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**Profitability analysis of smallholder aquaculture farms:  
the case of Lagos State, Nigeria**

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## Appendix 1

$$NCAI = X1 + X2 + X3 + X4 \quad (1)$$

Where,

NCAI = Non-current asset of investment

X1 = Cost of additional ponds

X2 = Cost of land for addition ponds

X3 = Cost of borehole

X4 = Cost of pumping machine

The rate of returns was then calculated by dividing the average net revenue by the initial cost

$$RT = \frac{ANR}{C} \quad (2)$$

Where,

RT = Rate of returns

ANR = Average net revenue

C = Cost (which was the non-current asset used for calculation)

The average net revenue was obtained by dividing the total cash revenue by the years put into consideration (five years was used as the basis for calculation<sup>1</sup>). The total cash revenue was based on the existing production and income of the farmers and was calculated by adding the annual cash revenue for the five (5) years.

$$ANR = \frac{TCR}{Y} \quad (3)$$

Where,

ANR = Average net revenue

TCR = Total cash revenue

Y = Year

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<sup>1</sup> Five years was used for calculation because it is expected that investment by expansion of an enterprise should have a short-term returns

## Appendix 2

### US Dollar to Naira Exchange Rates

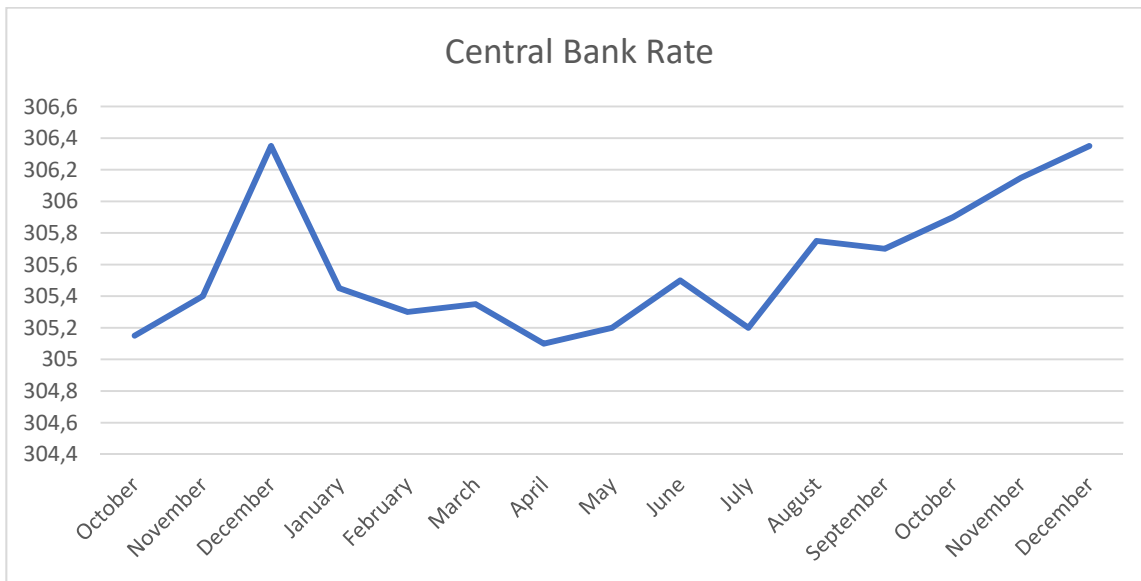


Figure 1: US Dollar to Naira Exchange Rates from October 2017 to December 2018 (every 5th of each month). *Data:* (Central Bank of Nigeria, 2018)

## Appendix 3

Table A1: Depreciation Schedule for Depreciable Assets

Items	Cost	Salvage value <sup>2</sup>	Useful life (years)	Depreciation
Pumping machine	₦ 116,333	₦ -	6	₦ 19,389
Drag Net	₦ 4,230	₦ -	1	₦ 4,230
Vehicles	₦ 150,000	₦ -	5	₦ 30,000
Refrigerator	₦ 70,000	₦ -	6	₦ 11,667
Wheel barrow	₦ 13,500	₦ -	5	₦ 2,700
Hoe	₦ 2,700	₦ -	2	₦ 1,350
Cutlass	₦ 2,825	₦ -	2	₦ 1,413
Weighing scale	₦ 34,750	₦ -	3	₦ 11,583
Test kit	₦ 14,000	₦ -	6	₦ 2,333
Shovel	₦ 4,733	₦ -	2	₦ 2,367
Pond	₦ 2,177,538	₦ -	5	₦ 435,508
Borehole	₦ 552,692	₦ -	20	₦ 27,635
Total	₦ 3,143,302			₦ 550,174

<sup>2</sup> The items are used until they wear out and they do not have salvage value

Table A2: Investment Costs of Non-Current Assets

Non-current Assets	N*		Value	SD	CV
Cost of Pumping machine	40	₦	116,333.33	88,407.36	0.76
Cost of drag net	61	₦	4,230.43	6,094.92	1.44
Cost of vehicle	6	₦	150,000.00	27,894.06	0.34
Cost of refrigerator	5	₦	70,000.00	18,826.40	0.27
Cost of wheel barrow	35	₦	13,500.00	7,474.18	0.55
Cost of hoes	27	₦	2,700.00	1,5553.13	0.58
Cost of cutlass	43	₦	2,825.00	2,096.85	0.74
Cost of weighing scale	69	₦	34,750.00	20,951.94	0.60
Cost of test kit	3	₦	14,000.00	2,599.73	0.19
Cost of shovel	16	₦	4,733.33	2,075.09	0.44
Borehole cost	35	₦	552,692.31	389137.29	0.7
Cost of land owned	32	₦	5,696,000	3,115,960.62	0.55
Pond Construction Cost	35	₦	2,177,538	2,477,646.17	1.14
Total		₦	8,839,303		
Expected Annual Cash Returns		₦	701,158		
Payback Period			12.6 Years		

SD- Standard deviation

CV- Coefficient of variation

\*N- these numbers are less than the total respondents interviewed because not all the farmers have these assets, some of them borrow them from other farmers

#### Appendix 4

$$ANR = \frac{TNR-ICV}{Y} \quad (4)$$

$$ANR = \frac{(701,158*15)-8,839,303}{15} \quad (5)$$

$$\text{Average Net Revenue} = 111,871.02 \quad (6)$$

$$RR = \frac{ANR}{C} \times 100 \quad (7)$$

$$RR = \frac{111,871.02}{8,839,303} \times 100 \quad (8)$$

$$\text{Rate of Returns} = 1.27 \% \quad (9)$$

Where,

ANR: Average net revenue

TNR: Total net revenue

ICV: Initial cost of investment

Y: Year

RR: Rate of returns

C: Cost of investment

## Appendix 5

### Weighted average interest rate and equity opportunity cost

$$\text{Loan Capital} = 0.35 \times \text{Investment} = \text{₦}3,052,701.16 \quad (10)$$

Where,

$$0.35^3 = \text{Percentage of loans used for production}$$

$$\text{Investment} = \text{₦}8,839,303$$

$$\text{Loan Average} = 15.3 \% \times \left( \frac{\text{₦}3,052,701.16}{\text{₦}8,839,303} \right) = 5 \% \quad (11)$$

Where,

$$15.3 \% = \text{Average interest rate on loan} \quad (12)$$

Also,

$$\text{Self Fund Capital} = 0.65 \times \text{Investment} = \text{₦}5,786,601.71 \quad (13)$$

Where,

$$0.65^4 = \text{Percentage of average owner's equity used for production}$$

$$\text{Capital Average} = 4.2 \% \times \left( \frac{\text{₦}5,786,601.71}{\text{₦}8,839,303} \right) = 3 \% \quad (14)$$

Where,

$$4.2 \% = \text{Opportunity Cost of Capital (Interest rate on bank savings)}$$

$$\text{Discount Rate} = 5 \% + 3 \% = 8 \% \quad (15)$$

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<sup>3</sup> 35 percent of production capital was from loans based on data collected

<sup>4</sup> 65 percent was owner's equity based on collected data

## Appendix 6

$$NPV = \frac{P1}{(1+i)^1} + \frac{P2}{(1+i)^2} + \dots + \frac{Pn}{(1+i)^n} - C \quad (16)$$

$$NPV = \frac{P1}{(1+i)^1} + \frac{P2}{(1+i)^2} + \dots + \frac{P20}{(1+i)^{n20}} = 6,884,071.37 \quad (17)$$

$$NPV = \frac{P1}{(1+i)^1} + \frac{P2}{(1+i)^2} + \dots + \frac{Pn}{(1+i)^n} - 8,839,302.87 \quad (18)$$

$$NPV = 6,884,071.37 - 8,839,302.87 = -\text{N} 1,955,231.50 \quad (19)$$

$$0 = \frac{P1}{(1+i)^1} + \frac{P2}{(1+i)^2} + \dots + \frac{Pn}{(1+i)^n} - C \quad (20)$$

$$IRR = 5 \% \quad (21)$$

$$BCR = \frac{NPV}{INV} = -0.22 \quad (22)$$

Where,

NPV: Net present value

C: Initial cost of investment

IRR: Internal rate of returns

BCR: Benefit cost ratio

INV: Initial investment



## Appendix 7

Table A3: Sensitivity Analysis of Feed Prices to Returns to Management (Profits)

Percent increase in feed price	Total Cost of feed based on total fish stocked	Net returns to management
<b>Current price</b>	<b>₦ 8,582,739.97</b>	<b>₦ 701,157.88</b>
1%	₦ 8,668,567.37	₦ 615,330.48
2%	₦ 8,754,394.77	₦ 529,503.08
3%	₦ 8,840,222.17	₦ 443,675.68
4%	₦ 8,926,049.57	₦ 357,848.28
5%	₦ 9,011,876.97	₦ 272,020.88
6%	₦ 9,097,704.37	₦ 186,193.48
7%	₦ 9,183,531.77	₦ 100,366.08
8%	₦ 9,269,359.17	₦ 14,538.68
<b>9%</b>	<b>₦ 9,355,186.57</b>	<b>₦ -71,288.72</b>
<b>10%</b>	<b>₦ 9,441,013.97</b>	<b>₦ -157,116.12</b>

Table A4: Sensitivity Analysis of output prices and quantities to returns to management (Profits)

Prices decrease	Quantities Produced				
	Current quantity	10% decrease	20% decrease	30% decrease	40% decrease
	₦	₦	₦	₦	₦
<b>Current Price</b>	<b>701,157.9</b>	<b>-423,587.7</b>	<b>-1,548,333.2</b>	<b>-2,673,078.7</b>	<b>-3,797,824.3</b>
1%	588,683.3	-524,814.8	-1,638,312.8	-2,751,810.9	-3,865,308.9
2%	365,983.7	-725,244.4	-1,816,472.5	-2,907,700.6	-3,998,928.8
3%	38,615.3	-1,019,876.0	-2,078,367.3	-3,136,858.6	-4,195,349.9
<b>4%</b>	<b>-384,781.2</b>	<b>-1,400,932.9</b>	<b>-2,417,084.5</b>	<b>-3,433,236.1</b>	<b>-4,449,387.7</b>
5%	-892,857.0	-1,858,201.1	-2,823,545.1	-3,788,889.2	-4,754,233.2
6%	-1,472,063.5	-2,379,486.9	-3,286,910.3	-4,194,333.7	-5,101,757.1
7%	-2,107,259.9	-2,951,163.6	-3,795,067.4	-4,638,971.1	-5,482,874.9
8%	-2,782,382.9	-3,558,774.3	-4,335,165.8	-5,111,557.2	-5,887,948.7
9%	-3,481,135.2	-4,187,651.4	-4,894,167.6	-5,600,683.9	-6,307,200.1
10%	-4,187,651.1	-4,823,516.0	-5,459,380.6	-6,095,245.2	-6,731,109.8
11%	-4,887,102.5	-5,453,022.0	-6,018,941.5	-6,584,861.0	-7,150,780.5
12%	-5,566,205.9	-6,064,215.0	-6,562,224.2	-7,060,233.4	-7,558,242.5