



**Socio-Economic Study of Sustainable Integrated Aquaculture Development: Fish cum Rice
and Pigs Production in Nigeria**

Prepared by

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For

**West and Central African Council for Agriculture Research and Development
(CORAF/WECARD)**

MARCH, 2013

SUMMARY

The adoption and sustained use of Integrated Aquaculture and Agriculture depends strongly on the perception of the farmers which in turn can be largely influenced by the socioeconomic attributes of the farmers. This study therefore examined the socioeconomic characteristics of fish farmers in relation to their perception and willingness to adopt integrated fish-rice and pig production system in south eastern Nigeria.

Abia and Imo States were purposely selected for the study because of the relative abundance of fish farmers in the two States. Primary data were collected through administration of questionnaires on fifty randomly selected fish farmers from the list of registered members of the fish farmers association in each of the states. Secondary data were also collected from published literature and internet. Data collected were analyzed with descriptive statistics and logit model.

Results show that 82.7% of the respondents were males, 41.9% were between 40 and 49 years of age, 83.3% were married, 91.5% were Christians, 89.8% were indigenes and 82.8% had tertiary education. Twenty nine percent had a household size of five, 10.1% engaged in farming as primary occupation, and 96.2% engaged in fish farming as secondary occupation. Furthermore, 29.1% had four years fish farming experience, 69.0% owned their land while 81.8% and 33.3% respectively received training before and after the establishment of the fish farms. Moreover, 60.3% of the fish farm workers were males, 50% possessed secondary education, while 50.9% were between 20 and 29 years of age. Personal savings accounted for 70.1% of funding of fish farms; 37.9% had concrete ponds, 51.1% was producing table size fish, 56% of the farmers were producing both fresh and smoked fish, 89.4% was producing *Clarias garipienus*, 44.2% of the farmers engaged in farm gate sales while 42.3% engaged in both farm gate sales and supplies to eateries. Though 78.4% of the farmers were aware of integrated fish farming, only 23.5% had practiced integrated fish farming. Also, 78.1% of the fish farmers agreed that integrated fish farming (IFF) utilizes natural resources efficiently, 79.7% subscribed that IFF ensures that wastes from each farming enterprise are appropriately utilized, 50% concurred that IFF minimizes cost of fish production, 61.1% agreed that IFF safeguards the environment from pollution through utilization of wastes, 75.9% also agreed that IFF provides other sources of income while 71.7% concurred that IFF ensures a spread of financial risk. Furthermore, 51.2% of the farmers were willing to adopt integrated fish cum rice and pig production.

Although the fish farmers in the study area are generally well disposed to the technology of integrated fish-rice-pig production system, the excitement for adoption of the technology is not so overwhelming. Therefore there is a need to put in place different platforms through which the merits of the technology will be explained and the fears of farmers on the perceived challenges of the technology will be allayed.

1. INTRODUCTION

The concurrent production of fish, rice and pigs in a system is a type of Integrated Aquaculture and Agriculture (IAA) which has been described by Gomez (2011) as the concurrent or sequential linkage between two or more farm activities, of which at least one is aquaculture. The main objective of integrated aquaculture and agriculture is to increase the productivity of water, land and associated resources while contributing to increased food fish production; the basic principle is to enhance on-farm resource-use efficiency and productivity via the integration of resource flows between terrestrial and aquatic subsystems. IAA moves from a fishpond focus to a whole-farm perspective, utilizing ponds and paddy fields by optimizing management of on-farm resources. IAA is thus a knowledge-intensive, holistic approach that integrates numerous component technologies within systems management (Jahan et. al. 2013).

According to FAO (1985), the main advantages of IAA include: the establishment of a man-made ecosystem without any wastes, increasing the food supply for the mankind, creation of more jobs and reduction in the cost, as well as increasing the output and economic benefits of farming.

Although IAA has been demonstrated to be a strategy that can be adopted by small scale farmers in many developing countries to increase farm returns from per unit area of land, and insure themselves against the risk of falling into crises of subsistence since they are able to spread the risk of production over several activities (Amarasinghe 1992), the adoption and sustained use of IAA depends strongly on the perception of the farmers. The farmers' perception in turn can be largely influenced by the socioeconomic attributes of the farmers. It is therefore necessary to

examine the socioeconomic characteristics of fish farmers, vis-à-vis their perception and willingness to adopt the integrated fish-rice and pig production system in Nigeria.

2. OBJECTIVES OF STUDY

The general objective of the study is to assess the effects of socioeconomic characteristics of fish farmers in the study area on their perception and willingness to adopt integrated fish-rice-pig production system.

Specific objectives include:

- Identify the socio-economic characteristics of fish farming in the study area.
- Assess the fish farmers' awareness and practice of integrated aquaculture agriculture
- Examine the perception of the fish farmers on the integrated fish-rice-pig production system
- Assess the willingness of the fish farmers to adopt integrated fish-rice-pig production system

3. METHODOLOGY

3.1. Study Area

The study area is South East Nigeria. It is a geopolitical zone comprising five States namely: Abia, Anambra, Ebonyi, Enugu and Imo. The zone has the smallest land area (Figure 1) and arguably the least population of 16381729 from the 2006 national population census (<http://www.nigeriamasterweb.com/Nigeria06CensusFigs.html>). The zone is predominantly inhabited by the Igbo people of Nigeria.

NIGERIA GEO-POLITICAL ZONES

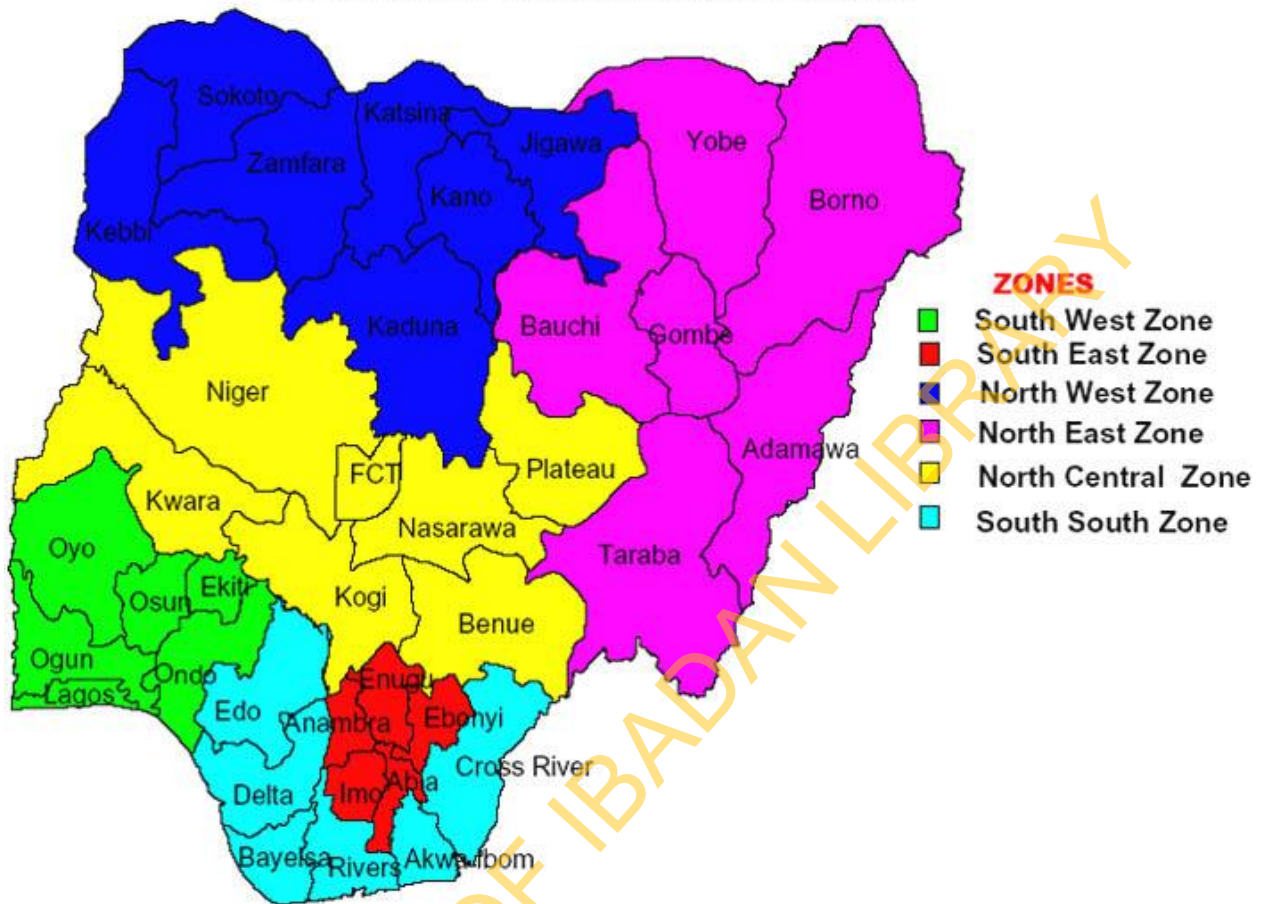


Figure 1: Map of Nigeria showing geopolitical zones. The zone earmarked with red colour is the south east geopolitical zone.

Source: <http://www.google.com.ng> (2013)

3.2. DATA COLLECTION AND ANALYSIS

Abia and Imo States were purposely selected for the study because of the relative abundance of fish farmers in the two States. Fifty fish farmers were randomly selected from the list of registered members of the fish farmers association in each of the states. Thus 100 respondents were selected from the two States for collection of primary data through questionnaire administration. Secondary data were also collected from published literature and internet. Data collected were analyzed with descriptive statistics and logit model.

4. RESULTS AND DISCUSSIONS

4.1. SOCIO-ECONOMIC CHARACTERISTICS OF FISH FARMING

4.1.1. Socioeconomic Characteristics of Fish Farmers in the Study Area

Results in Table 1 show that fish farming in the study area is dominated by male (82.7%); people within the age range of 40-49 years (41.9%); married (83.3%); Christian (91.5%) indigenes (89.8%) with modal household size of five (29.0%). Only 10.1% engaged in farming as primary occupation, 44.6% and 26.8% were primarily civil servants and businessmen respectively, while 96.2% engaged in fish farming as secondary occupation. Most of the farmers have tertiary education, hence 38.5% had HND/B.Sc. degrees; 23.1% had NCE/OND certificates while 21.2% had postgraduate degrees.

As regards training of the fish farmers, results in Table 2 show that 81.8% received training before the establishment of the fish farms while only 33.3% received training after the establishment of the fish farms. Forty percent of the farmers received pre-establishment training in other farms and institutions of learning, while 33.3% received the post establishment training through consultation with friends. Most of the farmers (67.6%) received formal training before the establishment of fish farms while on the contrary, 70% received informal training after the establishment of the fish farms. Furthermore, most of the farmers – 40% and 50% - attended short term training of 1 and 2 months respectively before and after the establishment of the fish farms.

The fact that most of the farmers have tertiary education and have received some form of training both before and establishment of their farms suggests that such farmers will have quick and deeper understanding of new innovations and will be able to take good decision with respect to the adoption of the new technology based on sound judgment.

Table 1: Frequency Distribution (%) of Socio-economic Variables of Respondents

Socio-economic variable	Frequency distribution (%)	Total
STATE OF ORIGIN		
Abia	57.6	100
Imo	42.4	
RELIGION		
Christianity	91.5	100
No response	8.5	
GENDER		
Male	82.7	100
Female	17.3	
AGE		
20-29	16.1	100
30-39	25.8	
40-49	41.9	
50-59	12.9	
60 and above	3.2	
MARITAL STATUS		
Married	83.3	100
Single	17.7	
HOUSEHOLD SIZE		
3	16.1	100
4	12.9	
5	29.0	
6	25.8	
7	16.1	
EDUCATIONAL LEVEL		
Primary	1.9	100
Secondary	15.4	
NCE/OND	23.1	
HND/B.Sc.	38.5	
Postgraduate	21.2	
PRIMARY OCCUPATION		
Civil servant	44.6	100
Business	26.8	
Politician	3.6	
Farming	10.7	
Pastor	1.8	
Retiree	3.6	
Student	5.4	
Scientist	3.6	
SECONDARY OCCUPATION		
Fish Farming	96.2	100
Civil servant	1.9	
Contractor	1.9	
NATIVITY		
Indigene	89.8	100
Non indigene	10.2	

Source: Field Survey (2013)

Table 2: Training of Farmers Before and After Establishment of Fish Farm

Training Items	Frequency Distribution (%)	
	Before Establishment of Farm	After Establishment of Farm
Attended Training		
Yes	81.8	33.3
No	18.2	66.7
Total	100	100
Where did the Training Take Place		
Consultation with friends	8.6	33.3
Another farm	40.0	22.2
Thru the association	11.4	22.2
Institution of learning	40.0	22.2
Total	100	100
Types of Training		
formal training	67.6	30
informal training	32.4	70
Total	100	100
Duration of Training		
1 month	40.0	20
2 months	15.0	60
3 months	2.5	-
4 months	15.0	-
5 months	2.5	-
6 months	7.5	-
7 months	2.5	-
8 months	5.0	-
1 year	5.0	-
2 years	2.5	-
3 years	2.5	20
Total	100	100

Field Survey (2013)

It can be observed in Figure 1 that the modal number of years of experience in fish farming is four (29.1%), followed by three years (20%) and five years (14.5%). Thus, 63.6% of the farmers had between three and five years of experience in fish farming.

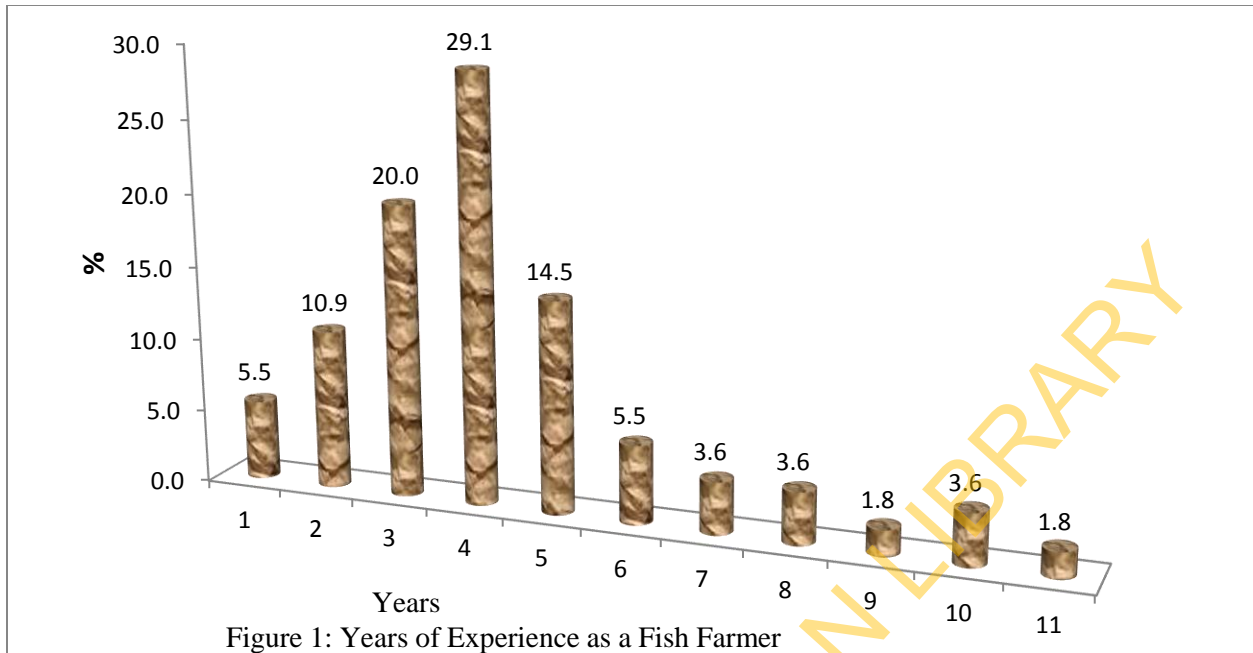


Figure 1: Years of Experience as a Fish Farmer

Field Survey (2013)

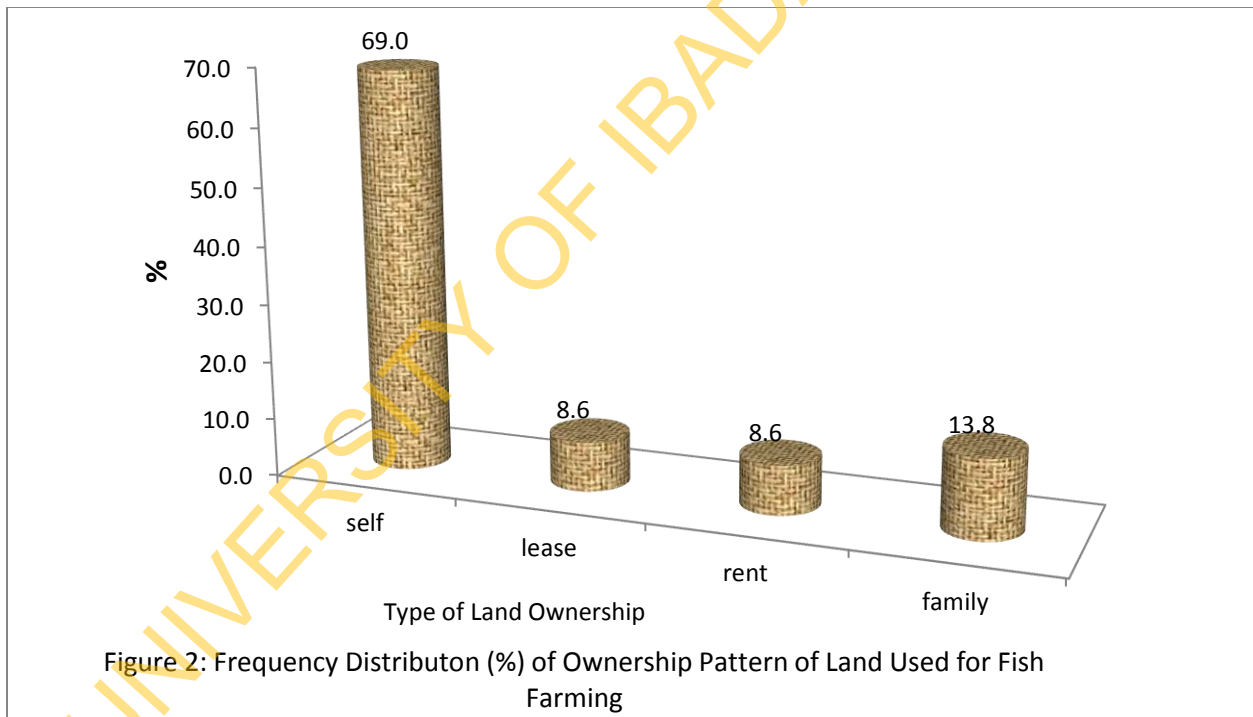


Figure 2: Frequency Distributon (%) of Ownership Pattern of Land Used for Fish Farming

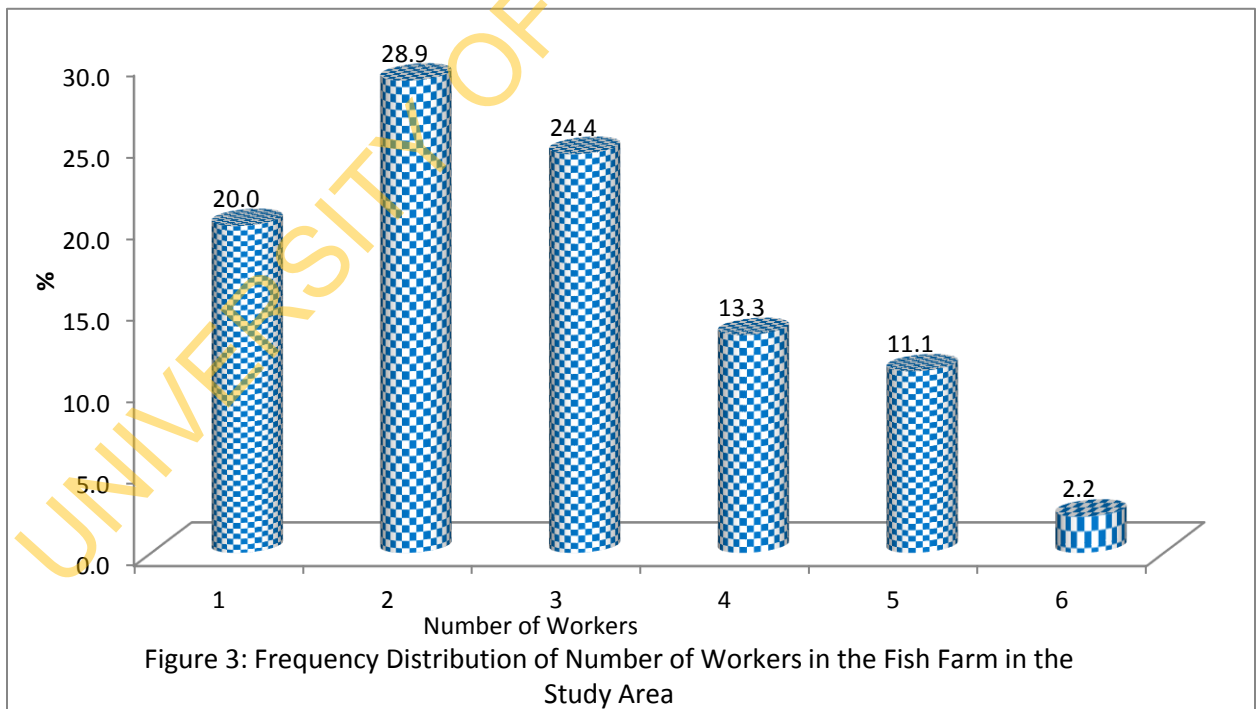
Field Survey (2013)

It can also be observed in Figure 2 that 69.0% of the fish farmers own their land. Land ownership plays very important role in determining the type of use land can be put and the level of investment on the land. A man who owns his land is not restricted to embark only on a particular

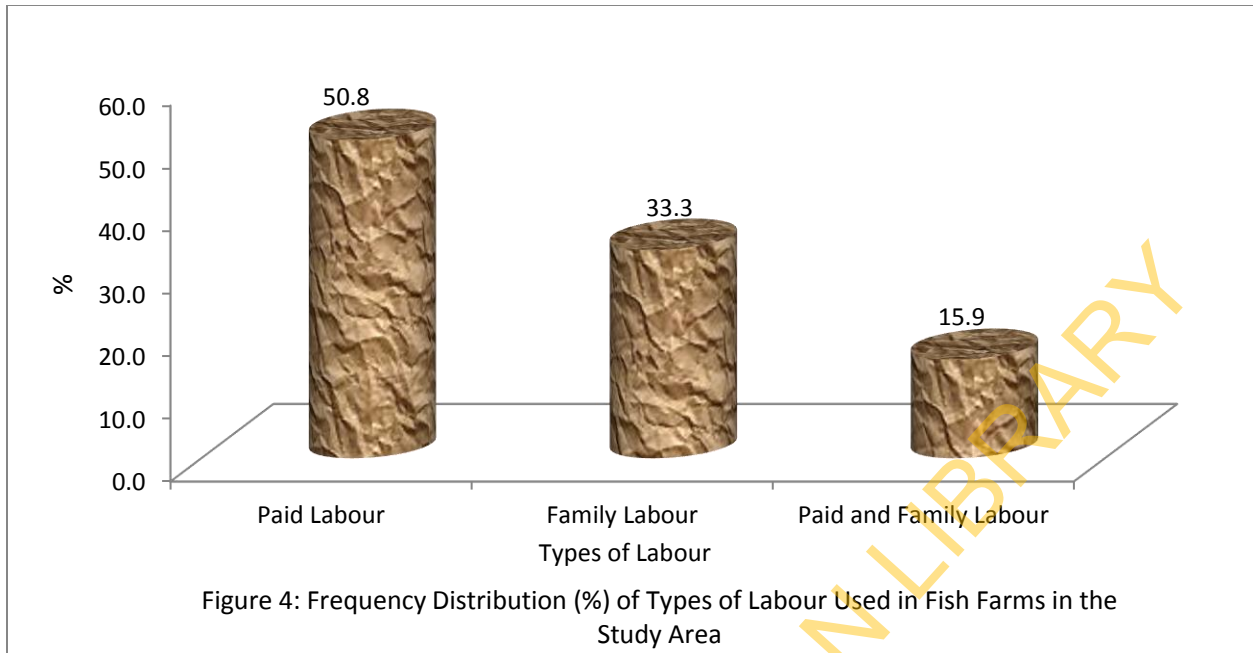
type of farming and can thus adopt new technology without fear of ejection from the land halfway into the practice of the new technology with possible consequence of loss of money and other resources.

4.1.2. Farm Labour Characteristics

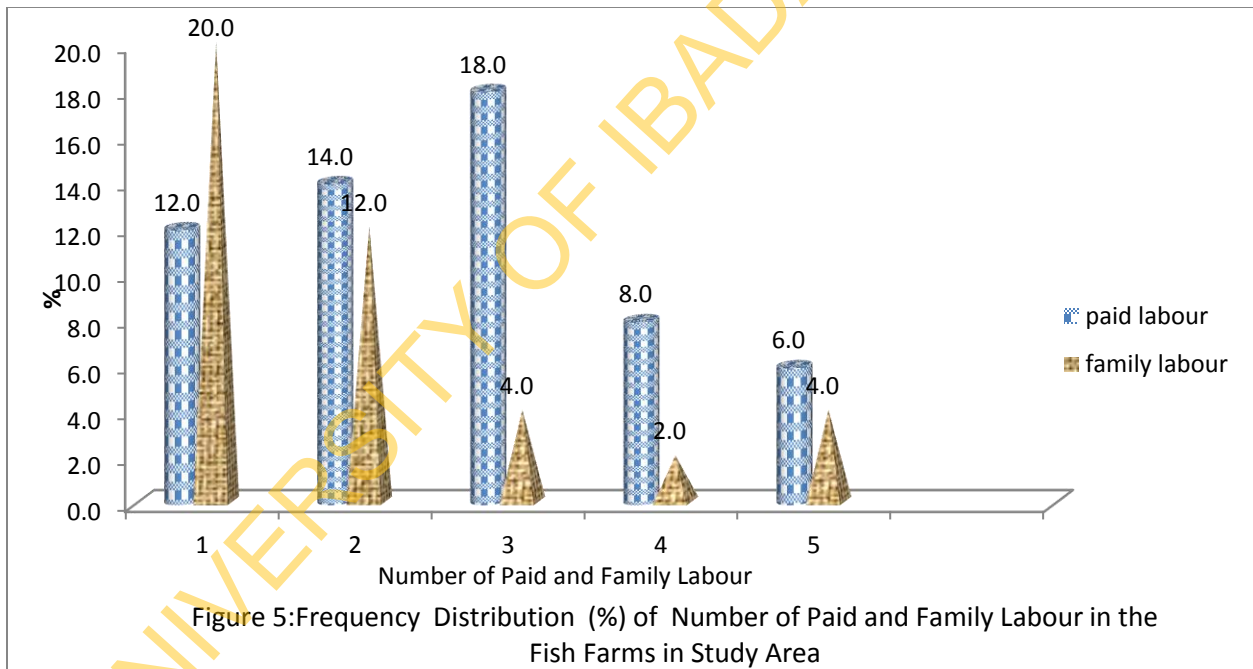
Results in Figure 3 show that 28.9% of the fish farms had two workers, 24.4% had three workers while 20% had only one worker. In essence, most of the farms had between one and three workers. Results in Figure 4 further show that most of the farms (50.8%) were making use of paid labour alone, 33.3% was using family labour while 15.9% was using both paid and family labour. The results in Figure 5 present a kind of comparative analysis of number of paid and family labour working in the fish farm. The results show that the most common number of family labour in the fish farms is one (1) as reported by 20% of the farmers; followed by two (2) reported by 12% of the farmers.



Field Survey (2013)

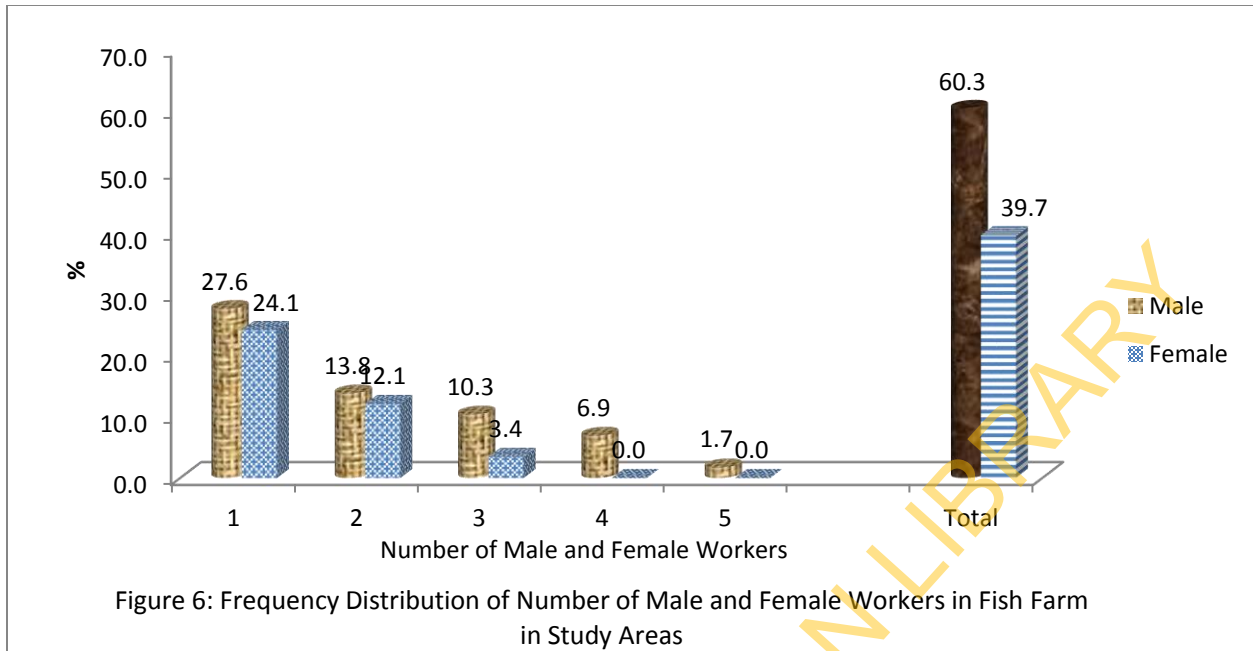


Field Survey (2013)

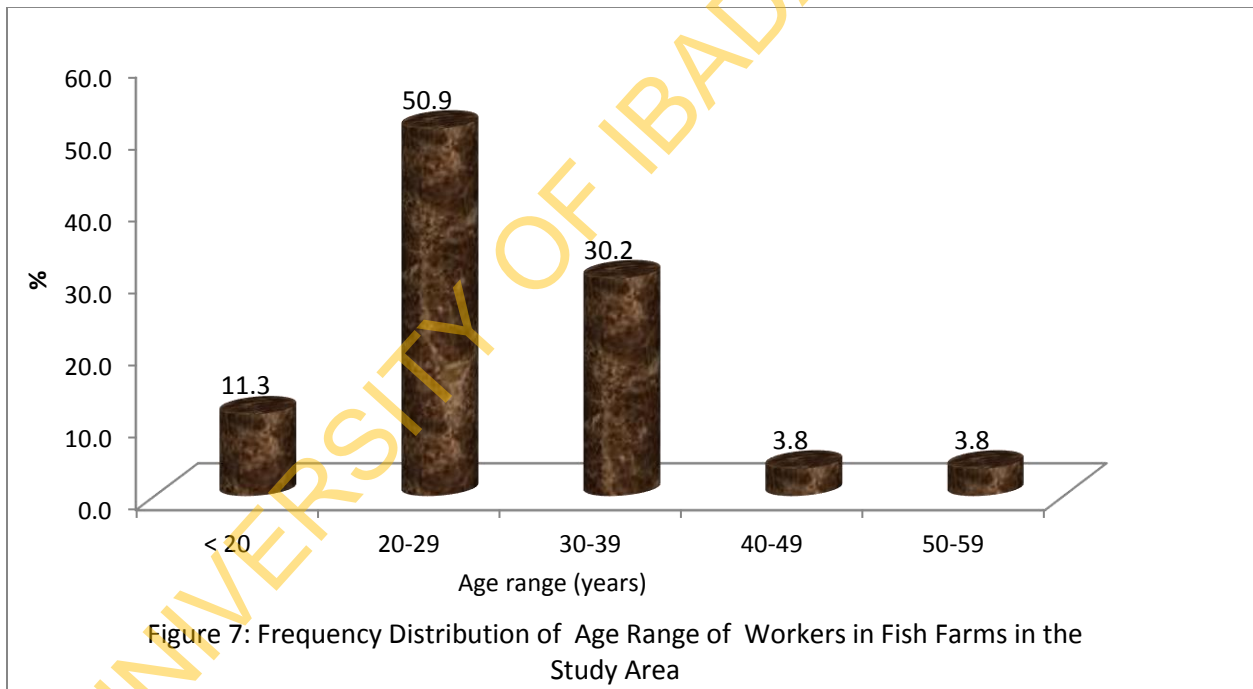


Field Survey (2013)

On the other hand, the modal number of paid workers is three (3) as indicated by 18% of the farmers; followed by two (2) indicated by 14% of the farmers. It can thus be inferred that in general the number of family labour in the fish farms in the study area varies between one and two, while it varies between two and three for paid labour.

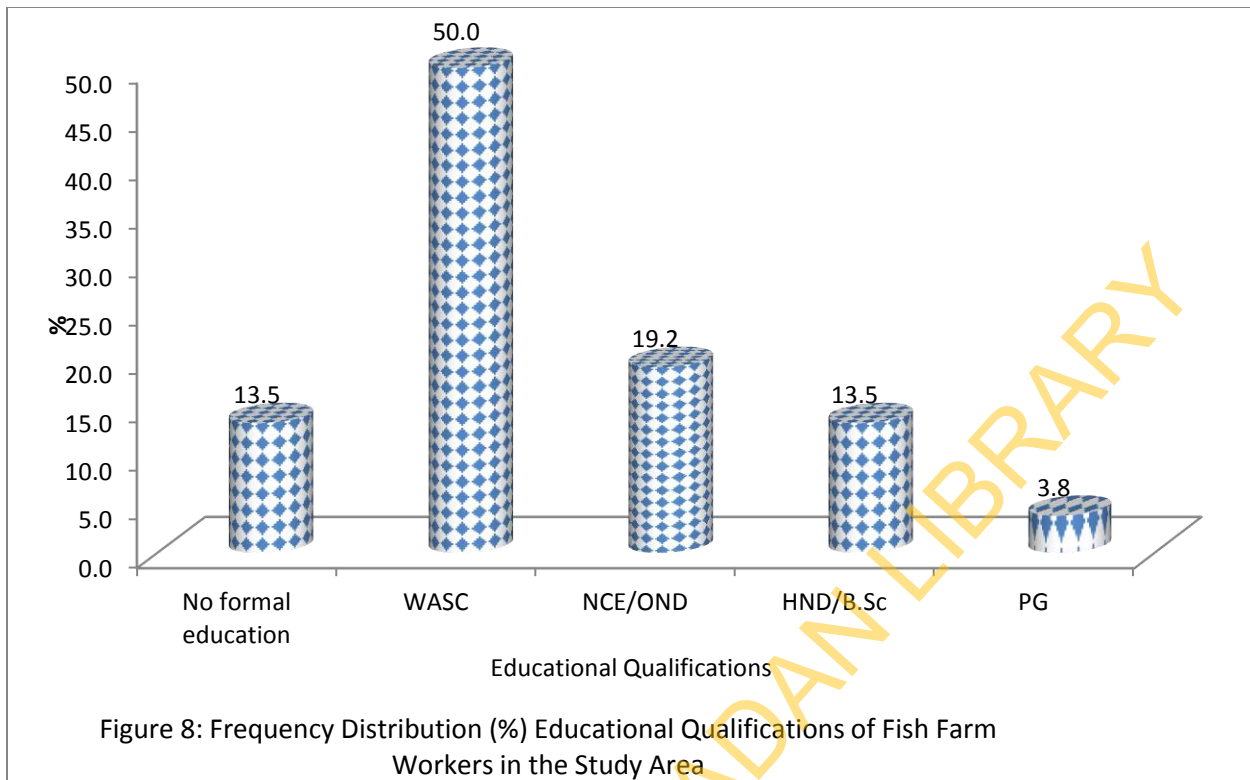


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The gender analysis of the fish farm workers is presented in Figure 6. The farm labour consists mostly of male (60.3) probably because of the tediousness of many components of farm work.



Field Survey (2013)

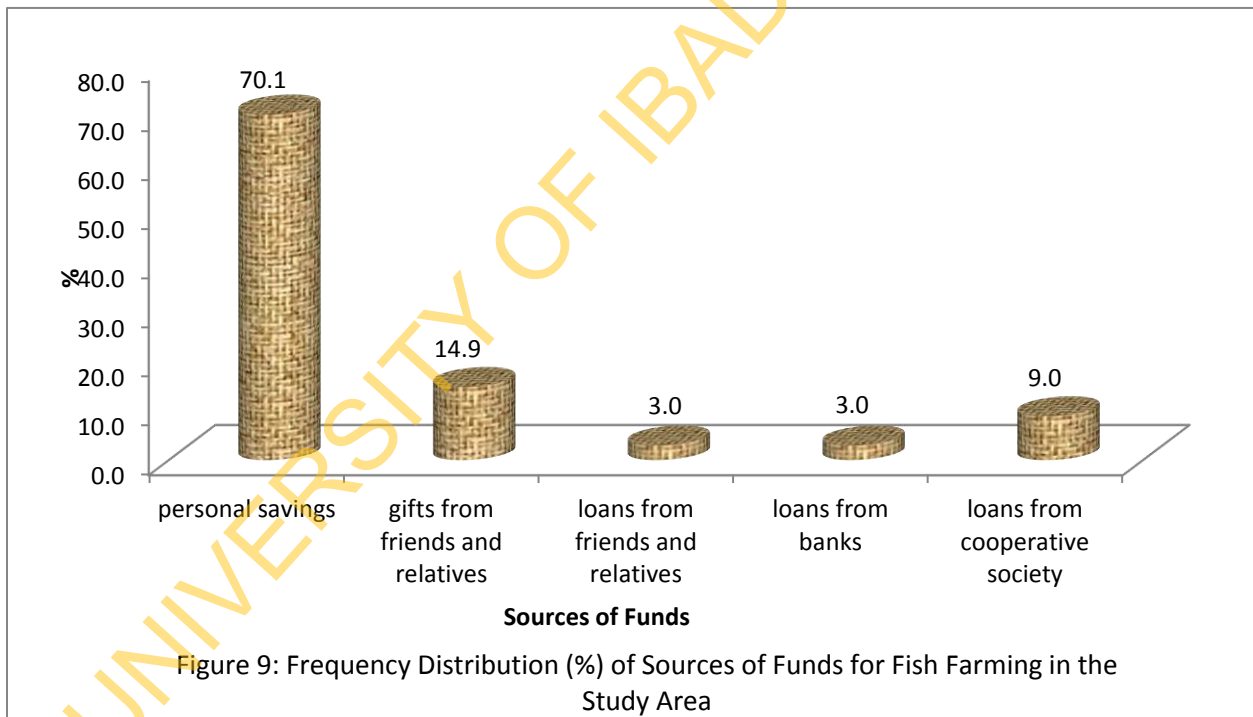
In terms of frequency distribution of number of male and female workers, the results follow the same trend except that as number of workers increases, the number of female workers tends towards zero. This is obvious in the results in Figure 6 where 6.9% and 1.7% of the farmers had four and five male workers respectively without female counterpart.

Other labour related variables considered include age and education. The age group 20 – 29 years accounted for 50.9% while age group 30 – 39 years accounted for 30.2% of the farm labour as shown in Figure 7. This is quite expected since the tedious nature of farm work demands that workers should be strong, energetic and young. Results in Figure 7 show the educational background of the farm workers. Fifty percent of the farm workers possessed West Africa School Certificate (WASC), 19.2% possessed NCE/OND, 13.5% possessed NCE/B.Sc., 13.5% did not have formal education while 3.8% had postgraduate education. It is important for

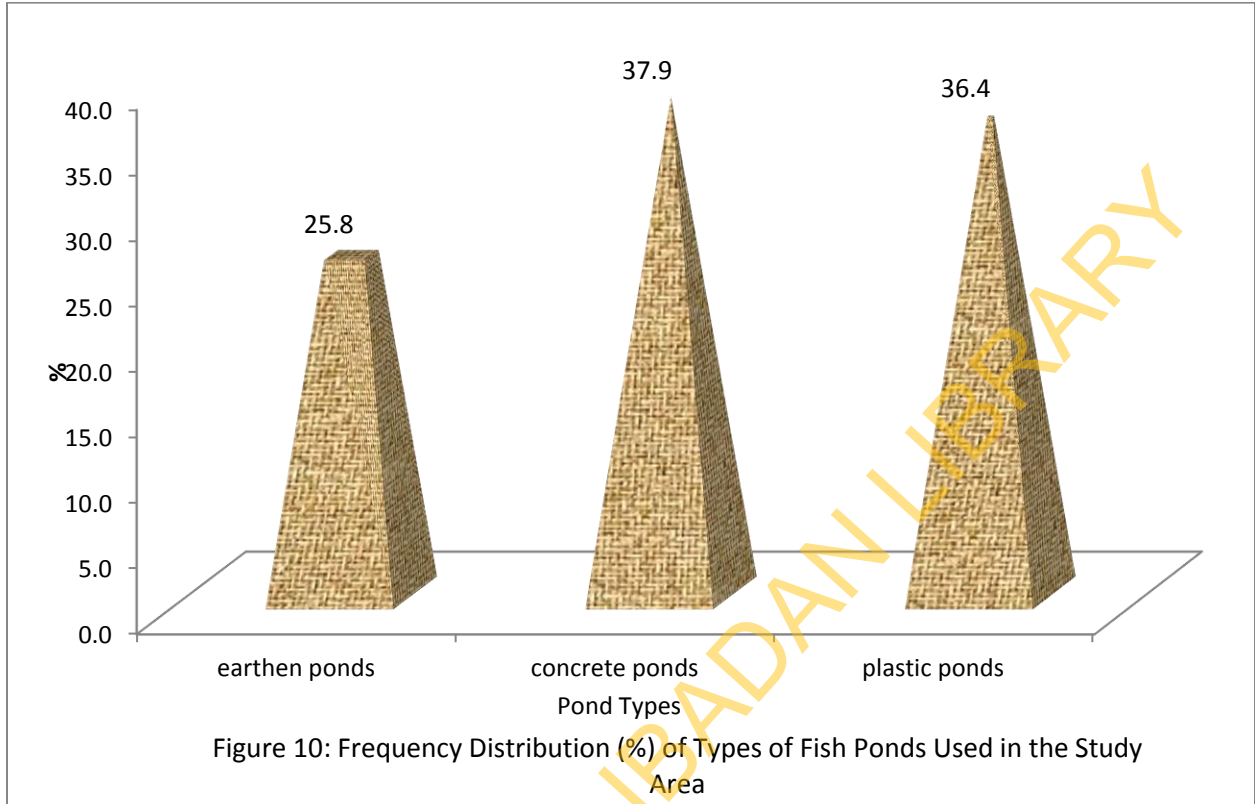
farm workers to be educated in order to be able to carry out instructions and activities with minimum error.

4.1.3. Other Fish Farming Related Variables

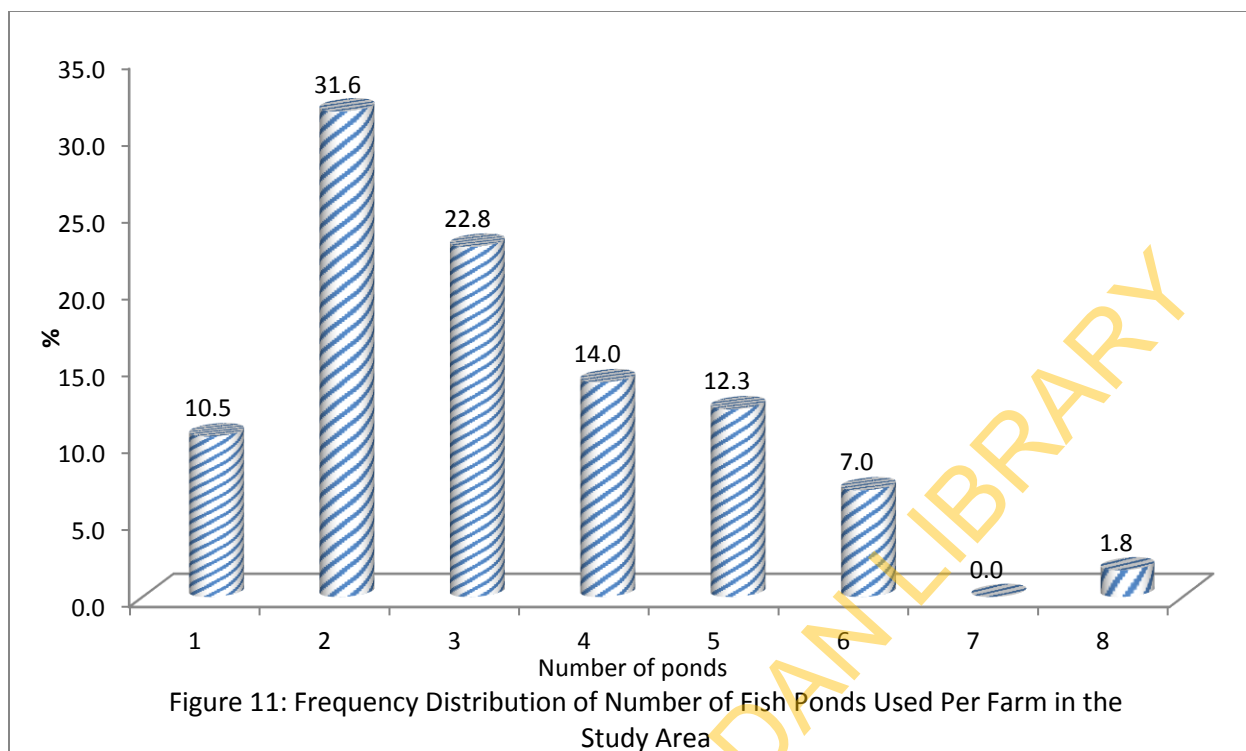
This section takes a look at several variables germane to sustainable management of fish farms. Such variables include funding, types and number of ponds, product types, waste generation and management and marketing of products. Results in Figure 9 show that personal savings constituted 70.1% while gifts from friends and relatives constituted 14.9% of sources of funding. Of particular interest is the low proportion of fish farmers who obtained loans from cooperative society (9.0%) and from banks (3.0%). This low patronage suggests that there may be some difficulties in accessing funds for the development of aquaculture in the study area.



Field Survey (2013)



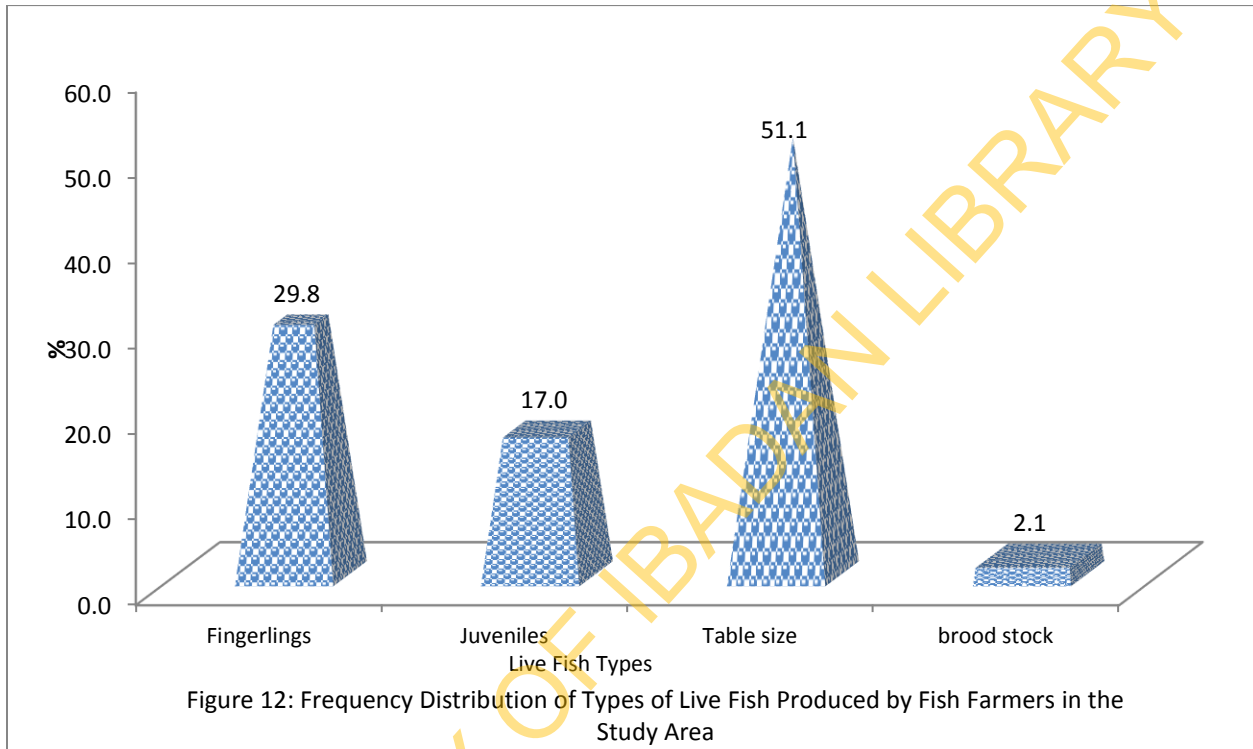
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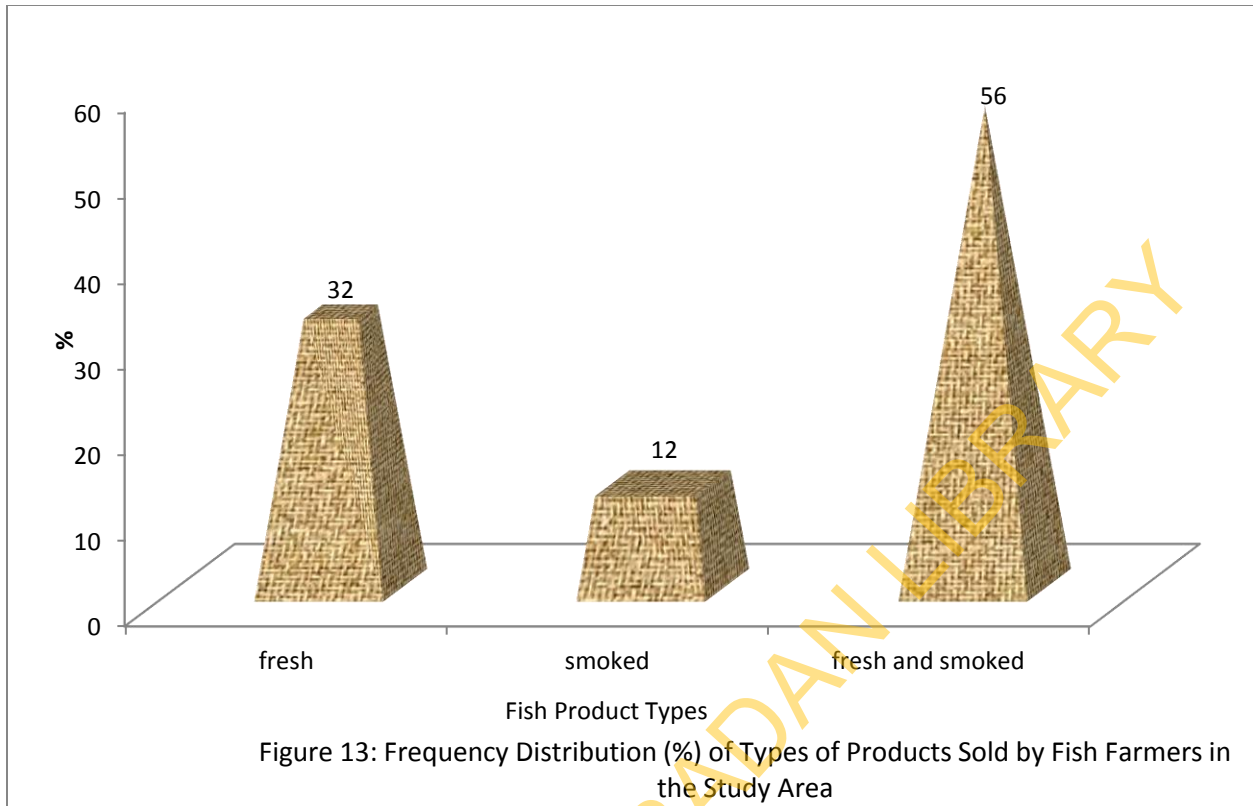
Field Survey (2013)

The results in Figure 10 show that 37.9%, 36.4% and 25.8% of the farmers were using concrete, plastic and earthen ponds respectively. Meanwhile, results in Figure 11 indicate that 31.6% had two ponds, 22.8% had three ponds, 14.0% had four ponds, and 12.3% had five ponds. Thus it is deducible that most of the farmers had between two and three ponds. Furthermore, 51.1% was producing table size fish, 29.8% was producing fingerlings, 17.0% was producing juveniles while only 2.1% was producing brood stock (Figure 12). Likewise, in Figure 13, 56% of the farmers were producing both fresh and smoked fish, 32% was producing fresh fish while only 12% was producing smoked fish. *Clarias garipienus* was the most commonly produced fish species (89.4%), 8.5% was producing *Clarias heterobranchus* while only 2.1% was producing *Tilapia* in the study area as can be observed in Figure 14. Fish farmers in the study area have two main outlets of selling their fish viz. farm gate sales and supplies to eateries. Thus it can be observed in Figure 15 that 44.2% of the farmers were engaged in farm gate sales while 13.5%

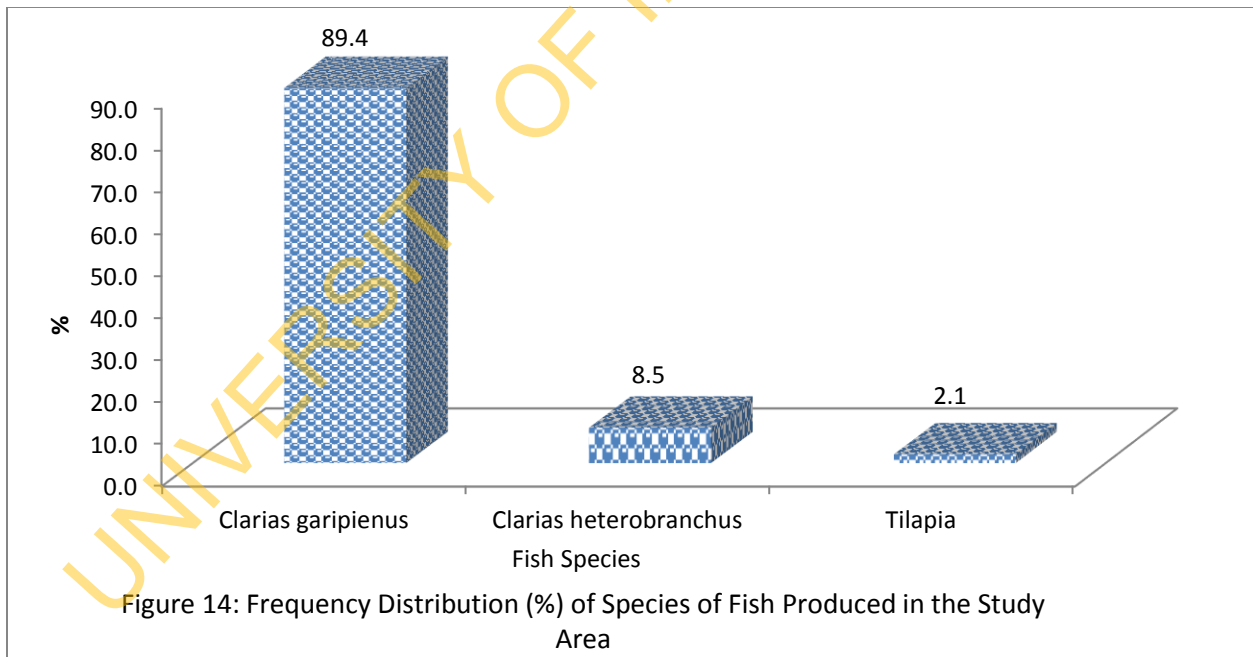
were engaged in supplies to eateries. However, many of the farmers (42.3%) were engaged in both farm gate sales and supplies to eateries.



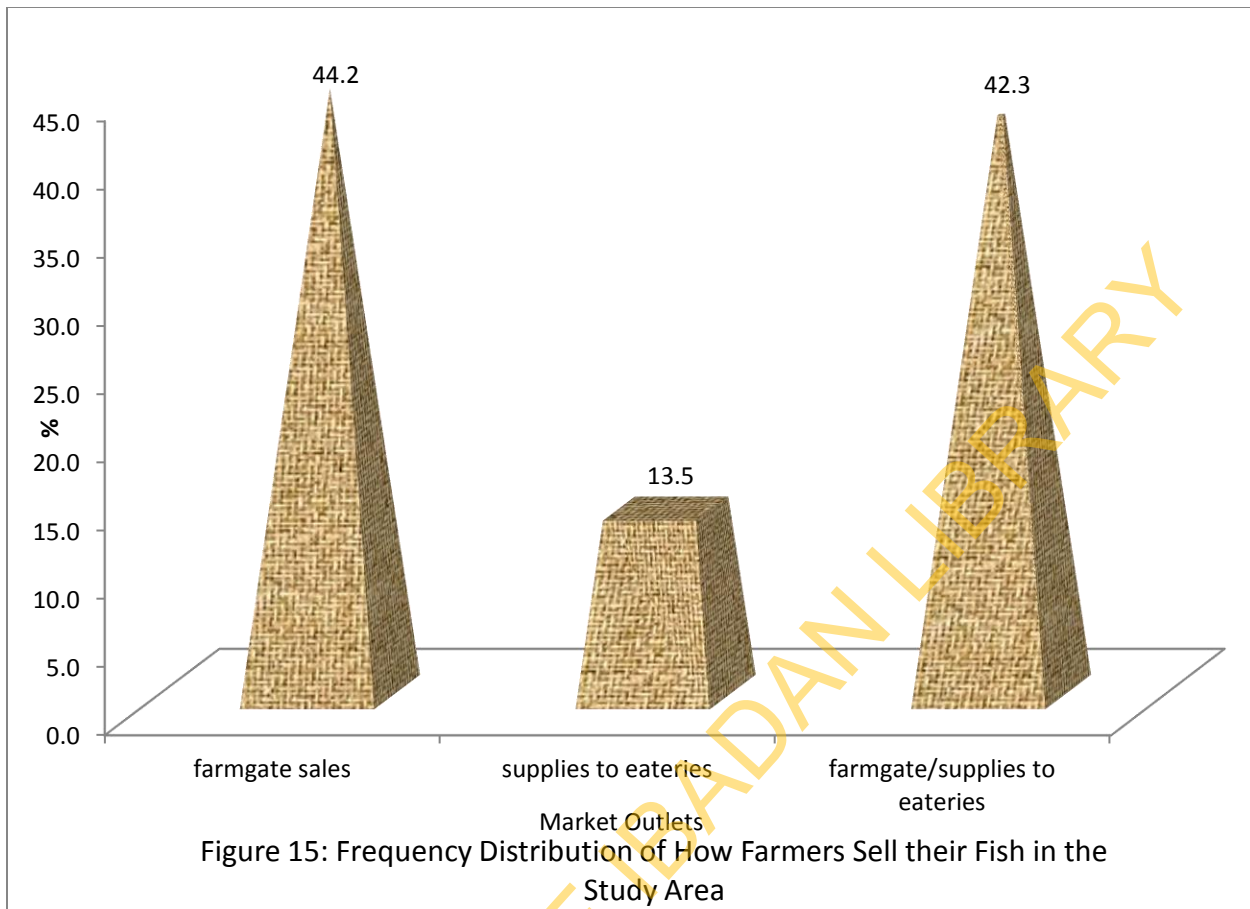
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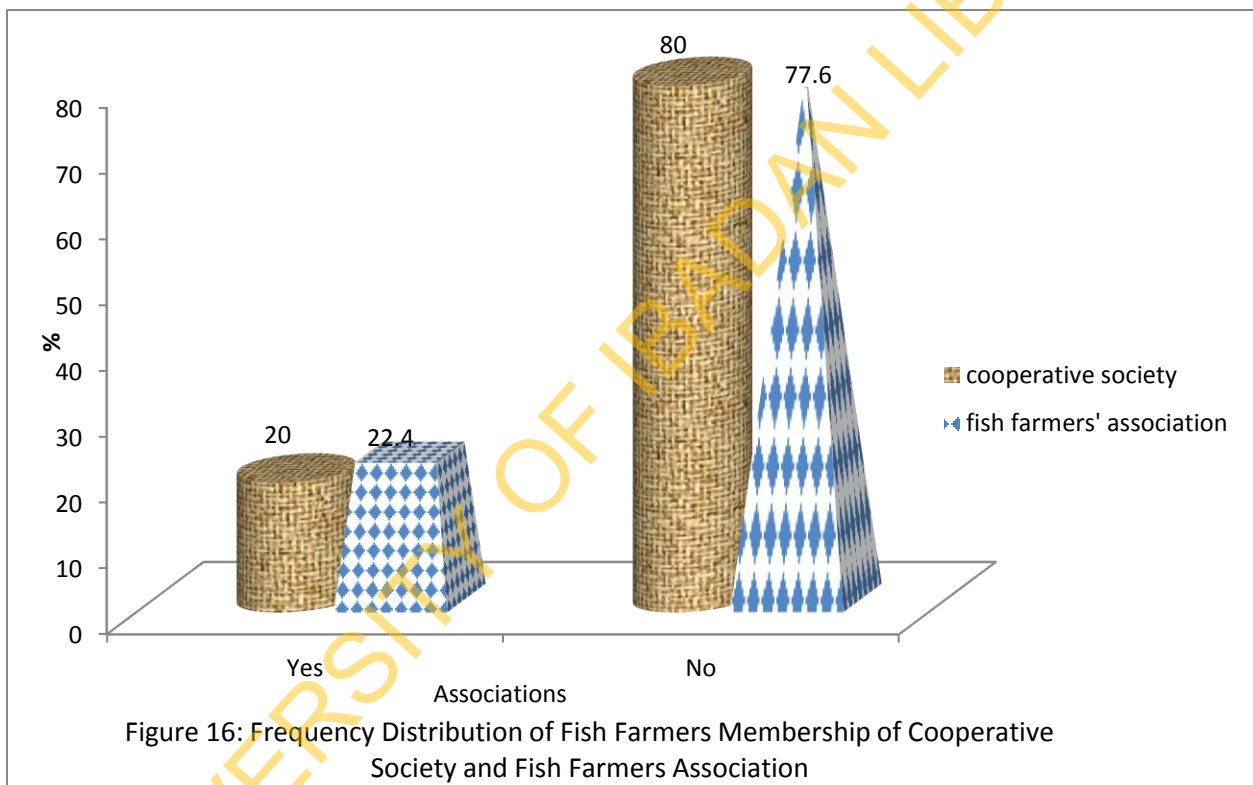
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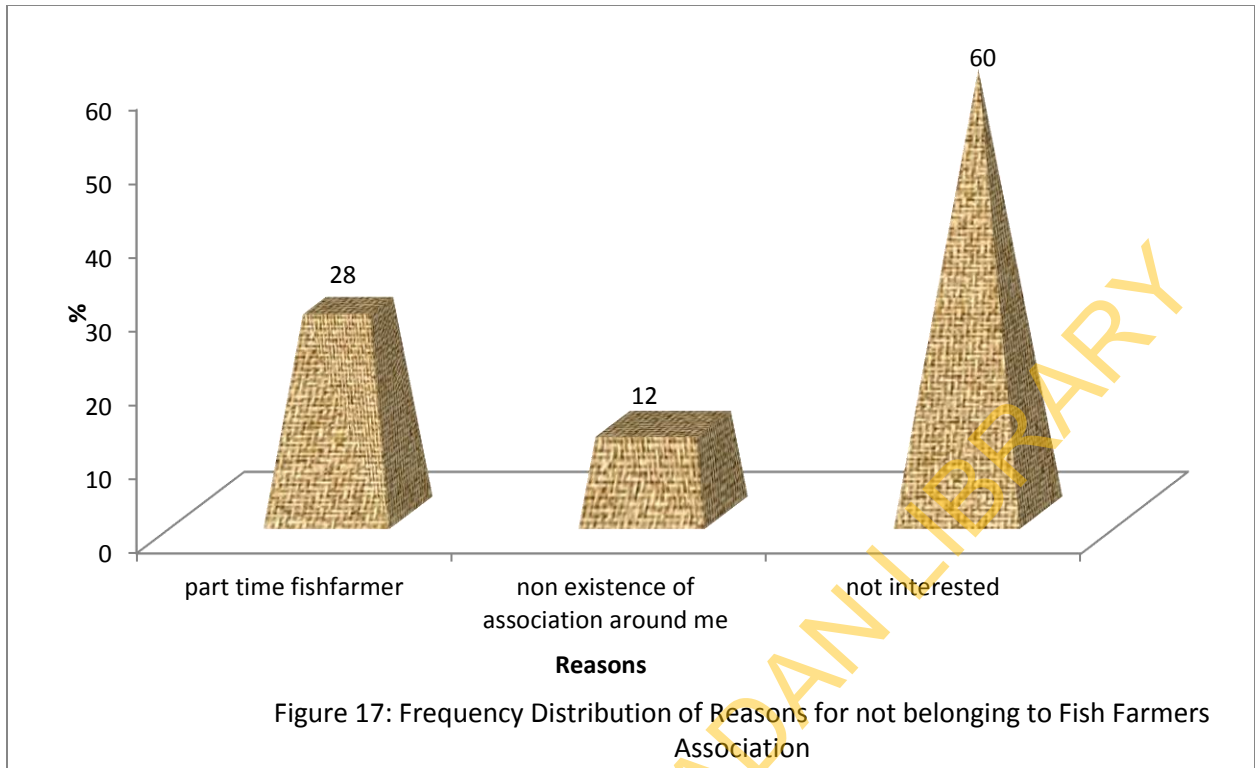
Field Survey (2013)

Figures 16, 17 and 18 present the frequency distribution of fish farmers' membership of cooperative society and fish farmers' association, reasons for not being members of the associations and benefits gained from membership of these associations. From the results in Figure 16 only 20% and 22.4% of the farmers were members of cooperative societies and fish farmers association respectively in the study area. The reasons for this low involvement of the fish farmers in the associations according to the results in Figure 17 include farmers not being interested in the associations (60%), being a part time fish farmer (28%) and non-existence of the associations around the farmers (12%). The associations appear to concentrate on a specific service to the members as shown in Figure 18. For instance, 77.8% of the members of cooperative society identified loan as a benefit derivable from being a member of the society

while 50% of the members of farmers' association identified information dissemination as a benefit derivable from membership of the association. Apparently, loan and information dissemination is the respective major service of cooperative society and farmers' association in the study area. Nevertheless, 11.1% identified consultation and information dissemination as other benefits derivable from being members of cooperative society. Similarly, 25% identified loan and consultation as other benefits derivable from membership of farmers' association.

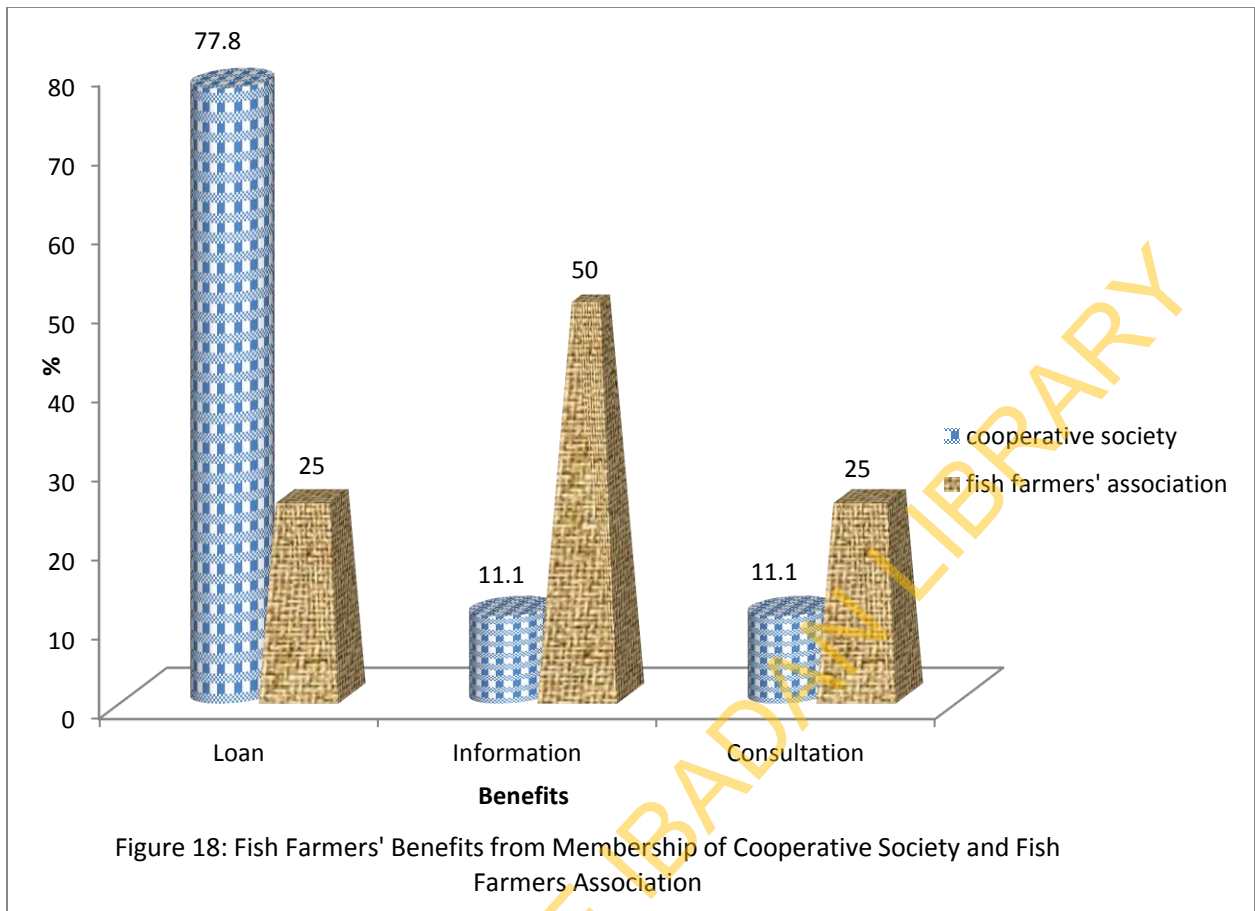


Field Survey (2013)



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Field Survey (2013)

4.2. FISH FARMERS' AWARENESS AND PRACTICE OF INTEGRATED FISH FARMING

The frequency distribution of awareness and practice of integrated fish farming is presented in Table 3. The results in the Table show that 78.4% of the farmers were aware of integrated fish farming, 77.1% has seen integrated fish farming in some farms (77.4%), on the television (16.1%) and in schools (6.5%). However, awareness of specific type of integrated fish farming system is generally low. For example only 16.7% was aware of fish cum vegetable and pig integrated farming system while only 11.8% was aware of fish cum vegetable and cattle integrated farming system. Similarly, 6.3% was aware of fish cum rice and poultry integrated farming system, 5.9% was aware of fish cum rice and pig integrated farming system while 5.3% was aware of fish cum rice and cattle integrated farming. The only exception to this trend is the awareness of fish cum vegetable and poultry integrated farming system in which 42.1% claimed to be aware of such an integrated fish farming system. Furthermore, only 23.5% of the farmers indicated that they have practiced one form of integrated fish farming or the other. The results show a generally poor level of awareness and practice of different types of integrated fish farming, thus the situation calls for awareness creation programme on the benefits and needs for integrated fish farming systems in this part of the globe.

Table 3: Frequency Distribution of Awareness and Practice of Integrated Fish Farming by Farmers in the Study Area

	Frequency Distribution (%)	Total
Awareness of Integrated Fish Farming		
Yes	78.4	100
No	21.6	
Previous sighting of Integrated Fish Farms		
Yes	77.1	100
No	22.9	
Where were the Integrated Fish Farms Sighted		
On other farms	77.4	100
On the Television	16.1	
In school	6.5	
Awareness of Fish cum Vegetable and Pig Integrated Farming		
Yes	16.7	100
No	83.3	
Awareness of Fish cum Vegetable and Poultry Integrated Farming		
Yes	42.1	100
No	57.9	
Awareness of Fish cum Vegetable and Cattle Integrated Farming		
Yes	11.8	100
No	88.2	
Awareness of Fish cum Rice and Poultry Integrated Farming		
Yes	6.3	100
No	93.8	
Awareness of Fish cum Rice and Pig Integrated Farming		
Yes	5.9	100
No	94.1	
Awareness of Fish cum Rice and Cattle Integrated Farming		
Yes	5.3	100
No	94.7	
Previous Practice of Integrated Fish Farming		
Yes	23.5	100
No	76.5	

Source: Field Survey (2013)

4.3. FARMERS' PERCEPTION ON INTEGRATED FISH-RICE-PIG PRODUCTION SYSTEM

Results in Table 4 show the perception of fish farmers on integrated fish-rice-pig production system. The results are indications of the extent of agreement or disagreement of the farmers to some statements on the integrated aquaculture. Perceptions on a technology can influence largely the disposition and eventual willingness to adopt the technology by the farmers. From the table, 9.1% and 80% of the fish farmers agreed and strongly agreed respectively with the concept of Integrated Fish Farming (IFF) being a combination of fish farming with crop or animal husbandry. Likewise, 14.5 and 63.6 agreed and strongly agreed respectively that IFF utilizes natural resources efficiently; 16.7% and 63.0% agreed and strongly agreed respectively that it ensures that wastes from each farming enterprise are appropriately utilized for increased production; while 16.7% and 59.3% agreed and strongly agreed respectively that IFF maximizes productivity through optimal utilization of resources. Similarly, 34% and 16% respectively agreed and strongly agreed that IFF minimizes cost of fish production especially fish feed; 24.1% and 36% agreed and strongly agreed respectively that it safeguards the environment from pollution through the use of industrial and agricultural by-products and wastes; 18.5% and 57.4% agreed and strongly agreed respectively that IFF provides other sources of income rather than only one from fish farming; while 16.3% and 46.5% respectively agreed and strongly agreed that IFF is more profitable than sole fish farming. Furthermore, 18.9% and 52.8% respectively agreed and strongly agreed that integrated fish farming ensures a spread of financial risk due to the varied and diversified nature in rearing of fish, animals and crops, and so did 14.5% and 45.5% respectively agreed and strongly agreed that integrated fish farming can improve income status of the rural farmers and reduce poverty level among fish farmers.

Table 4: Frequency Distribution (%) of Farmers' Perception on Integrated Farming of Fish cum Rice and Pig

Statements	Agree	Strongly agree	I don't know	Disagree	Strongly disagree	Total
Integrated fish farming (IFF) involves combination of fish farming with crop or animal husbandry.	9.1	80.0	10.9	-	-	100
IFF utilizes natural resources efficiently.	14.5	63.6	20.0	1.8	-	100
IFF ensures that wastes from each farming enterprise are appropriately utilized for increased production.	16.7	63.0	18.5	1.9	-	100
Integrated fish farming maximizes productivity through optimal utilization of resources.	16.7	59.3	22.2	1.9	-	
Integrated fish farming minimizes cost of fish production especially fish feed.	34.0	16.0	24.0	4.0	22.0	100
Integrated fish farming safeguards the environment from pollution through the use of industrial and agricultural by-products and wastes.	24.1	37.0	24.1	11.1	3.7	100
Integrated fish farming provides other sources of income rather than only one from fish farming	18.5	57.4	16.7	7.4	-	100
Integrated fish farming is more profitable than sole fish farming.	16.3	46.5	25.6	4.7	7.0	100
Integrated fish farming ensures a spread of financial risk due to the varied and diversified nature in rearing of fish, animals and crops.	18.9	52.8	22.6	1.9	3.8	100
Integrated fish farming can improve income status of the rural farmers and reduce poverty level among fish farmers.	14.5	54.5	23.6	5.5	1.8	100
Integrated farming of fish-rice-pig should not be practiced because of the noise of pigs	18.5	16.7	20.4	22.2	22.2	100
Integrated farming of fish-rice-pig should not be practiced because of the odour of faeces of pigs	20.4	13.0	22.2	20.4	24.1	100
Integrated farming of fish-rice-pig can cause outbreak of disease for fishes if not well managed and should therefore not be practiced	22.2	16.7	16.7	22.2	22.2	100
Integrated farming of fish-rice-pig does not have any advantage at all	3.7	14.8	27.8	27.8	25.9	100
The advantages of integrated farming of fish-rice-pig exceed the disadvantages and should therefore be encouraged.	25.9	29.6	25.9	7.4	11.1	100

Field Survey (2013)

The last five statements in Table 4 focus on the integrated fish-rice-pig production system and try to explore in specific term the farmers' perception of this particular integrated system. From the table, it can be observed that 22.2% disagreed and equally strongly disagreed with the statement that integrated farming of fish-rice-pig should not be practiced because of the noise of pigs. However 18.5% and 16.7% agreed and strongly agreed with the statement while 20.4% of the farmers could not make up their minds. Similarly 20.4% and 24.1% respectively disagreed and strongly disagreed with the statement that integrated farming of fish-rice-pig should not be practiced because of the odour of faeces of pigs; 20.4% and 13.0% respectively agreed and strongly agreed with the statement while 22.2% was neither here nor there. Likewise, 22.2% disagreed and also strongly disagreed with the statement that integrated farming of fish-rice-pig can cause outbreak of disease for fishes if not well managed and should therefore not be practiced; 22.2% and 16.7% respectively agreed and strongly agreed with the statement while 16.7% neither agreed nor disagreed.

The trend of the responses however changes when it comes to the statement that integrated farming of fish-rice-pig does not have any advantage at all. Thus, 27.8% and 25.9% disagreed and strongly disagreed respectively with the statement and on the contrary only 3.7% and 14.8% respectively agreed and strongly agreed with the statement.

Moreover, 25.9% and 29.6% agreed and strongly agreed with the statement that the advantages of integrated farming of fish-rice-pig exceed the disadvantages and should therefore be encouraged. Nevertheless, 7.4% and 11.1% respectively disagreed and strongly disagreed with the statement.

The summary of the results in Table 4 is that 89.1% was of the opinion that integrated fish farming involves combination of fish farming with crop or animal husbandry; 78.1% concurred

with the statement that integrated fish farming utilizes natural resources efficiently; 79.7% also subscribed to the statement that integrated fish farming ensures that wastes from each farming enterprise are appropriately utilized for increased production; 76% acceded to the statement that integrated fish farming maximizes productivity through optimal utilization of resources; and 50% was of the view that integrated fish farming minimizes cost of fish production especially fish feed. Furthermore, 61.1% was in accord with the statement that integrated fish farming safeguards the environment from pollution through the use of industrial and agricultural by-products and wastes; 75.9% supported the statement that integrated fish farming provides other sources of income rather than only one from fish farming; 62.8% consented that integrated fish farming is more profitable than sole fish farming; 71.7% assented that integrated fish farming ensures a spread of financial risk due to the varied and diversified nature in rearing of fish, animals and crops; while 69% approved of the statement that integrated fish farming can improve income status of the rural farmers and reduce poverty level among fish farmers. However, 44.4% did not support the statement that integrated farming of fish-rice-pig should not be practiced because of the noise of pigs; similarly 44.5% did not concur with the statement that integrated farming of fish-rice-pig should not be practiced because of the noise of pigs; neither did 44.4% approve of the statement that integrated farming of fish-rice-pig can cause outbreak of disease for fishes if not well managed and should therefore not be practiced. Furthermore, 53.7% vehemently disagreed with the statement that integrated farming of fish-rice-pig does not have any advantage at all and moreover, 55.5% concluded that the advantages of integrated farming of fish-rice-pig exceed the disadvantages and should therefore be encouraged.

The inference from the preceding summary is that the farmers have a generally positive perception and favourable disposition to integrated fish farming, however the disposition and by

extension support for integrated fish-rice-pig production is not overwhelming as evidenced from less than 50% of the farmers that presented positive perception and good disposition to this integrated production system.

4.4. WILLINGNESS TO ADOPT INTEGRATED FISH-RICE-PIG PRODUCTION SYSTEM

Results in Table 5 show that 51.2% of the farmers were willing to adopt integrated fish cum rice and pig production while 48.8% were not willing to adopt the technology. Maximization of production i.e. improved resource use efficiency accounted for 50% of the reasons why farmers were willing to adopt the technology. Other reasons include boosting of food production which accounted for 33.3%, as well as waste utilization and reduction in cost which accounted for 16.7% of the reasons for willing to adopt the technology.

On the other hand, 33.3% of the farmers were not willing to adopt the technology because according to them it is stressful and time consuming, 25% believed that the technology will require large land, 12.5% also believed it will require large capital, 12.5% opined that it will spread diseases while 6.5% was just not interested. The foregoing are the reasons why only 51.2% of the farmers were willing to adopt integrated fish-rice-pig production system.

Incidentally, many of the reasons show the level of understanding of the farmers and thus the proponents of the technology need to educate the farmers in order to clear their minds about their perceived misgivings of the technology and to instill on them the merits of the technology.

The results in Table 6 show that the selected socioeconomic variables have no significant influence ($p=0.05$) on the fish farmers' willingness to adopt integrated farming of fish cum rice and pig production.

Table 5: Frequency Distribution of Willingness to Adopt Integrated Farming of Fish cum Rice and Pig

	Frequency (%)
Willingness to Adopt Integrated Farming of Fish cum Rice and Pig	
Yes	51.2
No	48.8
Total	100
Reasons for Willing to Adopt Integrated Fish Farming of Fish cum Rice and Pig	
Food production	33.3
Maximize production	50.0
No waste and less expenditure	16.7
Total	100
Reasons for not Willing to Adopt Integrated Farming of Fish cum Rice and Pig	
Spreads disease	12.5
Not interested	6.3
Require large land	25.0
Require large capital	12.5
Stressful and time consuming	31.3
Non rice growing region	12.5
Total	100

Field Survey (2013)

Table 6: Logit Regression Analysis of Influence of Selected Socioeconomic Factors on Willingness to Adopt Integrated Fish cum Rice and Pig Production

	B	S.E.	Wald	df	Sig.
Sex	-16.622	40192.967	.000	1	1.000
Age	.390	.428	.830	1	.362
Civil Servant	-1.183	3.640	.106	1	.745
Household Size	4.809	4.477	1.154	1	.283
Businessman	46.320	56841.441	.000	1	.999
Farmer	-5.314	6.299	.712	1	.399
Secondary Education	-23.215	56841.442	.000	1	1.000
NCE/OND	14.313	17.717	.653	1	.419
HND/B.Sc.	12.316	12.021	1.050	1	.306
Constant	-75.932	56841.484	.000	1	.999

Dependent Variable: Willingness to adopt Integrated Fish-Rice-Pig Production System

Source: Computed from Primary Field Data (2013)

CONCLUSION

Even though the fish farmers in the study area are generally well disposed to the technology of integrated fish-rice-pig production system, the excitement for adoption of the technology is not so overwhelming. Therefore there is a need to put in place different platforms through which the merits of the technology will be explained to the farmers and their fears on the perceived challenges of the technology will be allayed.

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APPENDIX

POVERTY ERADICATION AND GRASSROOTS EMPOWERMENT THROUGH SUSTAINABLE INTEGRATED AQUACULTURE DEVELOPMENT: FISH CUM RICE AND PIGGERY PRODUCTION RESEARCH INSTRUMENT

Dear Fish Farmer,

This study is focused on the development of a sustainable integrated aquaculture system with rice and pig production in Nigeria. Please can you take few minutes to attend to this questionnaire? All information you provide will be used only for research purpose and treated with utmost confidentiality.

Thank you.

Dr Ajewole. O.I

University of Ibadan, Nigeria.

1. State _____
2. Name of farm: _____
3. Religion: _____
4. Sex: a) Male () b) Female ()
5. Age: _____
6. Marital Status: a) Single () b) Married () c) Divorced () d) Others _____
7. Household size _____
8. Primary Occupation: _____
9. Secondary Occupation _____
10. Educational Level: i) No formal education () ii) Primary () iii) Secondary ()
iv) NCE/OND () v.) HND/B.Sc.() vi) Postgraduate () vii) Others.....
11. Income (₦) per annum _____
12. How long have you been a fish farmer?.....
13. Did you receive any training on fish farming BEFORE you started fish farming? i) Yes () ii)No ()
If No to Question 13, please go to Question 17
14. If yes to Question 13, where did you receive your training?
15. What was the duration of your training?
16. What kind of training did you receive?
17. Did you receive any training on fish farming AFTER you started fish farming? i) Yes () ii) No ()
18. If yes to Question 17, where did you receive your training?
19. What was the duration of your training?
20. What kind of training did you receive?
21. Are you an indigene of this town/state?
22. Do you own the land you are using for fish farming? i) Yes ii) No
23. If No to Question 22, how did you get the land you are using for fish farming? i) Lease () ii) Rent ()
iii) Others.....
24. How many people are working for you in your farm?
25. How many of the workers are you paying?
26. How many of the workers are members of your family?
27. How many of your workers are: i) Men () ii) Women ()
28. How many of your workers are within the following age ranges (in years) : i) below 20 ()
(ii) 20-29 () iii) 30-39 () iv) 40-49 (), v) 50-59 () vi) 60 and above
28. How many of your workers possess the following academic qualifications: i) No formal education ()
ii) WASC (), iii) OND/NCE (), iv) HND/B.Sc. () v) Postgraduate (), vi) Others ()
29. Please fill in the Table below to indicate sources and cost of funds for your fish farming?

Sources of Funds	Year	Interest rate (%) per year	Amount
Personal savings			
Gifts from friends and relatives			
Loans from friends and relatives			
Loan from Banks			
Loan from cooperative societies			
Other sources			

30. Please can you give information on your ponds in the Table below?

Types	Number	Dimension/m ² /ha	Unit cost
Earthen ponds			
Concrete ponds			
Plastics			
Others			

31. Please can you give information on fish products that are being produced by you in the Table below?

Types	Species	Annual production (Kg)	Reasons for producing the product
Fry/ fingerlings			
Juveniles			
Post Juveniles			
Table Size			
Brood stock			

32. What kind of waste do you generate in your fish farm?

33. How do you dispose the waste from your fish farm?

34. Do you have any challenges with your waste disposal? i) Yes (), ii) No ()

35. If yes to Question 34, what kind of challenges do you have?

36. How do you sell your fish products? i) Fresh (), ii) Smoked (), iii) Sun dried, iv) Filleted (), v) Grilled (), vi) Others.....

37. Do you belong to any cooperative society? i) Yes (), ii) No ()

38. If yes to Question 37, what benefits have you enjoyed from being a member of the cooperative society?.....

39. Are you a member of fish farmers association? i) Yes (), ii) No ()

If No to Question 39, please go to Question 43

40. If yes to Question 39, what benefits have you derived from being a member of the association?

41. Are there guidelines/regulations of the association that are limiting your fish farming activities? i) Yes (), ii) No ()

42. If yes to Question 41, can you mention those guidelines/regulations?

43. If No to Question 39, why are you not a member of fish farmers association?

44. How do you market your fish produced: i) Sales at farm gate (), ii) Wholesaler/middle men () iii) Supplies to eateries on request (), iv) others specify)_____

45. Do you encounter problems during fish marketing? a) Yes () b) No ()

46. If Yes to Question 45, what problems do you encounter during fish marketing?

i) Bad road network () ii) Poor fish demand () iii) Middle men exploitation () iv) High transport cost () v) Irregular fish supply (), vi) Others (please specify)

47. Do you think your scale of operation is sufficient to yield significant profit? a)Yes () b) No ()

48. If no what is the reason for your low scale of operation? i) Inadequate finances () ii) Low demand for the cultured fish () iii) High cost of fish feed () iv) Diseases () v) Bad quality water () vi) Poachers () vii) Predators () viii) Others (please specify)_____

49. Are you aware of Integrated Fish Farming? i) Yes (), ii) No ()

50. If yes to Question 49, what in your understanding is Integrated Fish Farming?
.....

51. Have you seen an integrated fish farm before? i) Yes (), ii) No ()

52. If yes to Question 51, where did you see the Integrated Fish Farm?

53. What type of Integrated Fish Farm have you seen or known of?

54. Can you please tick appropriate spaces in the Table below to provide information on knowledge and adoption of integrated fish farming system?

Integrated fish farming system	Not aware	Aware but not adopted	Reasons for non-adoption	Year of awareness	Adopted	Year adopted
Fish-vegetable-pig						
Fish-vegetable-poultry						
Fish-vegetable-cattle/goat/sheep						
Fish-rice poultry/duck						
Fish-rice- pig						
Fish-rice- cattle/goat/sheep						
Others (Specify)						

55. Have you ever practiced any form of integrated fish farming? i) Yes (), ii) No ()

If No to Question 55, please go to Question 60

56. If yes to Question 55, what are the components of integrated farming system you practiced?

57. What are the advantages of the integrated fish farming system that you practiced?

58. Are you still practicing integrated fish farming? i) Yes (), ii) No ()

59. If No to question 58, why did you stop practicing integrated fish farming?
.....

60. Why have you never practiced integrated fish farming?

61. What do you think are the disadvantages of integrated fish farming?

62. Will you be willing to adopt an integrated farming of fish-rice-pig? i) Yes (), ii) No ()

63. If the answer to Question 62 is No, why will you not be willing to adopt an integrated farming of fish-rice-pig?.....

64. Please fill the Table below using the provided notations: SA – Strongly Agree; A – Agree; DK- Don't Know; D – Disagree; SD - Strongly Disagree to indicate your perceptions on the integrated farming of fish-rice-pig?

S/N	QUESTIONS	SA	A	DK	D	SD
1	Integrated fish farming involves combination of fish farming with crop or animal husbandry.					
2	It utilizes natural resources efficiently.					
3	It ensures that wastes from each farming enterprise are appropriately utilized for increased production.					
4	Maximizes productivity through optimal utilization of resources.					
5	Minimizes cost of fish production especially fish feed.					
6	Integrated fish farming safeguards the environment from pollution through the use of industrial and agricultural by-products and wastes.					

7	It provides other sources of income rather than only one from fish farming					
8	Integrated fish farming is more profitable than sole fish farming.					
9	It ensures a spread of financial risk due to the varied and diversified nature in rearing of fish, animals and crops.					
10	Integrated fish farming can improve income status of the rural farmers and reduction of poverty level among fish farmers.					
11	Integrated farming of fish-rice-pig should not be practiced because of the noise of pigs					
12	Integrated farming of fish-rice-pig should not be practiced because of the odour of faeces of pigs					
13	Integrated farming of fish-rice-pig does not have any advantage at all					
14	Integrated farming of fish-rice-pig can cause outbreak of disease for fishes if not well managed and should therefore not be practiced					
15	The advantages of integrated farming of fish-rice-pig exceed the disadvantages and should therefore be encouraged.					

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