Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 21, Issue 3, 2021
PRINT ISSN 2284-7995, E-ISSN 2285-3952

AN ANALYSIS OF FISH FARMERS' MANAGEMENT PRACTICES AND INFORMATION NEEDS IN ADAMAWA STATE, NIGERIA

Amurtiya MICHAEL[1], Mark POLYCARP[1], Mark Kauna SANDA[2], Sarah Afusai DAVID[1]

[1]Adama University of Technology Yola, School of Agriculture and Agricultural Technology (SAAT), Department of Agricultural Economics and Extension, Moddibo PMB 2076, Yola, Nigeria, Phone: +2347063472148, +2348035827693, +2348060988948, Email: michaelamurtiya@yahoo.com, polymarkson@yahoo.com, sarahdavid8084@gmail.com
[2]Moddibo Adama University of Technology Yola, School of Agriculture and Agricultural Technology (SAAT), Department of Fisheries, PMB 2076, Yola, Nigeria, Phone: +2348031878552, Emails: mksnd127@gmail.com

Corresponding author: michaelamurtiya@yahoo.com

Abstract

This study analysed the management practices and information needs of fish farmers in Adamawa State, Nigeria. The study adopted a multistage sampling technique to collect primary data from 166 fish farmers. Descriptive statistics, Likert Scale, and Ordinary Least Square regression model were used to analyse the data collected. The findings of the study indicated that the prominent information sources among the farmers were the internet and acquaintances/friends. Similarly, the study established that the majority of the respondents need information on most aspects of fish farming and that the socio-economic characteristics of the farmers influence these information needs. Furthermore, high-cost of fish feed, lack/inadequacy of capital, lack of good/reliable market information, and poor breeds of fish were identified as the leading respondents' constraints in fish production. Based on the findings of the study, it was recommended that there is a dire need for the government and other agricultural development actors to employ and also motivate more agricultural extension agents in the area to enable the fish farmers to access them for information. The findings of this study will substantially contribute to aquaculture planning in the country so as to enhance gains from the sector.

Key words**:** *aquaculture, agricultural extension, fisheries*

INTRODUCTION

In Nigeria, the fishery sub-sector plays a very prominent role in the livelihoods of a large percentage of the nation's populace over the years [8; 16]. Available records have shown that the country has the largest market for fish and fish products in the whole of Africa, and it is ranked second in the region in terms of production of the commodity [2; 24]. Fish consumption accounts for over 40% of the protein sources consumed in the country. Currently, in terms of consumption per capita, the country holds the 68th position on the global ranking [20; 45]. Apart from the role of the sector in the provision of food, it creates employment opportunities for all classes of people regardless of their age and social status, hence, foreign exchange can hugely be generated from the sector as obtainable in other climes [38; 28; 50]. Traditionally, capture fisheries have been the most popular in the country, however, it is becoming hugely depleted owing to various climatic and social challenges [24; 40]. This has led to a huge deficit in both production and consumption [34; 31]. Generally, the country's average fish production in recent years is about 1.123 million Metric tons per annum, while the annual deficit is over 2 million metric tons [24]. Yet, an average of 221,412.6 metric tons annually has been the contribution of aquaculture to the overall production by an average of 13,215 fish farmers [13]. In monetary terms, the country over the years has been importing fish and other fish-related products to the tune of about USD 1,461 Million [43]. Similarly, the contribution of the sub-sector to the gross agricultural Gross Domestic Product (GDP) of the country has

been marginal (0.48%) [46]. This trend is also obtainable in some of the nation's neighbouring countries, particularly the republics of Benin and Cameroun [37; 19]. To adequately bridge the gap, there is a need for a sustainable increase in production. The African Union developed a policy framework and reform strategy for fisheries and aquaculture aimed at enhancing livelihoods by creating wealth from the sector through better governance [5; 22]. Specifically, the framework was aimed at creating awareness of the potentials and importance of the sector, especially for small-scale fisheries actors. In line with this regional effort to maximise gains from the fishery sector, attempts were made by the Nigerian government to reduce the effects of some of the factors limiting aquaculture development were contained conspicuously in the second phase of the National Development Plan [17; 30; 48]. Sequel to that, the Nigerian National Fisheries Policy was developed to increase domestic fish production from all sources on a sustainable and renewable basis to the level of self-sufficiency and fish export in the medium to long term [23]. The policy provided blueprints for the development and harnessing of the blue economy through fishery management for the sustainable production of fish to adequately satisfy the demand for ensuring food security and earning foreign exchange via international trade [13]. This will ensure that the gains made in other regions of the world, particularly in Asia (producing about half of the world's total capture fisheries production and about 90% of the world's aquaculture production) are replicated in Nigeria. Due to the proper implementation of fishery policies in those areas, farmed fish production has increased 12 times at an average annual growth of over 8% in the last three decades [28]. The inability of the nation's fishery sub-sector to adequately meet demands is attributed to the myriads of challenges affecting the sector caused by climatic, social, and economic factors. Prominent among these challenges was the inability to add value, low technical knowledge on the part of fish farmers, and the high cost of inputs [40]. Therefore, focus on these areas will substantially contribute to achieving productivity from the sector [25]. But, these challenges vary with location in the country. This is because the development of aquaculture in Nigeria is not evenly distributed as the growth rate and contribution are higher in the southern part of the country compared to the Northern parts [15]. The development in aquaculture is not only in output, but also the practices and operations which has cut across the chains of activities in the production, including culture practices, culture systems, water quality management, and feed types and feeding system. Similarly, there has been a consensus in the literature about the role of information access by fish farmers as a key challenge of the sector, thereby making the average fish farmer ill-equipped for successful and sustainable fish production [3; 30; 15; 47; 50]. Adamawa State is notable for both artisanal fishery and aquaculture which is conducted across various parts of the State [33; 21]. Inadequate access to information on innovations and technologies has limited the capacities of fish farmers to maximise gains from the venture [49]. This is because fisheries technology is continuously changing, hence, the need for farmers to access information sustainably. However, there is a paucity of literature on the management practices and information needs of the fish farmers in the area. Therefore, the main objective of this study was to analyse fish farmers' management practices and information needs in Adamawa State, Nigeria. Specifically, the study sought to describe fishers' socio-economic characteristics, assess the management practices being adopted by the farmers, determine the farmers' information needs, identify factors influencing the fish farmers' information needs and also identify constraints affecting fish farming in the study area.

MATERIALS AND METHODS

Description of the Study Area

Adamawa State is situated in the North-East geopolitical region of Nigeria. The area lies between Latitude 70◦ and 110◦N and between Longitude 11◦ and 140◦E and stretches over a

landmass of about 38,700 km^2. In terms of climate, the area has a tropical climate that is notable for having high temperatures and humidity as well as marked wet and dry seasons [1]. The mean annual rainfall of the State ranges between 197mm and 700mm along with the Southern and North-Western parts of the State. The State has an estimated population of more than four million people who mostly (about 80%) rely on agriculture for sustenance [21].

Data Collection and Analysis

The study's targeted population were fish farmers spread across the entirety of Adamawa State. A survey research design was adopted using both online and offline media. For the online data collection, a snowball sampling technique was used while the questionnaire's weblink was posted on Facebook, WhatsApp, Twitter, and LinkedIn. Similarly, snowball and convenience sampling techniques were used for the face-to-face method in which questionnaires self-administered. Data for the study were collected over a period of eight weeks (1 August to 30 September 2020). At the end of the data collection period, 166 fish farmers responded to the survey (42% online, and 58% face-to-face). The instrument for data collection being a semi-structured questionnaire covered various aspects of fish farming, especially the farmers' sociodemographic characteristics, routine management of the fish farm, feeding, biosecurity, information sources, and constraints. In analysing the data obtained from the study, both descriptive and inferential statistics were used. The socio-economic characteristics of the respondents were described using frequency distribution, means, and percentages. In the same vein, frequency distribution was used to assess management practices and identifying fish farming constraints among the respondents. Similarly, a three-point Likert scale was used to identify the information sources and also determine the information needs of the respondents. Responses of the respondents concerning the identified information sources in the area were coded from "3-1" based on the frequency of usage (3=Frequently, 2=Occasionally, 1=Not at all). Regarding the respondents' information needs, the responses were coded from "1-3" based on the level of information access (1=High, 2=Moderate, 3=Low). The decision rule is based on the mean score (2.0). Responses having scores below the mean were considered to be incorrect, while those with scores equal to or higher than the mean were considered to hold. The three-point Likert-scale model is shown as follows;

$$\bar{x} = \frac{\sum F}{Nr} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where:

$\bar{x}s$ = Mean Score

$\sum$ = Summation

F = Frequency of the Respondents

Nr = Number of respondents to the item

The decision rule is computed thus;

$$3 + 2 + 1 = \frac{6}{3} = 2.0$$

Equally, the ordinary least square (OLS) regression was used to assess the factors affecting the information needs of the respondents. The OLS model is specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots + \beta_9 X_9 + U \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where:

Y= Information need (mean score)

β_0 = Constant

X_1 = Age (years)

X_2 = Gender (Male=1: Female=0)

X_3 = Marital status (Married=1: Unmarried=0)

X_4 = Household Size (Number of people in the house)

X_5 = Educational Level (Number of years spent in school)

X_6 = Stock Size (Number of fish in ponds)

X_7 = Farming Experience (Years)

X_8 = Access to Credit (Yes=1: No= 0)

X_9 = Membership of Fish Farmers' Association (Yes=1: No= 0)

U= Error term

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of Fish Farmers

Table 1 present the socio-economic characteristics of fish farmers in the study area.

Table 1. Socio-Economic Characteristics of the Respondents

Variable	Frequency	Percentage	Mean
Gender			
Female	11	11.8	
Male	82	88.2	
Age			
<30	35	37.6	34.28
30-39	36	38.7	
40-49	10	10.8	
>49	12	12.9	
Marital Status			
Married	40	43.0	
Single	53	57.0	
Household Size			
1-5	15	16.1	7
6-10	58	62.4	
>10	20	21.5	
Level of Educational			
Primary school	5	5.4	
Secondary school	15	16.1	
Tertiary level	73	78.5	
Farming Experience			
1-5	10	10.8	6.5
6-10	52	55.9	
>10	31	33.3	
Stock Size of the farm			
<500	33	35.5	
500-999	11	11.8	
1,000-1,499	12	12.9	
1,500-1,999	16	17.2	
>1,999	21	22.6	
Number of Ponds in the farm			
1-5	56	60.2	5
6-10	25	26.9	
>10	12	12.9	
Number of Employees in the farm			
1-5	59	63.4	4
6-10	25	26.9	
>10	9	9.7	
Access to Credit			
No	73	78.5	
Yes	20	21.5	
Membership of fish farmers' association			
No	58	62.4	
Yes	35	37.6	

Source: Field Survey, 2020.

The distribution of the respondent by gender reveals that 88.2% were male, while 11.8% were female. In terms of age, the findings of the study show that 37.6% were less than 30 years, 38.7% were aged 30-39 years, 10.8% were within the age range of 40-49 years, while 12.9% were 49 years and above. Considering the mean age of the respondents (34.3 years), it can be deduced that majority were young people that can be economically active in fish production.

The respondents' household characteristics indicated that 57% were single while 43% were married. With respect to household size, the findings of the study revealed that households having 1-5 members were 16.1%, while households with 6-10 people and those with more than 10 people constituted 62.4% and 21.5% respectively. The average household size was 7 people, implying the availability of family labour for enhanced production. The respondents' educational attainment revealed that all the fish farmers were educated, the majority (78.5%) had tertiary education, while those with a primary and secondary level of education were 5.4% and 16.1% respectively. Similarly, the respondents' experience in fish farming showed that 10.8% had 1-5 years' experience, 55.9% have been farming for 6-10 years, while 33.3% were farming for more than 10 years. The study also assessed the characteristics of fish farmers. Findings of the study revealed that in terms of stock size, 35.5% had a stocking density of fewer than 500 fishes, while 11.8%, 12.9%, 17.2%, and 22.6% have a stocking density of 500-999, 1,000-1,499, 1,500-1,999, and those with more than 1,999 fishes respectively. Based on the farms' number of ponds, 60.2% had between 1-5 ponds, 26.9% had 6-10 ponds, while 12.9% had more than 10 ponds. The average number of ponds in the area was 5. The distribution of the respondents by the number of employees revealed that 63.4% had 1-5 employees, while 26.9% and 9.7% had 6-10 employees and more than 10 employees respectively. The respondents have 4 employees on average. Regarding the respondents' access to a credit facility, 78.5% lack access while 21.5% had access. Similarly, 62.4% were not members of the fish farmers association, while 37.6% were members. Fish farmer's socio-economic characteristics are key determinants of information access and the profitability of fish farms [39]. In this study, persons of the male gender constitute the majority of farmers, and they are mostly educated. This finding lends credence to the submissions of [2] and [42]

who reported similar trends in Kwara and Osun States of Nigeria. This implies that fish farming is mostly considered an elitist trade since the bulk of the farmers are educated persons as compared to other forms of animal farming. Hence, the need to encourage people with every level of formal education to participate in fish farming. This can be achieved if fish farming information is relayed to farmers to stir interest in the trade. As revealed by this study also, fish farmers in the area do not have access to agricultural extension agents as they should. This has serious implications for how profitable such ventures could be. This is because [7] established that there is a positive relationship between farmers' access to extension services and their profitability. This outcome is expected since agricultural extension agents access trusted information from reliable sources that farmers can adopt without hesitation.

Management Practices

Table 2 presents the management practices being adopted by the respondents to manage their fish ponds. Findings of the study on pond management indicated that 5.4% use collapsible mobile fish ponds, 35.5% use concrete ponds, while those having earthen ponds and liner were 26.8% and 32.3% respectively. The distribution of the respondents by type/species of fish under cultivation revealed that 76.2% were into catfish production, while 23.8% cultivate tilapia. Similarly, water in the farms is sourced mostly (78.5%) from boreholes, followed by wells (10.8%), and then reservoirs and roof catchment for rain (5.4% each). The study further revealed that visual evaluation is the most widely (62.4%) adopted method of testing water quality among the respondents, while 37.6% use test kits. The frequency of changing the water in the ponds was also assessed, and the result indicated that 10.8% change water daily, 30.1% do it once a week, 43% carry out the activity twice a week, while those that do it thrice a week were 16.1%. In terms of fishery production systems of the farms, 43% adopted the grow-out system only, while 57% were practicing hatchery and grow-out systems. The findings of the study also discovered that 78.5% of the respondents sourced their fingerlings from a commercial hatchery, while 21.5% used their hatcheries.

Table 2. Respondents' Fish Pond Management Practices

Variable	Frequency	Percentage
Pond Type		
Collapsible Mobile fish pond	9	5.4
Concrete	59	35.5
Earthen	44	26.8
Liner	54	32.3
Fish type/Specie		
Catfish	126	76.2
Tilapia	40	23.8
Source of Water		
Borehole	130	78.5
Reservoirs	9	5.4
Roof catchment for rain	9	5.4
Wells	18	10.8
Method of Testing Water Quality		
Test kits	62	37.6
Visual evaluation	104	62.4
Frequency of Changing Water		
Daily	18	10.8
Once a week	50	30.1
Twice a week	71	43.0
Thrice a week	27	16.1
Fish Production System		
Grow out	71	43.0
Hatchery and grow out	95	57.0
Sources of Fingerlings		
Commercial hatchery	130	78.5
Personal hatchery	36	21.5
Type of Aquaculture System		
Cage culture	71	43.0
Flow-through system	50	30.1
Pond	9	5.4
Recirculating Aquaculture system	36	21.5
Ability to Formulate Feed		
No	104	62.4
Yes	62	37.6
Types of Feed		
Animal offal	54	32.3
Food waste	9	5.4
Pellet	104	62.4
Type of Pellets		
Imported floating pellet	86	51.6
Local floating pellet	63	37.7
Sinking pellet	18	10.8
Feeding Method		
Broadcasting	89	53.8
Point	77	46.2

Source: Field survey, 2020.

The distribution of the type of aquaculture system being used in the farms revealed that 43% were into cage culture, while those practicing the flow-through system, pond, and

recirculating aquaculture system were 30.1%, 5.4%, and 21.5% respectively.

Feed constitutes a large portion of the production costs of fish farms. The feeding methods being adopted by the farmers as shown in Table 1, and indicated that the majority (53.8%) broadcast, while 46.2% use the point feeding method. The distribution of the respondents' most widely served feed revealed that 62.4% offer pellets, 32.3% serve animal offal, while 5.4% rely on food waste. Similarly, the result showed that the imported floating pellet was the most (51.6%) widely used type of pellet being used, followed by the local floating pellet (37.7%), and then the sinking pellet (10.8%). The study also assessed the respondents' ability to formulate feeds, findings revealed that 62.4% cannot formulate ration, while 37.6% have the ability.

Fish Farm Biosecurity Measures

The ability to prevent or manage diseases in the fish is to a large extent dependent on the biosecurity measures the farmer adopts. Figure 1 assessed some of the farmers' management practices. Findings of the study show that 67.7% of the farmers regularly sample/sort fish on the farm and that 89.2% can recognise disease symptoms, while78.5% are knowledgeable in disease control and prevention. In the same vein, 67.7% can select broodstock, and that 51.6% know how to use pesticides on the farm to manage pests.

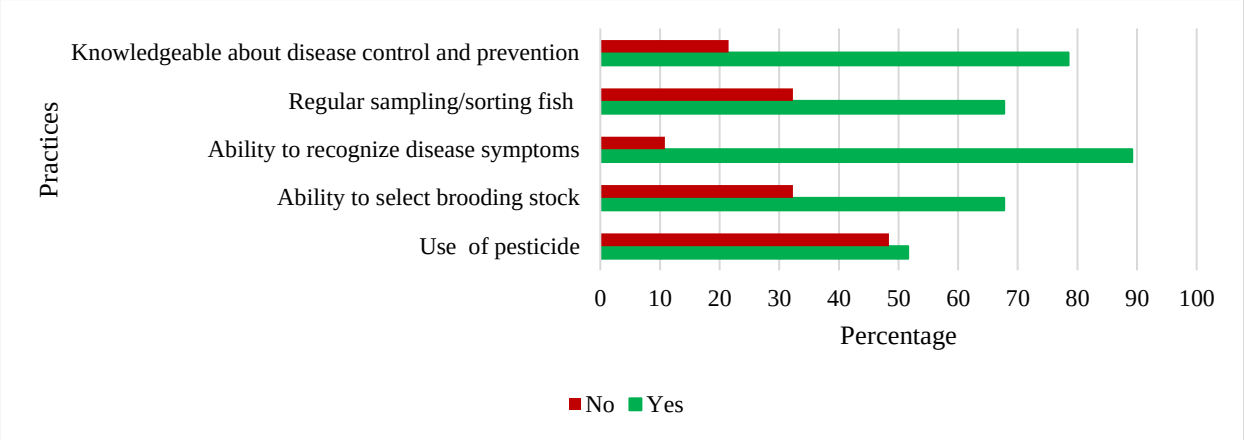

Fig. 1. Some Fish Farm Biosecurity Measures

Fish Value Addition

For fish farmers to maximise gains, there is the need for value addition on the produce. In this study, Table 3 presents some value addition practices the farmers use in the study area. Findings of the study showed that most (64.9%) of the respondents add value by keeping the harvested fish in cold-room/ refrigeration, while others use basins/ holding tanks (19.4%), sales directly (5.4%) to consumers, or smoke (10.8%) the produce.

Table 3. Fish Value Addition Strategies

Method	Frequency	Percentage
Basins/ Holding tank	32	19.4
Cold-room/ Refrigeration	108	64.9
Sale directly	9	5.4
Smoke	17	10.3

Source: Field Survey, 2020.

Information Sources

Modern techniques of raising fish are normally passed to fish farmers through agricultural extension services that are saddled with the responsibility of disseminating new agricultural innovations and technologies that farmers are expected to adopt. Table 4 presents the distribution of the respondents' information sources. The findings of the study revealed that the main information sources of the respondents were the internet (85%), acquaintances/friends (75%), religious bodies (52.5%), agricultural extension agents (40%), and fish farmers' association (37.6%). Other sources included radio (37.5%), television (25%), and family members (12.5%) among others. This suggests that the majority of the respondents hardly rely on the mass media (both electronic

and print) or agricultural extension agents for agricultural information. In this study fish farmers rely heavily on the internet and acquaintances/friends for information on fish farming activities. This has a negative implication on the quality and relevance of the information the respondents can access [44]. This finding conforms to the submission of [18] who reported the inadequacy of agricultural extension agents in Nigeria which has encouraged farmers to rely on other alternatives affordable to them. The implication of this as stated by [42] is that the government and all other stakeholders in the aquaculture sector should focus more attention on the usage of these identified sources of information when making efforts in capacity building and extension of information among the fish farmers. However, the finding of this study is contrary to that of [11] who revealed that agricultural extension agents play a significant role in disseminating information to fish farmers across Uganda.

Table 4. Respondents' Information Sources

Variable	Frequency	Percentage *
Family members	21	12.5
Acquaintances/friends	125	75.0
Traditional leaders	21	12.5
Extension Agents	66	40.0
Internet	141	85.0
Radio	62	37.5
Television	42	25.0
Magazines and Newspapers	21	12.5
Religious bodies	87	52.5
Fish farmers' association	62	37.6

Source: Field survey, 2020. *Multiple Responses.

Information Needs

This study also determined the fish farmers' information needs, and the result is presented in Table 5. The findings of the study disclosed that the respondents require information on enterprise combination, site selection for housing, pond construction, and transportation of fingerlings. Similarly, information on stocking operations, hormones identification, selection of broodstocks, and fish breeding are also needed by the respondents. In the same vein, the farmers need information regarding water treatment, feed formulation, preservation/processing techniques, weeding, and environmental sanitation. Other information needs of the respondents were on-farm keeping records and accounts, sourcing of formal credit, membership of fish farmers association, and the marketing of produce. The provision of this information will substantially influence farmers' performance.

It is expected that fish farmers adopt certain management practices to efficiently manage the business [10]. The efficiency with which these management practices are adopted by the farmers depends on the quality of information they were able to access. When highly relevant information is accessed, it can likely trigger high productivity on the farm [6]. As shown by the result obtained in this study, there is a need for the respondents to access information across all aspects of managing the fish farm. According to [9], proper management of the fish farm using improved technologies can substantially boost production which has a bearing on the farmers' income earnings. One area that should be emphasised is the issue of value addition by the farmers. As opined by [25] fishers and fish farmers can increase their income by enhancing the quality of their output through proper post-harvest handling. Hence, there is a need for farmers to be encouraged to add value to their produce.

Table 5. Distribution of Respondents' Information Needs

Variable	Mean	St. Dev.
Enterprise Combination	2.65	0.65
Site selection for housing	2.39	0.61
Pond construction	2.52	0.50
Transportation of fingerlings	2.41	0.67
Stocking operations	2.68	0.47
Hormones identification	2.52	0.61
Selection of broodstocks	2.52	0.50
Fish breeding (Fertilization)	2.52	0.60
Disease control	1.42	0.67
Water treatment	2.41	0.67
Liming	1.41	0.66
Feed formulation	2.11	0.56
Preservation/processing techniques	2.35	0.67
Weeding	2.30	0.65
Environmental Sanitation	2.41	0.75
Keeping Records and Accounts	2.41	0.68
Sourcing of formal credit	2.35	0.74
Being a good member of the fish farmers association	2.11	0.65
Marketing of produce	2.65	0.74
Farm security	2.41	0.65

Source: Field survey, 2020.

Factors Influencing Information Needs

The result of the ordinary least square regression analysis used in identifying the factors influencing the information needs of the fish farmers is presented in Table 6. The model's coefficient of determination (R^2) was 0.67, implying that about 67% variability in the dependent variable was accounted for by the independent variables used in the model. Similarly, the model had a good fit on the overall considering the F-value (35.98) that was statistically significant at 1% (p-value =0.0000). Equally, in order to ensure that all the basic assumptions of Ordinary Least Square (OLS) regression were upheld, several diagnostic tests were conducted and the result showed that none of the assumptions were violated in any way, hence the model was used. Based on the result, fish farmers' need for information is negatively related to their age, marital status, household size, educational attainment, and access to credit. Similarly, gender, stock size, and farming experience positively influence the information needs of the respondents at various levels of significance. This result implies that the respondents' information needs declines with an increase in age and vice versa. Based on the finding, as the farmer becomes older, the need for information reduces. This may be attributed to a decline in economic productivity with a decline in age. In the same vein, an increase in household size reduces the information needs of the farmer and vice versa. This can be attributed to the fact that having a large number of people in the household (particularly adults) widens the social capital base, and increases access to information. The study further indicated that respondents having access to credit have limited information needs and vice versa. The likely explanation for this is the fact that the majority of the respondents rely on the internet for information, and having access to credit increases resources at the disposal of farmers to source for information, thereby reducing their deficiency in information access. This study also indicated that the information needs of the farmers are positively influenced by gender, stock size, and farming experience. This implies that the need for information increases with being a male compared to a female. Similarly, having a large stock size increases the need for information among the respondents. This is as expected since having a large stock size entails a huge investment that requires proper management. In the same vein, an increase in farming experience is also positively related to the information needs of the fish farmers. This implies that an increase in fish farming experience increases the need for information and vice versa.

Access to information generally depends on the person's socioeconomic status and location [4; 14; 26]. This study outlined that deficiency in information access concerning fish farming is directly linked with the farmers' age, household size, and the ability to access the credit facilities. This finding implies that respondents' information needs decline with an increase in these variables. Coversely also, gender, stock size, and farming experience positively influence the information needs of the respondents at various levels of significance. This result implies that the respondents' information needs declines with an increase in age and vice versa. This finding is supported by the submissions of [36] and [12] who also revealed that farmers' need for information can be influenced positively or negatively by farmers' socioeconomic characteristics, particularly education, age, and farming experience. They established a strong negative relationship between the level of education and information needs. They suggested that less educated farmers have a higher need for agricultural information than educated ones. This is probably because educated farmers can have the ability and the chance to search and consult different information sources compared to less educated and hence their information needs may differ in such aspects. Similarly, in conformity with the finding of this study age was negatively associated with farmer's information needs. The likely explanation for this was the likelihood that younger farmers can be less experienced in farming when compared to experienced adult farmers who may have limited information needs. The study further indicated that

respondents having access to credit have limited information needs and vice versa. This is since the majority of the respondents rely on the internet for information, and having access to credit increases resources at the disposal of farmers to source for information, thereby reducing their deficiency in information access.

Table 6. Factors Influencing Information Needs of Fish Farmers

Variable	Coefficient	Std. Error	Z-statistic	Prob.
Age(X_1)	-0.008	0.003	-2.931 * *	0.004
Gender(X_2)	0.429	0.079	5.438 * * *	0.000
Marital Status (X_3)	-0.338	0.081	-4.200 * * *	0.000
Household size (X_4)	-0.042	0.007	-6.325 * * *	0.000
Educational Level (X_5)	-0.022	0.010	-2.196 * *	0.030
Stock Size (X_6)	0.227	0.031	7.420 * * *	0.000
Farming Experience (X_7)	0.022	0.006	3.874 * * *	0.000
Access to Credit (X_8)	-0.121	0.065	-1.861 *	0.065
Membership of Association (X_9)	-0.010	0.056	-0.177	0.860
Constant	2.288	0.173	13.256	0.000

Source: SPSS Output.

*, **, *** Significant at 10%, 5% and 1%, respectively.

Fishery Constraints

Fish farmers in the study are faced with a wide range of constraints as shown in Table 7, prominent among these constraints were; high-cost fish feed (100%), lack/inadequacy of capital (78.5%), lack of good/reliable market information (78.5%), and poor breeds of fish (73.1%). Other challenges include the incidence of disease/pest (67.7%), scarcity of good water/ poor quality in farm area (67.7%), poor policies and political will by the government (67.7%), and low demand leading to the low price of fish (64.5%). In the same vein, the respondents reported that inadequate extension or advisory services (64.5%high cost of drugs and vaccines (59.1%), lack of readily available market for fish (57%), high cost of processing (48.4%), insecurity due to theft (48.4%), and the high cost of electricity (46.2%). The interplay of these constraints limits the ability of farmers to maximise gains from the venture. Hence, the need to eliminate or minimise the effects of these constraints through the adoption measures that will enhance fish farmers' access to resources, especially capital and relevant agricultural information.

In this study, high-cost fish feed and lack/inadequacy of capital were the most prominent challenges of fish farmers in the study area. The inability of the farmers to generate reasonable capital can limit their ability to maximise gains from the enterprise. This can be attributed to the ineffectual implementation of the fishery policy over the years. These issues are also challenges in Benin Republic where the Fisheries and Aquaculture Department has been starved of funds leading to its overdependence on foreign aids to develop the sector [19]. Similarly, the farmers have limited availability and access to good quality feeds. In the Cameroun Republic, inadequate financing and inadequate quality of feed were prominent barriers to fish production in the country [35]. Therefore, improving aquaculture in Nigeria will contribute to improving the wellbeing of its immediate neigbouring countries. But, achieving this will require strong political will to implement the policies and programs designed to enhance the performance of fish farmers. In most countries, aquaculture developed because entrepreneurs were able to benefit from favourable policies of the government [27]. Therefore, the proper implementation of such policies will enable fish farmers to surmount the challenges of the sector [21]. According to [29] and [32], the implementation of relevant fishery policies has made South-East Asian countries be leading nations in both aquaculture and capture fisheries. Examples

of such initiatives were the establishment of brood banks and seed certifications, and also the promotion of farm-made feeds using local ingredients to minimize costs of production in the region. In other instances, a reasonable number of aquaculture extension workers employed and stationed at district offices to disseminate information and send feedbacks to the Fisheries Departments for further actions. Such an initiative can substantially contribute to mitigating some of the challenges identified by fish farmers in this study and unleash the unexhausted potentials of the sector to the nation's economy. Studies in recent years have established that fish farming is the fastest-growing animal-based food production sector in Nigeria [41; 8; 15].

Table 7. Distribution of Fishery Constraints

Variable	Frequency	Percentage*
Lack of/inadequacy of capital	130	78.5
High-cost fish feed	166	100.0
Poor breeds of fish	121	73.1
Incidence of disease/pest	112	67.7
The high cost of electricity	77	46.2
Scarcity of good water/ poor quality in the farm area	112	67.7
Lack of readily available market for fish	95	57.0
Low demand leading to the low price of fish	107	64.5
The high cost of processing	80	48.4
Lack of good/reliable market information	130	78.5
The high cost of drugs and vaccines	98	59.1
Extreme weather condition	80	48.4
Inadequate extension or advisory services	107	64.5
Poor policy and political will by the government	112	67.7
Insecurity due to theft	80	48.4

Source: Field survey, 2020.
*Multiple Responses

CONCLUSIONS

This study has outlined the need to improve information access by fish farmers to adopt management practices that can enhance their productivity. Having a thorough understanding of the fish farmers' management practices and information sources/needs should be critical considerations in the planning and delivery of aquaculture extension services. Based on the findings of the study, it can be deduced that fish farmers in the study area do not rely on agricultural extension agents or the mass media for information. Rather, the internet and friends/acquaintances were prominent sources. Similarly, the study established that the majority of the respondents need information on most aspects of fish farming and that these information needs are influenced by the farmers' socio-economic characteristics. Furthermore, the high cost of fish feed, lack/inadequacy of capital, lack of good/reliable market information, and poor breeds of fish were identified as the leading constraints of the fish farmers in the study area. Based on the findings of the study, the following recommendations were made:
(i)Efforts should be made to avail fish farmers of relevant fish farming information on the internet and also receive feedback in good time. This will require upgrading facilities at agricultural extension departments by adequate budgetary provisions and ensuring implementation.
(ii)Similarly, dedicated aquaculture extension service agents should be employed and trained for each agricultural extension block to improve face-to-face contact between the agents and the farmers.
(iii)Fish farmers should be encouraged through agricultural extension agents to join farmers' associations to enhance their access to relevant agricultural information and resources. The associations would also be a means of fostering social relations among fish farmers and improve the current ad hoc and unplanned farmer-to-farmer extension.
(iv)The government and other actors in the agricultural sector should assist farmers by easing their access to credit facilities which can enable them to adopt a wide range of fish production technologies.

REFERENCES

[1]Adamawa State Government. 2016, About Adamawa State. www.adamawastate.gov.ng, Accessed on August 8, 2020.

[2]Adefalu, L., Olorunfemi, O. D., Aderinoye-Abdulwahab, S., 2013, Information Needs of Fish Farmers in Ilorin Metropolis, Kwara State, Nigeria. Nigerian Journal of Agriculture, Food and Environment, 9 (2): 1–5.

[3]Adereti, F. O., Fapojuwo, O. E., Onasanya, A. S., 2006, Information Utilization on Cocoa production Techniques by Farmers in Oluyole Local Government area of Oyo State, Nigeria. European J. Soc. Sci., 3(1): 1-7.

[4]Adesoji, S. A., Kerere, F. O., 2013, Assessment of the knowledge level of fishers and fish farmers in Lagos State, Nigeria. International Journal of Knowledge, Innovation and Entrepreneurship, 1(1– 2): 41–56.

[5]African Union Commission- New Partnership for Africa's Development, 2014, The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa. pp.1-62.

[6]Agbamu, J.U., 2006, Essentials of Agriculture Communication in Nigeria. Lagos Malthouse Press. Ltd.

[7]Agbebi, F. O., 2012, Assessment of the Impact of Extension Services on Fish Farming in Ekiti State, Nigeria. Asian Journal of Agriculture and Rural Development, 2(1): 62-68.

[8]Allen, K., Rachmi, A.F., Cai, J., 2017, Nigeria: faster aquaculture growth needed to bridge fish demand–supply gap. FAO Aquaculture Newsletter, 57, 36–37.

[9]Amusat, A. S., Oyedokun, M. O., 2018, Media use pattern of fish farmers in Oluyole Local Government Area, Oyo State, Nigeria. International Journal of Advance Agricultural Research, 6: 47–54.

[10]Aphunu, A., Agwu, A. E., 2014, Adoption of Improved Aquaculture Management Practices by Cluster Fish Farmers in Delta State, Nigeria. Journal of Agricultural Extension, 18(2): 37–43.

[11]Atukunda, G, State, A. E., Molnar, J., Atekyereza, P., 2018, Aquaculture Development and Uganda's Agricultural Extension System: The Case of Fish Farmers in Central and Northern Regions. J Fish Aqua Dev: JFAD-137. https://doi.org/10.29011/2577-1493. 100037, Accessed on August 8, 2020.

[12]Benard, R., Dulle, F. W., Hieromin, L. A., 2018, Information needs and accessibility by fish farmers in the southern highlands of Tanzania. Global Knowledge, Memory and Communication, https://doi.org/10.1108/GKMC-08-2017-0070, August 8, 2020.

[13]Chinonyerem, N. T., Uzoma, O. C., Okechukwu, A. J., Ndikom, O. C., 2020, Gap analysis evaluation of Nigeria's fish demand and production: Empirical evidences for investment in and policy development for offshore mariculture practices. International Journal of Fisheries and Aquatic Studies, 8(3): 384-394.

[14] Curtis, G., 2013, Business Information Systems: Analysis, Design, and Practice (3rd Ed.). Addison Wesley.

[15]Dauda, A. B., Ibrahim, H. I., Bichi, A. H., Tola-Fabunmi, A. S., 2017, Assessment of Fish Farming Practices, Operations, Water Resource Assessment of Fish Farming Practices, Operations, Water Resource Management and Profitability in Katsina State, Nigeria. Journal of Northeast Agricultural University, 24(4): 89–96.

[16]Digun-Aweto, O., Oladele, A. H., 2017, Constraints to adoption of improved hatchery management practices among catfish farmers in Lagos State. Journal of Central European Agriculture, 18(4): 841–850. https://doi.org/10.5513/JCEA01/18.4.1965, August 8, 2020.

[17]Ezenwa, B., 1994, Aquaculture development and research in Nigeria: In aquaculture development and research in Sub-Saharan Africa, National Reviews. CIFA Technical paper, 223 supl. FAO, Rome. Pp 45-79.

[18]Falola, A., Banjoko, I.K., Ukpebor, P.O., 2012, Willingness-to-pay for agricultural extension services by fish farmers in Nigeria: A case study of Kwara State, Nigeria. J. Sustain. Dev. Afr., 14(5): 197 – 207.

[19]FAO, 2018, Fishery and Aquaculture Country Profiles; The Republic of Benin. FAO Fisheries and Aquaculture Department, Rome, Italy.

[20]FAO, 2019, Fishery and Aquaculture Country Profiles; The Republic of Cameron. FAO Fisheries and Aquaculture Department, Rome, Italy.

[21]FAO and ICRISAT, 2019, Climate-Smart Agriculture in the Adamawa State of Nigeria. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); Food and Agriculture Organization of the United Nations (FAO). Rome, Italy.

[22]FAO, 2015, Regional Review on Status and Trends in Aquaculture Development in Sub-Saharan Africa. FAO Fisheries and Aquaculture Circular.

[23]Federal Department of Fisheries (2007): Fishery Statistics of Nigeria for 2006. Abuja: Abuja Federal Department of Fisheries, Federal Ministry of Agriculture and Water Resources.

[24]Food and Agriculture Organization, 2014, The state of world fisheries and aquaculture. http://www.fao.org/3/a-i3720e/i3720e01.pdf, Accessed on 20th August 2020.

[25]Hall, S. J., Delaporte, A., Phillips, M. J., Beveridge, M., O'Keefe, M., 2011, Blue Frontiers: Managing the Environmental Costs of Aquaculture. Penang, Malaysia: WorldFish Center.

[26]Haruna, M. A., Obaroh, I. O., Yahaya, A., Muhd, I. U., 2015, Access of fisheries information to fish farmers in Hadejia, north western Nigeria. European

Journal of Physical and Agricultural Sciences, 3, 2, 49–53.

[27]Hishamunda, N., Bueno, P.B., Ridler, N., Yap, W.G. (2009): Analysis of aquaculture development in Southeast Asia: a policy perspective. FAO Fisheries and Aquaculture Technical Paper. No. 509. Rome, FAO. 69p.

[28]HLPE, 2014, Sustainable fisheries and aquaculture for food security and nutrition. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.

[29]Hossain, M.A.R., Shrestha, R.B., 2019, Fisheries in South Asia: Trends, Challenges and Policy Implication. Đp. 332-346. In: Shrestha et al. (eds.) Agricultural Policy and Program Framework: Priority Areas for Research & Ýevelopment in South Asia. SAARC Agriculture Center, Dhaka, Bangladesh, and Asia-Pacific Association of Úgricultural Research Institutions (APAARI), Bangkok, Thailand.

[30]Ibeun, M.O., 2006, Information for Fisheries Management in Nigeria: The Role of Libraries and Networking. In Anderson, K.L. & C. Thiery (eds.). 2006. Information for Responsible Fisheries: Libraries as Mediators: proceedings of the 31st Annual Conference: Rome, Italy, October 10 – 14, 2005. Fort Pierce, FL: International Association of Aquatic and Marine Science Libraries and Information Centers.

[31]Ijatuyi, E. J., Abiolu, O. A., Olaniyi, O. A., 2016, Information Needs of Fish Farmers in Osun-State, Nigeria. J Hum Ecol, 56(3): 309–317. https://doi.org/10.1080/09709274.2016.11907068, Accessed on August 20, 2020.

[32]Komatsu, M., 2013, Special Study on Sustainable Fisheries Management and International Trade in the Southeast Asia and Pacific Region. ADBI Working Paper 438. Tokyo: Asian Development Bank Institute. http://www.adbi.org/working-paper/2013/10/16/5913.sustainable.fisheries.mngt.international.trade/, Accessed on August 20, 2020.

[33]Linus, B. G., Amos, S. O., Michael, E. T., Kesonga, G., 2014, Fishing communities and fishing as livelihoods in Adamawa state. Direct Research Journal of Agriculture and Food Science (DRJAFS), 2(Dec.): 195–204.

[34]Mgbakor, M.N., Ochiaka, C.D., Ugwu, J.N., Okorie, A., 2014, Contributions of fish farming to poverty alleviation in Nigeria. International Journal of Agricultural Science and Veterinary Medicine, 2(4): 75-82.

[35]Mkong, C. J., Molua, E. L., Mvodo, S., 2018, Determinants of Profitability of Fish Farming in Cameroon. Agriculture, Forestry and Fisheries, 7(3): 89-93. https://doi.org/10.11648/j.aff.20180703.14, Accessed on August 20, 2020.

[36] Moagi, T.M. and Oladele, O.I. (2012): Analysis of information needs among land redistribution for agricultural development beneficiaries in Waterberg district, Limpopo Province, South Africa. Journal of Human Ecology, 39(2), 95-101.

[37]Ndah, H. T., Knierim, A., Ndambi, O. A., 2011, Fish Pond Aquaculture in Cameroon: A Field Survey of Determinants for Farmers' Adoption Behaviour. The Journal of Agricultural Education and Extension, 17(4): 309-323.

[38]Neiland, A.E., Madakan, E., Béné, C., 2005, Traditional management systems, poverty and change in the arid zone fisheries of northern Nigeria. Journal of Agrarian Change, 5: 117–148.

[39]Ofuoku, A. U., Emah, G. N., Itedjere, B. E., 2008, Information Utilization among Rural Fish Farmers in Central Agricultural Zone of Delta State, Nigeria. World Journal of Agricultural Sciences, 4(5): 558–564.

[40]Ogunmefun, S. O., 2018, Technical efficiency of pond fish production in Lagos State, Nigeria. MOJ Food Process Technol., 6(1): 104–111. https://doi.org/10.15406/mojfpt.2018.06.00152, Accessed on August 20, 2020.

[41]Olaoye, O. J., Ashley-Dejo, S. S., Fakoya, E. O., Ikeweinwe, N. B., Alegbeleye, W. O., Ashaolu, F.O., Adelaja, O. A., 2013, Assessment of Socio-Economic Analysis of Fish Farming in Oyo State, Nigeria. Global Journal of Science Frontier Research Agriculture and Veterinary, 13(9): 24-39.

[42]Olorunfemi, O.D., Adekunle, O. A., Oladipo, F. O., Oladele, T. O., Oladele, J. I., 2017, Training needs of fish farmers on value addition initiatives in Kwara State, Nigeria. Sarhad Journal of Agriculture, 33(1): 14-21. DOI | http://dx.doi.org/10.17582/journal.sja/2017.33.1.14.21, Accessed on August 20, 2020.

[43]Price Water House Coopers Limited. (2017). Transforming Nigeria's Agricultural Value Chain; A case study of the Cocoa and Dairy industries.

[44]Richard, W., Malcolm, B., Randall, B., Sarah, C., Nuttapon, C., Sadasivam, K., Michael, P., 2014, Improving Productivity and Environmental Performance of Aquaculture. WorldFish, World Bank, 60.

[45]The Embassy of the Kingdom of the Netherlands. 2019, Aquaculture in Nigeria Fact Sheet. www.nigeria.nlembassy.org, Accessed on August 20, 2020.

[46]Thompson, O. A., Mafimisebi, T. E., 2014, Fisheries and Aquaculture Profitability of Selected Ventures in Catfish Aquaculture in Ondo State, Nigeria. Fisheries and Aquaculture Journal, 5(2): 1–7.

[47]Udo, O. M., Akinbile, L.A., Chinkata, S. I., 2017, Management Information Needs of Fish Farmers in Egbeda Local Government Area of Oyo State. Annual Conference of the Agricultural Extension Society of Nigeria, 139–150. https://doi.org/https://dx.doi.org/10.4314/jae.v22i1.15S, Accessed on August 20, 2020.

[48]Worldfish, 2018, WorldFish Nigeria Strategy: 2018-2022. Penang, Malaysia: WorldFish. Strategy: 2018-09.
[49]Yeasmin, M. S., Hoque, M. J., Rahman, M. Z., 2013, Training Needs of the Fish Farmers on Integrated Fish Farming. Progress. Agric., 24 (1 & 2): 181–189.
[50]Zittawuyep, S., Rampedi, S. T., 2018, Fish Farming Nigeria: Contributions towards Employment Opportunities, Income Contributions ds Employment Opportunities, for Income towards Employment Poverty Alleviation for Improved Livelihoods Generation, and Poverty Alleviation for Livelihoods. *Agriculture*, 8 (110): 1–16. https://doi.org/10.3390/agriculture8070110, Accessed on August 20, 2020.