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FUNCTIONALITY OF AQUACULTURAL TECHNIQUES IN DELTA STATE, NIGERIA: ADOPTION APPROACHES

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Abstract: Appropriate adoption techniques in aquaculture contribute to food security. The study appraised the functionality of aquacultural techniques in Oshimili South Local Government Area of Delta State, Nigeria using adoption approaches. The objectives were to ascertain the level of adoption management techniques, examine the pond types of adoption, assess fish farmers' technological needs and identify constraints affecting adoption. A quota sampling technique was used to select respondents to acquire a sample size of 82 who were administered with questionnaire to elicit information. Data obtained were analyzed statistically. Results revealed that respondents were male (83%) with mean age of 44 years, mean household size 5 persons, married (65%) and had mean farming experience of 7 years. Majority (92%) had annual extension visit. Majority (78%) adopted earthen pond management techniques with high adoption score = 5.4. Again, majority (88%) adopted earthen pond over plastic (79%), concrete (71%) and wooden pond (59%). Majority (90.2%) indicated that integrated techniques were their prioritized need and respondents (80.5%) pointed out that high feed cost was their most serious constraint (mean = 3.06). It was concluded that there was a high adoption rate of aquacultural techniques in the study area. It is recommended that extension visits should be monthly and training on integrated techniques, feed formulation among others is needed.

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1. Introduction

Aquaculture in Nigeria enables man to culture his desired fish species. Other advantages of aquaculture include the utilization of vast available untapped land and water resources that abound in swamps and burrow pits, reduction of pressure on fishing in natural waters, ease of getting fish from a pond relative to catching fish from the river, obtain healthier fish relatively free of pesticides and additional harmful toxicants, and the control of fish growth through supplementary feeding (Agbamu and Orhorhoro, 2007)

The economic status, age, scale of production, education level, cosmopolitans and socio-cultural situation of farmers are possible factors that could affect adoption of innovations. The rate of adoption of innovations differs greatly according to place and circumstances of farmers (FAO, 2011). Water management plays a vital role in fish farming. To help the fish farmer better understand the properties of water as they affect fish culture. These properties include: physical characteristics of water, water balance in fish, sources of water, water quality, water physical and factors and chemical factors (Singh, 2007).

Following the dissemination of information on assistance to aquaculture technologies by the Delta State Agricultural and Rural Development Agency (DARDA) over a decade ago, through farm inputs and assets supports, the provision of loans for aquaculture development in Delta State and the activities of non-governmental organizations on fisheries extension which have created awareness on aquaculture technologies, it has become necessary to examine the level of adoption of aquaculture management techniques in the state (MANR, 2017).

There are needs to assess the functionality and success of the existing aquaculture business whether Nigerians are satisfied with the currently available or usable techniques. If farmers seem satisfied with their own technique, then there is need to evaluate their annual yield in relation to technological inputs. If maximum productivity is not attained then there is need for a change and this change will have to go with the farmers' willingness to adopt the technology brought before them (Donye et al., 2008).

Why technology adoption in aquaculture? It has been observed that, there is low level of production, poor storage facilities, lack of awareness of rural farmers, low adoption rate of this farmers to new techniques and inconsistent trade policies have been found to be responsible for the insufficient market supply of

aquaculture products (Akindele and Alabi, 2010).

Land and Location has to be considered first because most villages in Oshimili South LGA are distant from the natural water source and thus farmers in this region have to create their own water source by sinking boreholes or channel water from nearby river and land is quite expensive for local fish farmers (Palash, 2015). In addressing these gaps, this study was proposed and was achieved by some set objectives.

The objectives were as follows to:

  I.   Describe the socio-economic characteristics of the farmers.
 II.   Ascertain the level of adoption of aquaculture management techniques.
III.   Determine the types of pond contributing to aquacultural techniques adoption.
 IV.   Assess the needs of fish farmers on new fishing techniques.
  V.   Identify the constraints affecting the adoption of aquaculture management techniques.

2. Material and Methods

The study was conducted in Oshimili South Local Government Area of Delta State. Delta State is located in the coordinates of latitude 6°34' – 645'E and longitude 5°59' - 608'N (MLSUD, 2013).

Sample Size and Sampling Technique: A pre-field survey revealed that there were registered fish farmers in Oshimili South Local Government Area which were found in Asaba, Okwe and Oko (Table 1). A quota sampling technique was used to select 50% of registered fish farmers. This resulted in a sample size of 82 fish farmers.

Table 1. Selection of respondents from workers*

Fish farm communities (Stage 1)	Registered fish farmers (Stage 2)	Selection of respondents (50%) (Stage 3)
Asaba	95	47
Okwe	47	24
Oko	22	11

*Delta State Agricultural Procurement Agency, Asaba

2.1. Methods of Data Collection

Data were collected by administering questionnaires.to the fisher folks and through field observations.

2.2. Measurement of Variables

Some socioeconomic variables such as ages, fish farming experience of respondents were measured in years. Education level options were made available for respondents to indicate as applicable: no formal education, primary or secondary school, OND/NCE, and HND/First Degree. Income generated was measured in the Naira amount as realized annually. Contact with extension agent was measured as applicable to weekly, monthly, quarterly, biannual or annual visits.

The scale used for measurement of the level of adoption of aquaculture management techniques was designed as positive (Yes) and negative (No). In order to standardize adoption scores, percentages obtained were translated to sigma score in the statistical Table of normal deviates (Ovharhe, 2020)

Factors that significantly contribute to adoption of the techniques were measured using location parameters such as Asaba, Okwe and Oko were listed alongside with selected technologies such as earthen pond, concrete pond, plastic pond and wooden pond for respondents to indicate as applicable.

The need assessments of fish farmers on new fishing techniques were measured on multiple response patterns. While constraints affecting adoption of aquaculture management techniques was measured by asking the respondents the level of seriousness of possible constraint affecting the adoption. This will be measured on a four (4) Likert-type scale of very serious=4, serious=3, not very serious=2, not serious=1. The mean value is 2.50 (4+3+2+1=10/4=2.5) was used as a cut-off point such that constraints with mean value of 2.50 and above will be regarded as serious and vice versa. However, the percentage scores and means from the Likert-type scale computation were used for results interpretation.

2.1. Ethical Consideration

The study was approved by Delta State University local ethics committee with the number S177/029.

3. Results and Discussion

The result in Table 2 shows that mean age of the respondents was 44. This is in agreement with the findings of Agbamu and Orhorhoro (2007) on the adoption of aquaculture management techniques in Delta State. Male respondents (83%) were more in participation. These findings are not agreement with the findings of Nwabueze, (2010) who reported that women were more than men in sustainable aquaculture development in Delta State. Respondents (65%), were married. This aligned with the findings of Okoedo-Okojie and Ovharhe, (2012) on assessment of information needs of fish farmers in Delta State that most farmers were married. Majority of respondents (44%) had HND/ First Degree as educational attainment. These results show that majority of the respondents had formal education and are literates which are in agreement with the findings of Ofuoku et al. (2008) and Ovharhe (2019) on the determinants of adoption of improved fish production technologies in Delta State.

Respondents (44%) farming experience mean was 7 years. This is in disagreement with the findings of Agbamu and Orhorhoro (2007) on adoption of aquaculture management techniques in Delta State that the mean farming experience was 10 years. On average, respondents (56.1%) household size was 5 persons; this is in agreement with the findings of Ifejike et al (2013) on emerging income-generating of fisher folks in riverine communities of Delta State whose results showed a mean household size of 5 persons. Respondents (49%) annual

mean income size was 125,277.14, which is in agreement with the findings of Ovharhe (2016) on income generation of fish farmers in Delta State discovered that farmers earned between 35,000 and 135,000 Naira only annually on small scale basis. Respondents (92%) got annual extension visit. These poor findings were reported by Ovharhe and Gbigbi (2016) on socioeconomic determinants of youth empowerment by Fadama III projects in Delta State.

Table 2. Respondents' socio economic profile (n= 82)*

Variables	Frequency	Percentages (%)	Mean/Mode
Age			
21-30	9	11	
31 -40	13	16	
41-50	45	55	44
51 -60	15	18	
Gender			
Male	68	83	
Female	14	17	
Marital status			
Single	28	34.1	
Married	53	65	Married
Separated	1	1.2	
Educational status			
Primary	3	4	
Secondary	17	21	
OND/NCE	21	26	
HND/ First Degree	36	44	HND/First Degree
Post graduate	5	6.1	
Farming Experience			
1-5	29	35.4	
6-10	36	44	7 years
11-15	7	9	
16-20	6	7.3	
21-25	2	2.4	
26-30	2	2.4	
House Hold Size			
1-3	33	40.2	
4-6	46	56.1	5
7 – 9	3	4	
Income/annum			
35,000 – 135,000	40	49	125,277.14
136,000 – 236,000	17	21	
237,000 – 337,000	16	20	
338,000 – 438,000	4	5	
439,000 – 539,000	3	4	
540,000 – 640,000	2	2.4	
Extension Contact			
Monthly	3	4	
Quarterly	3	4	
Biannually	1	1.2	
Annually	75	92	Annually

*Field responses

3.1. Adoption of Aquaculture Management Techniques

Entries in Table 3 show that respondents (78%) adopted earthen pond technique while respondents (15.9%) had the lowest adoption rate in integrated technique. This is not in agreement with the findings of Agbamu and Orhorhoro (2006) on the Adoption of Aquaculture Management Techniques in Delta State which followed that respondents adopted the integrated technique which enabled them to culture different fish species in the same pond. This sigma method was used by Ovharhe (2016) to assess the adoption level of Fish Farmers in the Niger Delta.

3.2. Pond Types Contributing to Aquacultural Techniques Adoption

Across the study area, data displayed in Table 4 shows that earthen pond (88%) had the highest adoption rate followed by the plastic pond (79%), concrete (71%) and wooden ponds (59%) respectively). This outcome is not in accordance with the findings of Okoedo-Okojie and Ovharhe (2012) who reported that fish farmers in Delta State practice more of plastic and concrete ponds than earthen ponds. Rouhani and Britz (2004) cautioned that adoption of pond types contributes to the success of any fish farming.

3.3. Needs Assessment Techniques of Fish Farmers

The data in Table 5 shows that integrated techniques (90.2%) had the highest value whereas record keeping (24.4%) had the lowest value. There is a need to supply farmers with affordable feed formulation techniques and training on how to keep farm records in order to boost the productivity of fish and to improve protein intake in Delta State and in Nigeria at large. This is in line with the findings of Ovharhe (2016) who asserted that farmers in Delta State need adequate funding.

Table 3. Respondents' adoption level of aquaculture management techniques (n=82)*

	Techniques	Yes	No	Total number of adopters and its %	Adoption score	Adoption level
1	Earthen pond	64	18	64 (78.0)	5.4	High
2	Concrete pond	34	48	34 (41.5%)	4.4	Medium
3	Plastic pond	41	41	41 (50%)	4.7	Medium
4	Wooden pond	21	61	21 (25%)	3.7	Low
5	Pond treatment technique	61	21	61 (74.4%)	5.35	High
6	Water treatment technique	59	23	59(71.95%)	5.3	High
7	Feed formulation	58	24	58 (70.7)	5.3	High
8	Integrated technique	13	69	13 (15.9)	3.2	Low
	Overall mean adoption level				5.0	

*Field responses

Table 4. Respondents' perceptions on pond types contributing to adoption of the techniques (Multiple responses)*

	Parameter	Earthen pond	Concrete pond	Plastic pond	Wooden pond
1	Asaba	70 (85.36%)	57 (69.51%)	62 (75.6%)	57 (69.51%)
2	Okwe	76 (92.68%)	65 (79.26%)	69 (84.14%)	65 (79.26%)
3	Oko	71 (86.58%)	54 (65.85%)	64 (78.0%)	54 (65.85%)
	% mean	88	71	79	59

*Field responses

Table 5. Respondents' needs assessment (Multiple responses)*

	Parameters	Frequency	Percentage (%)
1	Integrated techniques	74	90.2
2	Pond preparation	64	78.1
3	Storage	54	65.9
4	Feed formulation	52	63.4
5	Spawning	45	54.9
6	Land	30	36.6
7	Water source	25	30.5
8	Market stategies	27	32.9
9	Equipment	22	26.8
10	Record keeping	20	24.4

*Field responses

3.4. Constraints Affecting Adoption of Aquaculture Management Techniques

Result in Table 6 shows that high feed cost with the highest percentage of 80.5% and a mean of 3.06 above the cut-off mean of 2.5 is the most serious constraint militating against adoption while poaching with the lowest percentage of 20.73% and a mean of 1.37 below the cut off mean of 2.5 is the least constraint. This assertion corroborates with that of Anene et al (2010) who reported that poor funding is the major constraint affecting the adoption of aquaculture techniques hence insufficient funds to handle the high cost of foreign feeds feed purchased. Therefore, farmers should be trained on how to formulate feed to supplement the exotic feeds. However, the pooled mean 2.40, which depict a management situation that the constraints are generally below average in theory and can be easily managed not to hamper fish farming adoption practices in agricultural productivity.

Table 6. Respondents' constraint militating against adoption (n=82)

	Parameter	*Percentage (%)	*Mean	Remark
1	High feed cost	80.5	3.06	Serious
2	High take off fund	75.6	2.89	Serious
3	Insufficient knowledge	65.8	2.78	Serious
4	Scarcity of feed	47.5	2.57	Serious
5	Costly technique	43.9	2.56	Serious
6	Labor cost	36.6	2.39	Not serious
7	Transportation	24.3	1.54	Not serious
8	Poaching	20.73	1.37	Not serious
		Pooled mean = 2.40		

*Implies values from Likert-type scale converted to % and means. Cut off mean = 2.5.

4. Conclusion

The study was guided by five objectives. Results obtained, besides the socio-economic characteristics, revealed that majority of fish farmers adopted earthen pond management techniques than plastic, concrete and wooden pond. Pond types contributed to aquacultural techniques adoption. The most prioritized need on assessment scale was integrated techniques and high cost of feeds was the most serious constraint. It was concluded that despite the prevailing constraints, there was a high adoption rate of aquacultural techniques among fish farmers in Oshimili South LGA of Delta State, Nigeria.

Based on the findings of the study, it is recommended that more awareness should be created among youths to increase participation in aquaculture, extension visit should be monthly and training on integrated techniques, feed formulation amongst others are needed.

Author Contributions

OJO; project supervisor, ON; fish expert and manuscript vetting, VO; data collection and analysis. All authors reviewed and approved the manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

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