Effect of Credit Facility on Aquaculture Technology Adoption by Fish Farmers in Oyo State

Fregene, B. Tosan and Ojo, E. Olumayowa
Department of Aquaculture and Fisheries Management, University of Ibadan,
Ibadan Nigeria
tosanfregene@yahoo.co.uk

ABSTRACT

The development of aquaculture can only be enhanced by the introduction of modern technologies. The study was therefore aimed to identify effect of credit on aquaculture technologies adopted by fish farmers,. The study area is Oyo state. Questionnaires were administered to registered fish farmers under Oyo State Agricultural Development Programme (OYSADEP) through stratified sampling method. Clarias gariepinus (84.0%) and Oreochromise niloticus (42.0%) were the most common species cultured. Majority (85.0%) of the fish farms were located in the urban or peri-urban where they can easily access credit. Sources of fund for aquaculture production were personal (45.0%), cooperative loan (35.0%) and bank loan (20.0%). There was an increase in units of technologies used before and after credit such as increase in boreholes users, number of nursery pond, drag net for fish harvesting and pumping machines. Quantity of fish seed produced, increased from 400,000 pieces to 900, 000 fingerlings/juveniles. In terms of their perception, 71.0% of the fish farmers were convinced that credit has a positive effect on technology adoption and that loans from cooperatives are the best (63.0%). Results of the Chi-square statistics show that access to credit has a significant effect on income and production ($p< 0.05$). Most of the farmers have challenges with being able to access bank credit, due to poor feasibility studies and inadequate farm record keeping. Other constraints to acessing credit include high interest rates, short pay back period and limited credit sources.The success of modern fish farming business in Nigeria is dependent on technology adoption and credit. More credit should be made available to the fish farmers at reduced interest rate, to enable them purchase inputs for increased fish yield.

Keywords: *Credit, Fish farmers, Adoption, Technology, Aquaculture*

INTRODUCTION

The development of the aquaculture industry can only be enhanced by the introduction of modern technologies. Various aquaculture technologies available include production of fish seed, management of aquaculture systems, fish feed, integrated farming, waste and waste water management, fish harvesting method and processing. These technologies will help reduce the inefficiencies of man power thereby boosting the rate of production within a reasonable period. The adoption of these technologies depends on awareness and the financial status of the fish farmers.

In effort to improve the level of production, credit facilities were provided. According to Babale (2008), Nigerian Agriculture, Cooperative and Rural Development Bank (NACRDB) Limited was established by the Federal Government of Nigeria, in October, 2000 following the merger of the former People's Bank of Nigeria (PBN), the defunct Nigerian Agricultural Cooperative Bank (NACB) and the risk assets of the Family Economic Advancement Programme (FEAP). The bank was incorporated as a limited liability company registered under the Company and Allied Matters Act in 1973. The mandate of the bank is to deliver affordable credit facilities to the micro, small and medium scale enterprises in the agricultural sector and the food industry in particular. It is also mandated to mobilize savings from among its target clients and the economically disadvantaged Nigerians in the agricultural sector.

One major constraint to increased fish production in Nigeria as identified by Federal Department of Fisheries (FDF), (2000) cited by Omitoyin and Fregene (2008) is poor rate of capital formation and lack of credit facility. Lack of fund is a major challenge that has direct impact on the level of technology adoption. The awareness and adoption of modern technology is important in equating demand to supply and developing the aquaculture sector. The amount of fund available to the aquaculturist will determine the level of technology

they can adopt. Though the fish farmers are aware of these technologies, they do not have adequate fund to adopt.

Due to the fact that credit is one of the major factors in the development of aquaculture, several researches had been carried out on it. The work done by Alufohai (2006) examined the sustainability rates of co-operatives and NGOs in farm credit delivery in Edo and Delta States of Nigeria. It was observed that, the adoption of new technology is a vital tool in development. This is because majority of the fish farmers are poor, therefore access to credit will enhance adoption of developed and improved technology. Although, researches has been carried out on the various sources of credit, its effect on the socio economic status of farmers and fisher men, its effect on the level of technology adoption is yet to be determined. The study was therefore aimed to identify sources of credit, aquaculture technologies adopted by fish farmers, estimate the relationship between aquaculture technologies adopted and access to credit, effect of credit and technology adoption on the total output among fish farmers in Oyo state.

Methodology

The study area is Oyo state. Oyo state is an inland state in south-west Nigeria and Ibadan is its capital. Oyo state covers 35,742.84 Km^2 with a population of 6,617,720 (NPC, 2006). The total number of registered fish farms under Oyo State Agricultural Development Programme (OYSADEP) and their locations was obtained from State Department of Fisheries in the state. There are thirty-three local government areas (referred to as blocks in the OYSADEP classification) in Oyo state. The local government areas (blocks) are grouped into four zones. Stratified random sampling was used to select proportionally from each zone to make up the targeted number of 100 being 23.2% of 431 fish farms registered in OYSADEP, Oyo state (Table 1). Questionnaires were administered to the fish farmers with assistance of the extension agents. Descriptive and inferential statistics were used for the analysis of data. Descriptive statistics used includes frequency counts and percentage, while inferential statistics are chi-square and regression.

RESULT AND DISCUSSION

Socioeconomic characteristics of fish farmers

Table 1 shows that 22.0% of the fish farmers were female, while 78.0% were males in the sample population. This implies that, more males engage in fish farming than females. Almost half (44.0%) were between 31 to 40 years of age, 39.0% fell between 41 to 50 years and 12.0% were above 50 years. Majority (93%) were married therefore have the possibility of making use of family labour and this will result to reduced cost of production. One-third 935.0%) had educational level below secondary education, while 45.0% had above and 20.0% attained tertiary education. The low level of education of the farmers could be responsible for most of the farmers having difficulty in accessing bank credit, due to poor feasibility studies and inadequate farm record keeping. The dominant religion was Christianity and 89.2% of them had 1 to 2 wives. Majority (79%) had fish farming as primary occupation while 21.0% as secondary and 59.0% earned above ₦100, 000 as annual income.

Aquaculture Technologies Adopted by Fish Farmers in Oyo State

More (82.0%) fish farmers used earthen pond compared to 53.0% that used concrete tank for culturing fish (Table 2). This indicates that, most farmers made use of earthen pond due to low cost of construction and good quality output as a result of availability of natural food i.e. planktons. Concrete tanks are used because it is easier to handle in terms of management, harvesting and test cropping. There are few (35.0%) that have both earthen pond and concrete tanks. The most common water exchange method for table size fish production was static water removal (100.0%) due to unreliable power supply which is required for water re-circulatory system. Water quality management is mostly done with the aid of pH meter (49.0%) and few (24.0%) test for oxygen.

Clarias gariepinus and *Oreochromis niloticus* are the most common species cultured, 84.0% and 42.0% respectively. This shows that some of the farmers practiced polyculture. Most of them adopted the culture of Tilapia for obvious reason (15.0%) being that they mature in 4 to 5 months with good output quality (15%), while majority culture *Clarias gariepinus* based on ease of handling (15.0%) in terms of hardiness and good quality output (15.0%). Other species cultured is *Heterotis niloticus*. Fish farmers prefer juvenile (65.0%) for stocking than fingerlings (35.0%). This is due to obvious advantage (relative large size), they tend to have higher survival rate than fingerlings and as such they are easy to adopt, handle and have good output quality. Only 44.0% of the fish farmers bred their own fish seed. This is because most of them lack the technical knowhow. Those that breed do it based on the low cost of breeding compared to buying fish seed and good output quality. In a study by Fregene and Aweto (2008) in Osun State, they observed that major problems confronting fish farmers are lack of capital and reliable sources of fingerlings (48.0%) among several others. Fish breeding (16.1%) and harvesting by pumping technology (14.5%) were

among the least adopted by the fish farmers. This could be due to the fact that some of the technologies are complex, costly and inadequately supplied (Fregene and Nwogu, 2010).

TABLE 1
Socioeconomic characteristics of fish farmers

Socioeconomic Variables	Frequency	Percentage
Gender: Female	22	22
Male	78	78
Age		
21-30	5	5
31-40	44	44
41-50	39	39
51-60	10	10
>60	2	2
Marital Status		
Single	5	5
Married	93	93
Divorced	2	2
Educational Qualification		
None Formal	20	20
Primary	15	15
Secondary	45	45
Tertiary	20	20
Religion		
Christianity	72	72
Islam	27	27
Others	1	1
Number of Wives		
None	7	7
1-2	83	83
3-4	10	10
Primary Sources of Income		
Fish Farming	79	79
Trading	18	18
Others	3	3
Secondary Sources of Income		
Fish Farming	21	21
Trading	76	76
Others	3	3
Annual Income		
< 50, 000	3	3
50, 000- 100, 000	38	38
>100, 000	59	59

TABLE 2
Distribution of aquaculture technologies adopted by fish farmers in Oyo State and reasons for adoption

Technologies	Frequency	Percentage (%)	Reason Adoption (Frequency)
Fish Enclosure			
Earthen pond	82	82.0	1* (33), 2* (12), 4* (24), 5*(84)
Concrete tank	53	53.0	3* (27), 4* (7)
Culture system			
Static system	100	100.0	1* (80), 4* (15)
Flow through system	17	17.0	2* (10)
Water recirculatory	1	1.0	5* (1)
Water quality management			
Use of pH meter	49	49.0	2* (8), 3* (26)
Testing for oxygen	24	24.0	-
Integrated farming			
Vegetable/rice cum fish	5	5.0	2* (5)
Poultry/piggery cum fish	5	5.0	2* (5)
Weed Control			
Manual	92	92.0	1* (41), 4* (19), 5* (13)
Chemical	1	1.0	-
Biology	1	1.0	-
Fish Feed			
Compounded	71	71.0	1* (32), 4* (4)
Floating feed	64	64.0	5* (39)
Maggot	80	80.0	1* (35), 5* (26)
Effluent Disposal			
Public drainage	97	97.0	1* (40), 4(19)
Soak away	3	3.0	-
Fish species cultured			
Tilapia spp	42	42.0	2* (15), 5* (15)
Clarias gariepinus	84	84.0	5* (40), 3*(7)
Others	4	4.0	2* (40)

Harvesting System			
Drag net	78	78.0	4* (17)
Pumping draining	13	13.0	-
Fish stock selectivity			
Fingerlings	35	35.0	2* (6), 4*(7), 5*(10)
Juvenile	65	65.0	2* (15), 3* (22), 4* (4), 5* (17)
Fish breeding	44	44.0	1* (11), 5*(30)
Total	**100**	**100.0**	

Key: the figures with asterisk represent the reasons for adoption**;**
1* = low cost, 2*= Obvious advantage, 3* = ease of handling, 4* = easy to adopt and 5* = good quality output. The numbers in parentheses represent the frequency..

Harvesting is mainly done using drag net (78.0%), others use pumping machine (13.0%) for total draining of the water. Vegetable/rice cum fish and poultry cum fish are the main form of integrated fish farming practiced by 10.0%. Weed Control is done manually (92.0%). The use of chemicals for weed control is discouraged in order to prevent contamination of the pond water with the chemicals most especially, during rainy season (Fregene and Ayodele, 2003). Majority of the fish farmers (71.0%) feed their fish with compounded feed and maggot (80.0%), but 60% use floating feed mainly. Waste is majorly disposed by public drainage (97.0%) is and very few (3.0%) used soak away. The waste water is collected and used for wetting vegetables.

Fish farmers' sources of credit, production and aquaculture technology adopted

In Table 3, personal savings (45.0%) was a main source of credit, 20% secured loan from banks and 35.0% from cooperatives. Majority of those who used their personal savings are those that saved as much as ₦ 200,000. More farmers (10.0%) seeking for for fund from formal financial institutions applied for loan from banks only when the capital needed is high (₦ 200,000) and cannot be easily obtained from other sources. This could be due to high interest rate (18.0 – 21.0%) by banks. Most of the loan (35.0%) obtained is from the Cooperative and this could be due to low interest rate attached. According to Aryeetey (1997), farmers get their fund from different sources, such as personal savings or loans from family, friends, fish farmers' cooperatives and banks.

Sources of credit available to fish farmers in Oyo state include microfinance banks, Cooperatives and the Nigerian Agriculture, Cooperative and Rural Development Bank (NACRDB) Limited at Total Garden Oyo state. The major cooperatives are the Agricultural credit cooperative, Multi-purpose Cooperative Society and Catfish Farmers' Association of Nigeria (CAFAN) Oyo state.

Technology adoption before and after Credit

Table 4 presents the units of technologies adopted before and after credit. There were only 30 boreholes users in the whole sample population before obtaining credit. After credit it increased to 39. The few units prior to obtaining credit could be due to insufficient capital. This also applies to the other technologies. Number of nursery pond increased from 40 to 60 units and the use of other rearing facilities increased from 30 to 40. Harvesting nets, which included drag net, and hand, increased from 100 to 150 units. It was observed that out of the 100 nets, 60 were drag nets. Most of the fish farmers rented drag nets at the inception of the farm. There was also an increase in fish seed production as a result of credit obtained. The quantity produced was 400,000 pieces; it increased to 900,000 fingerlings or juvenile as the case may be. During this research, it was observed that majority of the fish farmers obtained their water from surface water bodies e.g. rivers, streams and lakes. The water is channeled into reservoirs or directly into the ponds, such that, the pond is often impounded and drained by gravity. This could be the reason for few numbers of pumping machine i.e. 45 units, although it increased to 56 units, but only one re-circulatory system was found.

TABLE 3
Distribution of fish farmers by sources of funds

Sources of fund (₦)	Interest rate	Frequency	Percentage
Personal Savings			
Less than 100,000	-	12	12.0
100,000 – 200, 000		25	25.0
More than 200,000		8	8.0
Sub-total for personal savings		45	45.0
Cooperative loan	10 – 12%		
Less than 100,000		12	12.0
100,000 – 200, 000		13	13.0
More than 200,000		10	10.0
Sub-total for cooperative loan		35	35.0
Bank Loan	18 – 21%		
Less than 100,000		4	4.0
100,000 – 200,000		6	6.0
More than 200,000		10	10.0
Sub-total for bank		20	20.0
Grand Total		100	100.0

TABLE 4
Distribution of technology adoption before and after credit

Technologies	Unit before credit	Units after credit
Borehole	30	39
Nursery pond	40	60
Production pond	500	550
Concrete tanks	200	250
Other rearing containers	30	40
Harvesting nets	100	150
Pumping machine	45	56
Fish breeding (fish seed)	400,000	900,000
Water re-circulatory system	1	1

Constraints of access to credit

The growth of the aquaculture industry has been confronted by several challenges as perceived by fish farmers to accessing credit (Table 5). Although, there was no response (36.0%) from some of the fish farmers, especially those that had no access to credit (33.0%), 17.0% believed that high interest rate was a major constrain and 16.0% indicated limited credit sources. Flores (2004) corroborating this assertion that institutional credit if made available to farmers could ameliorate some of the farmers problems such as small farm size, low output, low income and low social –economic status. It can also relieve farmers of the excess interest impose on them by the informal creditors who usually charge high interest rate of between 100.0-300.0 % per annum.

Others were short payback period (15.0%), unavailability of collateral (9.0%) and delay in the release of loan (7.0%). All these factors were as a result of the unpredictable nature of aquaculture production. This has to do with its yield which could be affected by several unforeseen factors such as disease outbreak, flooding, theft etc. Another factor is the literacy level. Most farmers are not well educated to be able to prepare a viable business proposal and a good farm accounting record which the banks often requested for and this has reduced the available credit sources.

It has been observed that, the highest source of credit is from the cooperatives, which may be because of the high interest rate of bank loans. The unpredictable nature of aquaculture product also made it difficult for the farmer to meet up with the short payback period and high interest rate. Due to the low resource control of fish farmers, very few can afford the collateral demanded by banks.

Presently most fish farmers are aware of most of these technologies but the major challenge is the purchasing power of the fish farmers which is based on their financial status. Fregene and Digun-Aweto (2008) observed that though the fish farmers are aware of these technologies, they

do not have adequate fund to adopt. Therefore the inability of farmers to afford technologies extended to them has made some fish farmers to abandon their ponds.

TABLE 5
Distribution of constraints of accessing credit

	Frequency	Percentage
Overall		
No response	36	36.0
Unavailability of collateral	9	9.0
Delay in the release of loan	7	7.0
High interest rate	17	17.0
Short payback period	15	15.0
Limited credit sources	16	16.0
Total	100	100.0

Relationship between access to credit and number of technologies adopted, fish production and income

The result of the Chi-square in Table 6 reveals that access to credit was significantly related to number of technologies adopted ($P < 0.1$), fish production and income after access to credit ($P< 0.05$). This implies that fish farms that have access to credit are likely to adopt more technology, thereby resulting in increase fish production and subsequently increase income.

TABLE 6
Result of Chi square analysis of farmers' access to credit and technology adoption, fish production and farmers' income

Variables	Chi square	df	p
Number of technology adopted	4.807	2	0.090*
Fish production after credit	10.411	3	0.015**
Income after access to credit	7.966	2	0.019**

* P < 0.10 ** P < 0.05

Regression results in Table 7 show that year of establishment ($P < 0.005$) and income ($P < 0.01$) had a significant effect on access to credit. Owners of fish farms that have been established for many years prefer the traditional methods of production and are reluctant to adopt new technologies. This may hinder their chances of being granted credit because they may not be able to pay. But fish farmers with high income level have better chances of obtaining credit because creditor tends to believe they are capable of paying back. Therefore, the null hypothesis is rejected.

TABLE 7
Regression analysis for relationship between socioeconomic characteristics and access to credit

Variables	Coefficient	t	p
Constant	0.005	- 0.024	0.981
Education	- 0.034	- 0.344	0.731
Fish farmers experience	0.084	0.862	0.391
Year of establishment	- 0.217	- 2.236	0.028**
Annual Income	0.371	3.680	0.000***
Household size	0.141	1.392	0.168

$R^2 = 0.230$, Adjusted $R^2 = 0.184$, ** P < 0.005 and *** P < 0.01

CONCLUSION AND RECOMMENDATION

The development of aquaculture is dependent on technology adoption and credit. Most of the fish farmers are aware of the technologies but only a few have the purchasing power. Those who have access to credit have the advantage of adopting more technology than their counterparts. Although most fish farmers are willing to access credit, sources of credit are limited and there are other conditions attached. Access to credit has improved the level of technology adoption and increased annual fish production. Due to the vast nature of aquaculture production input, more credit should be made available to the fish farmers. Commercial banks should be encouraged to invest in fish farming by allocating more loans and more credit institutions should be set up. If the loan will be useful to fish farmers, reduced interest rate and affordable collateral should be demanded. Fish farmers' loan should be released on time and the payback time should commence at least two years after the loan has been given in order to prevent unnecessary disappointment in pay back.

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