FACTORS AFFECTING ADOPTION OF FISHING INNOVATIONS IN JEBBA LAKE

By

ATTAHIRU MOHAMMED SULE

A thesis submitted to the Post-Graduate School, Ahmadu Bello University.in partial fulfillment of the requirement for the Degree of Master of Science (Agricultural Extension).

Department of Agricultural Economics and Rural Sociology
Faculty of Agriculture **I**
Ahmadu Bello University, Zaria
Nigeria

February, 3000

DECLARATION

I hereby declare that this thesis was written by me and it is a record of my research effort, except where references were made to published and unpublished literature which were duly acknowledged. It has not been presented before in any degree programme.

Attahiru M. Sule — Date: 29/2/2000

The above declaration is confirmed;

Dr. S.A. Ogunwale
Chairman, Supervisory Committee

Date: 7/3/2000

CERTIFICATION

This thesis entitled: FACTORS AFFECTING THE ADOPTION OF FISHING INNOVATIONS IN JEBBA LAKE by Attahiru Mohammed Sule meets the regulations governing the award of the Degree of Master of Science of Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge and literary presentation.

Dr. S.A. Ogunwale
Chairman, Supervisory Committee

7/3/2000
Date

Prof. T.K. Atala
Member, Supervisory Committee

8/3/2000
Date

Dr. D.O.A. Phillip
Head, Department of Agric. Economics and Rural Sociology

8/3/2000
Date

Prof. S.B. Ojo
Dean, Post-Graduate School

05/10/01
Date

DEDICATION

This thesis is dedicated to my beloved wife, Maimunah,

and children: Aishah, Aminah, Isah, Zainab and

Hamidah.

ACKNOWLEDGEMENT

The constructive criticisms by my supervisors, Dr. S. A. Ogunwale and Prof. T. K. Atala which gave this thesis the standard it assumes are grateful acknowledged.

My unreserved appreciation and gratefulness go to the Directors of National Institute For Freshwater Fisheries Research (NIFFR) New Bussa and National Agricultural Research Project (NARP) Skill Gap Analysis Mission for giving me the nomination for further studies and Mrs. Marina Mdahili, the project adviser of the Nigeria-German Kainji Lake Fisheries Promotion Project (NGKLFPP) New Bussa, for footing the bills of the programme and my upkeep for two sessions.

Equally worthy of mention are: Mr. J. O. Ayanda, my Head of Programme for all his support, Mallam Abubakar Ibrahim (administrative secretary)and Dr. Aminu Raji (Principal) both of the Fisheries College, New Bussa. Dr I. G. Mbagwu, and Dr M. O. Ibeun of NIFFR for their contributions in various forms, Mallam Danladi Jarma for the data analysis. My acknowledgement will be incomplete if Mallam Mohammed Garafini and Mr. T. A. Adelu both field overseers of the Socio-Economics and Extension Programme of NIFFR are not mentioned here for their tireless and committed services in the administration of the questionnaires and their useful observations to which they drew my attention in the fishing villages.

I am also indebted to my colleagues and all those who attended my seminars and made useful suggestions which were all incorporated in the appropriate places. Above all, my sincere gratitude to Allah (SWT) who made every thing possible and He is responsible for all successes.

ABSTRACT

The efforts to accomplish the task of self-sufficiency in food production and improvement in the quality of life in rural areas necessarily entail shifting away from the drudgery of age-long use of traditional human physical labour to utilization of modern technological machinery or innovations. Modernising agriculture in Nigeria will eventually lead to discarding the tendency to depend on imported finished food products for local consumption in a predominantly agrarian economy.

This study was conducted at Jebba Lake which is bordered by Kwara and Niger States. Data were collected randomly from 120 respondents in fourteen fishing communities utilizing a structured questionnaire. Interviews and observations were also employed as checks and as a form of triangulation. Data were analysed using descriptive statistics and quantitative techniques of correlation and multiple regression. The study investigated the relationships between cosmopoliteness, awareness, household size, extension contact, education, income, age and experience and adoption of fishing innovations. The results showed high level of awareness of the innovations, low overall rate of adoption and the variables that affected the adoption positively in the following order of importance at the 5% level of significance as cosmopoliteness, awareness and education. There was no innovation in the package that was not adopted at all and there was no respondent that did not adopt at least one innovation.

The study recommends exposure to more sources of information, provision of credit facilities, input supply, operating facilities for extension staff and formation of modern functional cooperatives by the fishermen.

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CHAPTER ONE

FACTORS AFFECTING ADOPTION OF FISHING INNOVATIONS IN JEBBA LAKE

1.1 Introduction

Agriculture is the oldest and one of the most important occupations the world over. FAO (1992) indicates that 46% of the world population depends on agriculture for its livelihood. The dependence on agriculture is even greater in the developing countries. For instance, 62% of the population depends on agriculture for its livelihood in Africa.

Agriculture's fundamentality to Nigeria's economic development remains undebunkable. This is because it provides the anchor on which food production for the sustenance of human lives and provision of vital industrial raw materials are dependent. There is every need for the nation to modernise agriculture in all its ramifications by adopting new technologies in agricultural production so as to produce adequate food to ensure food security, provision of employment opportunities, provision of raw materials for the growing industrial sector, provision exportable products as a source of foreign exchange earnings, and provision markets for products. The bid to accomplish the task of self-sufficiency in food production and improvement in the quality of life in rural areas necessarily entails shifting away from the drudgery of age-long use of traditional human physical labour to utilization of technological machinery or innovations.

Modernising agriculture in Nigeria will eventually lead to discarding the tendency to depend on imported finished food products for local consumption in a predominantly agrarian economy, which became the practice after the

discovery of petroleum in the 1970s. As soon as agricultural practices are modernised, the sector will regain its former glory of providing substantial amount of revenue to the government. Moreso, the sector can make maximum contribution to capital formation for economic development as borne out by the experiences of Japan and Russia amongst other countries (Kahan, 1964).

Government's commitment to agricultural development is demonstrated through the establishment of sixteen agricultural research institutes that cater for agricultural education, research and extension in crops, livestock, fisheries and forestry. There are faculties of agriculture in conventional Nigerian Universities teaching and producing agricultural graduates in addition to engaging in research that are relevant to agriculture and finding solutions to farming problems. There are three Universities of Agriculture in the country as follows: Abeokuta (Ogun State), Makurdi (Benue State) and Umudike (Abia State) in line with experiences of agriculturally advanced countries like USA, India, Malaysia and the Netherlands, with the tripodal mandate of teaching, research and extension to serve as catalyst in transforming Nigeria's agriculture (Gambo, 1996).

1.2 Fishery Sub-sector in Nigeria's Agriculture

One of the foods domestically available to Nigerians is fish. Fish provides the cheapest source of animal protein the world over. This sub-sector has an estimated 8 million people directly or indirectly employed in sub-Saharan African (FAO, 1996) Nigeria by her geography is endowed with a number of inland states, extensive flood plans, rivers, streams, creeks, reservoirs and lakes rich in fresh water fishery in addition to the maritime waters in the coastal states. This was acknowledged in the second National Development plan (1970). The country also has great potentiality for fishing.

Ita and Sado (1985) in that direction showed that Nigeria is blessed with an estimated inland water mass of about 12.5 million hectares capable of producing about 512,000 metric tonnes of fish annually. They further showed that marine waters belonging to Nigeria can be estimated at about 328,545km^2 capable of producing about 273,500 metric tonnes per annum. Though the inland water mass is small (124.878km^2) compared with marine, it has a higher fishery potential. Total production by the sub-Saharan region (minus north Africa) amounted to 3.9 million tonnes in 1994 (FAO, 1996).

In line with low productivity and use of noxious fishing methods and under size gears, available statistics showed that our inland water bodies are producing less than 13% of their estimated fishery potential. Yet, Matton (1982), quoted by Ita and Sado, 1985) observed that Nigeria consumed about 1.5 million metric tonnes of fish in 1980 out of which about 900,000 metric tonnes of frozen fish was imported. By his projection, more than 2 million metric tonnes was demanded by 1985 and out of this figure about 1.4 million metric tonnes was imported.

From the evidences so far, it is obvious that domestic demand for fish in Nigeria has never been met by dependence on yields from available aquatic resources (Ita and Sado, 1985). They further asserted that artisanal fisheries constitute over 97% of the total domestic fish supply in the country between 1981 and 1985.

Computation of the grand total potential annual fish yield of the various inland water resources shows that about 2,290,496 metric tonnes of fish could be produced locally if both material and manpower resources are fully mobilised throughout the country (Ita and Sado, 1985). Unfortunately the

1985	1568,582	2,443,330	873,74

Source: National Committee on Green Revolution, 1981.

The situation of actual local production from 1985 - 1997 is so al if not frustrating. Whatever fish or fish related product that is consumed teeming population over the above local fish production (Table 2) is impo spite of all the available resources for local production for home consu and export.

By the year 2,000, it is estimated that with proportionate incre population growth, demand for fish and fish products will reach an astron level of over 4 million metric tonnes per annum (Ita, 1987).

To improve the fishery situation, the agricultural policy for approved in 1988 has set the objectives for the national fishery develop fish production with its numerous objectives, targets for achievin sufficiency in fish production within five years, strategies, provision of ec incentives, fish investment services, fisheries organisations, input supp subsidy, regulation and enforcement, improvement of the quality of

1991	315
1992	343
1993	343
1994	237
1995	328
1996	335
1997	362

Source: Central Bank of Nigeria Annual Reports of 1985 – 1997.

The actualisation of self-sufficiency in fish production in Niger inception to date remains largely an utopia and a wishful process. Gove support and institutional efforts notwithstanding. Of major concern relatively low production level couple with noxious fishing methods and under gear sizes capable of causing depletion and environmental degra This situation raises a question as to what might be happening to the sub-sector. This was laid bare in the 1998 Budget speech of the H State, General Sani Abacha, that food crop, livestock and fishery hav neglected for a long time.

1.3 Problem Statement.

The fishery sub-sector is relatively a late comer when compared to the other sub-sectors of the agricultural components especially the crop based. Within the fishery sub-sector again, there exist discrepancy between marine and inland waters despite the higher yields from the latter. Ita and Sado (1985) succinctly put it thus: "the greatest obstacle to increased inland fish production is the haphazard method of exploitation..."

One of the measures introduced to overcome the perpetual low annual production level in Nigeria inland water mass was the recommended fishing mesh sizes in the country. This deals with the development of efficient fisheries management system based on the abundance - depletion cycle of the common resources. The recommended mesh sizes were:

1. Gill net 8 mm (3 inches),
2. Cast net 5 mm (2 inches),
3. Clap net 6 mm (2½ inches),
4. Webbing trap 5 mm (2 inches),
5. Drift net 6 mm (2½ inches).

The aim of this innovation was to step up productivity and conserve the natural environment. With the problem of low productivity, and the use of under size meshes identified with solution proffered, the next logical step was to find out the outcome of the recommended solution. That is, has it been adopted?

The dearth of information as to the extent to which the fishermen adopted the innovations form the basis of this investigation. Specifically, the study will focus on the following questions related to the fishermen's adoption behaviour:

1. To what extent are the fishermen aware of the recommended fishing innovations.
2. What was the rate of adoption of the recommended fishing innovations.
3. What socio-economic and institutional factors could be responsible for adoption of non-adoption of the innovations?
4. What were the implications of adoption and non-adoption of the innovations for extension, fishery research and government fishery development policy.

1.4 Objective Of The Study

The general focus of this study was to give an insight into adoption behaviour in relation to recommended fishery innovations on exploitation.

The specific objectives are to

1. Determine the level of fishermen's awareness of recommended fishery innovations on exploitation,
2. Study the rate of adoption of fishery innovations by the fishermen.
3. Examine the socio-economic and institutional variables that affect fishermen's adoption behaviour.
5. Make recommendations on the basis of the findings as to how the process of adoption of fishery innovations can be accelerated.

1.5 Hypotheses

This portion states the general hypothesis of the study "That there is no significant relationship between the socio-economic characteristics of the fishermen and institutional variables with their adoption behaviour".

The specific hypotheses were as follows:

1. That there is no significant relationship between fishermen's age and their adoption of the fishing innovations on mesh sizes.
2. That there is no significant relationship between fishermen's financial resource level and adoption.
3. That there is no significant relationship between fishermen's literacy level and adoption.
4. That there is no significant relationship between fishermen's awareness of the innovations and adoption.
5. That there is no significant relationship between fishermen's cosmopoliteness and adoption.

1.6 Justification

The abysmal disparity between potential and actual fish quantum produced in Nigeria is so scaring to the extent of almost negating scientific finding. The fact remains that the period of agricultural and rural development is dominated by two fundamental themes. One is the themes is the increased food production to meet the needs of growing populations. Governments have intervened by attempts to transform the traditional agricultural systems by encouraging the adoption of modern varieties of crops, livestock and fishery. The other theme is the conscious desire to prevent the degradation of natural resources caused largely not only by the growing populations but bad practices. This double barrel rationale which formed the management decision on exploitation of the fishery resource on a sustainable basis deserved due consideration. It therefore follows that all agricultural research findings are of little use if they are not adopted by the target groups.

U.S. Agency for International Development said

> "if there is an area where we have not been most successful, it has been the development of cost effective and programme-efficient models for the delivery of new scientific and technical knowledge to the millions upon millions of farm producers in the third world. We know how to harness the creative and inventive forces of science and technology in the war on hunger, but I submit that we still have not been successful in technology diffusion".

It is hoped that this study would greatly improve our knowledg fishermen's behaviour regarding the adoption or non-adop recommended fisheries innovations developed to be extended by eve Ministry of Agriculture and any other Agency.

This is very crucial since agricultural and rural development in depend to a large extent on the degree to which the ordinary farm fa willing and able to incorporate research findings into their activities about a change in their living conditions.

The feedback would provide a more rational basis for det research priorities and selecting more practical and efficient commu strategies by the extensionists.

Adoption	Decision to apply an innovation and to cont use it.
Adoption Process	The changes that take place within individua regard to an innovation from the moment th first become aware of the innovation to th decision to use it or not.
Artisanal fishermen	Are small-scale canoe fishermen who ear living by exploiting the water bodies using gears such as gill-nets, cast nets, hooks, and
Black flood	The rise in water level of the lake due to the around the head waters of the River Niger (December - March).
Feed back	The process in which knowledge c surroundings or of the consequences of actio system leads to adjustments of future action in the light of achieving a certain goal.

Fishing entrepreneur	A fishing boat/fishing gear owner who usually takes decision concerning fishing operations.
Fishing innovation	Deals with gear and craft such as gill net, cast net, long line, beach seine, and traps.
Frame Survey	Provision of information on the size and distribution of the fishery of any particular water body. It usually details parameters that change from year to year such as number of fishing entrepreneurs, assistants, canoes, and types of fishing gears in use.
Inland water	Freshwater bodies comprising rivers, Lakes, reservoirs, springs, creeks, streams.
Marine Water	Ocean water including brackish waters, which are generally salty.
Mesh size	The length between two opposite knots of the mesh when pulled apart. Usually termed stretched mesh size and expressed in inches.
White flood	The rise in water level from local rain (from June-October).

1.8 Limitation of the Study

This study is limited to the lake area where a representative sample was drawn. The absence of very influential institutional variables such as credit facilities, input supply, functional cooperative organisations and efficient extension delivery all had devastating impact on the rate of adoption. Generalisation is difficult for want of benchmark data. Fishing gears also could vary from one water body to the other depending on the species available.

CHAPTER TWO

LITERATURE REVIEW

In this section literature on and adoption diffusion of innovations were reviewed to portray the extent of similar studies carried out to provide a theoretical base. The quality, capability and performance of farmers in agriculture are fundamental indicators of the level of agricultural sector's efficiency, productivity, development and sustainability. However, high quality and good performance in farmers (fishermen) are not in born qualities. They are mostly acquired.

Cernea (1985) asserts that description of picturesque fishing communities have occupied a central place in the ethnographic literature since field work was first carried out among the Trobriand Islanders. Yet systematic productive activities and development needs of fishermen as agricultural communities are being mechanically extrapolated without consideration of the crucial social-organisational and cultural differences between the two that is fishermen and land based agriculturists.

2.1 Socio-Cultural Characteristics of Fishing Communities

Pollnac (1985) indicates that, fishermen like other occupational sub-cultures, form societies unto themselves. Capture fishermen, are isolated - because they must live along the narrow margins of lakes, rivers or the sea. This conforms to one of the three categories of settlement by (Finch in Olayide *et al.*, 1975) called the Isolated or Dispersed settlement where possibilities of intra- and inter-cooperative efforts among such settlements with respect to provision of social amenities and infrastructural facilities may not be easily

realized. Fishermen's settlements are generally small, scattered, non-literate, transhumance and homogenous with a sense of group solidarity. Their ways of living are conventionalised into a coherent system. Kinship relations, institutions and familiar group form the unit of action.

By the nature of their fishing practices that separate them from the land based society , fishermen are often treated as social outcasts(Pollnac, 1985). To drive home the point, fishermen in India are classified among the lowest castes (Norr, 1975). He continues by indicating that in both China and Korea they are the object of considerable prejudice and oppression. They are ranked very low on the social scale in Japan (Norbeck, 1968).

In Africa , the Somali leave fishing to "the Midgan and other despised groups "(Murdock, 1959), in Mauritania, the Imraugen, a low - status coastal group, conduct the fishing. The situation of the fishermen in Nigeria is not different from the ones cited above. Studies by Jenness (1970) inform us that fishing is carried out by a low - status people in Lake Kainji.

With the above examples of the status of fishermen, socio-cultural information, about them is highly needed before the introduction of any innovations to fishing communities. This scenario is often neglected. Prominence was accorded to it in this study to portray the actual situation of the fishermen concerning adoption in the area of exploitation.

2.2 Appropriate Technology

In the 1970s, a new view of the relationship between technology and development emerged known as the technology debate. One extreme had argued that the import of an existing body of industrial capitalist technology "capital formation" was the key to development. Others argued that only

traditional, craft based skills and techniques would provide a basis for development. The formers were called the "conquistadors," the latter, the "Gandhism." These two schools of thought represent the development paradigms of the LDCs. Technology transfer was earlier based on the former until when the realisation, was made that it does not favour the LDCs. In that wise, Ita (1983) maintains that the technically advanced countries of Europe and America that are able to feed themselves did so by acquiring their technology and not by buying the technologies as experienced in the Less Developed Countries (LDCs).

Therefore, the issue of appropriate technology is of paramount importance. "Appropriate technology... is a radically new approach in which production technique becomes subordinate to social need. (Hanlon, in Sandbach, 1980). In this vein, technology's low cost, ease of maintenance, compatibility with local skills, labour intensity, miniaturization or decentralization are of vital importance. As Galtung (1980b) put it. What we should demand of technology is this: that it produces for the satisfaction of basic needs for all, preserving essential ecological balances, and that it has built into it structures that also are compatible with the satisfaction of basic non-material needs for all. This leads Reddy (1975) to a series of preferences, which ought to be taken into account in deciding what kind of technology to adopt. The preferences are:

1. A preference for capital saving and employment generating, rather than capital-intensive and labour saving technologies,
2. A preference for cottage-scale and small scale, rather than large-scale technologies,
3. A preference for the technologies of goods and services

appropriate for mass consumption, rather than for individual luxuries,

4. A preference for techniques requiring little skill or small modifications in the skills of traditional craftsmen,
5. A preference for techniques using local materials rather than materials which have to be imported from abroad or transported from distant places,
6. A preference for energy-saving, rather than energy intensive technologies,
7. A preference for locally available sources of energy such as the sun, wind, and biogas.
8. A preference, in the machine-building and machine tool sector for the technology of mass-producing scaled-down dispensable miniaturized factories rather than the technology of mass-producing consumer goods in gigantic city-based enterprises,
9. A preference for technologies, which promote a symbiotic and mutually reinforcing, rather than parasitic and destructive, dependence of metropolitan industry upon the rural population,
10. A preference for technologies based on rational use, rather than indiscriminate rapid devastation, of the environment.

Writing for the International Labour Organisaton's (ILO;s) World Employment Program, Singer (1977) outlines similar criteria: "the technology required for a basic needs strategy in a developing country must concentrate more than in the past on meeting the requirements of the small farmer, small scale rural industry and the informal sector producer". The implication is that the technology must bear the double burden of adapting existing or imported

new technology to the general situation of the developing country and underpinning the redistribution of incomes, which goes with a basic needs strategy. The range of problem areas needing new and adapted technology is suggested by a list of the major areas of concern of the United Nations (UN) conference on Science, Technology and Development (Svedin, 1979):

1. Food and Agriculture
    a. Agricultural technology and techniques and their improvement
    b. Nutrition
    c. Fisheries
    d. Food storage and processing
2. Natural Resources including Energy
    a. Renewable and non-renewable
    b. Conventional and non-conventional sources of energy
    c. Development and conservation
    d. Rational management and utilization
3. Health, Human settlement and Environment
    a. Medicinal plants and pharmaceuticals
    b. Health services
    c. Housing
    d. Social services and environment
4. Transport and communications
5. Industrialization including production of capital goods

He contends that, it is important to note that technologically speaking neither Africa nor Kenya in particular is starting from scratch. There is considerable experience to be elicited, systematized and in some cases

hybridized. There is also considerable project level experience with immediate technology. Examples include labour-intensive improved lake and marine fishing technology (Cook, 1981), fish farming (not artisanal) is also well researched in Africa (Moyes, 1979).

The implication of appropriate technology has been demonstrated by (Maurya, 1989) that when technology makes sense to farmers, farmers have adopted new technology, and done so quickly, even without enhanced extension services. This has put to rest the belief that technological innovations can not spread without formal agricultural extension support. Barlow et al (1983) found that "... where technologies are appropriate... there should be no need for costly and elaborate extension services... to service their introduction". A practical case in point in lakes Kainji and Jebba is the Malian trap, which was adopted by so many fishermen without any extension services.

2.3 Decision-Making

Many extension agents see their task as one of improving the quality of the farmer's decision-making in order to help them achieve their goals more satisfactorily.

According to Van den ban and Hawkins (1996) a normative sound decision-making process should pass through the following stages:-

1. Become aware of the problems
2. Establish what the goals are
3. Diagnose the causes of the problem
4. Review possible alternative solutions to the problem.
5. Evaluate the expected results against the criteria for a good solution.

6. Choose the best possible solution

7. Implement this choice

8. Evaluate if we have really achieved the expected results and therefore whether the problem has been solved satisfactorily.

There are reasons to doubt whether the phases of the decision making process can be worked out in the way that people with a normative view of the process suggest. Bos (1974) has developed a completely different model of group formation which also appears to have relevance for individual decision - making. The issues involved are `what must I choose'? And `what is the present situation'? The first question deals with goals and means and the second with facts and interpretation of facts.

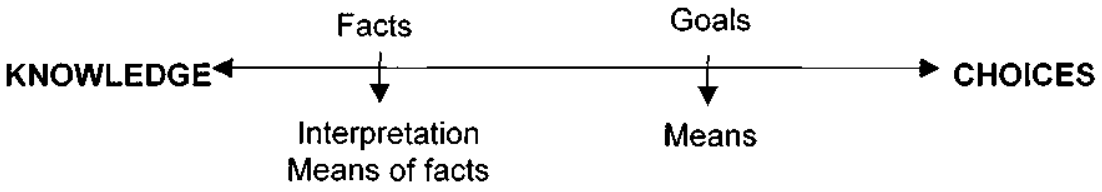


Figure 1. Bos's decision-making model (In: Van den Ban and Hawkins (1995).

Feedback is highly desirable from any of the approaches so that a more likely satisfactory correction can be made.

2.4 Diffusion and Adoption of Innovations

An innovation is an idea, method, or object which is regarded as new by an individual, but which is not always the result of recent research (Van den ban and Hawkins, 1996). Extension administrators in U.S were worried about delays in farmers' use of the research findings. The Ministries of Agriculture in LDCs saw the need for large number of farmers to use the results of scientific agriculture in order to prevent famine. People wanted to know how the

adoption of relevant innovations could be accelerated. Similar concern with the low adoption of innovations was expressed in other scientific disciplines. It is worthy of note that diffusion is an essential but not sufficient condition for adoption.

Interviews with potential users of innovation generally form the basis of diffusion studies. The following questions were usually the ones investigated by most studies on adoption of innovations:

1. What decision-making pathways do individuals follow when considering whether or not to adopt an innovation? Which sources of information are important?
2. What are the differences between people who adopt innovations quickly or slowly?
3. How do potential characteristics of innovations affect the rate of adoption?
4. How do potential users communicate among themselves about these innovations? Who play the important role of opinion leaders in this communication process?
5. How does an innovation diffuse through a society over time? (Van and ban and Hawkins, 1996).

The desirable assumption for every one in the group studied by diffusion researchers is to accept the innovation but certainly this is not always the case. Extension agents will often achieve more effective results with these innovations when they base their strategies and methods on diffusion research finding.

At any rate, research studies have clearly demonstrated the extension delays that often occur between the time farmers first hear about favourable innovations and the time they adopt them. It takes four years on average for the majority of the mid-Western U.S farmers to adopt recommended practices (Van den ban and Hawkins, 1996). In Nigeria and many other developing countries, there is a lag of about fifty years between the discovery of new farming practices (fisheries inclusive) through research and their application to the existing farm practices (Olayide et al, 1975). The gap between research finding and adoption in the developing countries is so long but might have been now reduced due to the reorganisation of extension services, the effort of the World Bank and donor agencies. However, the precise time lag is not yet determined in most agricultural sub-sectors. This calls for immediate studies. Research workers have been naturally keen to find out what happens during this time. The following stages, which resemble the normative decision-making model are often used to analyse the diffusion process (Van den ban and Hawkins, 1996).

1. "Awareness", first hear about the innovation.
2. "Interest", seek further information about it.
3. "Evaluation", weigh up the advantages and disadvantages of using it.
4. "Trial", test the innovation on a small-scale for yourself.
5. "Adoption", apply the innovation on a large-scale in preference to old methods.

In a similar vein, Peace Corps (1976) postulates that farmers must pass through five stages of adoption before the idea is accepted. If they are not

aware of the idea they will never become interested, if they are not **interested**, they can't evaluate its usefulness, if they don't **evaluate** it, they will never try it, if they never **try** it, they certainly won't **adopt** it. These five stages of adoption are inseparable as the links of a chain. Adoption takes place only after people have successfully passed through the five stages. This is highly mechanical and rigid.

The adoption process according to (Rogers, 1995) does not always follow this sequence in practice. Decision in practice may often be made in a much less rational and systematic manner than was outlined. He proposes a different set of stages including:

1. Knowledge
2. Persuasion (forming and changing attitudes)
3. Decision (adoption or rejection)
4. Implementation.
5. Confirmation.

To him, there is clear evidence that the `knowledge' and `decision' stages exist, but evidence for the other stages is much less clear. The adoption of new agricultural technology has become an important part of the economic development strategies in many countries. However, the success of past efforts have been limited. Some of the problems in many countries include: few resources devoted to the technology development and transfer process, lack of trained personnel, little research, agricultural policies that discourage farmers from adopting new technology.

These problems are difficult to be solved within the research-extension systems. Some of the problems, which limited success but can be tackled by extension are hereby grouped into four:

1. Lack of knowledge and understanding of farming system
2. Insufficient feedback from farmers to research programmes.
3. Insufficient understanding of the environment within which farmers work
4. Lack of mechanisms for testing and adapting technology on farmers field.

Adoption should be understood as a gradual process in extension's role in planning and design of technology adoption through:

1. Identifying the target group of farmers/fishermen,
2. Laying the ground work for field activities,
3. Considering alternative activities and methods, and
4. Finalising plans for field trials (Peace Corps, 1976).

Overall, adoption by farmers (fishermen) might not be worthwhile unless the new practices are:

1. culturally appropriate
2. in agreement with self interest
3. respectful of tradition
4. clearly beneficial and
5. not economically risky (Peace Corps, 1976).

2.5 Adopter Categories

It is a known fact that not everyone adopts innovations at the same rate. Some people accept new ideas years before others. Differences between people who readily adopt innovations and those who play a waiting game are an interesting topic for investigation. Many of these investigations combine a

sample of several innovations into an adoption index; rather than studying a single innovation. Innovations commonly studied often relate to economic growth and are based on scientific research. For example, agricultural methods that increase yield per hectare or per person. Other personal traits are neglected. Example of different learning styles include farmers who need to see and test results for themselves, farmers who are unsure **how** to do something, farmers who need to get their information from people they know rather than strangers, and farmers who need ideas expressed in a logical framework that is consistent with their own world view. When an effective match is made between training method and learners, the quality of communication between the extension agent and the farmer increases, trust is established and risk in the eyes of the farmer is reduced.

The adoption index is usually calculated by asking people if they have adopted the recommended innovations. They receive a point for each one adopted. If an adoption index is used, it should be based on the percentage innovations adopted that are applicable to a given situation (Van den ban and Hawkins, 1996).

People are often divided into five categories according to their scores on an adoption index. These are:

1. Innovators,
2. Early adopters,
3. Early majority,
4. Late majority,
5. Laggards (Van den ban and Hawkins,1996).

These investigations between adoption index and other variables cited on Table 3 allows us to predict which type of people will apply extension advice quickly in practice. It can be concluded that often, but not always, the same relationship was found in these studies.

Table 3. Showing percentage of studies with positive relationship between adoption index and other variables.

Variable	% of studies	No. of studies
Education	74	275
Literacy	63	38
Higher social status	68	402
Larger size units	67	227
Commercial economic orientation	71	28
More favourable attitude to credit	76	25
More favourable attitude to change	75	57
More favourable attitude to education	81	31
Intelligence	100	5
Social participation	73	149
Cosmopoliteness (urban contacts)	76	174
Change agents	87	156
Mass media exposure	69	116
Exposure to interpersonal channels	77	60
More active information seeking	86	14
Knowledge of innovations	86	55
Opinion leadership	76	55

Source: Rogers, E.M. (1983).

For a long time, the thought was that people adopted innovations only very slowly because of their traditional or conservative attitude towards life. This is called the individual blame' hypothesis. Individual blame hypothesis - means that the low level of adoption of modern technology by some is caused by their values and characteristics e.g. their level of education income, age. Recent research among Latin American farmers has focused attention on the `system blame' hypothesis meaning that the low level of adoption of modern technology by some people is caused by the structure of the society in which they live and by their place in this structure. This makes it impossible, unprofitable or difficult for them to adopt modern technology that it is not sensible for farmers to adopt ideas in their present situation. Either they do not have sufficient resources, or the power relationships in the society benefit others rather than the farmers themselves. It is also possible that innovations are not available in remote village or are sold only in much larger quantities than the small farmer can use and afford (Van den ban and Hawkins, 1996).

These authors in continuation assert that some innovations are adopted more rapidly than others because the farmers perceive them to have different characteristics. It is not the objective characteristics that are important, but how the farmers perceive them. Does it require a change in knowledge, in skills, in attitudes and/or in roles performed by different family members?

A number of studies have analysed the relation between characteristics of an innovation and its rate of adoption. Most of these studies have used more or less objective judges or have assumed that all farmers perceive these characteristics in the same way. This may be why all studies do not come to the same conclusion.

However, they do indicate that the following characteristics are important:

1. Relative advantage. Does the innovation enable the farmer to achieve his goals better or at lower cost than he could previously? This advantage is influenced by giving incentives in form of inputs at subsidised rate.
2. Compatibility with socio-cultural values and beliefs with previously introduced ideas or with farmers' felt-need. It is very difficult to introduce pig husbandry among Muslim even if it is a very profitable enterprise. On the other hand, farmers who have received large yield increases by growing improved wheat varieties are likely to be very happy about accepting improved rice varieties as well. However, if an innovation fails after introduction, it will be very difficult to get similar innovations adopted.
3. Complexity. Innovations often fail because they are not implemented correctly. Some require complex knowledge or skill.
4. Trialibility. A farmer will be more inclined to adopt an innovation which he has tried first on a small scale on his own farm, and which proved to work better than an innovation he had to adopt immediately on a large scale.
5. Observability. Farmers(fishermen) learn much from observing and discussing their colleagues' experiences. Their observations are often a reason to start these discussions. Successful innovations diffuse rapidly without much attention from extension organisations (Van den ban and Hawkins, 1996).

2.6 Some Implications of Adoption Research for Extension

Researchers who study the adoption and diffusion of innovations analyse how adoption processes happen at that time. They do not describe how things happen in every community but how things might happen. These research findings could either accelerate or change adoption processes. There exist possibilities for accelerating adoption. Research has shown that different information sources are to be used at the beginning and the end of the process of adopting an innovation. Hence, it is better to combine different media so that they reinforce each other in an extension programme. The mass media can be very useful in creating interest in interpersonal communication about innovations. However, they are relatively ineffective unless there is extensive personal follow-up by extension agents in the field. In the words of the Peace Corps (1976) the more times people are exposed to a new idea through a variety of channels, the more likely they are to adopt the idea. This simply means if you use radio, newspapers, meetings, demonstrations etc. the farmers are more likely to adopt the idea than they are if they are reached with a single method.

Active promotion of an innovation may be taken over from extension agents by farmers who have adopted it already. Considerable attention has been paid to accelerating adoption among those farmers who are now slow to adopt (Van den ban and Hawkins, 1996). This is because these farmers tend to be poor and many people believe it is desirable to decrease income differences among farmers.

Research findings about the characteristics of different adopter categories provide extension agents with important information for choosing their target groups.

It is necessary to develop different messages to meet the needs and the situation of each category of adopters.

Extension agents may not be able to help poor farmers working under rainfed conditions. Extension agents and policy-makers may have to redistribute agricultural research towards solving the problems of these small farmers. In the meantime, extensionists can offer limited help by noting why some farmers get higher yields than others, then develop messages for the less successful on the basis of what they have learned from the more successful.

Extension agents may also be able to help poor farmers to organise themselves into groups to help each other, and which have more power in dealings with salesmen and money lenders. This can be an important way of changing the system, which makes it unprofitable for poor farmers to adopt innovations.

2.7 Limitations of Diffusion Research

Diffusion of innovations is the area of extension education, which has received the most support from empirical research. Instead of digging deeper into old questions, it is pertinent to ask new questions and study new problems if we wish to advance science and solve practical extension problems such as:

1. Utilization of scientific knowledge but ignoring the way this knowledge is produced and how it is integrated into ways in which the farmer sees his own problems. It might be useful to study who decides why certain innovations are developed and which of these are diffused to a certain group of farmers. Diffusion research usually assumes that all innovations originate at research institutes, whereas in fact many

innovations either originate from farmers (fishermen) or are modified by farmers to adapt them better to their situation. This research also assumes there is a centralized agency which tries to diffuse innovations, whereas some innovations are diffused mainly by a decentralized system of active farmers and other citizens.

2. Most diffusion research assumes implicitly, that the adoption of innovations is always desirable. The nature of the innovation and the circumstances and goals of the farmers must be given strong consideration first. Most diffusion studies have assumed implicitly that farmer's major goal is to increase his income. However, risk aversion can be a more important goal among poor farmers (fishermen) especially in developing countries.

3. Few diffusion research projects have looked at the advantages and disadvantages of innovations from a potential users' viewpoint, whereas this is an important information for developing innovations, which solve some of the farmers' problems.

4. The content and interpretation of messages given to farmers are other topic requiring more research. The role of different information sources have been studied extensively, but little attention has been paid to how the message content is selected and treated by the source, decided by the receivers and incorporated in their knowledge, attitudes and behaviour.

5. Adoption studies generally assume sufficient research information is available for extension agents to give good advice on how to apply innovations. This is often not the case.

6. Few systematic check have been made of farmers' reactions to

extension agents efforts to promote diffusion and adoption. Farmers' answers of questionnaires give us relatively little information about this problem.

7. Most diffusion studies have concentrated on relatively small and direct technical changes. Little attention has been given to major changes in social structure or on individual's way of life, for example, when changing occupation or changing from subsistence to commercial agriculture. There is more concern with 'peripheral' innovations than with those, which are 'central' to a social system.

8. Changes by individuals and groups have been the focus of much diffusion research. Changes in institutions and societies have seldom been investigated despite the obvious importance of social changes taking place in rural societies everywhere.

So many other authors have expressed their views on the limitations of diffusion. Galjart (1971) maintains that for some one to change, he/she must want to know how to, and be able to. This negates our hasty introduction of innovations and our anxious anticipation of wholesome adoption.

In support of the `trickle down approach' (Roling *et al.*, 1981) outlines the merits as:

1. The impact on agricultural production in the short term, is greater than when the extension effort is diffused over a large number of small farmers because the large farmers are the major potential producers of commercial crops and export earning.

2. The progressive farmers are eager to follow advice and not much time is required to convince them of the desirability of an innovation.

3. They have the means to try out new ideas.

4. They have the political clout with which to endanger the career of workers who by pass them.

5. They provide an intellectual challenge to the extension worker who also learns from them what to tell others.

Other studies on adoption criticized the focus on individual characteristics or 'trickle down approach' as misleading. Galjart (1971) from his studies of small holder farmers in Brazil suggest that in addition to reluctance to adopt innovations, one should consider the inability to adopt new practices. In a similar vein, Engel (1976) argues that the laggards were with little or no access to resources. For Caplan and Nelson (1973) blaming people for lack of innovativeness was replaced by blaming the system.

A Kenyan agricultural extension worker, cited by Roling *et al.* (1981) explained the problem very aptly: 'my farmers are too poor to follow my advice'. This type of situation in the LDCs produces what (Arnon, 1987) says instead of a minority of laggards, there is a majority who are non adopters, not by choice, but by force of circumstances. The 'trickle down approach' according to (McAllister, 1981) could be counterproductive. To Roling *et al.* (1981) the question being asked is whether extension is not contributing to poverty going by the 'trickle down approach'. If research and extension continues to focus on increasing agricultural production, particularly by increasing the output of large-scale farmers or units, they are likely to contribute to more acute rural poverty, hunger and/or forced rural-urban migration of small farmers (Swanson *et al.*, 1984).

To avoid these negative effects, a balanced approach that is based on both increased production and social equity is more desirable. A two-pronged extension strategy must be adopted. Conventional methods can be followed for those farmers able to adopt innovations whilst special efforts must be desired to make it possible for the disadvantaged sector to follow suit. This is because no developing country like Nigeria can afford to allow the non-adopters to stagnate, both for economic and social reasons.

According to Roling (1982) attempts to reorient the extension activities in favour of the under privileged sectors in the rural areas must incorporate the following elements if it is to be successful.

1. identification of the relevant homogenous target group,
2. assessment of the requirements and potentials of the various target groups, learning from below.
3. participation by local target groups, and helping them to develop into grassroots organisations.
4. ability to take decisions quickly under a unified or coordinated command.
5. access to a research system that is capable of coping with the problems relevant to the target group.
6. ability to reach various hard-to-reach target groups such as women,
7. political commitment and support,
8. a staff recruited from among sons and daughters of small farm families.

2.8 Nigeria's Experience in Empirical Adoption-Diffusion Studies

Regarding research findings on the adoption and diffusion of agricultural innovations, scholars have concentrated their efforts largely on finding whether

there exist any relationship between adoption of innovations and certain socio-economic, institutional and socio-cultural or even environmental factors.

Socio-economic variable: Several studies carried out in Nigeria and elsewhere have shown that there exist a close association between farmers socio-economic characteristics and their awareness and adoption of recommended practices. In this vein Voh (1979) and Atala (1980) both found that socio-economic factors like age, household size, formal education, income, cosmopoliteness and community status were related to adoption. They also found that adopters were younger than non-adopters.

In a study conducted by Mijindadi and Njoku (1985) to assess the extent to which tomato innovations are adopted on cooperative and individual forms in Ikara, they reported statistically significant association between extension contact, membership of association and farmers' awareness and adoption of horticultural innovations. Whereas studies by Thomas, (1993) covering 28 villages in the flood plain, not a single example of cooperative fishing was found.

Socio-cultural characteristics: Research findings on farmers' awareness, income and adoption reveal that certain socio-cultural variables, such as friends, neighbours, family/village structures tend to influence individual adopters in that they serve as consultants in farmers decision to either adopt or reject farm innovations. Awogbade (1981) found that because of the family/village structural arrangement in which the household head acts as both the legal and political spokes person on all matters, his decisions often influence others to either adopt an agricultural innovation or not. Onazi (1973) found in Nigeria that among other reasons given for farmers non-adoption of agricultural practices is, reluctance to give up their old ways.

Institutional factors: There are indications that farmers' response to agricultural innovations are attributable to certain institutional factors like extension, credit, input delivery and sources of information.

Edache (1978) and Voh (1979) both found highly significant and positive relationship between the frequency of extension agents visit and the adoption of improved farm practices. Kidd (1968) found that farmers did not adopt certain agricultural innovations because they lack credit facilities.

From the foregoing, it is abundantly clear that adoption studies are concentrated on the crops with the fisheries sub-sector, more often than not extrapolated. Studies conducted to date on African inland waters were majorly concerned with the biological and technical aspects of the fisheries. Very little, if at all, attention has been directed at an understanding of the social and economic factors which act more directly on the human resource and which are also important to the overall development and management of the fishery. This human resource consists of those small-scale fishermen that are wholly dependent on the fishery for their livelihood. Such artisanal fishermen are very vulnerable to the effects of changing conditions within the fishery.

To buttress this point, Kudhongania (1972) says "further and continuing research of the bio-socio-economic vectors of the fishery will be necessary in order to generate the rational of an efficient fishing regime for a rational management strategy and a realistic utilization of the fishery resource".

The establishment of extension centres around Lake Chad to introduce modern methods of catching and treatment, the development of a fresh fish trade, the installation of a boat yard, common fishery regulations and a unified collection of fishery statistics was put in place (Staunch, 1972). But no elaborate adoption studies followed.

In sum total, as far as the artisanal fishery is concerned in most of the developing countries, in spite of its importance, developmental issues ends at recommendations and unsystematic introduction of innovations with hardly any adoption studies followed to date. This weakness should be strengthened because of social, economic, and ecological considerations such long neglect can produce.

2.9 Theoretical Framework

2.9.1 Planned Change

The Option of planned change was informed by the present day realities of economic growth, social development and technological advancement. Neil Smelser, a close associate of parsons conceives of modernizaton in terms of the differentiation/reintegration process - as a movement from multiformational to uniformation social structures.

When people adopted innovations, diverse socio-economic changes do occur. These changes affect the socio-economic and socio-cultural institutions. We shall examine these changes with regards to the effects, which adoptions had on the adopters. The fact remains that the behaviour of the fishermen and their attitude to change has not been given much attention in the developing countries.

Rogers (1995) defined social change as the process through which alternation occurs in the structure and function of a social system. Change to Liton (1963) is inevitable in as far as human beings are always in contact with one another and there are such elements like culture facts, materials and social structures to be diffused. In order to achieve the desired goal of planned change programmes, like that of modernizing agriculture, Hiegel and Kivhin,

(1966) reason that it would depend on the attributes of the innovations (the cost, the returns to investment, the efficiency of the innovation, the risks and its availability) and the socio-economic characteristics of the clients. These attributes act as incentives or disincentives to adoption.

In addition, Leagons and Loomis (1971) suggested three routes to the process of agricultural modernization:

1. Creating a macro-environment that makes change possible and encourages the ultimate decision makers to modify farming pattern,
2. Building a body of useful technology and available requisites production inputs that fill the modernization requirement, and
3. Optimising an extension education system that effectively relates these conditions and resources to each other, and watering them in a way that stimulates innovations with progressively over achievement disparities common to traditional agriculture.

Importantly, the over all goal of any change programme, particularly in modernizing agriculture, is to increase productivity and income of the farmers (fishermen) and make them highly dynamic, able to shift rapidly in adjustment to changes in technology, prices and market demand Mosher, (1969). In line with the above, Reynolds (1970) suggests that outcome of a social programme could be determined by the following indicators;

1. Changes in knowledge and attitudes,
2. Mediating behaviour outcomes (e.g. information seeking activities)
3. Changes in individual behaviour toward the programme activities (e.g.. trial adoption),and
4. Resulting social indicators effects (e.g. indices of economic or general well-being of the recipients).

Similarly, Lippit *et.al.* (1958) also identify three forces that may interact to determine effects of a social interaction. They are:

1. Change forces that motivate people to change by creating dissatisfaction with the existing situation and favorable judgment of potential future dimensions.
2. Resistance forces, which act as disincentives to change from known to the unknown and
3. Interference forces which obstruct change without necessarily having any thing to do with it.

In essence, these are forces that have to do with the circumstances of the social intervention, the attribute of the client and the environment. Thus, Zald (1975) observes that factors like the organisation, target population and environment may, among others, affect the success of social change programmes.

Equally, researchers have clearly shown that awareness and adoption behaviour of farmers (fishermen) be it in Nigeria or elsewhere is a function of a number of variables, some socio-economic characteristics of the farmers (fishermen), some socio-cultural and some institutional factor as early cited from various studies.

For any planned change to succeed, Williams (1978) and Abalu and D'Silva (1979) maintained that when farmers (fisher folks) find recommended farm innovations not to be technically feasible, economically viable and cultural compatible they often reject such innovations. This was earlier touched under appropriate technology. Agbanifo (1974) advises that any agricultural innovation that is being introduced to the farmer must not only be compatible

with their existing farming traditions but also with the existing social structures and institutions in the community. Where this is ignored, the transfer of agricultural technologies to farmers and getting them to accept and practise the innovations become a major problem.

The above theories and concepts have generally shown that factors that could interact to produce change or maintain the status quo could be socio-economic characteristics, socio-cultural factors both of the farmers (fisher folks) and institutional factors. This contradicts (Onazi,1973; Okafor, 1979) that farmers (fisher folks) are resistant to change, conservative, illiterate and lacking innovations. The reasons could rather be that certain institutional and environmental factors of the farmers inhibit or facilitate their responses.

For the purpose of this study, certain socio-economic, institutional, cultural and environmental factors were selected for analysis in relation to farmers' awareness and adoption of fisheries management. The institutional variable was extension contact, while the socio-economic characteristics of the farmers are: age, household size, level of education, income, and cosmopoliteness.

CHAPTER THREE

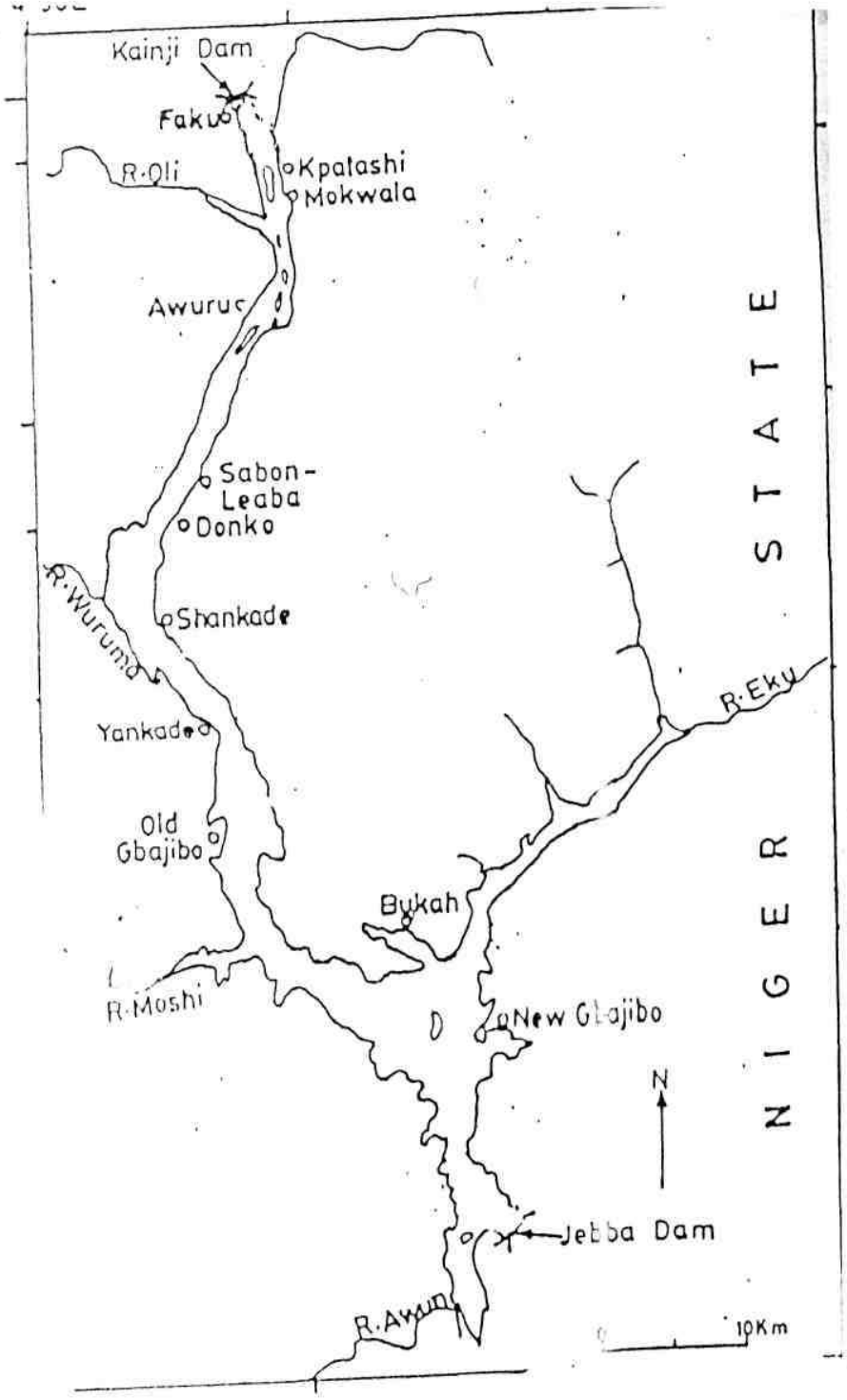
METHODOLOGY

In this section, attention was concentrated on the description of the study area, sampling procedures and method of data collection. The operational indices of this study for the variables in the theoretical framework and the procedure used in analysing the data were discussed.

3.1 The Study Area

Jebba Lake was formed in August 1983 as a man-made impoundment in the valley of the river Niger. The lake is unique in that it has a direct inflow from another man-made lake, the Kainji Lake, located upstream to it with same black and white floods pattern.

The history of its formation can be traced to the late 1950s when Nedeco and Balfour Beathy started investigations into that part of the river Niger that would eventually be covered by the Jebba Lake. Nedeco and Balfour Beathy Ltd (1958) recommended the construction of two or more low dams to develop the hydro-electric, navigation and irrigation interests in the river Niger at Jebba. The expanded water mass would provide opportunity for intensification of traditional fisheries and the development of modern pisciculture on the lake and its tributary stream. The construction of the Jebba dam commenced in 1978 while the dam and its corresponding lake were completed in 1982/83 (Map 1).



Map of Jebba lake

3.2 Location and General Characteristics

Jebba lake is located in the Northern hemisphere between latitudes 9^{o} 10'N to 9^{o} 55'N and longitudes 4^{o} 30'E to 5'E00E. It is surrounded by Kwara State on the West and Niger State on the East.

Some of the general characteristics of the lake as presented by Adeniji *et al.* (1984) are:

i) The lake is 76 metres above mean sea level in the valley with a maximum reservoir operating water level of 103 metres and a minimum reservoir water level of 99 metres.

ii) The lake has a maximum length of 100 kilometres, maximum depth of 32.5 metres, maximum width of 10.0 kilometres and a mean depth of 3.3 metres.

iii) The lake's surface area is $303x10^{6}$ square metres and maximum volume of 1,000x106 square metres and maximum volume of $1,000x10^{6}$ cubic metres.

There is clearly defined rainy season (May to October) with the peak monthly rainfall of 340mm at Faku and 385mm at Jebba in August and September respectively (Adeniji, 1990).

3.3 Socio-Economic Characteristics of the Target Group

Arungbemi (1983) indicated that the indigenous ethnic groups in the lake area are the Bussa, Hausa, Kambari, Lopawa and Nupe. The Nupe are the most populous. The main non-indigenous ethnic groups are the Urhobo, Itsekiri and Yoruba. The people of the area are predominantly Muslims.

Farming, fishing, hunting, pottery and transportation are the main economic activities of the people. Next in importance to farming in the lake

area is fishing which is mostly done on the river Niger and her tributaries - Eku and Moshi. In Mazhi, Tungan Jirgi, Sunko, Tungan Alhaji Sallah etc, over 90% of the people engage in fishing . But in places like Bukah, Gbajibo, Awuru Kontagora, Fallah North, Tungan Jebba, Kpata, Tungan Makeri, Mokulagi etc there seems to be a balance between fishing and farming. The fishing methods include the use of nets, hooks and traps with both canoes boat and outboard engines.

Arungbemi, (1983) also noted a total of six thousand one hundred and eleven people in forty-two villages located in the Jebba lake area were physically displaced by the creation of the lake. Nine out of the said villages with an initial population of 2,135 in Kwara State while 33 with an initial total population of 4,632 are in Niger State. There is no current number of fishermen in the Lake. As a matter of urgency, the Lake is overdue for a frame survey.

3.4 Estimated Fish Production of the Study Area

Quantities of fishes caught vary with places and season. The fishes are used for both domestic and commercial purposes either fresh or smoked. With the construction of the Jebba Dam and forming of a lake, fishing as well as quantities caught have greatly increased to the extent that fishermen from Yauri, Sokoto and Benue states dot the edges of the lake from Jebba to Kainji.

Estimates of fish catch in Jebba Lake have been made by Ita *et.al.* (1984). The fish catch assessment survey gave an estimate of 28,044kg/month or 28.04 metric tons per month. The annual estimate from this was 336.48 tons per annum. The number of fishing boats on the lake during that survey was 369 but the authors indicated that the maximum number of fishing boats that could be safely operational on the lake without over-fishing is 600. The

situation has now changed from what it was. However, there has not been any recent catch assessment from which to ascertain the current status.

3.5 Sampling Procedure and Sample Size

Fourteen fishing villages were selected randomly for the purpose of this study. One hundred and twenty fishing entrepreneurs were randomly selected as shown in Table 4, based on the sizes and population of the fishing villages.

State	L.G.A.	Village	Number
Niger	Borgu	Faku	10
Niger	Borgu	Farin Dutsi	10
Niger	Borgu	Awuru	10
Niger	Mokwa	Gbajibo	15
Niger	Mokwa	T. Agatu	10
Niger	Mokwa	Kurgawa	10
Niger	Mokwa	Saminaka	5
Niger	Mokwa	T. Gero	5
Niger	Mokwa	Gungun Zaki	5
Niger	Mokwa	Tsohon Buka	10
Kwara	Kaiama	Masama	8
Kwara	Kaiama	Tungan Dukiya	7
Kwara	Kaiama	Dada	5
Kwara	Kaiama	Hutawa	10
Total			120

The issue is not the number of fishing villages and entrepreneurs, but the homogeneity of the fishermen at any particular water body.

The fishing entrepreneurs were used as the unit of analysis. This is because they are the main decision-makers in issues pertaining to fishing operations and participation in agricultural programmes.

3.6 Data Collection Instruments

A survey questionnaire, with interview and observation as checks to the given responses were used in collecting data for this study. The questionnaires were administered by the researcher and two experienced enumerators of the Socio-Economic and Extension programme of the National Institute for Freshwater Fisheries Research (NIFFR).

3.7 Measurement of the Study Variables

The dependent variable in this study was adoption of fishing innovations i.e. recommended mesh sizes. The independent variables are: awareness, level of education, household size, age, cosmopoliteness, income, experience and extension contact. Below are the measurement techniques that were designed for every one of the variables.

3.8 Operational Indices: Dependent Variable

Adoption: This was the reported use of improved fisheries management measures, with major concern on the fishing recommendations on exploitation. Equal weightage was given to the innovations to have a maximum possible score of five points and a minimum of zero.

Independent Variables

Age: This was defined as the years of the fishing entrepreneur as given by him/her at the time of interview. The years given made the score of the respondent.

Experience: This was the number of years the fishing entrepreneur gave as being engaged in fishing. The number of years made the score of the respondents.

Awareness of recommended innovations: This was the extent to which the fisher folks have heard of improved fisheries innovations. It was be measured by the number of fishing innovations an entrepreneur reports to be aware of . Each of the innovations was given equal weightage. This is based on the argument that unequal weighting are negligible on a statistical point (Rogers, 1961).

Extension contact: This is the degree of contact between extension agents and the fishermen. It was measured by the total number of visits reported by the respondents.

Level of Education: This referred to the number of years the fishermen spent in Koranic, adult education, primary, secondary and post secondary schools. Respondents were scored on the number of years spent in attending each. The total number of years of school constituted the respondents score.

Financial position/gross income: This was defined as the total income that accrued to the fisherman from sales and consumption of fish. To score this, the respondent was asked to give an estimate of the quantity (amount) of fish he consumed. The estimated amount was summed up with what the respondent gave as the amount usually earned from the sales of fish. The summation of this amount gave the respondent's gross income score.

Household size: This variable was measured by adding up the total number of dependents that were living with the entrepreneur at the time of data collection. The total number of people in the respondents' household formed his score.

Cosmopoliteness: This refers to the entrepreneurs' level of exposure to urban centres and other water bodies to know the experiences gained. The score of the respondent was be the number of urban centres and other water bodies to know he had visited.

3.9 Statistical Analysis

The data for this study were analysed with two sets of statistical tools, namely: descriptive and quantitative techniques.

Descriptive statistics employed were: frequencies, percentages, means and standard deviation. These were used to show fishermen's awareness, adoption of fishing innovations and level of income .

Quantitative methods used were correlation and regression analyses to determine the relationship between fishermen's socio-economic and institutional factors in relation to their adoption behaviour and to test the postulated hypotheses.

Correlation is the measure of association between variables with its coefficient giving the degree of association between any two variables under consideration. It was used to measure the strength of relationship between the variables.

Linear Model equation: Implicit form:

$$Y\ (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8).$$

Where; Y = adoption

X_1 = age

X_2 = household size

X_3 = awareness of recommended innovations

X_4 = income level

X_5 = cosmopoliteness

X_6 = extension contact

X_7 = level of education

X_8 = experience

U = error term.

CHAPTER FOUR

RESULTS AND DISCUSSION

In this chapter, attempt was made to classify responses based on the socio-economic background of the respondents, the findings in relation to the stated objectives and the hypothesized relationships with the selected variables.

4.1 Socio-Economic Background

The socio- economic parameters in this study were: age, household size, level of education, ability to read, fishing experience, and income. All survey respondents were males and only one of them was not married. Eight tribes were identified among the respondents with Hausa, Nupe, and Gungawa dominating as follows: 65.8%, 21.7% and 6.7% respectively.

4.1.1 Age structure

Age is an essential determining factor in adoption studies particularly in the area of fish exploitation. The minimum age was 21 years and maximum was 60 years. The mean age of all the respondents was 38 years.

Age was classified into three categories. All those between 21 - 35 years were classified as young and enthusiastic. They constituted 46.7 % of the respondents. Those between 36 - 50 years as active with 49.2% and those of 51 - 60 as old and nearing retirement and were 4.0% of the respondents.

4.1.2 Household Size

Table 6 showed the distribution of the respondents by household sizes. The mean household size was 11, minimum of 4 and maximum of 25

members. Household sizes of the respondents were classified into three as follows: 1 - 10 members as small and constituted 60.8% of the respondents, 11-20 members as medium with 30.8% and 21 and above as large with 8.3%. The average household size in the study area was 11 members

Table 5. Age distribution of the respondents.

Age Group (Years)	Frequency	%
21 - 35	56	46.7
36 - 50	59	49.2
51 - 60	5	4.0
Total	120	100.0

Mean = 38 years; std. Dev. = 8.69; min = 21 years and max 60 years.

Table 6: Categorization of household sizes of the respondents.

Category	Frequency	%
1 - 10	73	60.8
11 -20	37	30.8
21 above	10	8.3
Total	120	100.0

Mean = 11.2; minimum = 4; Maximum = 25.

4.1.3 Level of Education

About 44% of the respondents had neither formal nor informal education. About 46% of them had Koranic education. Only 7.5% of them had primary education with just 1.7% having secondary training. The mean of the years spent in education was as low as 3.7 years (Table 7).

Table 7. Distribution of level of education of the respondents.

Type Of education	Frequency	%
None	53	44.2
Koranic school	55	45.8
Adult	1	0.8
Primary	9	7.5
Secondary/equivalent	2	1.7
Total	120	100

Mean = 3.7 std dev = 3.8 minimum

4.1.4 Respondents ability to read

Closely related to the level of literacy is the percentage distribution of the respondents into languages in which they can read as shown in Table 8.

Table 8. Distribution of respondents according to their ability to read.

Can read in	Frequency	%
No Language	59	49.2
Ajami	49	40.8
Hausa	6	5
Nupe	3	2.5
English	3	2.5
Total	120	100

It was glaring that about 49% of the respondents cannot read in any form of language. About 41% of them can read in Ajami (Hausa using Arabic alphabets). Just 5% of them can read in Hausa and about 3% in both Nupe and English.

This finding has its implications on both present and future endeavors for extension in that extension guides, bulletins and technical papers cannot be

read by the majority of the respondents. Policy designers have to incorporate adult education learning in order to increase the literacy level of the fisher folks.

4.1.5 Fishing experience

A glance at the number of years the respondents had been engaged in fishing in Table 9 revealed that majority of them had more than 15 years of experience, About 42% had been fishing for a range of 5 - 20 years, 50% had been fishing for a range of 21-36 years while about 8% had been fishing for a range of 37-52 years.

Table 9. Distribution of fishing experience

Years of Experience	Frequency	%
5 - 20 years	50	41.6
21 - 36 years	60	50.0
37 - 52 years	52	8.3
Total	120	100.0

Mean = 27.8, Minimum = 15 and maximum = 52

4.1.6 Income level

Table 10 provides a glimpse that was enough to portray the financial resource level of the fishermen. About 11% of the respondents earn roughly ₦5,000 – ₦20,000 per annum. About 28% of them earn between ₦20,000 – ₦36,000 per annum. About 28% of them earn ₦36,0001 – ₦52,000. About 24% of the respondents earn ₦52,001 – ₦68,000 per annum. The last category of the respondents earn between ₦68,001 – ₦99,000 per annum and they constituted about 9%.

Table 10. *Income distribution of the respondents.*

Income Category (₦)	Frequency	%
5,000 - 20,000	13	10.8
20,001 - 36,000	34	28.3
36,001 - 52,000	33	27.5
52,001 - 68,000	29	24.2
68001 - 99,000	11	9.2
Total	120	100.0

Mean = 50,316.67; std. dev. = 18,886.21; min = 15,000; max 98,000.

In order to alleviate their conditions, the respondents engage in other secondary occupations like farming, petty trading and livestock keeping (Table 11). They produce rice, maize, millet, melon and sorghum. The rice and melon were mainly for market while maize, millet and sorghum were for home consumption. 95% of the respondents engaged in farming while about 3% each are engaged in petty trading and livestock keeping. The livestock, like poultry and ducks were kept by the women and mostly for the market. The men keep bulls for animal traction. The petty trading engaged in included the sales of cooked food like tuwon' rice, tea and bread, 'fura' and minor provisions.

Table 11. Secondary occupations of the respondents.

Secondary Occupation	Frequency	%
Farming	114	95.0
Petty trading	3	2.5
Livestock keeping	3	2.5

Closely associated with the secondary occupation is the income generated from it. The income was categorized into four in which the respondents gave the category into which they fall. About 58% of them produce for home consumption only, 15% made ₦20,001 and above, about 13% made ₦10,000 to ₦20,000 while about 11% realized ₦1000 to ₦10,000 per annum.

Table 12 which showed the exposure of the respondents revealed that about 46% of them had traveled to so many water bodies in the country and to other countries like Niger, Cameroon, Ghana, Mali, Chad. About 27% of them traveled to other countries with less exposure to other places in Nigeria. Lastly, about 28% of them only traveled to places in Nigeria without going to other countries.

Table 12. Percentage distribution of respondents according to exposure.

Cosmopoliteness	Frequency	%
Within the country	33	27.5
To other countries	32	26.7
Within the country and other countries	55	45.8
Total	120	100.0

Table 13 revealed that about 71% of the respondents showed that extension workers visit them once in a year. About 27% indicated that they come into contact with extension workers twice in a year in the study area. Respondents in large fishing villages revealed that extension staff visit them four times in a year.

Table 13. Percentage distribution of respondents to extension contact.

Extension contact	Frequency	%
Monthly	0	-
Quarterly	3	2.5
Twice in a year	32	26.7
Once in a year	85	70.8
Total	120	100.0

4.2 Findings as Related to Study Objectives

The general objective of the study was to gain an insight into adoption behaviour of relation to recommended fishing innovations. Objective one in the study was to determine the level of fishermen's awareness of recommended fishing innovations on exploitation. The awareness level of the fishermen about the innovations was investigated. Table 14 showed the percentage distribution of the respondents who heard about the five fishing innovations.

Table 14. Percentage distribution of respondents who heard the innovations.

S/No.	Recommended mesh sizes	Frequency	% that heard
1	Gill net 8mm (3 inches)	95	79.1
2	Cast net 5mm (2 inches)	95	79.1
3	Clap net 5mm (2 inches)	95	79.1
4	Webbing tap 5 (2 inches)	95	79.1
5	Drift net 6mm (2½ inches)	95	79.1

It was found that a very good percentage of about 79% of the fishermen heard and were aware of the recommended innovations on exploitation. However 20.8% of the respondents did not know about the innovation. If after

hearing, they still refuse to adopt, they could be classified as the laggards needing more empirical proof before they would be convinced. For both groups, the extension personnel need to work harder and cover the area more extensively and intensively.

The conventional role of extension is the transfer of technology from scientific researchers to farmers. Success is indicated by its adoption by the farmers. Extension contact has to be intense and effective other than just giving "commands" as found in the study area. The extension agents from Kwara did not even reach the fishermen at all. The new challenges for extension is more encompassing. The new thinking is by consultation with and education of the local people in participatory decision-making.

The second objective of this study was to determine the rate of adoption of the five innovations. Table 15 showed the percentage distribution of respondents' adoption of the innovations. This shows that adoption level was highest for gill net 71.6% followed by cast net 58.3% and the least adopted was webbing trap 12.5%. However, when all the recommended innovations were considered together, only 10% of the respondents adopted the whole innovations. That means 10% were full adopters while the remaining majority of 90% adopted in different proportions as shown on the table. Each of the innovations is independent. An entrepreneur needs to use the recommended mesh size for whatever type of gear he is using. The mean adoption of the whole innovations was 1.9.

The level of adoption, defined as the number of technologies used by a farmer (Nweke and Akorhe, 1983) was used to arrive at the above figures. Thus, the maximum level of adoption possible was five. The highest level of

adoption attained in the study was 71.6% on (gill net) and the lowest was 12.5 on Webbing trap.

Table 15. Distribution of the innovations and percentage adoption.

Recommended Mesh Sizes	Frequency	%
Gill net 8mm (3 inches)	37	30.8
Cast net 5mm (2 inches)	15	12.5
Clap net 5mm (2 inches)	28	23.3
Webbing trap 5mm (2 inches)	86	71.6
Drift net 6mm (2½ inches)	70	58.3

Mean = 1.9, Minimum = 15 and Maximum 86

In the study, there was no innovation in the package that was not adopted and there was no respondent that did not at least adopt one innovation.

Factors Affecting Adoption

Table 16 sums up the co-variability between the factors affecting adoption of fishing innovations. There were positive correlations between the factors influencing adoption in the sample. The influencing factors were useful in the estimation of the variability of the adoption. The high co-variability between awareness and cosmopoliteness indicates that exposure is a very significant determining factor in adoption. This is because being so versatile by exposure, conservatism and ostracism gets eroded and one becomes more receptive to change. There occurred a high correlation between education and adoption. Years of formal education is expected to influence adoption positively because education increases access to useful information. The low correlation between age and adoption indicates that age varies inversely with innovation adoption because old people tend to be more risk-averse than young people.

Table 16. Variable correlation coefficient.

		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Adoption	X_1	1.00								
Cosmopoliteness	X_2	0.04761**	1.00							
Education	X_3	-0.0979**	-0.2477	1.00						
Awareness	X_4	-0,9285	0,9094**	-0.2723	1.00					
Extension contact	X_5	0.1244	0.1659	0.1011	-0.0599	1.00				
Income	X_6	-0.0669	0.0281	0.1116	0.1316	0.0578	1.00			
Household size	X_7	-0.0437	0.0547	0.2018	-0.0636	0.1849	0.2764	1.00		
Age	X_8	0.0476	0.0351	0.2902	-0.0091	-0.1256	0.1796	0.3277	1.00	
Experience	X_9	-0.2879	-0.0497	0.2180	0.0594**	0032	0.3409	0.3571	0.4767	**1.00**

**coefficient significant at 5% <05.

Further explorations of the relationship among the influencing variables for some concrete inferences are carried out using regression results (Table 17), Hence, the level of innovation adoption was regressed on X_1 (age) X_2 (household size) X_3 (awareness) X_4 (income level) X_5 (cosmopoliteness) X_6 (extension contact) X_7 (Level of education) and X_8 (experience).

Table 17: Regression results of the factors influencing adoption.

Variables	Coefficient	S.E.	t value
Cosmopoliteness	0.836118	0269957	3.097**
Awareness	1.153961	0.505344	2.284**
Household size	-0.003914	0.021042	-0.186
Visit (extension contact)	0.006715	0.006340	1.059
Education	-0.069448	0.031667	-2.193**
Income	-4.76475E-06	6.28531-06	-0.758
Age	0.049840	0.033127	1.504
Experience	-0.061053	0.033825	-1.805
(Constant)	1.085615	0.901450	1.204

R^2 = 0.13716 **Coefficient significant at the 5% level.

F=0.07497

Table 17 sums up the co-variality between the dependent and independent variable. There were positive correlations between the independent variables such as cosmopoliteness, extension contact and age with adoption. The high co-variability between extension contact and adoption indicates that extension contact is a very important factor in adoption. The low correlation between the other variables indicates the low contributory role they played in relation to the adoption process.

The regression results showed that cosmopoliteness, awareness, and education were all positively significant determinants of adoption of fishing innovations in capture fishery. Cosmopoliteness has a positive coefficient. Hence, there exist a direct relationship between it and adoption. This conforms with a very strongly believed and upheld Hausa adage "tafiya mabudin ilmi" Meaning travel is a key to knowledge.

Age has a positive coefficient, though not significant at 5% indicating that older people adopt more than younger people. This finding negates literature reviewed such as Atala (1980) and Mijindadi and Njoku (1985) but corroborates with the findings of Ahmed (1984). In the fishery sub-sector especially exploitation, some of the deviations from the old practices (traditional ways) in mesh sizes were carried out by the younger ones. Hence, the older people whose practices as far as mesh sizes were concerned conforms with the innovations would be more of adopters than the younger ones.

The household size variable has a negative coefficient, suggesting that adoption level was lower among large than small sized households. Reasons adduced in literature reviewed such as Voh (1979) was that households with larger size tend to attach greater importance to food security than those that were small in size.

A similar result was found by (Akinola, 1997) in his study area with 12 members as the mean household size. This similarity could be explained by the fact that both studies were conducted in the Northern part of the country where Muslims predominate and practise polygyny. Household size has a great role to play in family labour provision in the agricultural sector. Right from time immemorial, large family size has been a mark of respect and a desirable

socio-cultural appellation in African social system. This phenomenon is now fast changing due to the acculturation of the western concept of family particularly among the elites.

This socio-cultural variable in some instance has been found to trigger adoption of innovations while in some cases mitigates it depending on the kind of innovation in question. A negative relationship was expected between household size and adoption because large household size would tend to stick to the known traditional methods. In livestock (Ahmed, 1986) found that household sizes that were large favoured adoption while the reverse was found in this study, which was in the fishery sub-sector.

The positive coefficient between awareness and adoption indicates that the more aware the fishermen were, the better their rate of adoption. This has been the conventional position. However, as far as fish exploitation is concerned, awareness has to be backed up with monitoring. If awareness alone can play a decisive role in adopting measures on exploitation, Lake Kainji would have been rid of all under mesh sizes particularly beach seines which the Nigerian-German Kainji Lake Fisheries Promotion Project has being mounting vigorous campaigns against through various communication channels such as extension contact, posters, meetings, mass media, VIP visits.

Income was found to be insignificantly related to adoption. This finding negates findings earlier reviewed such as Atala (1980) in the crop sub-sector. There was a similar finding under livestock by Ahmed (1986). This simply means that the earning of the fishermen were so meager. Therefore they could hardly invest on mesh sizes that might not catch fish always.

There occurred a positive coefficient between extension contact and adoption. This means that adoption level increases with increase in the intensity and effectiveness of extension services rendered. Recent studies by Cleaver, (1997) and Orejobi *et al.* (1997) all indicated the high impact of extension on farmer adoption of improved technologies. Extension is a necessary ingredient of agricultural development. But a peculiar problem existed in the study area between the extension agents and the respondents. The extension agents visited the fishermen on their market days mainly to extol the wealthy fishermen and extort some money from the poor fishermen and fishmongers who were found with fingerlings of commercially important species. The extension agents were "settled" there and then. But the end result of this undesirable practice would be depletion of some of the fish species and degradation of the ecosystem.

By experience the respondents have been fishing for quite a long time. Attention should be concentrated on the very active and young category, which were the 16 - 36 years. This showed that majority of the respondents were staying in that part of river Niger before its impoundment. It also means that some of the respondents migrated from elsewhere to avail themselves of the opportunities of the fish boom that was attendant after the lake has formed in 1983. The migratory nature of fishermen in search of fish boom could make them over fish a particular waterbody if stringent measures are not taken to prevent them. Fishermen are transhumance by the nature of their occupation. They move from one water body to the other in search of fish boom.

The coefficient of level of education was also significant. The level of education of the fishermen was expectedly directly related to the adoption

index of the fishery innovations on exploitation. Years of formal education influences adoption positively because education increases access to useful information. Majority of the respondents had Koranic education, which have fatalism. Hence, it was timely to conscientise the fishermen that God's given resource (fish) deserves proper management against their argument that God is able to provide at any time He wishes and therefore fish can never finish in a water body.

The fishermen being transhumance by their occupation travelled within and outside the country as shown on Table 12. A lot of experiences were gathered and used. Being so versatile by exposure, conservatism and ostracism gets eroded and made some of the respondents more receptive to change.

About 11% of the respondents earn roughly ₦5,000 - ₦20,000 per annum which is grossly below the poverty line. About 9% of the respondents earn roughly ₦68001 - ₦99000 per annum. All the estimated amount for the categories were inadequate in relation to the satisfaction of basic needs. This low level of earning could inhibit the adoption of any innovation that is expensive. This tallied with what a Kenyan agricultural extension worker, cited by Rohling *et al.* (1981) explained that `my farmers are two poor to follow my advice'.

The third research question which was about the socio-economics and institutional variables and how they affect adoption were all translated into objectives and hypotheses tested using the multiple regression co-efficient at 0.05% level of probability.

4.3 Test of Hypotheses

A general hypothesis was postulated that there is no significant relationship between the socio economic characteristics of the fishermen and institutional variables with their adoption behaviour. The general hypothesis basically comprised two set of variables viz; socio-economic characteristics (i.e. age, household size, level of education, fishing experience, cosmos-politeness and income). The second set of variables were the institutional factors awareness and extension contact. The broad hypothesis was postulated in the null which applied to all the specific ones. For convenience the 5% level of significance was chosen.

Cosmopoliteness was postulated to have no significant relationship with adoption. But this variable proved to the contrary by its coefficient value and was significant at 5%. So the null hypothesis under this variable was rejected.

Under the institutional variables, awareness was hypothesized in the null. By virtue of the finding it was rejected and hence a direct relationship was established between awareness and adoption. The influence was significant at 5%.

Level of education was hypothesized in the null as having no significant relationship with adoption. The expectedly direct relation of this variable with adoption gained rejection to the advanced hypothesis at 5% level of significance by its coefficient. This finding has a lot of implications for extensionist, in terms of kinds of extension messages, policy makers, i.e. in terms of policy thrust to reflect agricultural education, the actual educational level and the need to incorporate adult education programme for the fisherfolk, research by designing researches that can be understood and adopted by the fisherfolk.

Age was hypothesized to be negatively related to adoption. The over all adoption index showed that age was positively related to adoption in capture fishery though not significant at 5% probability from the coefficient obtained for age. The hypothesis that there was no significant relationship between fishermen's age and adoption was not supported by the finding Therefore age was an important variable that bored relationship with adoption. Hence the null hypothesis was rejected.

Extension contact, has a positive coefficient, establishing a direct relationship with adoption but not significant at the 5%. The null hypothesis must be rejected.

With regards to household size, the null hypothesis was accepted though not significant at the 5% level per the coefficient value obtained.

Fishing experience was also hypothesized in the null which found support and acceptance though not significant at the 5% level. So experience was accepted in view of the coefficient of the regression analysis.

Income variable was stated in the null hypothesis, findings as shown in the coefficient gave it acceptance though not significant at the 5%.

4.4 Effects of Adoption

Adoption studies are carried out to discover the target groups' receptability to change. Such change is to occasion improvement. In spite of the variations obtained in the adoption rate of the fishing innovations, the adopters claimed being better.

The respondents who adopted the innovations all claimed that the use of the recommended mesh sizes were beneficial (Table 18). Except that the catch might not be on daily basis. It has been shown that 90% of the fishermen

realised two hundred naira per sale above those who did not adopt the package. In the same vein, about 9% and 1% made additional four and five hundred naira respectively. In general, there was an average increase of in earning of two hundred and twenty naira eighty kobo for the adopters of the package over their colleagues who did not adopt. Adopting these innovations would not only improve the resource level of the fishermen but also conserve the natural ecosystem from depletion.

Table 18. Effects of adoption on income.

Increase in income (₦)	Frequency	%
200	108	90
400	11	9.2
500	1	0.8

Mean = 220.8.

By the regression results obtained, Table 17 showed the socio - economic characteristics measured (age, household size, level of education, fishing experience, cosmopoliteness and income) and the institutional variable (intensity of extension contact) influenced adoption to the extent of a coefficient variability of R^2 = 0.13716. Without any misgivings, it simply means the socio-economic and institutional variables measured were not wrongly done rather they did not act in the same manner for all technologies.

Consequently, it was necessary that models dealing with adoption of agricultural technologies should recognise these variations or specifications if success is to be made instead of giving sweeping generalisations and recommendations.

It was found, for instance, that age has positive coefficient with adoption, which is a true manifestation in capture fishery. By implication it means more concerted effort was required to educate the youth (most active in fishing) to understand the scientific meaning behind the recommended mesh sizes aimed at improving the living conditions of the fishermen and preserving the natural ecosystem.

The low level education called for more effort not only the pedagogical type, but a functional one. It can be organised by the government, research institutes, private sector and NGOs in a participatory form where all participants are learners and teachers. This could steep up the adoption level of the youth. Most development writers make it clear that any country wanting to bring about significant development must provide educational opportunities, provide its people with the basic skills of reading and writing. Cuba provides a living example in this direction. Lerner (1963) calls literacy the basic personal skill that underlies the whole modernization process. Literacy level consistently has been found to correlate with various indicators of modernization though the correlations might explain a small percentage of the variance. What was realistically needed is national programmes of literacy training and educational improvement.

Household size in artisanal fishery and in agriculture generally plays significant role in family labour provision. Larger family sizes were found to adopt less, because of risk aversion. Much as the social system should not be tampered with, reorientation for rational and sustainable exploitation of the fishery resource should not be compromised.

Fishing experience was found to be insignificant in relation to adoption of innovations in fish exploitation with a coefficient of r = -0.061053. Nonetheless, this should not be strange, studies by (Orejobi *et al.*, 1997) found positive but insignificant relationship between farming experience and adoption. This is dependent on the type of innovations in question and related to age and other socio-economic and institutional variables.

Income was found to be inconsequential to adoption of fishing innovations. This was not strange, because the earnings of the respondents were generally meager. There was no credit facility introduced in the study area for the fishermen to utilize.

4.5 General Problems of the Respondent

Table 19 showed the general problems facing the respondents decried in the following magnitude. About 68% of them complained about credit assistance from the government. This is because credit facilities enhances adoption. The practice of not granting institutional credit to fishermen is not uncommon.

Table 19. Percentage distribution of general problems of the fishermen.

General problems	Frequency	%
Credit assistance	80	66.7
High cost of fishing gears	71	59.2
Modern cooperatives	65	52.2
Ineffective extension services	50	41.7

The respondents lament the high cost of fishing gears. About 59% of them revealed that purchase of outboard engines and maintenance are above the reach of a common man.

About 54% of the respondents indicated their interest in participating in modern functional cooperation because it enhances access to material inputs at cost. The government initiated cooperatives have since become moribund.

Lastly, about 42% of them showed the ineffectiveness of extension services in the area. Extension agents are responsible for educating fishermen the use of improved innovations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

The fishery sub-sector is the focus of this study. Nigeria is so blessed with inland water rich in freshwater fishery capable of producing over 2.2 million metric tonnes locally if both material and man power resources are fully mobilised in addition to the maritine of 273,500 metric tonnes per annum (Ita and Sada 1985). Available statistics showed that our inland water bodies are producing less than 13% of their estimated fishery potential (Ita and Sado, 1985). It is obvious that demand for fish in Nigeria has never been met by dependence on yields from local resources.

With the problem of low productivity and under mesh sizes identified, recommendations were made after research in National Institute for Freshwater Fisheries Research New Bussa (NIFFR) on the standard sizes of gears. This was to lead to efficient fisheries management system based on the abundance depletion cycle of the fishery resources. This was to be extended by every state Ministry of Agriculture and any other agencies for adoption by the fishermen.

The study focused on the following questions in relation to the fishermen's adoption behaviour. To what extent were the fishermen aware of the recommended innovations on fishing? What was the rate of adoption of the recommended fishing innovations? What socio-economic and institutional factors could be responsible for adoption or non-adoption of the fishing innovations for extension, fishery research and policy makers?

The general objective of the study was to gain an insight into the adoption behaviour of the fishermen in relation to the recommended innovations on fishing. The specific objectives were to: Determine the level of fishermen's awareness of the recommended innovations on fish exploitation. Study the rate of adoption of the innovations by the fishermen.

Examine the socio-economic and institutional variables that could affect fishermen's adoption behaviour.

Make recommendations on the basis of the findings as to how the process of adoption of the fishing innovations could be accelerated.

The study area was Jebba Lake. The lake was formed in August 1983 as a man-made impoundment in the valley of the river Niger. The lake is surrounded by Kwara State on the West and Niger state on the East. Fourteen fishing villages were sampled randomly with one hundred and twenty fishing entrepreneurs interviewed. A structured survey questionnaire was used. Interviews and observations were used to serve as checks on the responses given to the questions asked and as a form of triangulation. Descriptive statistical analysis was employed to measure fishermen's awareness, rate of adoption and level of income. The quantitative methods used were correlation, multiple regression to determine the relationship between fishermen's socio-economic and institutional factors in relation to their adoption behaviour was to measure the association between the variables and the result was used to test the hypotheses using 0.05% level of significance.

It was found that about 79.1% of the respondents were aware of the innovations on fish exploitation. However only 10% of the respondents adopted the whole package. There was no innovation in the package that was not

adopted and there was no respondent that did not at least adopt one innovation.

It was also found that cosmopoliteness awareness, and education were positive and significant determinants of adoption in capture fishery at the 5% level of significance. The socio-economic and institutional variable measured influenced adoption by a co-efficient variability of $R^2 = 0.13716$.

The respondents who adopted the innovations have increase in their sales of varying amounts of ₦200 - ₦500 per sales.

5.1 Conclusion

In conclusion, the awareness level of the respondents about the innovation was high. It was found that 79.1% confirmed that they heard about the recommended fishing gears. However only 10% of the respondents adopted the whole package. there was no innovation in the package that was not adopted and there was no respondent that did not at least adopt one innovation. Secondly, the most important factors affecting the adoption of fishing innovations were cosmopoliteness, and education. All these were also positively related to fishing innovations adoption.

These conclusions have some implication for fishing innovation adoption within the context of capture fishery. For instance, the fact that 10% of the respondents adopted the whole package and confirmed that the innovations were beneficial implied that the cost of the package could inhibit the others from adopting. Some of the constraints to adoption noted during the study were high cost of fishing gears, lack of credit facilities and declining catches in the lake. Despite all the potentials Nigeria has for fishery, to date, fisheries management has been very poor.

In sum total, socio-economic and institutional variables are not really homogenous, nor can they act in the same manner for all innovations. Consequently, it is imperative that studies dealing with adoption of agricultural innovations should recognise these distortions or specifications.

5.2 Recommendations

Nigeria needs fishery resource management plan that identifies fishing potential and the opportunities for exploiting it in a manner consistent with long-term conservation and environmental considerations.

There is the need to strengthen the extension services to make it more functional, responsive and highly task oriented by providing operational facilities particularly flying boats for the riverine areas. This will enable the extensionists to reach their clients in their fishing communities to extend innovations.

Enlightenment campaigns, mass media, interpersonal contacts, posters, group discussions should be mobilised to occasion a change in the perception of the clients which is the art of extension. This is because the more times clients are exposed to a new idea through a variety of channels, the more likely they are to adopt the idea.

More work in training needs to be done on improving the quality of agricultural education. Collaboration between NGO managed systems and the public sector system is needed to complement each other. According to Cleaver (1997) recent projects incorporating some of these improved design ideas include Kenya, Senegal, Tanzania, Zaire and Malawi Agricultural Extension.

The policy makers should provide some of the institutional variables such as credit facilities and input supply through the fishermen's cooperatives as necessary ingredient for adoption. Artisanal fisheries can be assisted through support (credit) to organization of fishermen.

Exchange of all under mesh sizes with standard mesh sizes could be one of the ways to manage the natural resources and the environment.

Much as the social system of the fishing communities should not be tempered with, reorientation for rational and substantial exploitation should not be compromised

4.3 Other Research Needs

The waterbody studied requires as a matter of urgency frame survey so as to plot in the new fishing communities now found there. A catch assessment to portray the current status of the lake in terms of fishery resource. Similar study can also be replicated in other water bodies like Shiroro and Kainji lakes for comparison.

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APPENDIX I

QUESTIONNAIRE

FACTORS AFFECTING ADOPTION OF FISHING INNOVATIONS IN JEBBA LAKE

Administrative Information

Form No. .....

Interviewer/Enumerator .....

Date of interview .....

Village.....

District ..... L.G.A..... State.....

Respondents' Characteristics/Socio-Economic Variables

1. Name.....
2. Age .....

3. Tribe:

Nupe	**1**
Hausa	**2**
Kambari	**3**
Urhobo	**4**
Itsekir	**5**
Others (Specify)	6

4. Marital status:

Married	**1**
Single	**2**
Divorced	**3**
Widowed	**4**

5. Total in the household:

1 – 5	1
6 – 10	2
11 – 15	3
16 – 20	4

6. Level of education:

Primary	1
Secondary or equivalent	2
Adult education	3
Koranic education	4

7. Which of these languages can you read, Tick

Hausa	1
Ajami	2
Nupe	3
English	4
Others (specify)	5

Occupational Details/Experience in Fishing

8. How long have you been fishing?

5 – 15 years	1
16 – 26 years	2
27 – 36 years	3
37 – 46 years	4

9. Your annual income from fishing is approximately (₦)

5000 – 20000	1
20001 – 36000	2

36001 – 52000 **3**

52001 – 68000 **4**

68001 – 99000 **5**

10. What type of gears are you using now?

Type	Size	Reason
a. GN		
b. CN		
c. DN		
d. LL		
e. Trap		
f. An		

11. What do you do besides fishing?

Farming **1**

Petty trading **2**

Livestock keeping **3**

Others (specify) **4**

Institutional Factors: Extension Intervention

12. Is there any fishery extension agent in your village?

Yes **1**

No **2**

13. If yes how long have you known him or her in that capacity?

1 – 5 years **1**

6 – 10 years **2**

11 – 15 years **3**

14. How often does the extension agent visit you?

Monthly **1**

Quarterly **2**

Twice in a year **3**

Once in a year **4**

15. When was the extension agent's last visit to your village?

1 month ago **1**

6 months ago **2**

1 year ago **3**

Can't remember **4**

What method(s) does the extension officer use in communicating with You.....

16. Are you aware of the fishing innovations?

Yes **1**

No **2**

17. Which of these fishing technologies are you aware of:

Gill net 8 mm (3 inches) 1

Cast net 5 mm (2 inches) 2

Clap net 5 mm (2 inches) 3

Webbing trap 5 mm (2 inches) **4**

Drift net 6 mm (2½ inches)

18. Which of the following recommended practices on exploitation have you adopted?

20. What are your reasons?

_____

_____

Cosmopoliteness

21. Do you travel to other water bodies?

Yes	**1**
No	**2**

22. If yes where?

Within the country	1
To other countries	2
Within the country and other countries	3

23. Are the fishing practices (gears and sizes) same with yours?

Yes	**1**
No	**2**

24. If No, what are the differences?

_____

₦1 – 200

₦201 – 400

₦401+