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Limitations to the Adoption of Recommended Aquaculture Production Technologies by small Scale Fish Farmers in Oyo State Nigeria

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Abstract - The study was designed to identify the limitations to the adoption of recommended aquaculture production technologies by small-scale fish farmers Oyo State. A structured interview schedule was utilized in obtaining information from two hundred and twenty two respondents. Data were analysed descriptive and inferential statistics. The study revealed majority (49.1%) of the respondents were with the economic active age and mostly males (84.2%). Constraints perceived by most of the farmers include high cost of fish feed and market price fluctuation (100%), high cost/lack of construction equipment (96.0%), non-availability/high cost of quality fish seed (90.1%) and preservation and storage facilities (75.2%). Chi square analyses showed that there is a significant association between adoption of innovation and sex ($\chi^2 = 2.16$, $p < 0.05$), educational level ($\chi^2 = 9.30$, $p < 0.05$), occupation ($\chi^2 = 4.81$, $p < 0.05$) and marital status ($\chi^2 = 5.32$, $p < 0.05$).

Keywords : *limitations, oyo state, small scale farmers, technologies.*

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Keywords : limitations, oyo state, small scale farmers, technologies.

I. Introduction

Aquaculture has been contributing to food supply and improving health and income levels for centuries through commercial operations that supply urban markets, households, and rural communities. The farming of fish in ponds is an ancient practice, as the earliest known as pond fish culture are from China, some 4,000 years ago (Messrs *et al.,* 2000). Aquaculture is a relatively new industry in most developing countries, being between 20 and 50 years old, but has developed significantly in the last 20 years. Edwards and Demaine (1997) argue that this recent growth in aquaculture is due to the growing human populations and the diminishing supply of products caught from the wild. This diminishing supply is caused by over fishing of some species and environmental degradation.

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Aquaculture presents many opportunities for development initiatives its objectives range from food production, income generation, and wild stock enhancement to recreational uses (Haylor and Bland, 2001). Beside aquaculture's contribution to food production, it creates employment in the rural areas. The employment generated by fish farming in the world has increased over the years; from 3.8 million in 1990 to 7.5 million workers in 2000 (New, 2003).

In 2002, the world's total fishery production was put at 133 million tonns (Vannuccini, 2004) while production from world capture fisheries amounted to 93.2 million tonns. This represents a slight increase of 0.4 percent compared with 2001, but a decline of 2.4 percent from 95.5 million tonns produced in 2002. However, evidence indicates that in many areas of the globe, fishery management is falling (Cichrame, 2000). The management of the fishery industry has not achieved its goal of employment and social peace. This is because the system is not operating in a sustainable and efficient manner (FAO, 2005). Over the years, however, efforts have been made to develop new technologies, which have been introduced to the industry. This has led to more fish being caught, but adversely this resulted in the overexploitation of fisheries (MacLennan, 1995). The global fisheries production data is not a true reflection of the development in some of the regions of the world. The Less Developing Countries (LDCs) have been experiencing serious decline in production in recent years. Per capita fish supply in the LDCs is still relatively low at an estimated 8.5kg in 2001 where as in, industrialized countries it is 13.2 kg (Greenfacts, 2004).

Animal protein is very essential for the growth, development and maintenance of human life especially because it contains all the essential amino acids needed for this purpose. Shortage of protein, particularly those of animal origin is prevalent in most parts of Africa where it is estimated that on the average, 10g of animal protein is consumed per day compared to a recommended daily intake of 35g (FAO, 1986). Obioha (1992) observed that the level of consumption of meat and animal protein in Nigeria is estimated at about 8g per caput per day, about 20g less than the minimum requirement by the National Research Council of the United States of

America. In order to ensure adequate supply of protein to the rapidly growing population of Nigeria, the output of animal products has to be increased especially by short cycle animals such as rabbits, poultry and pigs (Ozor and Madukwe, 2001).

Nigeria with a population of approximately 140.7 million and 3.2% annual growth rate (2006 census) is multi-ethnic. Despite the abundance fisheries resources and the relatively high consumption of fish in Nigeria that is the largest simple consumer of fish products in Africa (FDF, 2005; 2008), its domestic output of 0.62 million metric tonns still falls short of demand of 2.66 million metric tonns (FDF, 2008). A supply of deficit of 2.04 million metric tonnes is required to meet the ever increasing demand for fish in Nigeria. This large deficit between the demand and supply of fish is augmented by massive importation of frozen fish and consequently effect on the exchange earnings of the national economy as well as caput consumption 9.68kg/ head/year (FDF, 2008). The species imported are mainly herring, mackerel and stock-fish to offset the deficit of 2.04 million metric tonns. Quantity of fish imported rose from 557,884.00 tonns to 739, 666.12 tonns between 2000 and 2007. The amount of foreign exchange on fish importation also rose from US$ 241,066.54 million in 2000 to US$ 594,373.69 million in 2007. Nigeria is a large importer of fish with official records indicating 681,000 metric tonnes while export in 2008 was 0.065 million metric tonns and valued at US$40.5 million. The local supply consists of productions from the artisanal (89.5% - 85.5%), industrial (5% - 2.5%), and aquaculture (5.5% - 12.0%) sub-sectors (FDF, 2009). However, it has been shown that Nigeria can substitutes fish importation with domestic production to create jobs, reduce poverty in rural and peri-urban areas where 70% of the population live and ease the balance of payment deficits (Areola, 2007; FDF, 2005, 2009).

The study was therefore designed to find out in detail, the major limitations to the adoption of recommended aquaculture production technologies by small scale fish farmers in Oyo State. Specifically, the study was designed to:

1. identify the socio-economic characteristics of the respondents;
2. determine the level of awareness and rate of adoption of recommended aquaculture production technologies;
3. identify the major limitations confronting adoption of recommended aquaculture production technologies;

a) Hypothesis of the Study

Ho_1: There is no significant relationship between the socio-economic characteristics of the fish farmers and adoption of recommended aquaculture production technologies.

II. Methodology

a) The Study Area

The study was conducted in Oyo State South - West Nigeria. Oyo State is one of the thirty-six states of the Federal Republic of Nigeria. It came into existence with the break-up of the old Western State of Nigeria during the state creation exercise of 1976. Ibadan, the capital which is reputed to be the largest indigenous city in Africa, South of the Shara, had been the centre of administration of the old Western Region since the days of the British colonial rule in Nigeria.

The state has an estimated population of over 5,591,589 million people (N.P.C, 2006). The state is located in the rainforest vegetation belt of Nigeria within longitude $7^0 23' 47''$N and $3^0 55' 0''$. It is bounded in the south by Ogun State and in the north by Kwara State, in the west by the Republic of Benin while in the east it is bounded by Osun State (Figure 1). Oyo state exhibits the typical tropical climate of averagely high temperatures, high relative humidity and generally two rainfall maxima regimes during the rainfall period of March to October. Oyo State now consists of thirty three Local Governments and the capital of the state is Ibadan. The main occupations of the people in the state are: Agriculture which is the mainstay of the economy of the State. The tropical nature of the climate favours the growth of variety of food and cash crops are yam, maize, cassava, millet, plantain, banana, rice and fishing.

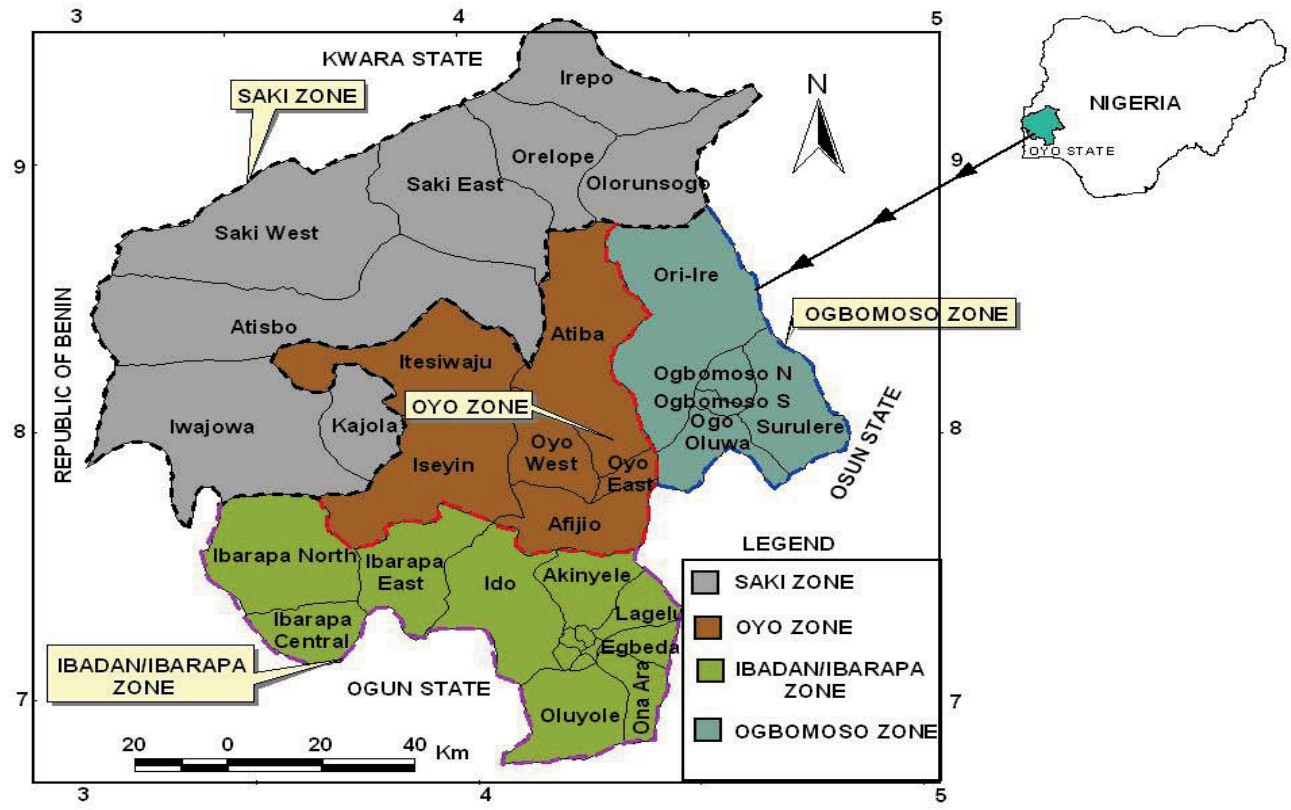
It is concerted efforts to revitalize agriculture in the state and thereby boost food production, the State Government has established the sate-wide Oyo State Agricultural Development Programme (OYSADEP), which is an offshoot of the defunct Oyo North Agricultural Development Project (ONADEP). According to OYSADEP, Oyo State was divided into four Agricultural extension zones namely: Ibadan/Ibarapa, Ogbomoso, Oyo and Saki.

b) Sampling Procedure and Sample Size

Multi-stage random sampling technique was used for the selection of two hundred and twenty two (222) fish farmers throughout the four extensional zones. In stage 1, 60% extensional blocks from each of the four zones to give a total of 16 blocks were purposively selected for the study. In stage 2, from each of the selected extensional blocks 60% were also randomly selected to give a total of 79 circles in all the selected blocks. In stage 3, from each circle, 60% fish farmers were selected using simple randomly sampling techniques to give a total of 222 fish farmers. Thus a total number of two hundred and twenty (222) fish farmers were selected throughout the four extensional zones.

A structured interview schedule was used in obtaining relevant information from the respondents.

The Variables considered under the personal characteristics of the respondents included: age, sex, marital status, educational level, years spend in school, religion, household size, other occupation, and fish farming experience. A four (4) point Likert type scale was developed and used to determine the extent to which the constraint factors listed posed a hindrance or limitation to the adoption of recommended aquaculture production technologies. The response options and values assigned were as follows: very serious = 0; serious = 1; not a problem = 2; I don't know = 3.In order to ascertain the level of adoption by the respondents, technologies from the production recommendations on aquaculture production practices from Oyo State Agricultural Development Programme (OYSADEP) were adapted. Adoption scores were calculated by using seven stages of adoption that were rated as follows: aware (yes) = 0, aware (no) = 1, adopted (yes) = 2, adopted (no) = 3, full adoption = 4, partial adoption = 5 and discontinuance = 0.Data obtained from the field was subjected to descriptive (Frequency counts, Percentage and Mean).



(Source: Field Survey, 2011).

Figure 1 : Oyo State ADP Zones & Blocks showing study location

III. Results and Discussion

a) Socio-economic characteristics of small scale fish farmers from Oyo State

Table 1 shows the distribution of fish farmers with respect to their socio economic characteristic. Most (49.1%) of the fish farmers fall within the age bracket of 41 – 50 years, 37.8 percent fall within 31 – 40 years, 8.1 percent were above 50 years of age while 2.0 percent fell within the age range of 21 – 30 years. This age bracket is a productive age which portends better future for catfish production also it is considered as economically active age (Olowosegun*et al.*, 2004). This indicates that very few young and old people are involved in fish farming. This is because fish farming requires adequate attention and a lot of sense of responsibility.

Sex plays a very important role in fish farming and agriculture, in terms of property acquisition, for example, fixed assets like land and machines. Majority (84.2%) of the fish farmers were male while 15.8 percent were female. This result can be justified by the assertion of Brummett*et al.*, (2010) that fisheries activities are mostly dominated by men. Ekong, 2003 pointed out that marriage in our society is highly cherished. This ascertain was further confirmed by the report of Fakoya (2000) and Oladoja*et al.,* (2008) who assert that marriage confer some level of responsibility and commitment on individual who are married. In this study, it was discovered that majority of the farmers were

married (46.1%) while very few were single, widowed and separated. Respondents without formal education were 3.2 percent while 87.3 percent had tertiary education. This means that fish farming is dominated by the educated class and mostly by those armed with high level of education. This is so because fish farming requires a lot of technical and scientific knowledge to be successfully undertake. Majority (58.1%) spent above 15 years in school, 23.0 percent spent between 11 – 15 years while 14.4 percent spent. It was found that, majority (53.2%) of the fish farmers were Christians, 43.2 percent of them practiced Islam while 3.6 percent were traditional worshippers. The mean household size was found to be 9 people per household. This was an indication that the more educated and urban-based an individual is, the less family-size that individual will keep (Yarhere, 2004). Based on farmer's response during field survey, it was discovered that some of the respondents engaged in other occupation apart from fish farming. Occupation remains valid in our society as people have one or two things they engaged in which gives them sense of satisfaction and belonging in the society. Assessing the occupational status of the respondent, majority (63.1%) of the fish farmers engaged more in other farming actives part from fish farming than any other occupation. It revealed that 40.5 percent had fish farming experience ranging between 11 – 15 years, 35.6 percent had between 5 – 10 years, and 15.8 percent had less than 5 years while 8.1 percent had above 15 years experience in fish farming. As a result, the respondents with the highest number of years of experience should have good skill and better approaches to fish farming business. The respondents with longer years of experience were also able to forecast market situation in which they sell their products at higher prices. Those with less years of experience, especially with less than 5 years faced many risks in the early days of their fish farming business. Majority (67.6%) of the respondents purchased the land they are using for fish farming, 23.0% rented the land, while 7.7% and 1.8% got the land through inheritance and gift respectively.

Table 1 : Percentage distribution of the socio-economic characteristics of small scale fish farmers in Oyo states (N = 222)

VARIABLES	FISH FARMERS Frequency	Percentage (%)	Mean($\overline{X}$) / Mode	Std
Age (years)				
Bellow 20	0.0	0.0		
21-30	11	5.0		
31-40	84	37.8		
41-50	109	49.1		
Above 50	18	8.1		
Total	**222**	**100.0**	**46**	**0.709**
Sex				
Male	187	84.2		
Female	35	15.8		
Total	**222**	**100.0**	**Male**	**0.365**
Marital Status				
Single	25	11.3		
Married	169	76.1		
Widowed	20	9.0		
Separated	8	3.6		
Total	**222**	**100.0**	**Married**	**0.588**
Educational status				
No formal Education	7	3.2		
Adult Education	0	0.0		
Primary Education	44	19.8		
Secondary Education	62	27.9		
Tertiary Education	88	39.6		
Others	21	9.5		
Total	**222**	**100.0**	**Tertiary**	**0.670**
Number of years spend in school				
1 – 5	10	4.5		
6 – 10	32	14.4		
11 – 15	51	23.0		
Above 15	129	58.1		

Total	**222**	**100.0**	**16**	**0.866**
Religion				
Christianity	118	53.2		
Islam	96	43.2		
Traditional	8	3.6		
Total	**222**	**100.0**	**Christianity**	**0.569**
House Hold Size (Persons)				
1 – 3	35	15.8		
4 – 7	152	68.5		
8 – 11	35	15.8		
Total	**222**	**100.0**	**6**	**0.563**
Other Occupation that Generate Income apart from Fish Farming				
Farming	140	63.1		
Civil service	40	18.0		
Trading	20	9.0		
Vocational job	22	9.9		
Total	**222**	**100.0**	**Farming**	**0.670**
Fish Farming Experience (Years)				
Less than 5	35	15.8		
5 – 10	79	35.6		
11 – 15	90	40.5		
Above 15	18	8.1		
Total	**222**	**100.0**	**9.3**	**0.850**

Source: Field Survey, 2011.

b) Awareness, adoption and level of adoption of recommended aquaculture production technologies by fish farmers

The technologies examined in this study were as follows:

i. *Culture System*

Entries in table 2 shows that majority (87.4%) of the respondents was aware of culture system, 78.8 percent adopted the practice, 51.8 percent fully adopted the practice and 17.1 percent partially adopted the practice while 9.9% discontinue the use of culture system.

ii. *Pond Site Selection*

It was found that 95.0 percent of the respondents were aware of pond site selection, 94.1percent adopted the practice, 45.5 percent fully adopted the practice, and 33.3 percent partially adopted the practice while 15.3 percent discontinue the use of pond site selection.

iii. *Pond Construction*

The result shows that majority (97.7%) of the respondents was aware of pond construction system, 91.4 percent adopted the practice, 64.9 percent fully adopted the practice and 22.1 percent partially adopted the practice while 4.5 percent discontinue the use of pond construction system.

iv. *Pond Installation System*

Majority (89.2%) of the respondents was aware of pond installation system, 77.9 percent adopted the practice, most (45.5%) of the respondents fully adopted the practice, 26.6 percent partially adopted the practice while about (5.9%) discontinue the use of pond installation system.

v. *Fish Pond Netting to Control Pest*

Out of 222 fish farmers interviewed, all of the respondents (100%) were aware and adopted the use of fish pond netting, 80.6 percent fully adopted the practice, 19.4 percent partially adopted the practice.

vi. *Application of Lime*

Result from table 2 revealed that majority (100%) of the respondents was aware of lime application, about 80.6 percent adopted the use of lime, 24.3 percent fully adopted the practice, and 31.1 percent partially adopted the practice while only (25.2%) discontinue the use of lime.

vii. *Fertilizer Application*

From the table below, it was revealed that majority (100%) of the respondents was aware of fertilizer application, 90.5 percent adopted the use of fertilizer, 44.6 percent fully adopted the practice and 27.5 percent partially adopted the practice while 18.5% discontinue the use fertilizer.

viii. *Stocking Density/Rate*

Table 2 shows that 96.8% were aware of stocking density/rate, out of which 90.5% adopted the practice, 64.4% fully adopted the practice and 18.5% partially adopted the practice while 7.7% discontinue the practice.

ix. *Feeding Method*

The result revealed that almost (99.1%) all the respondents were aware and thus adopted feeding method practice, 78.8 percent fully adopted the practice while 21.2% percent partially adopted the practice.

x. *Fish Feed Formulation (Compounded feed)*

It was shown in the table below that almost (96.4%) all the respondents were aware of fish feed formulation method,out of which 88.7 percent adopted the practice, 81.5 percent fully adopted the practice and 7.2 percent partially adopted the practice.

xi. *Use Maggot to Feed Fish*

Table 2 revealed that all (100%) the respondents interviewed were all aware about the use of maggot as feed supplement, out of which 90.5 percent adopted the practice, 50.0 percent fully adopted the practice, and 31.5 percent partially adopted the practice while about (9.0%) discontinue the practice.

xii. *Water Quality*

Majority of (100%) the respondents in the study area were aware and adopted water quality monitoring practice, 95.5percent fully adopted the practice while 4.5 percent partially adopted the practice.

xiii. *Artificial Production of fry/fingerlings*

The result shows that majority of (100%) the respondents were aware of artificial production of fry/fingerlings, 77.9 percent adopted the practice, and 34.7 percent fully adopted the practice while 43.2 percent partially adopted the practice.

xiv. *Culture of Hybrid*

From the table below, it was revealed that most (77.0%) of the respondents were aware of the culture of hybrid, 36.5 percent adopted the practice (culture of hybrid species), 4.5 percent fully adopted the practice, and 14.0 percent partially adopted the practice while 22.5 percent discontinue the practice.

xv. *Live Fish Transportation*

Result shows that, most (85.1%) of the respondents were aware of the live fish transportation, 57.2 percent adopted the practice, 31.5 percent fully adopted the practice, and 20.3 percent partially adopted the practice while 5.4 percent discontinue the practice.

xvi. *Stock Management (Fish Sorting)*

It was found that out of 222 fish farmers interviewed, 87.4 percent were aware of stock management practice, 81.1 percent adopted the practice (fish sorting), 32.9 percent fully adopted the practice, and 36.5 percent partially adopted the practice while 11.7 percent discontinue the practice.

xvii. *Test Cropping*

It was gathered that out of 222 fish farmers interviewed, 95.5 percent were aware of test cropping, 78.4 percent adopted the practice (Test cropping), 54.5 percent fully adopted the practice and 22.1 percent partially adopted the practice while 1.8 percent discontinues the practice.

xviii. *Harvesting Techniques*

From the table below, it was revealed that 86.0 percent were aware of different harvesting techniques, 85.1 percent adopted the practice (harvesting techniques), 41.8 percent fully adopted the practice, and 33.3 percent adopted the practice partially while 9.9 percent discontinue the use of the practice.

xix. *Post Harvest Technology*

It was gathered form table 2 below that majority (71.6%) of the respondents were aware of post harvest technology, 32.9 percent adopted the practice, 8.6 percent fully adopted the practice, 9.5 percent partially adopted the practice while 14.9 percent discontinue with the practice.

xx. *Processing techniques (Adding value to harvested fish)*

From the table below, it was revealed that (65.3%) of the respondents were aware of processing techniques, about 23.4 percent adopted the practice, 9.9 percent fully adopted the practice and 5.4 percent partially adopted the practice while 8.1 percent discontinue the practice.

Table 2 : Percentage distribution of the fish farmers according to awareness, adoption practice and level of adoption of recommended aquaculture production technologies (N = 222)

INNOVATIONS	Aware of Activity		Adopting Practice		Level of adoption of innovation introd uced to farmers		
	Yes Freq (%)	No Freq (%)	Yes Freq (%)	No Freq (%)	Full Adoption Freq (%)	Partial Adoption Freq (%)	Discontinued Freq (%)
Culture System	194 (87.4)	28 (12.8)	175 (78.8)	47 (21.2)	115 (51.8)	38 (17.1)	22 (9.9)
Pond Site Selection	211 (95.0)	11 (5.0)	209 (94.1)	2 (0.9)	101 (45.5)	74 (33.3)	34 (15.3)
Pond Construction system	217 (97.7)	5 (2.3)	203 (91.4)	14 (6.3)	144 (64.9)	49 (22.1)	10 (4.5)
Pond Installation system	198 (89.2)	24 (10.8)	173 (77.9)	25 (11.3)	101 (45.5)	59 (26.6)	13 (5.9)
Fish Pond Netting to Control Pest	222 (100)	0 (0.0)	222 (100)	179 (80.6)	43 (19.4)	0 (0.0)	0 (0.0)
Application of Lime	222 (100)	0 (0.0)	179 (80.6)	43 (19.4)	54 (24.3)	69 (31.1)	56 (25.2)
Fertilizer Application	222 (100)	0 (0.0)	201 (90.5)	21 (9.5)	99 (44.6)	61 (27.5)	41 (18.5)
Stocking Density/Ratio	215 (96.8)	7 (3.2)	201 (90.5)	14 (6.3)	143 (64.4)	41 (18.5)	17 (7.7)

Feeding Method	220 (99.1)	2 (0.9)	220 (99.1)	0 (0.0)	175 (78.8)	47 (21.2)	0 (0.0)
Fish Feed Formulation (Compounded feed)	214 (96.4)	8 (3.6)	197 (88.7)	17 (7.7)	181 (81.5)	16 (7.2)	0 (0.0)
Use maggot to feed fish	222 (100)	0 (0.0)	201 (90.5)	21 (9.5)	111 (50.0)	70 (31.5)	20 (9.0)
Water Quality Monitoring	222 (100)	0 (0.0)	222 (100)	0 (0.0)	212 (95.5)	10 (4.5)	0 (0.0)
Artificial Production of fry/fingerlings	222 (100)	0 (0.0)	173 (77.9)	49 (22.1)	77 (34.7)	96 (43.2)	0 (0.0)
Culture of Hybrid	171 (77.0)	51 (23.0)	91 (41.0)	80 (36.0)	10 (4.5)	31 (14.0)	50 (22.5)
Live Fish Transportation	189 (85.1)	33 (14.9)	127 (57.2)	62 (27.9)	70 (31.5)	45 (20.3)	12 (5.4)
Stock Management (Fish Sorting)	194 (87.4)	28 (12.6)	180 (81.1)	14 (6.3)	73 (32.9)	81 (36.5)	26 (11.7)
Test Cropping	212 (95.5)	10 (4.5)	174 (78.4)	38 (17.1)	121 (54.5)	49 (22.1)	4 (1.8)
Harvesting Techniques	191 (86.0)	31 (14.0)	189 (85.1)	2 (0.9)	93 (41.9)	74 (33.3)	22 (9.9)
Post harvest technology	159 (71.6)	63 (28.4)	73 (32.9)	86 (38.7)	19 (8.6)	21 (9.5)	33 (14.9)
Processing techniques (Adding value to harvested fish)	145 (65.3)	77 (34.7)	52 (23.4)	93 (41.9)	22 (9.9)	12 (5.4)	18 (8.1)

Source: Field Survey, 2011

c) Limitation or constraints to adoption of recommended aquaculture production technologies

Major Limitation or constraints to adoption of recommended aquaculture production technologies Majority of the fish farmers (58.6%) claimed that land accusation is not a problem militating againt adoption of recommended aquaculture production technologies in Oyo state thus 40.5 percent claimed that is a serious problem. Most (57.2%) of the respondents claimed that insufficient labour is a problem while 42.8 percent claimed that is not a problem. 49.5 percent claimed that distance of the extension staff's office to the village/farm is not a constrain militating against adoption of recommended aquaculture production technologies but 41.5% claimed that is a serious problem. Preservation and processing facilities is considered to be a constraint affecting adoption of recommended aquaculture production technologies (75.2%).

Majority of the respondents (74.3% and 63.5%) does not consider absence of strong co-operative society and lack of finance (capital and credit) as major challenges affecting adoption of recommended aquaculture production technologies but majority of the fish farmers (90.1%) claimed that non-availability/high cost of quality fish seed is factor militating against adoption of recommended aquaculture production technologies. Likewise, majority of the fish farmers (94.6% and 96.0%) also claimed that poaching/ predators and high cost/lack of construction equipment respectively were one of the major challenges limiting adoption of recommended aquaculture production technologies. It was also show that all (100%) of the respondents considered market price fluctuation and high cost of fish feed as a problem hindering adoption of recommended aquaculture production technologies. Some other factors working against adoption of recommended aquaculture production technologies include; water shortage during dry season (92.3%), diseases and pest infestation (32.4%) and lack of technical know-how (42.4%).

Table 3 : Limitation or constraints to adoption of recommended aquaculture production technologies

Limitations	SEVERITY			
	Very serious Freq (%)	Serious Freq (%)	Not a problem Freq (%)	I don't know Freq (%)
Land accusation	18 (8.1)	72 (32.4)	130 (58.6)	2 (0.9)
Insufficient labour	48 (21.6)	79 (35.6)	95 (42.8)	0 (0.0)
Distance of the extension staff's office to the village/farm.	39 (17.6)	53 (23.9)	110 (49.5)	20 (9.0)
Preservation/Storage/Processing Facilities	71 (32.0)	96 (43.2)	40 (18.0)	15 (6.8)
Inadequate Motivation from extension officer	31 (14.0)	49 (22.1)	69 (31.1)	73 (32.9)
Absence of strong co-operative society	0 (0.0)	47 (21.2)	165 (74.3)	10 (4.5)
Lack of finance (capital and credit)	12 (5.4)	34 (15.3)	141 (63.5)	35 (15.8)
Non-availability/High cost of quality fish seed	152 (68.5)	48 (21.6)	22 (9.9)	0 (0.0)
Poaching/predators	40 (18.0)	170 (76.6)	12 (5.4)	0 (0.0)
High cost/lack of construction equipment	91 (41.0)	122 (55.0)	9 (4.1)	0 (0.0)
Market price fluctuation	167 (75.2)	55 (24.8)	0 (0.0)	0 (0.0)
High cost of fish feed	200 (90.1)	22 (9.9)	0 (0.0)	0 (0.0)
Water shortage during dry season	31 (14.0)	174 (78.4)	0 (0.0)	17 (7.7)
Disease and pest infestation	8 (3.6)	64 (28.8)	150 (67.6)	0 (0.0)
Lack of technical know-how	41 (18.5)	53 (23.9)	128 (57.7)	0 (0.0)

Source: Field Survey, 2011

d) Hypotheses of the Study

This section shows the relationship/difference between some of the independent variables and dependent variables.

Ho_1: There is no significant relationship between the socio-economic characteristics of the fish farmers and adoption of recommended aquaculture production technologies.

The socio-economic characteristics of the respondents are significantly related to adoption of recommended aquaculture production innovations. The independents variables considered were; age, sex, educational level, occupation, marital status, years of experience, and house hold size. Each of these variables was tested against each of the scores for the dependent variables in line with the set hypotheses.

To test for the relationship between the variables in hypothesis one, Pearson Product Moment Correlation (PPMC) and Chi-square (χ^2) analysis were used. PPMC was used and the variables were measured at the interval level, while for Chi –square variables were measured at nominal level. The Chi – square analysis shows that, there is a significant association between adoption of innovations and sex ($\chi^2 = 2.16$, $p < 0.05$), educational level ($\chi^2 = 9.30$, $p < 0.05$), occupation ($\chi^2 = 4.81$, $p < 0.05$) and marital status ($\chi^2 = 5.32$, $p < 0.05$). The result (table 4) from the correlation coefficient obtained from the statistical analysis shows that, there is a significant relationship between adoption of innovations and age ($r = 0.05$, $p < 0.05$), years of experience ($r = 0.72$ $p < 0.05$) and house hold size ($r = 0.52$, $p < 0.05$) correlation coefficient obtained from the statistical analysis in table 5 shows that, there was a significant relationship between adoption of innovations and age ($r = 0.05$, $p < 0.05$), years of experience ($r = 0.72$ $p < 0.05$) and house hold size ($r = 0.52$, $p < 0.05$).

Table 4 : Chi-square analysis of respondent's socio-economic characteristics and adoption of innovations by fish farmers

Variables	χ^2	Df	CC	Decision
Sex	2.16	1	0.03	S
Educational level	9.30	3	0.02	S
Occupation	4.81	3	0.01	S
Marital status	5.32	3	0.03	S

Source: Field survey, 2011.

χ^2= chi square calculated, df = Degree of freedom, S = Significant, NS = Not significant ($p < 0.05$).

Table 5 : Correlation analysis of the respondent's personal characteristics and adoption of innovations by fish farmers

Variables	R	P	Decision
Age	0.50	0.04	S
Years of experience	0.72	0.01	S
House hold size	0.52	0.00	S

Source: Field survey, 2011.

NS = Not significant, S = Significant ($p < 0.05$).

IV. Conclusion

This study examined the limitations to the adoption of recommended aquaculture production technologies by small-scale fish farmers in Oyo State. It observed that majority of the fish farmers were males and fall between the age ranges of 41 – 50 years. Majority of them were married and had 11 – 15 years of experience in fish farming. The study further revealed that majority of the fish farmers had a household size ranging between 4 – 7 and majority of the fish farmers had fish farming experience between 11 – 15 years. The study further showed that the major limitations to the adoption of recommended aquaculture production technologies in the study area were; "land accusation, non-availability/high cost of quality fish seed, preservation/storage/processing facilities, high cost/lack of construction equipment, poaching/predators, market price fluctuation and high cost of fish feed. Chi – square analysis and correlation coefficient shows that, there is a significant association and relationship between adoptions of recommended aquaculture production technology.

V. Recommendation

In the light of the major findings of this study, the following recommendations are advanced as a panacea to the limitations encountered by small-scale fish farmers Oyo State. There should be effective and stronger co-operation or linkage between the fish farmers and agricultural extension programmes. In this case, the extension agents should endeavour to organize farmers' Clubs with the assistance of national research institute (Research institutions and University). These efforts should be directed mostly towards the

active fish farmers to achieve higher results. In order to surmount the limitations to the adoption of recommended aquaculture production technologies by these farmers, efforts should be made by extension workers to organize training programmes directed toward fish farming, fish processing and marketing. Seminars, workshops and agric. show on improved fish production and management practices should be organized for farmers. This will definitely improve the knowledge, skills and techniques in fish production which will lead to increased production of animal protein and hence a better and improved health status of the final consumers.

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