1st
Lack of modern processing Equipment	19	38	2nd
Bad roads	04	08	3rd
Inadequate storage facilities	03	06	4th
Poor power supply	01	02	5th
Insecurity	01	02	6th
Difficulty Accessing market	01	02	7th
Total	**50**	**100**	

Source: Field survey, 2022.

In Table 3b, the constraints highlighted by the processors were: Inadequate fund/credit facilities, lack of modern processing equipment, bad roads, inadequate storage facilities, poor power supply, insecurity, and difficulty accessing the produce market. Inadequate fund/credit facilities ranked topmost of the problems for the processors and also marketers. The lack of modern processing equipment was ranked 2nd among processors. The processors still use the crude method of processing fish. Such a crude method involves the use of

cylindrical metal opened at both ends with the fish on a wire gauze at the top end and firewood at the bottom. This method emits a lot of smoke which can be injurious to the sight of the processor over a long period. Some of the processors fry fish which can get spoilt because of a lack of preservative facilities such as the refrigerator. Bad roads and inadequate storage facilities were ranked 3rd and 4th, while poor power supply, Insecurity, and difficulty accessing the market were ranked 5th, 6th, and 7th respectively.

Table 3c: Constraints to fish marketing in Argungu

Constraint	Frequency	Percentage	Ranking
Inadequate fund/credit facilities	33	66	1st
Bad roads	10	20	2nd
Inadequate storage facilities	03	06	3rd
Insecurity	03	06	4th
Difficulty Accessing market	01	02	5th
Total	**50**	**100**	

Source: Field survey, 2022.

Table 3c shows the various problems confronting the fish marketers in the study area. Inadequate fund/credit facilities ranked topmost of the problems for the processors and also marketers. This is in line with that of the producers also, as 42% and 66% of processors and marketers respectively complained of this variable as the most problematic and Issa et al., (2014) made a similar discovery in Kaduna state. They said the government (both State and Federal) has not supported them with fund/credit facilities to encourage their businesses. 20% of the marketers complained of bad roads which ranked 2nd among the constraints. They said the bad roads were impeding them from moving from one point to another to carry out their business.

CONCLUSIONS

The results of this study reveal that although artisanal fisheries are predominantly practiced in Kebbi State, because of the large water body in the communities, aquaculture has also been established to be a viable enterprise. The three major enterprises in the aquaculture value chain were production, processing, and marketing with women more involved in the marketing aspect compared to other aspects. These enterprises are profitable with the production aspect being the most profitable along the value chain and the value chain recording a minimum return to investment of 0.41 (Marketing) and a maximum return to investment of 0.65 (Production). The major constraint of inadequate fund/credit facilities can be addressed by setting up a revolving loan scheme in the headquarters of the Argungu Local Government Area. There is a prospect in the enterprises along the aquaculture value chain in Argungu if the constraints highlighted in the study are adequately addressed.

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