

Cooperative Funding as Driver of Aquaculture Development: Evidence from Nigeria

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Abstract

Cooperative-based development model is gaining popularity in public and academic debates. It is important to assess the drivers of cooperative aquaculture development in Delta State, Nigeria. Multistage sampling method was adopted to randomly select Two hundred and forty aquaculture business cooperative members. Structured questionnaire and interview schedule were the instruments used to collect primary information for the study. Descriptive statistics, multiple regression model, cost and return analysis and 4-point Likert- type scale was applied to analyze data. The result of the linear regression model showed that educational level, farming experience, fingerlings cost, cost of other inputs, access to credit and pond size influence the growth of cooperative aquaculture business. Return on investment of 1.06 showed that aquaculture enterprise is profitable to cooperative members. High cost of inputs, inaccessibility to credit facilities, political instability, organizational and operational and pilfering were serious constraints. Fish culture, fish product marketing and fish processing were the major aquaculture activities performed by cooperative members. The result indicates that all the surveyed aquaculture business cooperators experienced development in terms of value of output but at different rates with fish culture recording the highest (55.4%) growth rate. More cooperative funding intervention could positively impact cooperative aquaculture business development with the merit of increased income and employment generation in the economy of Nigeria.

Keywords: Farmers, cooperative society, aquaculture, development, profitability

1. Introduction

Aquaculture is the practice of rearing, growing or producing fish in a managed water system. It is an important component of agricultural production. According to the world fish center (2009), aquaculture

is the world's fastest growing food production subsector, growing at an annual rate of 8.9% since 1970. Aquaculture (fish farming) involved spawning, production of feeds, pond construction, and management. Although, aquaculture in Nigeria has the potential for satisfying the increased demand for protein and has been experiencing unprecedented growth during the last decade, question remains regarding the sustainable development of the industry (Adeogun, 2012). Nigeria is regarded as the largest consumer of fish and fish products in the African region with a demand estimate of 1.4 million metric tons. There is an annual demand gap of at least 0.7 million metric tons with import making up the short fall at a cost of about 0.5 billion US dollars per year (Kudi et al, 2008). This has prompted the government to package the presidential initiative on fisheries and aquaculture development in 2003 to provide financial and technical assistance to government programmes and projects encouraging fish production. Hence, the government encouraged formation of cooperative society as a strategy to promote collective action aimed at raising productivity and efficiency of smallholder's fish farmers.

Cooperatives are established by people of the same mind to jointly pursue beneficial economic interest. ICA (2005) and Gábor (2005) defines a cooperative as an autonomous association of persons united voluntarily to meet their common economic, social needs and ambitions through a mutually owned and democratically controlled enterprise. Cooperative societies have been a tool to accelerate progress in aquaculture development over the years. The effective mobilization of production resources brought about increase in output and income levels of the cooperative members. Cooperatives are financial organizations that provide savings and loan services to their members in the community (Sharma et al, 2005). Suffice to say that insufficient funding has continued to be the greatest limiting problem of agricultural production. In the views of Alufohai and Okorosobo (2013) that every aspect of agriculture from the production point till it gets to the consumers table requires finance. Effiong et al, (2012) opined that cooperative activities explain the best methods by which peasant farmers can take part in economic advancement and gain valuable experience of democratic procedure and business management. According to Ibitoye (2012) cooperatives represent a strong and viable economic alternative since the movement started in Rochadale-England during the last 150 years.

Fish farmers joined cooperative to meet their pressing needs. Therefore, need finance to acquire farm inputs. The cooperative also assists in making supplies available to fish farmers at reduced rate to ease production.

Agricultural cooperatives in particular, occupy 80 to 99% of milk production in Norway, New Zealand and the United States, 71% of fishery production in the Republic of Korea and 40% of agriculture in Brazil (ICA, 2007). In the EU, cooperative firms account for over 60% of the harvest, handling and marketing of agricultural products with a turnover of about 210,000 million euros.

But in Nigeria, to the best of my knowledge, studies on aquaculture development determinants and constraints determinants among fish farmers cooperators has not been carried out in Delta state, before now. This is a research gap that this study investigated and filled. This study therefore will provide a panorama into cooperative activities on aquaculture development and motivate more serious interest therein. The outcome will serve as a reference material for other studies. Likewise, the results of this study will be great benefits to aquaculture cooperators, lending institutions and policy makers. The broad objective of this study was to examine the factors influencing fish farmers cooperative in aquaculture development in Delta State, Nigeria. The specific objectives of the study were to:

- (i) describe the socio-economic characteristics of the farmers
- (ii) identify aquaculture business development activities of cooperative members
- (iii) identify the roles of cooperators in aquaculture business development in the study area.
- (iv) ascertain the rate of aquaculture business development among cooperators.
- (v) determine the factors affecting aquaculture business development by cooperative farmers
- (vi) determine the profitability of cooperative farmers and
- (vii) identify the constraints militating against aquaculture business development by cooperative members.

2. Previous Studies

The participation of farmers' cooperative in agricultural activities which bring about production and development cannot be over emphasized. The growing concern of farmers valuable contribution to agricultural development has steer up research of farmers cooperatives in agriculture (Durosh, 2008). Agbo (2009) contributed that poor cooperative education, mismanagement of existing cooperative societies, illiteracy, political instability, overdue loans, lack of patronage of existing cooperative societies, bad projects, diversion of farm inputs meant for all by a few and unfulfilled promises by government as major constraints to cooperative growth.

Hartley (2003) stressed that cooperative societies engaged in cooperative financing, production, processing, marketing, distribution, management and taxation of cooperatives. Nweke, et al (2005) asserted that cooperative societies procure agricultural inputs such as chemicals, equipment, fingerlings and educate farmers on modern farming and management techniques.

Olaoye et al. (2012) examined the impact of Nigerian Agricultural Cooperative loan on fish farming enterprises in Ogun State, Nigeria. They found out that there was a significant increase in the income level of the beneficiaries of co-operative loans. High cost of feeding, inadequate finance and poor marketing channel were the major constraints hindering fish farming. They recommended that co-operatives should increase the funding of fisheries sector to enhance further development.

3. Methodology

3.1. Description of Study Area and Sampling Procedure

This study covered Delta State, Nigeria. The state is situated within longitudes 5° 50` and 6° 45` east of the Greenwich meridian and latitudes 5°, 25` and 6° 30` north of the equator. Delta State is demarcated into three (3) agricultural zones by the Delta State Agricultural Development Programme (DTADP). These zones are Delta North, Delta Central and Delta South Agricultural Zones. The state is vegetatively covered by mangrove forest in the South, rain and fresh water forest in the central and derived savannah in the northern parts. A multistage sampling technique was adopted in the selection of cooperatives and fish farming cooperators. Firstly,, one local government area each was randomly selected from the three agricultural zones. Secondly, five fish farmers cooperative societies each were randomly selected from the list obtained from the Ministry of Commerce and Industry of the three Local Government Areas amounting to fifteen fish farmers cooperative societies in all. Lastly, from the thirty fish farmers cooperative societies selected, eight cooperators were randomly selected totaling two hundred and forty (240) respondents for the study.

3.2. Data Analysis Techniques

Data were analyzed using descriptive statistics and inferential statistics. Multiple regression model was used to estimate the determinants of aquaculture development by members of co-operative societies in the study area. The change in the value of output from aquaculture business over the years (before and after accessing cooperative funding) was used as a proxy for aquaculture business development among cooperative farmers.

3.3. Model Specification

Multiple regression was used to establish the causal relationship between value of output of aquaculture farming by cooperative members and associated exogenous variables. This is a statistical tool that measures the relationship between independent variables (regressors) and the dependent variable (regressand). In this study, the regression analysis was carried out to examine the factors influencing aquaculture business development by cooperative members. The implicit form of the multiple regression models is specified as follow:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, \dots, X_n, e) \quad (1)$$

Four functional forms of the multiple regression model, (linear, semi-log, exponential and double log) was fitted to the data and the one with the best fit was chosen as the lead equation based on the economic, statistical and econometric criteria.

The explicit forms of the four functional equations are stated as follow:

Linear:

$$Y = b_0 + b_1X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + e \quad (2)$$

Semi-log:

$$Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + e \quad (3)$$

Double log:

$$\log Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + e \quad (4)$$

Exponential function:

$$\ln Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + e \quad (5)$$

Where ;

Y= revenue (₦)

X₁ =age (years)

X₂= gender (dummy, male=1, otherwise =0)

X₃=household size (number of persons)

X₄= education (years)

X₅= fish farming experience (years)

X₆= fingerlings (₦)

X₇= cost of other inputs (₦)

X₈= credit access (₦)

b₁ –b₈ = coefficients of explanatory variables

e= error term

The constraints to aquaculture development by cooperative members were achieved using 4 point likert type scale. This employs an ordinal level of measurement. The responses to various limitations were scored in a way that the response indicating the core severe constraints were given the highest score 4. As a point scale the responses were grouped into four as shown below:

Strongly agree =4; agree=3; disagree=2; strongly disagree=1. This method of examining constraints is important because it identifies those constraints that are of least importance and those of major importance. A mean score above 2.50 was considered serious while those below the mean cut-off mark were considered less serious.

4. Results and Discussion

4.1. Socio-economic Characteristics of the Cooperative Farmers

The socio-economic characteristics of the cooperative farmers are shown in Table 1. Majority (48.33%) of the cooperators were aged between 41 – 50 years, about 24.17% fell within 31-40 years; 14.17% of the respondents were above 50 years of age while 13.33% of them were 30 years and below. The mean age of the respondents was 42 years. This is an indication that the cooperative farmers are still in their active age for effective aquaculture development. The result supports (Gabriel et al, 2015). The result revealed that 77.5% of the cooperative respondents were males while 22.50% of the respondents were females. This is indicative of the fact that aquaculture development is laborious. This result contradict the findings of Edun et al (2018) in their study on the roles of cooperative societies in aquaculture development in Rivers State, Nigeria reported that 70.0% of the respondents were females. Majority of the respondents (63.33%) had household sizes ranging from 4 – 6 persons. This was followed by 24.17% of them having between 7-9 persons while 10.83% of them had household size above 9 persons. Only 1.67% had household sizes less than 4 persons. The mean household size was 6 persons. About 17.50% of the cooperators had no formal education while majority (55.83%) had primary education. About 24.17% and 2.50% of them had secondary and tertiary education

respectively. Thus, greater percentages (82.50%) of the cooperative farmers were literate possessing formal educational levels ranging from primary to tertiary education. This could enhance active participation and adoption of new technologies increased productivity and income generation. The result is in agreement with Ibitoye (2006) in his study on cooperatives in agricultural activities in Kogi State, Nigeria..

On cooperators experience, majority (57.50%) of the respondents had between 6-10 years, while 31.67% had between 11-15 years of cooperative experience. The cooperators that fell within the range of 1-5 years of aquaculture experience represented 9.17% of the respondents while only 1.67% of them had over 15 years of experience. The mean fish farming experience was 9 years. This means that majority of the cooperative farmers had acquired sufficient experience in fish farming which could enhance efficiency and effectiveness in aquaculture development (Adekunle and Henson, 2007). Majority (73.83%) of the cooperative farmers were married while 19.17% were single and 5.00% were divorced and widowed. this means that aquaculture development in the area is majorly practice by married people who probably needs helping hand to carry out the tedious farming operations. This could also be attributed that married people tend to be more committed to cooperative tasks and so highly productive. Majority (67.50%) had income of ₦100,000 – ₦200,000 while 19.17% earned income of less than ₦100000. About 13.33% of them earned above ₦200,000. The mean annual income of the cooperative farmers was ₦ 143,875.00.

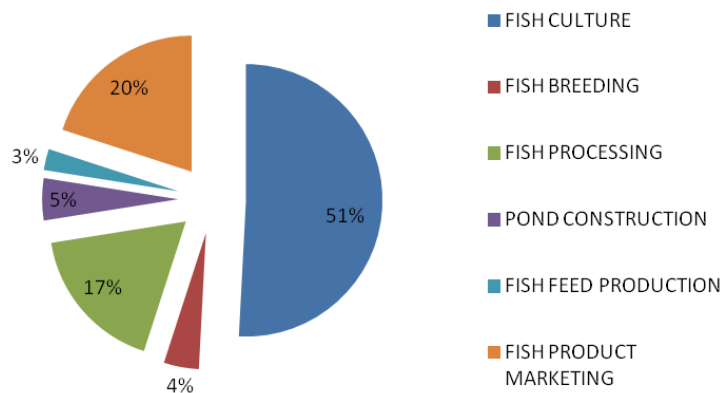
Table 1: Socio-economic Characteristics of Aquaculture Business Cooperative Farmers (N= 120)

Variable	Frequency	Percentage	Mean/mode
Age (years)			
<31	16	13.33	42 years
31-40	29	24.17	
41-50	58	48.33	
>50	17	14.17	
Gender			
Male	93	77.50	Male
Female	27	22.50	
Household size			
<4	2	1.67	6 persons
4-6	76	63.33	
7-9	29	24.17	
>9	13	10.83	
Education			
No formal education	21	17.50	Primary
Primary education	67	55.83	
Secondary education	29	24.17	
Tertiary	3	2.50	
Farming experience (years)			
1-5	11	9.17	9 years
6-10	69	57.50	
11-15	38	31.67	
>15	2	1.67	
Marital status			
Married	91	75.83	Married
Single	23	19.17	
Divorced	2	1.67	
Widow	4	3.33	
Income level			
<N100,000	23	19.17	₦143,875.00
N100,000-N200,000	81	67.50	
>N200,000	16	13.33	

4.2. Aquaculture Business Activities of Cooperative Members

The aquaculture activities engaged by the cooperative members are presented in Fig. 1, the result indicates that 51% of cooperative members were engaged in fish culture as their main occupation. This result is in consonance with Odetola et al (2015) study on the roles of cooperative societies in Lagos state. This was closely followed by marketing of fish product (20%) and fish processing (17%). While 5%, 4% and 3% engaged in pond construction, fish breeding and fish feed production respectively. They were majorly involved in fish culture, marketing of fish product and processing activities because those were the predominant activities embarked by the people in the environment to raise finance for the cooperative society.

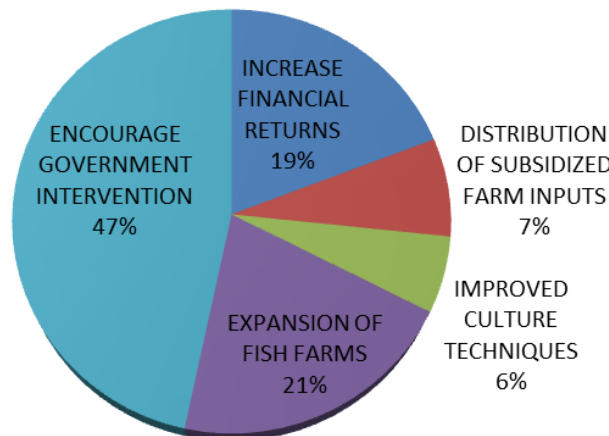
Figure 1: Aquaculture Business Development Activities



4.3. Roles of Cooperative Members in Aquaculture Business Development

The roles of cooperative members in aquaculture development are presented in Fig.2. The result showed that 47% of the respondents opined that cooperative societies encouraged government intervention, while 21%, 19%, and 7%, of them asserted that the cooperative society developed aquaculture through expansion of fish farms, increased financial returns, subsidization of farm inputs. Only 6% of them said cooperative improved culture techniques. This result is congruent with Kareem et al (2012) findings of cooperative societies in Ogun State, Nigeria. This was not unexpected because financial enhancement of members was a cardinal task performed by cooperative society in Nigeria.

Figure 2: Cooperatives in Aquaculture usiness Development



4.4. Growth Rate of Aquaculture Business among Cooperators

Table 3 shows the aquaculture business development among cooperators in Delta State, Nigeria. The result shows that fish culture recorded the highest growth in value of output from ₦410,000 to ₦920,000 (55.4%), followed by marketing of fish products ₦280,000 to ₦530,000 (47.2%) and the least was fish feed production (34.7%). The result is attributed to the fact that access to cooperative credit can act as a boost to business growth. The result is in agreement with Akerele and Adekunmbi (2018) in Ogun State that cooperative credit societies is very productive and effective in helping members achieving their goals and also improve their standard of living.

Table 3: Growth level of Aquaculture Business Development among Cooperators (value of output in Naira)

Aquaculture businesses	Past period 1 (i.e before membership of cooperative society)	Present period 2 (i.e after becoming cooperative member)	Income difference (₦)	Percentage growth %	Remarks
Fish processing	500000	870000	370000	42.5	3rd
Fish culture	410000	920000	510000	55.4	1st
Pond construction	385000	650000	265000	40.8	4th
Fish breeding	250000	400000	150000	37.5	5th
Marketing of fish product	280000	530000	250000	47.2	2nd
Fish feed production	160000	245000	85000	34.7	6th

4.5. Determinants of Aquaculture Business Development by Cooperative Farmers

The result in Table 4 showed that the linear regression model was chosen as lead equation based on the level of R^2 value of 0.653 and number of significant explanatory variables implying that 65.3% variability in output of aquaculture development was explained by the independent variables included in the model. The coefficient of education was positive and significant at 5% probability level, this conforms with *a priori expectation*. The implication is that an increase in educational status of the respondent will lead to a corresponding increase in aquaculture output. The coefficient of farming experience was positive and significant at 5% level of probability, which agrees with *a priori expectation*. This implies that any increase in farming experience will lead to a corresponding increase in aquaculture output. The coefficient of fingerling cost was positive and significant at 1% level of probability; this implies that an increase in cost of fingerlings will lead to a corresponding increase in aquaculture output because the more money expended on the production the higher profit is expected. This agrees with *a priori expectation*. The coefficient of cost of other inputs in naira was positive and highly significant at 1% level of probability, which conforms to *a priori expectation*. This suggests that an increase in other inputs will lead to a corresponding increase in aquaculture output. The coefficient of credit access was positive and significant at 1% level of probability. This means that access to credit is a strong determinant of aquaculture output and concurs with *a priori expectation*. The coefficient of pond size was also positive and significant at 5% level of probability, which agreed with *a priori expectation*. The implication is that an increase in pond size will lead to a corresponding increase in aquaculture output by cooperative farmers.

Table 4: Determinants of Aquaculture Development of Cooperative Farmers

Variable	Parameters	Linear	Semi-log	Exponential	Double-log
Age(years)	X ₁	-68.472 (-0.11)	-5821.061 (-0.18)	-0.002 (-0.37)	-0.112 (-0.49)
Gender	X ₂	3593.047 (0.31)	1152.559 (0.35)	0.125 (1.04)	0.013 (0.57)
Household size	X ₃	2012.053 (0.35)	-8947.048 (-0.86)	-0.040 (-1.90)*	-0.082 (-1.09)
Education	X ₄	5844.838 (2.92)**	-6928.517 (-0.50)	0.052 (0.85)	0.034 (0.34)
Farming experience (years)	X ₅	1552.486 (2.26)**	10874.36 (0.78)	0.023 (1.78)*	0.146 (1.44)
Fingerling (₦)	X ₆	1.606 (3.19)***	16177.3 (1.90)*	9.27e-06 (1.75)*	0.207 (3.36)***
Cost of other inputs	X ₇	1.033 (5.66)***	40613.32 (4.53)***	9.82e-06 (5.11)***	0.477 (7.38)***
Credit access	X ₈	0.330 (5.33)***	17394.68 (2.17)**	1.43e-06 (2.19)**	0.055 (0.96)
Pond size	X ₉	3.910 (2.47)**	-21164.36 (-0.93)	-0.0000513 (-1.83)*	-0.331 (-2.02)**
Intercept	b ₀	32857.84 (1.09)	-465670.9 (-1.94)*	10.718 (33.61)***	6.853 (3.97)***
R ²		0.653	0.421	0.499	0.609
F-ratio		17.60	6.79	9.30	14.53

*, ** and *** is significant at 10%, 5% and 1% level of probability respectively

4.6. Profitability of Cooperative - Funded Aquaculture Farmers

Gross margin and profitability ratio were used to determine the level of profitability of cooperative members production in the study area. The cost structure indicates that 12.07% of total cost incurred is used for the purchase of fingerlings, 23.17% was used for the payment of labour wages. The cost of feeding accounted for 55.43% which is the largest cost incurred. Cost of medication, cost of fertilizer, cost of transportation and cost of fixed inputs accounted for 2.96%, 2.03%, 1.11% and 3.23% respectively. The BCR value of 2.06 and ROI of 1.06 showed that aquaculture enterprise is profitable. The result is presented in Table 5.

Table 5: cost and return of cooperative members

Production parameter	Amount (₦)	Percentage
Total revenue	556,400	
Variable cost		
Cost of fingerlings	32,650	12.07
Cost of feeding	150,000	55.43
Cost medication	8,000	2.96
Cost of fertilizer	5,500	2.03
Cost of labour	62,700	23.17
Cost of transportation	3,000	1.11
Total variable cost (TVC)	261,850	96.77
Gross margin	294,550	
Total fixed cost	8750	3.23
Total cost	270,600	
Net income	285,800	
BCR	2.06	
ROI	1.06	

4.7. Constraints to Aquaculture Business Development among Cooperators

Five items were ranked on a four point likert type scale in order to estimate the relevant variables that acted as constraints to aquaculture development by cooperative farmers as shown in Table 4. According to the cooperative members, access to credit facilities (mean=3.68), high cost of inputs (mean=3.54), pilfering (mean=3.50), organizational and operational (mean=3.50) and political (mean=3.40) were major constraints encountered in aquaculture development as they all had mean values greater than the cut-off mark of 2.50. This would discourage participation in aquaculture development.

Table 6: Constraints to Aquaculture Business Development by Cooperative Members

Constraints	Mean score	Std. deviation	Remark
High cost of inputs	3.043	1.057	Serious
Access to credit facilities	3.213	0.411	Serious
Political instability	2.809	0.447	Serious
Organizational and operational	2.904	1.298	Serious
Pilfering	2.574	0.849	Serious

(SA) = 4, Agreed (A) = 3, Disagree (D) = 2 and strongly disagree (SD) = 1 with a cut-off score of 2.50.

5. Conclusion

The study revealed that cooperative funding substantially enhanced the development of aquaculture value chain. Other determinants of aquaculture business development among the cooperative farmers were: educational level, farming experience, fingerlings cost, cost of other inputs and pond size. Cooperators who operated aquaculture businesses with cooperative fund could expand their scale of operation. The result calls for policies aimed at aquaculture business development to encourage massive involvement of all and sundry for human and economic transformation. Policy should focus on ways to attract and encourage cooperators to remain in the business of aquaculture development. Policies should be pursued by making fund available to cooperative members to operate their aquaculture businesses sustainably in Nigeria.

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