RESEARCH ARTICLE

Assessment of Socio-demographic Predictors of Fish Farmers' Access to Formal Credit Sources in Ogun West Senatorial District, Nigeria

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ABSTRACT

This study assessed socio-demographic predictors of fish farmers' access to formal credit sources (FCSs) in Ogun West Senatorial District, Nigeria. A multistage sampling procedure was used to select 75 fish farmers. Data were elicited with an interview schedule and subjected to descriptive and inferential statistics. Results revealed that the mean age of the fish farmers was 45.25±9.362 years old and that the majority were male (88.0%), married (74.7%), had tertiary education (72.0%), non-members of cooperative societies (77.3%), practiced monoculture (94.7%), and had a household size of 1-5 persons (76.0%) with a mean household size of 5±2 persons. The highest proportion of fish farmers (64.0%) sourced the fish seeds from commercial hatcheries, while 40.0% sourced the fish seeds from their own farms. Borehole was the source of water for 76.0 % of the fish farmers, while 41.3% used well water sources. Over one-third (34.7%) had no access to any FCSs. Inadequate funding (64.0%), inadequate fish farm inputs (80.0%), and poor extension service (69.3%) were considered severe constraints to fish farming development. Results of logistic regression revealed that age (Wald = 11.826, $p \leq 0.01$), membership in cooperative societies (Wald = 5.013, $p \leq 0.05$), and educational level (Wald = 5.984, $p \leq 0.05$) were significant socio-demographic predictors of fish farmers' access to formal credit sources. It was concluded that socio-demographic variables could significantly predict fish farmers' access to FCSs. It was recommended that fish farmers should join cooperative societies and participate in the activities of their societies.

*Corresponding Author: *oluwagbemiga2013@gmail.com*
Received: *September 27, 2021*
Accepted: *February 22, 2024*

Keywords: *aquaculture, credit source, credit use, financial sources, personal savings*

1. INTRODUCTION

Nigerian agriculture is characterized by smallholder farmers who are poor and have minimal or no access to inputs, credits, and other productive resources (Babatunde et al. 2008; Akinola and Owombo 2012; Umebali et al. 2021; FAO 2022). This has strong implications on agricultural productivity, as well as food security in the country. The Nigerian agriculture sector is comprised mainly of small and medium enterprises (SMEs). SMEs have been regarded as engines for the development of growing economies like that of Nigeria (Ofoegbu et al. 2013; Muazu cited by Chinwo 2019). The importance of SMEs includes their contribution to job creation, income disparity reduction, and production of goods and services in the economy, as well as providing a fertile ground for skill development and acquisition. Scholars (Oyelarin-Oyeyinka 2007; Eniola 2014; PwC 2020) have established that SMEs are a crucial part.

Aquaculture is the fastest-growing food-producing sector, accounting for 50% of the world's fish used for food (FAO 2016). This sector is important in many low-income countries as fish remains the most frequently consumed animal source of protein. Fish makes a valuable contribution to the diversity of human diets dominated by carbohydrate-rich staples (Thompson and Subasinghe 2011; Thilsted et al. 2015; Gibson et al. 2020). Considering the nutritional importance of fish, the demand for fish continues to increase, especially with the high cost of purchasing other animal sources of protein such as beef, turkey, and chicken. This has led to an increase in the number of people who venture into aquaculture in Nigeria and Ogun West Senatorial District, in particular.

To ensure that agriculture and other related SMEs, including aquaculture, are able to live up to their potential as engines for growth and development of the nation's economy (Ofoegbu et al. 2013; Ghandi and Amissah 2014; Muazu cited by Chinwo 2019; PwC 2020), different regimes of Nigerian government initiated several projects and schemes intending to provide credit to SMEs in the country. Despite these efforts, the importance of SMEs has not been significantly felt by the average Nigerian, as well as the country itself in terms of contribution to the nation's gross domestic product (Ghandi and Amissah 2014; Effiom and Edet 2018) because most of the SMEs do not have access to formal credit sources. This means that the interventions provided by the government do not reach the SMEs that need.

Lack of funds and access to credit facilities have been noted to be significant obstacles to the development and sustainability of micro-enterprises in Nigeria that discourage those with entrepreneurial skills (Gbigbi et al. 2019; Gherghina et al. 2020). Agricultural credit could be accessed from formal and informal financial sources. The formal sources are mainly the conventional commercial banks and agricultural banks, as well as cooperative societies, while the informal sources of credit include personal savings, loans from money lenders, and from friends, neighbors, and relatives. Access to credit, especially from formal financial institutions, such as commercial banks, in the form of loans, is a major constraining factor among aquaculture and other agricultural SMEs in Ogun State. This is consistent with the findings of Ndifon et al. (2012) and Gherghina et al. (2020), stating that credit is a major factor in the development of Nigerian SMEs, especially those based on agriculture because those SMEs encounter funding barriers. Osuntade and Babalola (2021) also reported that less than half of poultry farmers in a local government in Ogun State had access to credit from commercial banks.

Several empirical studies (Baruwa et al. 2012; Olaoye et al. 2016; Olaoye 2016; Ashley-Dejo et al. 2017) had identified the informal sources of credit as the most commonly utilized funding available to fish farmers and other agriculture-related enterprises in Nigeria. Those studies reported that fewer proportions of agricultural SMEs utilized formal credit sources, such as banks and cooperative societies. According to Olaoye et al. (2016), the informal credit sources were ineffective in fish farming business because the credit amount provided at a time is usually smaller to execute any major business investments than what could be obtained from commercial banks and other formal credit.

It is important to mention that small farms dominate the production of fish from the aquaculture sector. Most of these farms need access to formal credit sources. While numerous studies have focused on access to credit among SMEs, there is a dearth of information on the socio-demographic determinants of credit access, especially in Ogun West Senatorial District. This study, therefore, assessed the socio-demographic predictors of fish farmers' access to formal credit sources in Ogun West Senatorial District with the specific objectives being to describe the socio-demographic characteristics of the fish farmers; assess the production characteristics of the fish farmers; identify the different formal credit sources available to fish farmers; and identify the constraints facing the fish farmers. A hypothesis that "socio-demographic characteristics such as age, household size, family type, marital status, education, sex, and membership in cooperative societies are not significant predictors of fish farmers' access to formal credit sources" was tested at 0.05 level of significance.

2. MATERIALS AND METHODS

2.1 The study area

This study was carried out in Ogun West Senatorial District, one of the three senatorial divisions in Ogun State (Figure 1). Ogun West Senatorial District comprises five Local Government Areas (LGAs) – namely Ado-Odo/Ota, Imeko Afon, Ipokia, Yewa North and Yewa South LGAs. It is home to Yewa Lagoon and other important rivers and streams which favor aquaculture production throughout the year. Aquaculture is a dominant occupation among the residents of Ogun West Senatorial District. Fish farming in senatorial district is predominantly done by small-scale farmers with low capital investment. This District was the choice of this study because only a few studies have focused on the District, despite the increasing concentration of fish farming activities in the area.

2.2 Sampling technique and sample size

A multistage sampling procedure was adopted in the selection of 75 fish farmers for this study. Stage 1 involved the random selection of 3 out of the 5 Local Government Areas (LGAs) from the Senatorial District. The selected LGAs are Ado-Odo Ota, Ipokia,

and Yewa North. This was followed by the purposive selection of three towns, each from the selected LGAs, making up nine towns, based on the intensity of fish farming activities. The final stage entailed the random sampling of 60% of the fish farmers in each of the selected towns. This was done using the proportionate sampling procedure described by Mbah et al. (2016). This resulted in a sample size of 75 fish farmers, with details summarized in Table 1. The interview schedule was used to collect data from the fish farmers between the months of June and July 2021. Leading questions were not asked to generate more empirical results, which can be used to support the findings from this study. This study relied on previous studies to discuss its findings.

2.3 Measurement of variables

Production characteristics: All the production characteristics in this study were measured at a nominal level with the exemption of output, which was measured as the actual production output per cycle in the nearest kilogram. The culture period was measured as either monoculture (1) or polyculture (2), cultured fish species were measured as Tilapia (1), African mudfish (2), and African catfish (3), and sources of fish seed were measured as government hatchery (1), own farm (2) and commercial hatcheries (3). Also, the types of feeds used were measured as local (1) and imported (2), and stages of stocking fish were measured as post-harvest (1), juvenile (2), fingerlings (3), and fish fry (4). Sources of water supply were measured as a river (1), well (2), and borehole (3); mode of land acquisition was measured as either purchase (1), rent/lease (2), gift (3), or inheritance (4). The type of labor used on the fish farms was measured as either part-

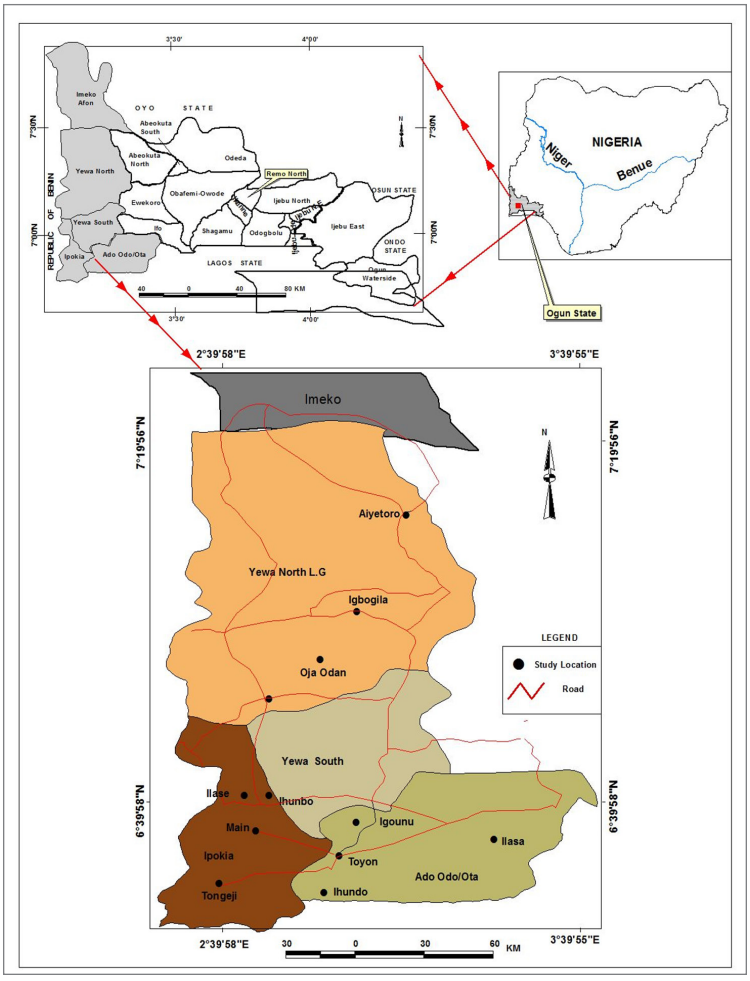

Figure 1. Map of Ogun West Senatorial District showing the study locations.

Table 1: Sampling frame and sample size determination.

Local Government Areas	Selected towns	Sampling frame*	Sample size
Ado-Odo Ota	Toyon	22	13
	Ihundo	16	10
	Igounu	18	11
Ipokia	Maun	9	5
	Tongeji	12	7
	Ilase	10	6
Yewa North	Igbogila	13	8
	Ayetoro	12	7
	Oja Odan	14	8
3	**9**	**126**	**75**

*The researcher compiled the sampling frame with the help of key informants from each of the communities.

time (1) or full-time (2), while the production cycle per year was measured as once (1), twice (2), and thrice (3).

Access to formal credit sources: This was measured at a nominal level of "Yes" or "No" with nominal scores of 1 and 2, respectively. A 5-item scale consisting of the different formal credit sources (microfinance banks, cooperative societies, commercial banks, religious organizations, and community-based organizations) was used in this study. Anyone who does not tick any of the provided options was considered to have no access to formal credit sources.

Constraints to fish farming development: This was measured using a 5-item scale on 4 points response options of "Very severe," "Slightly severe," "Not severe," and "Not a constraint," with assigned scores of 3, 2, 1, and 0, respectively. The items are inadequate funding, inadequate fish farm inputs, poor literacy of fish farmers, lack of access to modern fish production technologies, and poor extension service. Items with a mean severity score of at least 1.50 were considered severe constraints, while those with a mean severity score of below 1.50 were regarded as not severe constraints. The mean severity scores were used to rank the items in order of severity.

2.4 Methods of data analysis

Data were subjected to descriptive (frequency, percentage, mean, and standard deviation) and inferential (binary logistic regression analysis) statistics using the Statistical Package for Social Sciences (SPSS) version 21.0.

If Y is the binary outcome variable indicating access/no access to formal credit sources with (0,1) and p be the probability of y to be 1, then p = P(Y=1). Let $x_1, x_2, \ldots, x_7$ be the predictors. Then the logistic regression of Y on $x_1, x_2, \ldots, x_7$ estimates parameter values for $\beta_0, \beta_1, \ldots, \beta_k$ via maximum likelihood method of the following equation:

$$\text{logit}(p) = \log(p/[1-p]) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7$$

Where x_1 = age of fish farmers, X_2 = family type of fish farmers, x_3 = household size of fish farmers, x_4 = fish farmers' membership in cooperative societies, x_5 = sex of fish farmers, x_6 = marital status of fish farmers, and x_7 = educational level of fish farmers. The interpretations and coding of these variables are detailed in Table 2.

3. RESULTS

3.1 Socio-demographic characteristics of fish farmers

The socio-demographic characteristics of fish farmers covered by this study are presented in Table 3. It reveals that the highest proportion (45.4%) of the sample fish farmers were in the 40–49 years age bracket, followed by those within the 50–59 years age bracket (37.3%), while those younger than 40 years accounted for 17.3% of the sample fish farmers.

Table 2: Interpretation and coding of the dependent and independent variables.

	Definition	Level of measurement	Coding
x_1 = Age	Actual age of the fish farmers in years	Interval	
x_2 = Family type	The type of family the fish farmer is from	Categorical - binary	1, if extended family type, 0 if otherwise
x_3 = Household size	Number of person eating from the same pot and living under the same roof	Interval	
x_4 = fish farmers' membership in cooperative societies	If fish farmers belonged to cooperative societies or not	Categorical - binary	1, if fish farmers are members in cooperative societies, 0 if otherwise
x_5 = sex of fish farmers	The sex of the sampled fish farmers	Categorical - binary	1, if the fish farmer is a male, 0 if otherwise
x_6 = marital status of fish farmers	Marital status of fish farmers	Categorical - binary	1, if the fish farmer is married, 0 if otherwise
x_7 = educational level of fish farmers	Highest level of fish farmers' educational attainment	Categorical - binary	1, if the fish farmer has at least secondary education, 0, if otherwise
Y = Access to formal credit sources	Fish farmers' access to any of the formal credit sources	Binary	1, if the fish farmer had access to any of the formal credit sources; 0 if otherwise.

The mean age was approximately 45±9 years. It was also shown that 88.0% of the fish farmers were male according to the sex distribution. The result in Table 3 further reveals that the majority of the fish farmers were married (74.7%) and had tertiary education (72.0%).

Also, 72.0% of the fish farmers belonged to extended families. Based on household size, Table 3 reveals that the majority (76.0%) of the fish farmers had household sizes of 1–5 persons, with the mean household size being 5±2 persons. The highest proportion (56.0%) of the fish farmers practiced Christianity, followed by those who practiced Islam (26.7%). Table 3 also reveals that more than three-quarters (77.3%) of the fish farmers were non-members of cooperative societies.

Table 3: Socio-demographic characteristics of fish farmers (n = 75).

Socio-demographic variables	Frequency	Percentage	Mean	SD
Age (years)				
30–39	13	17.3		
40–49	34	45.4	45.25 years	9.362
50–59	28	37.3		
Sex				
Female	9	12.0		
Male	66	88.0		
Marital status				
Widowed	4	5.3		
Divorced	7	9.3		
Married	56	74.7		
Single	8	10.7		
Educational level				
No formal education	1	1.3		
Tertiary education	54	72.0		
Secondary School	17	22.7		
Primary School	3	4.0		
Types of family				
Nuclear	21	28.0		
Extended	54	72.0		
Household size (number of persons)				
1–5	57	76.0	5 persons	2
6–10	18	24.0		
Religious				
Not disclosed	3	4.0		
Traditional	10	13.3		
Islam	20	26.7		
Christianity	42	56.0		
Membership of cooperative societies				
Members	17	22.7		
Non-member	58	77.3		

SD = Standard deviation

3.2 Production characteristics of the fish farmers

Table 4 shows that almost all (94.7%) of the fish farmers practiced monoculture. The majority of the fish farmers reared African mudfish, *Heterobranchus bidorsalis* (76.0%), and African catfish,*Clarias gariepinus,* (70.7%), while only 20.0% reared Tilapias. The highest proportion (64.0%) of the fish farmers sourced fish seeds from commercial hatcheries, while 40.0% and 16.0% sourced fish seeds from their own farms and government hatcheries, respectively. Also, the majority (77.3%) of the fish farmers stocked fish seeds at the juvenile stage.

Table 4 further reveals that the highest proportion (46.7%) had 1,001–1,500 kg of output per production cycle, while 32.0% and 21.3% harvested ≤ 1,000 kg and > 1,500 kg of fish, respectively. The mean weight of harvested fish was 1213.35±275.571 kg. The fish seeds were fed with imported and local feeds by 92.0% and 72.0%, respectively. As shown in Table 4, the borehole was the source of water for 76.0% of the fish farmers, while 16.0% and 41.3% of the fish farmers made use of river and well water sources, respectively.

The distribution of the farmers based on their mode of land acquisition reveals that the highest proportion (41.3%) acquired land through purchase, followed by 38.7% whose mode of land acquisition was lease. Also, the majority (73. 3%) of the fish farmers hired laborers on a full-time basis. More than half (58.7%) reported that their production cycle was once a year, while the production cycle of 34.7% of the fish farmers was thrice a year.

3.3 Access to different formal credit sources

According to the results in Figure 2, 34.7% of the fish farmers had not sourced credit from any of the listed organizations. However, 25.3% of the fish farmers had sourced credit for fish farming from microfinance banks, while commercial banks and religious organizations were

Table 4: Fish production characteristics in Ogun West Senatorial District (n = 75).

Production variables	Frequency	Percentage
Culture methods		
Poly culture	4	5.3
Monoculture	71	94.7
Fish Species*		
African mud fish - *Heterobrachus bidorsalis*	57	76.0
African catfish - *Clarias gariepinus*	53	70.7
Tilapias	15	20.0
Sources of fish seeds*		
Government hatchery	12	16.0
Own farm	30	40.0
Commercial hatcheries	48	64.0
Stages of stocking fish*		
Post -harvest	18	24.0
Juvenile	58	77.3
Fingerlings	19	25.3
Fish fry	20	26.7
Output (kg) per production cycle		
≤ 1000	24	32.0
1001–1500	35	46.7
> 1500	16	21.3
Mean±SD = 1213.35±275.571		
Type of feed used*		
Local feeds	54	72.0
Imported feeds	69	92.0
Sources of water supply*		
River	12	16.0
Well	31	41.3
Borehole	57	76.0
Mode of land acquisition		
Purchase	31	41.3
Lease/Rent	29	38.7
Gift	3	4.0
Inheritance	12	16.0
Types of labor used		
Full time	55	73.3
Part time	20	26.7
Production cycle per year		
Twice	5	6.7
Thrice	26	34.7
Once	44	58.7

*** = multiple responses**

the sources of credit for 24.0% and 21.3% of the fish farmers, respectively. Other formal credit sources utilized by the fish farmers were community-based organizations (20.0%) and cooperative societies (18.7%).

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The general features of credit available to fish farmers are presented in Table 5. It shows that only about two-thirds (65.3%) of the fish farmers have had access to formal credit sources in the last production year. The majority (73.5%) of those who had access to a loan obtained it twice a year. More than three-quarters (77.6%) of the fish farmers who obtained the loan had utilized it solely for fish production. About half (51.0%) of the fish farmers who accessed formal credit obtained it with at least a 10% interest rate, while 44.9% said their loans were at less than a 10% interest rate. Also, 40.8% reported that the loans were disbursed to them in cash, 16.3% received the loan in kind, while 42.9% reported that the loan amount was received by them in both cash and in kind. Table 5 further shows that the same proportion, or 38.8%, of the respondents paid back the loans within six months and 7–12 months, while 22.4% paid back their loans in more than 12 months.

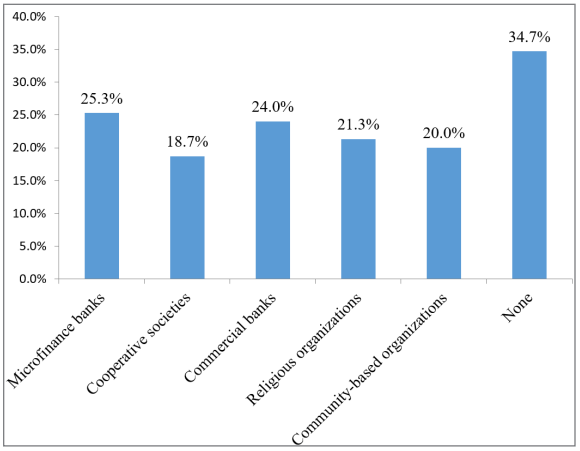

Figure 2: Distribution of fish farmers by access to formal credit sources.

Table 5: General features of formal credit sources available to fish farmers in Ogun West Senatorial District (n = 75).

Variables	Frequency	Percentage
Ever obtained credit from formal sources		
No	26	34.7
Yes	49	65.3
Number of times production loan was obtained per year*		
Once	13	26.5
Twice	36	73.5
Usage of granted loans *		
Fish production only	38	77.6
Fish production and other related needs	11	22.4
Interest rate on loan (%)*		
Interest free (0.0)	2	4.1
1–9	22	44.9
≥ 10	25	51.0
In what form are the loans given*		
Cash only	20	40.8
In kind only	8	16.3
Both	21	42.9
Payback period (months)*		
≤ 6	19	38.8
7–12	19	38.8
> 12	11	22.4

*indicates that the sample size was 49

3.4 Constraints to fish farming development in Ogun West Senatorial District

Constraints to fish farming development in the study area are presented in Table 6. It reveals that inadequate funding (64.0%), inadequate fish farm inputs (80.0%), and poor extension service (69.3%) were considered severe (either very severe or slightly severe) constraints to fish farming development in Ogun West Senatorial District, Ogun State. Lack of access to fish farm inputs has the highest mean value (2.21±0.11), followed by poor extension service (2.20±0.13), inadequate funding (1.99±0.09), and lack of access to modern fish production technologies (1.55±0.13) while poor literacy of fish farmers has the least mean value of 1.55±0.13.

Cut-off point = 1.50; mean values ≥ 1.50 indicate severe constraints, while mean values < 1.50 indicate not severe constraints.

Table 6: Constraints to fish farming practice in Ogun West senatorial district.

Constraints	Very Severe	Slightly severe	Not severe	Not a problem	Mean	SD
Inadequate funding	26 (34.7)*	22 (29.3)	27 (36.0)	0 (0.0)	1.99	0.09
Inadequate fish farm inputs	37 (49.3)	23 (30.7)	9 (12.0)	6 (8.0)	2.21	0.11
Poor literacy of fish farmers	8 (10.7)	19 (25.3)	15 (20.0)	33 (44.0)	1.03	0.12
Lack of access to modern fish production technologies	11 (14.7)	19 (25.3)	45 (60.0)	0 (0.0)	1.55	0.09
Poor extension service	46 (61.3)	6 (8.0)	15 (20.0)	8 (10.7)	2.20	0.13

*Figures in parentheses () are expressed as percentages, SD = standard deviation

3.5 Relationship between socio-demographic characteristics and access to FCSs

The results of binary logistic regression analysis on the socio-demographic predictors of fish farmers' access to formal credit sources are presented in Table 7. It reveals that 58.9% of the variations in the prediction of fish farmers' use of formal credit sources could be explained by the model and that the model correctly predicts 80.0% of the cases. The 2 log likelihood value was -93.249. Also, the age of the fish farmers (Wald = 11.826, $p \leq 0.01$), membership in cooperative societies (Wald = 5.013, $p \leq 0.05$), and educational level (Wald = 5.984, $p \leq 0.05$) were significant socio-demographic predictors of fish farmers' access to formal credit sources. The odds ratios were 1.224, 8.283, and 17.795 for age, membership in cooperative societies, and educational level, respectively. Though other socio-demographic variables contributed to the explanatory power of the model, results show that they are not significant predictors of the fish farmers' access to formal credit sources ($p > 0.05$).

4. DISCUSSION

The age distribution of farmers usually influences their productivity, according to Dambatta et al. (2016), who state that age is positively correlated with agricultural productivity. Findings indicated that all the fish farmers were within the active working population. They are, therefore, within the economically active age categories and are innovative and motivated individuals who can cope with the inherent challenges in farming activities (Fakoya and Daramola 2005). This could be attributed to the fact that young adults or middle-aged persons are more energetic and healthier and may have a better entrepreneurial drive in fish farming activities, which are mostly tedious, strenuous, and energy-sapping. The mean age of the fish farmers falls within the age group that Abbas (2015) described as having the capacity to withstand farm stress and explore how best they can improve their productivity based on their adventurous nature. By implication, the fish farmers must have explored different sources of credit based on accessibility and need.

Table 7: Results of binary logistic regression showing the relationships between the socio-demographic characteristics and fish farmers' access to formal credit sources.

Variables in the Equation	B	S.E.	Wald	df	Sig.	Odds ratio - Exp (B)	Probability (odds ratio/[1+odds ratio)
Actual Age in years	0.202	0.059	11.826	1	0.001**	1.224	0.5504
Family type	-0.356	0.799	0.198	1	0.656	0.701	0.4121
Household size	-0.074	0.153	0.232	1	0.630	0.929	0.4816
Membership in cooperative societies	2.114	0.944	5.013	1	0.025*	8.283	0.8923
Sex	-0.091	1.147	0.006	1	0.937	0.913	0.4772
Marital status	-0.162	0.799	0.041	1	0.839	0.850	0.4595
Educational level	2.879	1.177	5.984	1	0.014*	17.795	0.9468
Constant	-6.820	2.571	7.036	1	0.008	0.001	
Nagelkerke R Squar e= 0.589, -2 log likelihood = 93.249, Overall percentage = 80.0, Percent negative = 65.4, Percent positive = 87.8							

The sex distribution of the respondents indicated that fish farming was dominated by men, and this implies that gender imbalance exists in fish farming in terms of involvement, thereby undermining women's contribution to fisheries development. This could be linked to the nature of fish farming activities, which are strenuous, tedious, and energy-demanding, and the belief that men are more energetic than women to be engaged in fish farming. The result is a confirmation of the assertion of previous studies (Brummett et al. 2010; Abbas 2015) stating that fisheries activities are mostly dominated by men. Olayiwola (2013) also positioned women's involvement in agriculture to be mostly in post-cropping activities such as marketing and processing of fish into consumable products like smoked fish. Adetimileyin and Okunloa (2018) also reiterated that men perform more difficult farming operations than women and children who perform lighter operations.

It was further observed that fish farming in the study area was dominated by married fish farmers. This finding could be directly linked to the age distribution of the respondents, as all of them were above the age restriction of 18 years for marriage. Based on their marital status, the farmers may receive financial and non-financial assistance from their spouses to carry out some activities on the farm. This agrees with the findings of Shava and Gunhidzirai (2017), who claimed that couples and their children are involved in fish farming so as to enhance the higher productivity of the enterprise. From another perspective, marriage places responsibilities that must be met continually through increased income and improvement of productivity, which could imply that married fish farmers are more likely to diversify their credit sources in order to expand their business (Olaoye et al. 2016).

Education is important in every aspect of life and plays a vital role in aquaculture development as it enhances easy assimilation, awareness, and receptivity to innovations (Dambatta et al. 2016) which are needed for improving fish production. The results of this study indicated that almost all of the respondents had some formal education, with the majority possessing tertiary educational qualifications. With higher educational attainment, they are likely to patronize all available formal credit sources because they are expected to be aware of and comprehend the terms and conditions associated with their loans. This higher level of education may encourage active participation and acceptance of innovation that will enhance farm productivity and income. This is in line with the point of Abbas (2015), who stated that educated fish farmers have the capacity to learn new things within a short period of time.

Family size has an inverse relationship with the demand for hired laborers. The observation that fish farmers with household sizes of 1-5 persons are the predominant set of people involved in fish production in Ogun West Senatorial District could imply that fish farming enterprises heavily relied on hired labor sources. This has the tendency to increase production costs through higher labor costs, thereby making farmers demand loans. The outcome from this study is in agreement with other recent studies (Abbas 2015), which reported that farmers now keep smaller household sizes but contradicted some earlier studies (e.g., Fabusoro et al. 2007; Odetola et al. 2015) who reported that most African families have household sizes of 6-10 persons.

It was further deduced that, although a majority of the sample fish farmers either practiced Christianity or Islam, the three dominant religions in Nigeria are found among the fish farmers. This could imply that fish production was not associated with religious beliefs that prevented some people of a certain faith from producing them. This is in tandem with the position of Olaoye et al. (2018), who stated that some residents of Ogun State still retain their traditional ways of life despite the pronounced civilization in the state. The dominance of non-members of cooperative societies revealed in the current study was supported by Olaoye et al. (2017), who reported that the majority of fish farmers in the Abeokuta zone were not members of any cooperative society. Reasons for not joining cooperative societies could be that fish farmers' cooperative groups are generally not available within their respective communities, the untimely release of credit, as well as fish farmers' inability to fulfill the capital build-up required to apply for credit. Other reasons, according to Meador et al. (2016) include high membership fees, poor cooperative societies, and conflict within existing cooperative societies.

Ugwumba and Ugwumba (2003) noted that the choice of fish species and culture system are essential criteria to ensure a successful aquaculture venture. Monoculture was the most preferred culture practice among the sample fish farmers, probably due to the competitive and cannibalistic nature of some fish species. Findings indicated that African mudfish (Heterobranchus bidorsalis) and African catfish (Clarias gariepinus) were the most commonly cultured fish species among the sample fish farmers. In line with the findings of Abbas (2015), the possible

reasons for the choice of these species include their rapid growth rate, wide market acceptability, high market value, acceptability of artificial feed, tolerance to culture conditions, regular availability of fish seeds and high flesh-to-bone ratio. Cultured fish seeds were mostly sourced from either the commercial hatcheries or the farmers' own farms while very few got their fish seeds from government agencies. This could imply that the fish farmers obtained fish seeds from reputable sources. The results further proved that government agencies are not playing active roles in ensuring fish farmers' access to desired stock of fish seeds at different stages (Wagle et al. 2012).

The findings further indicated that the majority of the fish farmers stock fish seeds at the juvenile stage and that both imported and local feeds were used in feeding the fish seeds. This implies that the fish farmers were likely to operate more than one production cycle, considering their choice of juveniles for stocking. The findings on output from fish farms indicated that almost all of the sample fish farmers operated on the medium-scale level, and this is in agreement with the findings of Olaoye (2016), which regarded fish farms with an output of 1,000–1,500 kg as medium-scale aquaculture enterprises, and those with an output of less than 1,000 kg as small-scale producers of fish. Findings further indicated that despite the availability of local feeds, the fish farmers preferred the imported feeds, suggesting that the fish farmers mostly considered the local feeds only when the imported feeds were not available. This could also be attributed to better quality of the imported feeds over the local feeds. This, however, does not ensure sustainable fish production, which may be negatively affected due to the scarcity of imported feeds.

An adequate and constant water source is a vital criterion for optimal production of fish because fish need water to grow. Hence, water is an indispensable input in fish production through aquaculture. Boreholes and wells were the most commonly used water sources for fish production among fish farmers. This could be attributed to the seasonality of naturally occurring perennial water sources, such as rivers and streams, within the study area. Olaoye et al. (2017) also observed that borehole was the main source of water among fish farmers in Ogun State. Olaoye et al. (2018) reported that the majority of the fish farmers in Ogun State do not have access to perennial water sources. This could have a detrimental effect on fish farming within the District, especially among those who could not afford to dig a borehole or deep well. As much as water is important in aquaculture, access to land is also essential to the commercial production of fish because fish ponds cannot be installed in the air. The most common modes of land acquisition, as revealed in this study, were through purchase and lease/rent. Both have implications for sustainable fish production in the study area as fish farmers whose productive lands were acquired through lease/rent could be disengaged from the land as the landowners deem fit.

Fish farmers' access to different credit sources has implications for sustainable fish production and the improvement of fish farmers' well-being (Odetola et al. 2015). The findings from this study further indicated that just about two out of every three sample respondents had access to at least one formal credit source, implying that not all fish farmers have access to formal credit sources to run their fish farming businesses. Those who had no access to formal credit sources are likely to finance their fish farming business through informal credit sources, thereby explaining their subsistence level of operation. This is consistent with findings from previous studies (Baruwa et al. 2012; Abbas 2015; Olaoye et al. 2018) that most fish farmers heavily relied on informal credit sources such as personal savings and loans from friends and families.

It was further indicated that several fish farmers who have availed of credit access had accessed this from microfinance banks (MFBs) and community banks (CBs), while the cooperative societies (CSs) and community-based organizations (CBOs) were the least patronized formal credit sources among the fish farmers. The chief reason for the low patronage of cooperative societies and CBOs could be attributed to non-membership in those organizations. This contradicted Olaoye et al. (2016), who found that more than half of fish farmers in Lagos state sourced credit from cooperative societies. While stressing the roles of agricultural cooperative societies, Adefila and Madaki (2014) submitted that they engage in the production, processing, marketing, and distribution of agricultural products in addition to providing credit facilities to their members. Nnadozie et al. (2015) also noted that cooperatives have greatly contributed to agricultural development, such as fish farming, through the provision of cash, processing, and marketing of agricultural products, and group management.

Based on findings from this study, it was deduced that inadequate fish farm inputs, poor extension services, inadequate funding, and lack of access to modern fish production technologies were the most severe constraints to aquaculture development in Ogun West Senatorial District, Ogun State. This is in tandem with submissions of

Oluwatayo et al. (2008) and Edun et al. (2018), who asserted that insufficient accumulation of funds was one of the major constraints faced by fish farmers. A number of previous studies had also attributed poor fish production to similar constraints identified in this study. Oota (2012) revealed that an ineffective aquaculture extension system was among the problems of fish farming. Adewumi and Olaleye (2010) found that poor management skills, inadequate supply of good fry or fingerlings, lack of capital, and high cost of feed are among the constraints to catfish production. Gbigbi et al. (2019) also considered the high cost of inputs and inaccessibility to credit facilities, among others, as serious constraints to aquaculture business development in Nigeria. This implies that inadequate finance is crucial to the smooth running of the day-to-day activities of fish farms, as adequate finance could ensure better access to fish farm inputs and modern fish production technologies. Hence, inadequate finance is a reason why fish farmers could source for credit facilities.

The Wald statistics from the logistic regression analysis indicated that age contributed most to the prediction of fish farmers' access to formal credit sources. This was followed by educational level and membership in cooperative societies. The results further indicated that as the fish farmers' age increases, their likelihood of accessing formal credit sources increases by 1.224. That is, older fish farmers are more likely to have access to formal credit sources than the younger ones. Also, the odds of fish farmers accessing formal credit sources who were members of cooperative societies and had at least secondary education were about five times and six times higher than non-members and less educated fish farmers, respectively. Considering the computed probabilities, the results indicated that the probabilities that members of cooperative societies and those with at least secondary education have access to formal credit sources were 89% and 95%, respectively. By implication, fish farmers who are members of cooperative societies and have at least secondary education are more likely to access formal credit sources than others. The 2 log likelihood value also suggests a better fit of the logistic regression model to the data.

5. CONCLUSION

The study concludes that fish farming in Ogun West Senatorial District was dominated by persons who were within the working population, had tertiary education, and were non-members of cooperative societies. The fish farmers, who mostly operated at small and medium scales, practiced monoculture. The study deduces that not all fish farmers had access to credit from the different formal sources despite the reliability of the formal credit sources. The study finally concludes that age, membership in cooperative societies, and educational level were significant socio-demographic predictors of fish farmers' access to formal credit sources.

Based on the findings of this study, and in order to increase fish farmers' access to formal credit sources, the following recommendations are suggested:

1. Fish farmers are encouraged to join cooperative societies and actively participate in their activities to facilitate their access to credit from cooperative societies;
2. Fish farmers should be sensitized on financial literacy in order to educate them on the requirements and proposal development for different formal credit sources, such as microfinance banks, commercial banks, etc.; and
3. Extension agents should disseminate appropriate improved or modern fish production technologies to fish farmers. This is likely to facilitate their access to improved production technologies.

CONFLICTS OF INTEREST

We declare that, to the best of our knowledge, there is no conflict of interest with respect to the manuscript

ETHICS STATEMENT

The authors obtained informed consent from all participants for inclusion in the study. No animal or human studies were carried out by the authors.

AUTHORS' CONTRIBUTIONS

Olaoye OJ: Conceptualization, Methodology, Validation, Supervision. **Ojebiyi WG**: Formal analysis, Data curation, Writing- Review and editing, Visualization. **Adenika OF**: Resources, Investigation, Writing - Original draft, Project administration.

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