A QUANTITATIVE COMPARISON OF ECONOMIC BENEFITS BETWEEN COLLAPSIBLE AND EARTHEN FISH PONDS IN IKORODU DIVISION OF LAGOS STATE

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ABSTRACT
This study focused on the quantitative comparison of the economic benefits of collapsible and earthen fish ponds in Ikorodu Division, Lagos State. Primary data was obtained with the aid of a questionnaire and supported by a focus group discussion. A two-stage sampling technique was used to select 112 fish farmers using both collapsible and earthen fish ponds from the three out of five (5) LG/LCDAs in the study area. The collected data were analyzed using descriptive statistics, budgeting, and a T-test. The study revealed that the mean age was 45 years, household = 5, and average fish farming experience was 11 years and above. Collapsible pond farmers in a cropping season had a total revenue (TR) of N3, 667,000 with a gross margin (GM) of N949, 500, while earthen pond users earn N3, 667,000 with a gross margin (GM) of N869, 500. The results also showed net farm income (NFI) of N773, 100, and N706, 909, with a net return on investment of 15.3 and 12.7 for both collapsible and earthen ponds, respectively. The test of the difference in profitability per five-month culture period of fish cultured in an earthen pond and that of a collapsible pond shows that the mean profit was N66, 191 and *the t-value* was 17.01. The major constraints on fish production in the study were the high cost of feed, the high inflation rate, water pollution, flooding, and poaching. The study recommended that the government at all levels should provide subsidies on production inputs such as feed and the provision of grants and single-digit interest loans with a moratorium period.
Keywords: *Collapsible ponds, earthen ponds, culture system, profitability, fish farming.*

1.1 INTRODUCTION

Aquaculture is the rearing of fish in artificial or natural bodies of water by manipulation of the environment with the aim of increasing production beyond natural limit. (Adeoye *et al*., 2015). Global aquaculture production has quadrupled over the twenty years and aquaculture production is likely to double in the next fifteen years, as a result of wild fisheries approaching their biological limits and word demand for cultured fish continuing to increase in Nigeria (Ayinla 2012). Aquaculture is the fastest livestock production sector in Nigeria with growth of about 29% in 2006 alone, and with prospects of continued growth (Adeyeye *et al.*, 2015). Although fish farming in Nigeria has the potentials to satisfy the increased demand for protein from the individuals and also has been experiencing unprecedented growth during the last decade, questions regarding sustainable development of the industry remain unanswered (Adeogun and Chukwuka,2012).

At present, there is a significant in- balance between food production and expanding population, this has resulted in an ever-increasing demand for fish consumption. In spite of the ambitious hope for fish production from the country's reservoirs, dams, Perennial River and saline mangrove swamps, fish as an affordable protein source still eludes the greater part of production. Nigeria has consistently fallen below the FAO's recommendation for daily minimum protein intake of 70 grams of which 35 grams should come from animal source. It is expected that fish would supply part of this protein needed from the use of collapsible pond and earthen pond. Lately, collapsible fish farming has gain a lot of prominence among fish pond operators. This is the way of raising fish closer to home because it requires less space and can be practiced within the home profitably. Fish farming is an enterprise that aims at profit maximization. To attained more than this, every element of production must be put together, to choose the type of production system to culture in, and its disadvantages must be minimal. The broad objective of this study is quantitative comparison of economic benefits between collapsible and earthen fish ponds in Ikorodu Ikorodu division of Lagos state Nigeria,
The specific objectives are to;

1. describe the socio-economic characteristics of fish farmers who produce fish in collapsible and earthen ponds in the study are;
2. assess fish farming characteristics in the collapsible and earthen pond;
3. estimate the costs and returns of collapsible and earthen fish farming and compare their profitability in the study area;
4. identify the constraints to fish produced in both collapsible and earthen ponds in the study area;

Materials and Methods

The study was carried out in Ikorodu Local Government Area (LGA) of Lagos state, Nigeria. Ikorodu is one of 20 LGA in Lagos state. It is located to the north-east of Lagos, along the Lagos lagoon and about 36 kilometers to the north of Lagos. Ikorodu is a city that shares boundary with Ogun State. According to 2006 census, Ikorodu has a population

of 689,045. Ikorodu is among the largest city in Nigeria and at a growing rate of 5.26% annually, it is projected to reach 1.7million inhabitant by 2035, making it the largest local government in Lagos state (LSG, 2023). Indigenous settler of Ikorodu emigrated from sagamu in Ogun State. Also, Ikorodu has a landmass of 394 kilometers square and is on Latitude of 60'38'31" N and a longitude of 3'31'18.

A two-stage sampling procedure was used to select respondents for the study. The first stage was the purposive selection of three out of the five (Ikorodu west, Ijede and Igbogbo) LCDAs in the Division due to presence of large catfish farms in the LCDAs. In the second stage, simple random sampling technique was used to select 112 catfish farmers using collapsible and earthen ponds from the three LCDA. The collected data were analyzed using descriptive statistics, budgeting, and a T-test. Budgetary technique (economic indicators) was used to determine the costs, returns and profitability such as gross margin, net fish farming income and benefit-cost ratio of earthen ponds and collapsible ponds of fish farmers. the equations for the different indices are provided below.

Fish farming will be profitable provided NFI and GM are positive, BCR > 1, and ROI >0.00 (Olaoye et al., 2016). That is, fish farming is profitable if TR > TC.

GMI=TR - TVC ……..... (i)
TR=Py · Yi …….……..... (ii)
TVC = TC - TFC ……..….. (iii)
TC = TFC + TVC ……..... (iv)
NFI= GM – TFC ……..... (v)
π= TR-TC …….... (vi)
RRI = NFI/TC. ……..... (vii)
RVC = (TR – TFC)/TVC.120 ... (viii)
VCR = TVC/TR …….. (ix)
BCR = TR/TC ……(x)
ESR = TFC/TC … …… (xi)
GR = TVC/TR ……(xii)
NM = GM-TFC …… (xii)

Where:
GMI = Gross Margin Income (N)
TR = Total Revenue (N)
TVC = Total Variable Cost (N)
TFC = Total Fixed Cost (N)
TC =Total Cost (N)
NFI = Net Farm Income (N)
Py = Unit Price of Output Produced (N)
Y = Quantity of Output (kg)
Pxi = Unit Price of Variable inputs i used (N)
Xi = Quantity of Variable Inputs i (kg)
PI = Profitability Index (Net Profit Margin)
NFI = Net Farm Income, (N)
RRI = Rate of Return on investment, (%)RVC = Rate of Return on Variable Cost

RESULT AND DISCUSSION

The findings in table 1 reveals the socio-economic characteristics of the respondents. 93% of the respondents are male while 7% are females. This implies that males are more represented in production of fish in both earthen fish ponds and collapsible ponds. 82% of the fish farmers were in the age range of 18 – 50 years, while 18% of the fish farmers were above 50 years, the mean age of the respondents was 45 years. this implies that the respondents are still within their active age. table 1 also shows that 92% had tertiary, 6.2% had vocational and 2% had secondary education. The result implies that majority of the fish farmers are learned which is expected to facilitate higher output and efficiency in fish production. Majority (92%) of the respondents were married. The reason is the fact that most of the respondents are in their 40s, when people are usually married. The average household size in the study area was found to be 5 persons. The relatively small size of the households may be attributed to their education as it relates to family planning. Table 1 also shows that majority (59%) of the fish farmers got their land through outright purchase, 27.7% got it through rents, 10.7% on inheritance, while 1.8% of the respondents got their land as lease and 0.9% as gift. The implication of this is that fish farmers have established themselves in the study area by acquiring land resources. the average years of farming experience of the respondents was 13years. The respondents with the highest number of years of experience should have good skills and better approaches to fish farming business. The result shows that 52.7% of the respondents had no access to farm credit and loan while 48 % indicated that they had access to farm credits, that means majority of the fish farmers source for finance was through personal savings.

Results from table 2 shows that 71.4% of the fish farmers used collapsible pond while 28.6% of the fish farmers used earthen ponds which implies collapsible ponds are safer than earthen in terms of flood. Majority (84.9%) of the fish farmers went into fish farming in order to make profit, while (14.2% and 0.9%) went into fish farming to augment income and for household consumption, respectively, 81.3% of the fish farmers depend on borehole, while 1.8% of the fish farmers depend on deep well, while 16.9% depends on rivers or stream as sources of water. The study showed that 90.2% of the fish farmers cultured *Claria s*sp. more while 9.8%cultured tilapia fish species, the reasons being that the species has a high market value, cheaper and it attain the market size under a few months of rearing. Majority (72.3%) of the fish farmers got their fish seed from commercial fish hatchery while 14.3% of the fish farmers depend on government farms for fish seeds and 13.4% also depend on own hatchery, which implies that fingerlings sourced from commercial fish farms were more likely to be healthier and well breed due to its commercial and integrity of the farms. Furthermore 72.3% of the fish farmers cultured their fish above five months, 14.3% of the fish farmers cultured between 3-5 months, while a very low percentage 13.4% of the

fish farmers cultured their fish between 1-3 months. Majority of the fish farmers in the study area concentrated on grow-out (table size) due to large turnover.

Table 1: Socio-economic characteristics of the respondents Characteristics

Characteristics	Frequency (n= 80)	Percentage	Mean
Sex			
Female	8	7	
Male	104	93	
Age			
18-30	11	10	
31-40	27	24	
41-50	54	48	
50-60	11	10	**45years**
61>	9	8	
Marital status			
Married	109	97	
Single	1	1	
Separated	1	1	
Widowed	1	1	
Education status			
Secondary	2	1.8	
Tertiary	103	92	
Adult/vocational	7	6.2	
Household size			
1-5	91	81	
6-10	13	15	
11>	8	4	**5person**
Farming experience			
1-5	15	13.3	
6-10	21	18.8	
11>	76	67.9	**14years**
Means Land Acquisition			
Rented	31	27.7	
Inheritance	12	10.7	
Bought	66	59	
Gift	1	0.9	
Lease	2	1.8	
Types of labour			
Family	12	10.7	
Hired	91	81.3	
Both	9	8.0	

Source: Survey, 2023

Table 2: Fishing practices and characteristics of fish farmers in the study area

Characteristics	Frequency	Percentage (%)	Mean
Fish farming system			
Earthen	32	28.6	
Collapsible	80	71.4	
Reason for going into fish farming			
To make profit	95	84.9	
Hobby	0	0	
augment income	16	14.2	
household consumption	1	0.8	
social status	0	0	
Sources of water			

Borehole	91	81.3	
Deep well	2	1.8	
Stream or River	19	16.9	
Culture species			
Tilapia spp	11	9.8	
Clarias spp	101	90.2	
Size of your pond			
Earthen			30x60 ft
Collapsible			20 x10 x3.5 ft
total number of fish stocked			
Earthen			1, 500
Collapsible			1, 500
Sources of fish seed			
Own fish hatchery	15	13.4	
Commercial fish hatchery	81	72.3	
Government fish farm	16	14.3	
Culturing period			
1-3 months	15	13.4	
3-4months	16	14.3	
5 above	81	72.3	

Source: Survey, 2023

Cost, return and profitability of earthen and collapsible ponds in Ikorodu, Lagos State

Results from Table 3 reveals that earthen fish pond users earned average revenue of N3,667,000, while collapsible pond users earned about N3, 667, 000 per cultured period of about five months. It revealed that the costs of feed (N2, 400, 000 and N2, 500, 000) for both the earthen pond and collapsible fish tank production techniques respectively accounted for the highest proportion (43.4% and 49.0%) of the costs of variable component pond fish farming in the study area, followed by the cost of land (N1, 500, 000 and N1,000,000). This implies that a large amount of money was spent by the fish farmers in the study area for purchase of fish feeds and land. The fixed cost of production consists of land rent, pond construction, water pump, wheel barrow, pond equipment (such as net, weighing scale, generator etc.). Equally, from the result is that an average total cost of N2, 797, 500 and N2, 717, 500 was incurred by the fish farmers in a cropping season for earthen fish ponds users and collapsible pond users, while the gross margin (GM) was N869, 500 and N949, 500respectively. This indicates that fish farming in the study area was profitable. The net rate of return on investment on earthen and collapsible ponds were rate of return on variable cost and operating ratio for earthen and collapsible fish ponds were 12.7 and 15.3 respectively. This implies that fish farming ventures were more profitable and viable if collapsible fish ponds are used. The implication was that collapsible ponds were found to be better than earthen ponds in terms of efficiency and profit.

Table 3: Estimate the costs of initial investment required for setting up fish pond

	Earthen Pond			Collapsible pond		
Item	**Amount (N)**	**Lifespan**	**Depreciation**	**Amount (N)**	**Lifespan**	**Depreciation**
Fixed cost						
Land Purchase/rent/lease	1,500, 000	99	-	1, 000, 000	99	-
Collapsible/Earthen pond construction	110, 000	5	20,000	280,000	10	25, 200
Water pump	109,000	5	19,800	107,000	10	9,630
Tank	75,000	5	13, 000	75,000	5	13, 500
Borehole/deep well	150, 000	-	-	200, 000	10	18,000
Plumbing material	47. 500	5	8,550	82, 000	5	14,760
Building/shed	320,000	20	14,400	170,000	20	7,650
Generator	350, 000	7	45,000	350 000	7	45, 000
Dragnet, scale, nets	150, 000	5	27, 000	150, 000	5	27, 000
Wheelbarrow, shovel, cutlass etc	87, 000	5	15,660	87, 000	5	15, 660
Total	**2, 898, 500**		**163, 410**	**2, 501, 000**		**176, 400**
Total fixed cost	**2, 735, 090**			**2, 324, 600**		
Variable cost						
Fish feed	2, 400 000			2, 500, 000		
Fish seed	67, 500			67, 500		
Lime/fertilization	20, 000			-		
Labour	200, 000			100, 000		
Transportation	50, 000			50, 000		
Other costs	60, 000			-		
Total variable cost	2, 797, 500			2, 717, 500		
Total cost	5, 532, 590			5, 042, 100		
Total Revenue (TR)	3, 667, 000			3, 667,000		
Gross Margin (GM)	869,500			949, 500		
Net Farm Income (NFI)	706, 909			773, 100		
Net Return on Investment	**12.7**			**15.3**		

Source: Field survey, 2023

Constraints to earthen and collapsible ponds fish farmers N=112

Results from Table 4 shows the constraints facing fish farmers in the study area. The mean severity of the constraints encountered by fish farmers using earthen ponds and collapsible pond is presented in a 4-point likert scale; 1+2+3+4=10/4=2.5. Any mean values of 2.5 or above is a constraint in the study area. It reveals that fish farmers using earthen ponds and collapsible ponds were considered to have a high cost of feed ($\overline{x}$ = 3.3; $\overline{x}$ = 3.2), high inflation rate ($\overline{x}$ = 2.7; $\overline{x}$ = 2.7). Earthen pond was considered to have flooding ($\overline{x}$ = 3.1) as the most severe constraints to their fish farming. Also, poaching ($\overline{x}$ = 3.01) was considered as additional severe constraint to earthen pond fish farmers. Other constraint items presented were not considered severe constraints to fish farmers using either the earthen ponds or collapsible pond.

Table 4: Constraints to fish farmers in the study area

		Earthen		Collapsible	
S/N	**Variables**	**Mean**	**Rank**	**Mean**	**Rank**
i	Lack of appropriate land or site	2.1	6th	1.9	5th
ii	Flooding	3.1	2nd	0.4	12th
iii	Insufficient Fund	2.1	6th	2.1	4th
iv	Poaching	3.01	3rd	1.6	6th
v	Lack of Technical know how	1.9	7th	1.6	6th
vi	Diseases and predator	1.1	9th	1.0	9th
vii	High inflation rate	2.7	5th	2.7	3rd
viii	High cost of input	2.1	6th	3.0	2nd
ix	Poor marketing channel	1.7	8th	1.4	8th
x	Poor Quality fish feed	0.9	10th	0.8	10th
xi	High cost of Quality feed	3.3	1st	3.2	1st
xii	Harvesting Cost	0.8	11th	0.5	11th
xiii	Unfavorable climatic condition	0.8	11th	1.2	7th
xiv	Water pollution	2.9	4th	1.0	9th

Source: Survey, 2023

Table 5: Test of difference in profitability per five months culture periods of Fish cultured in earthen pond and that of collapsible pond

Variables	**Mean profit/5 months (N)**	***df***	***Significance***	***t-value***
Earthen Pond	706, 909	68	0.01	
Collapsible pond	773, 100	20	0.03	17.01
Mean difference	66,191			

Source: Statistical analysis, 2024 *5% confidence level*

The table above shows Test of difference in profitability per five months culture periods of Fish cultured in earthen pond and collapsible pond in Ikorodu Local Government area of Lagos State. The average Net Farm Income (NFI) of earthen fish ponds was N706, 909, while that of collapsible fish pond was N773, 1000, and the mean difference of N66, 191 with t-value of 17.01 at 5% level is significant. This implies that collapsible fish ponds were more efficient in terms of profit level.

CONCLUSION

The study showed that the respondents in the study area ventures into collapsible ponds more than earthen ponds because its more profitable and viable, and it's found out that collapsible pond is better than earthen in terms of efficiency and profitability. Also, reduction in high cost of feed can help the fish farmers in the study area, it indicates that if earthen pond flooding and poaching can be easily avoided or prevents.

Recommendation

Based on the findings from the study, the study therefore recommends:

1. High Inflation and Input Costs:
   i) Diversify income: Try doing more than just fish farming, like glowing plants with the fish. This can bring more income.
   ii) Team up with others: work with nearby farmers to buy fish feed in bulk, which might make it cheaper.
2. Flooding and Environmental Challenges (Earthen Pond)
   i) Pick a good spot: choose a higher place for the fish ponds so that it doesn't get flooded easily.
   ii) Plants trees around the pond: put plants around the ponds to stop darts and pollution when it rains.
3. Poaching and Water Pollution in Earthen Pond
   i) Protect the fish: using things like fences and lights to stop people from stealing the fish. Also teach the community about why it's important to keep the water clean.
4. High Cost of Feeds
   i) Find cheaper food: Look for less expensive feed option for the fish, like using kitchen waste or getting together with other farmers in a big group.
   ii) Feed the feed smartly: make sure to give the fish right amount of feed, without wasting feed.

General Recommendation

1. Get insurance: think about getting insurance to help if something bad happens like flooding or theft.
2. Government agencies like extension agents from ministry of Agriculture should be empowered to carry out their responsibilities to fish farmers.

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