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DOCTOR OF PHILOSOPHY OF the UNIVERSITY OF IBADAN

Constraints to technology transfer and productivity of fish in Nigeria : a case study of three maritime states

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CONSTRAINTS TO TECHNOLOGY TRANSFER AND PRODUCTIVITY OF FISH IN NIGERIA: A CASE STUDY OF THREE MARITIME STATES

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DEDICATION

To the loving Memory

of my

Mother in-law,

Margaret Abigail Akeredolu

ABSTRACT

Fish is a vital source of protein supplement in the diet of most Nigerians. Its production has however never met up with demand resulting in high market cost and the fishery subsector's inability to significantly improve the nutritional standard of the diet of the average Nigerian. Federal and State Governments concur that a modernization of the means of production through technological improvement and concomitant change in fishing location and attitude of the artisanal fishermen were solutions to the problem. These efforts have not improved the situation. It is against this backdrop that this study aimed generally at analysing the constraints to the transfer of technology and productivity of artisanal fishermen users and non-users of Yamaha 25 Horse power outboard engine in three Nigerian coastal States was carried out. More specifically, the study sought to describe the demographic and occupational characteristics of the fishermen, analyse the reasons for their preference or non-preference of the technology and to ascertain the constraints to the transfer of the technology at the service and supply levels, organizational level as well as categorizing the constraint factors at utilization level. The study also aimed at investigating the attitude of fishermen to the technology and their sources of information. Determinants of dependent variables such as fishing

income/productivity, knowledge about technology from selected independent variables, and investigation of the relationship between fishing location and constraints at the utilization level were also carried out. The landings, costs and returns of traditional fishermen and users of the technology were also compared in the three States.

The results were as follows: Age, Number of wives, number of children, number of dependants, religion, tribe and education were not significantly different among the users and non-users of Y25Hp Outboard engine in Lagos and Ogun States. While in Ondo State, age and education were significantly different between the users and non-users of the Y25Hp Outboard engine.

Active fishing years, number of canoes owned, number of people employed in fishing, number of trips made per week, all had significant association with the use of Y25Hp Outboard engine by the sea fishermen in Lagos State. While in Ogun State, the number of trips made by fishermen per week and the number of people employed in fishing had significant association with the use of the Y25Hp Outboard engine. Age, education, number of people employed in fishing and number of fishing trips made per week were found to have significant association with the use of Y25Hp Outboard engine by the sea fishermen.

The gross income from fishing and the place of fishing explained significantly the variation in Y25Hp Outboard engine utilization, by the sea fishermen. Outboard engine utilization, educational level, place of fishing and fishing experience also made significant contribution to the variation in the knowledge scores of the sea fishermen. Only the type of gear used and labour contributed significantly to the fishing income scores of the traditional fishermen. While the type of gears, use of Y25Hp, fishing place, labour, fuel, fishing time and canoe number were important determinants of the fishing income of the sea fishermen.

The result of the Discriminant Analysis gave the following constraints profile at the user category - Economic constraint (.91), Institutional constraint (.90), Supply constraint (.74), Outboard engine technical constraint (.60).

At the non-user category, the following results were also obtained:- Economic constraint (.87), Institutional constraint (.87), Gear constraint (.69), Social-cultural constraint (.57), Supply constraint (.55), Geographical constraint (.55), Specie/value constraint (.53).

However, at the extension and service levels, lack of funds, insufficient transportation to fishing villages, high fishing population, lack of facilities in the fishing villages, inadequate supply system, lack of technical training in Y25Hp Outboard engine, policy of the government, high import duties and the high cost of the Y25Hp Outboard engine were important constraints.

Lastly, a the Multinational Company level, lack of local control, restrictive transfer practices, prices, government control, contract agreement clauses were highly rated constraint variables.

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CERTIFICATION BY SUPERVISORS

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ABBREVIATIONS

Y25Hp Outboard engine	:	Yamaha 25 Horse Power Outboard engine
F.D.F.	:	Federal Department of Fisheries.
NIOMR	:	National Institute for Oceanography and Marine Research.
M.A.N.R	:	Ministry of Agriculture and Natural Resources
m.t	:	Metric tonnes
ADP	:	Agricultural Development Project

CHAPTER ONE

INTRODUCTION

1.1 Agriculture and food problem in Nigeria

Nigeria is predominantly an agricultural country with immense wealth of agricultural resources. Its vast land areas, rivers, sea and creeks support many tropical crops, animals and aquatic foods (Giant, 1988). Inspite of these abundant resources, there is grave concern that food production is not keeping pace with demand. While population has been growing at geometric rate, food production has increased at a painfully slow rate (National Institute of Oceanography and Marine Research (NIOMR), 1980). McNamara (1990) paraphrased the report of Economic Commission for Africa (Nigeria inclusive) (1983) on the consequences of the high population growth rate thus.

"The picture that emerges from the analysis of the perspective of the African region by the year 2008, under the historical trend scenario, is almost a nightmare ...

At the national level, the socio-economic conditions would be characterized by a degradation of the very essence of human dignity, the rural population would have to survive on intolerable toil, will face an almost disastrous situation of land and food scarcities. Poverty would reach an unimaginable dimension ... " (McNamara, 1990).

This undesirable state of affairs has also resulted in nutritional deficiencies of varying magnitudes. According to the study by Food and Agricultural Organization (FAO) (1983) of the level of food inadequacy in 96 countries including Nigeria, one third of African nations, Nigeria inclusive, had negative production growth rate and one-quarter made only marginal improvements from an already high level of food inadequacy. In order for food production to cope with population growth and meet up with the caloric need in a country like Nigeria, the Science Advisory Committee of the United States as far back as in 1976, prescribed that food output would have to double by the mid-1980s and early 1990s or grow at a rate between 4% to 5% annually. However, in its agricultural projections for 1985 to 1995, the FAO (1980) described the food and production performance of a nation like Nigeria as one which "gives no ground for optimisim." The project showed more concern for gross protein deficiency inspite of higher growth rate of 3% to 5% in demand for animal based protein as against the slim prospect for sourcing it.

Protein of animal origin is in very short supply in Nigeria (Talabi, 1983). In terms of the number of animals per caput, Nigeria has more cattle than Europe and more sheep and goats than Asia but the protein supply in Nigeria is only 36.97% and 8.46% of that in Asia and Europe respectively (NIOMR, 1984). Protein supply in Nigeria is also less than the average for Africa (Okpanefe, 1982). Factors considered responsible for the low level of supply of protein of animal origin include diseases, parasites, climatic conditions and the genetic potentials of indigenous breeds (Tobor, 1984). The perennial increase in the cost of beef has distanced it from the diet of a great percentage of Nigerians and has invariably increased dependency on plant based protein sources, much of which have low quality protein when compared with animal and aqua-based sources (NIOMR, 1987). The Nigerian situation strongly emphasizes the need to supplement animal and plant protein with fish protein. This has attracted emphasis on the technology and productivity of the fishery sub-sector in Nigeria.

1.2 The role of fisheries in the economy

The significance of the fishery sector in the nation's economy can be viewed from two major perspectives. First, it is an important source of animal protein for a wider spectrum of the

Nigerian populace. Based on information in the fourth and fifth National Development Plans (1980/85, 1990), 40% of animal protein consumed by the average Nigerian comes from fish. Olayide et al. (1972) showed that the per caput consumption of fish per day is 29.1 grams, yielding. 2.6 grams of animal proteins and representing 36% of ingested protein. Also present in fish are minerals and vitamins.

Protein in fish

Intracellular-proteins in fish consist of myosin, globulin X, myogen and myoalbumin (Dyer, et al., 1970). Myosin appears to be the most abundant fraction in all fish, a situation which is also true for land animals (Reay, 1971). According to him, the connective tissues in fish are present in smaller proportions to those of land animals. The skin of fish is also very rich in collagen (Green, 1969; Tressler, 1962),

Work done by Connel and Howgate (1972) on a number of British food fishes has shown that there are rather small differences in the amino-acid composition of the flesh protein of different species. According to them, lysine, leucine, isoleucine, arginine, and valine appear to be present in the highest concentrations, with all the other amino-acids, except tryptophan, tyrosine, cystine and methionine, well above the level of 200 mgm of amino-acid nitrogen per gram of protein-nitrogen.

Vitamin in fish

Fish contains a wide variety of vitamins. There are large inter and intra species-differences in the level of these vitamins. According to Stansby (1972), fish vitamins include: Vitamin A, B - Vitamins like Thiamine, Riboflavin, Nicotinic Acid; Vitamin B12; Pantothenic Acid, Pyoidoxine, Biotin, Folic Acid; Vitamin C, D and E. The riboflavin content of fish is also fairly high (Reay, 1970). Fluorescyamine and apterine, which possess vitamin activity analogous to that of riboflavin have been identified in fish (Buckle, 1967). Pyridoxine is known to exist in fish as pyridoxamine and fish appear to be one of the best natural sources of this vitamin, as well as the very active cyanocobalamins (FAO, 1970).

Minerals in fish

Fish is also very rich in minerals like potassium, calcium, iron, manganese, zinc, flourine, arsenic, copper and iodine (Stansby et al., 1973). Many other elements occur in trace amounts and these include aluminium, barium, chromium, cobalt, lead, lithium, silver and strontium.

Apart from the supply of proteins, minerals and vitamins in the diet of Nigerians, fish is also an animal feeding-stuff. This grew out of the importance of fish meal in the formulation of practical feeding rations, which became even more important following the realization of the role of animal protein in the nutrition of intensively reared animals especially pig and poultry. Vickery (1971) estimated that 43% of the world's fish catch is being fed to domestic animals. He went further to state that the presence of growth-factors in fish would explain the large role fish-meal has continued to play in the formulation of practical rations for animal feeding. Richery (1970) ascribed one of these factors to the presence of adenosine in fish.

Fisheries provide gainful employment for many Nigerians especially people in the coastal, riverine and lake areas of the country. According to Bayagbona (1976) about 2 million people depend directly or indirectly on artisanal fishery alone in Nigeria. Other subsectors in which many Nigerians are gainfully employed are the aquaculture and industrial fishing. Apart from employment in direct fishing, many Nigerians earn their living from fish processing and, or marketing while some others are engaged in fishery research projects.

Furthermore, fishery sector of the economy contributes to gross domestic product (GDP) and also act as a source of foreign exchange earning. According to Adesimi and Aderinola (1986), the contribution of the fishery sector to the GDP during the 1973 fiscal year rose from ₦465.00 million to ₦743.60 million in the 1979/80 fiscal year. Adetayo (1987), also estimated that the quantity of shrimps exported in 1973 was 824 tonnes (tails only) yielding ₦0.95 million at ₦1.14 per kg. While in 1974, 66% of the Nigerian shrimp export went to Japan, the export rose by 323% to 2851 tonnes valued at ₦2.54 million, thereby depressing the wholesale price to ₦0.87 per kg, a decrease of 22%. This price increased to ₦1.15 in 1975, ₦1.92 in 1976 and finally at ₦2.82 in 1977. These price increases, Adetayo (1987), observed, were simultaneous with decrease in export quantities resulting in higher demand in the international market. Major importers of Nigerian shrimp include the United States of America and Britain.

It is noted that the production of fish in the country is declining while its demand is on the increase. Okpanefe (1982), estimated that the demand for fish will increase from 1,018,000 tonnes in 1985 to double this quantity by 2,000 A.D. Demand projections between 1981 and 1985 were all in excess of 2 million metric tonnes. Total domestic production on the other hand, varied slightly between 581,475 m.t. in 1981 to 687,446 m.t. in 1985 leaving the country with a deficit over 1.5 million m.t. to be made up either through import or increased local production (Ita, 1987). It is also evident that as the population increases, the demand for fish also increases. Based on an average of 3.2% growth rate, Olayide et al. (1972) had estimated that the population of Nigerian would increase from 90,327,000 in 1981 to 102,456,000 in 1985. Similarly, NIOMR (1981) estimated that the demand for fish in Nigeria increases at a rate of 2.99% annually with domestic production having an annual growth rate of 4.3%.

The per caput fish consumption at present is estimated at 9.0 kg per annum while the nutritional requirement as stipulated by FAO (1987) require a per caput fish consumption of 19 kg per annum. However, with the current wide gap between production and demand, the deficit in supply by the year 2,000 will be astronomical. Ita (1987) estimated the demand at 2.8 million m.t. by 1990 and about 4 million m.t. by the year 2,000.

Two issues are therefore critical to fisheries development in Nigeria. That which aims at bridging the gap between the present level of domestic production and consumption thereby eliminating imports, and that which aims at increasing fish consumption in order to raise the nutritional status of the diet of the Nigerian populace. It is therefore essential to examine fishing activities in Nigeria as well as problems and prospects for development.

1.3 Fishing activities in Nigeria: problems and prospects

With a claim to 200 nautical miles territorial sea and about 800 km of coastline, Nigeria has territorial waters of 370,400 km and an estimated inland water mass of about 12.5 million hectares (Ita, 1986; NIOMR, 1987). These extensive coastline and numerous in-land waters endow the country with suitable aquatic habitat for fish. Coupled with this, the ecological location of the maritime states (Lagos, Bendel, Cross River, Rivers, Ondo, Akwa Ibom, Ogun) makes fishing a perennial activity.

Ajayi (1984) put the potential of fishery resources in Nigerian waters at 523,400 metric tones. Tobor (1985) estimated that only 3.12 percent of the country's fishery potential of 656,815 m.t. was under exploitation. Mabawonku (1985) agreed and estimated that less than 30% of the potential of the country's coastal fisheries was being harvested, hence the need for expansion and development.

The fishing population in Nigeria comprises three groups namely:-

1. The artisanal fishermen who make use of paddled and motorized canoes, operate in fresh waters and brackish waters, and offshore limit of 16 kilometres, and account for 97.69% of the total fish production (Okpanefe, 1986).
2. The industrial fishermen who engage in deep sea, general coastal fishing and shrimpting.

Lastly, are the fish farmers who engage in aquaculture, ponding, etc.

The poor performance of the industry against the ever increasing domestic requirements could be attributed to many factors. Among these are: poor production techniques, inadequate supply of fishing gears and tools, over-exploitation of the lagoons, low-level technology, lack of credit, inadequate storage facilities, poor means of transportation and fish marketing systems, inadequate fishery extension services, etc. (FAO, 1980).

Over the past two decades, both Federal and State governments have implemented numerous fisheries development projects aimed at solving the problems in the subsector; and to achieve among other objectives, self sufficiency in fish production. It is important to outline the strategies designed for increased local production and most especially those for artisanal fisheries development.

1.4 Artisanal fisheries development in Nigeria

Artisanal fisheries constituted over 97% of the total domestic fish supply in the country between 1981 and 1985 (Ita, 1987). Artisanal fishermen are small scale canoe fishermen who also employ simple gears such as gill-nets, cast nets, set nets, hooks and traps. Majority of the fishermen still operate their canoes manually but inspite of their low-efficiency gears, they land a tremendous amount of fish because of the huge number of canoes operating in both marine and in-land waters.

However, during the Fourth National Development Plan period, a lot of development projects were set in motion to help develop artisanal fisheries.

Among these were:-

a) The National Accelerated Fish Production Project (NAFPP): for the supply of fishing inputs to fishermen at subsidised rates.

b) Inshore Fishing Projects: aimed at bringing about a change from the small canoes to medium size inshore fishing vessels.

c) UNDP/FAO Artisanal and inshore fisheries project: Intended to establish satelite fishing villages along with maintenance complexes.

d) Mechanized fishing, extension and training project: to train fishermen in the use of mechanized canoes and vessels.

e) Fish storage, processing and marketing scheme: for the collection and bulk storage, processing and marketing of fish.

Identified as the core or root problem necessitating the mapped strategies was the sub-sector's low technological base (FDF, 1984; UNDP, 1974; FAO/UNDP, 1972; FDF, 1970). It is important to note that though the projects successfully took off, they were short-lived because they were not backed with rational exploitation and conservation laws. The artisanal fishermen have therefore reverted to their low technologically based methods.

1.5 Technology and low fish production in Nigeria

One major constraint to increased fish production in Nigeria is technology (Bayagbona, 1979; Emakpae, 1982; Tobor, 1972). Generally, a vast majority of the fishermen are artisanal who employ low level production technology and consequently, output and production efficiency are low. Olayide (1979) attributed

> "Stagnant production technology and rapid over-exploitation of the lagoon,"

as the fundamental causes of the low growth rate in fish production in Nigeria. Fishing by the use of simple traditional tools such as the paddle canoe is seen as an important factor which heightens the drudgery associated with artisanal fishing. FDF (1985), noticed that

> "improved production inputs (fingerlings, strains and gears) were not widely used."

Further identified by FDF as fish production problems were

> "poor rate of capital formation and lack of credit facilities, inadequate extension services, poor fish farm management techniques, and lack of incentives for fish producers."

In realization of the magnitude of these problems, the failure of earlier projects, and their implications, Government (both Federal and State) have taken various measures in the direction of trying to look for possible solutions. These range from the stop-gap measure of fish importation to supplement what is locally available, to the setting up of industrial fishing companies, research centres, supply of infrastructures to communities and the establishment of various bodies, all aimed at solving the nation's fish shortage problems. There is also the quest for "technological base" to ensure improved fish production. This concerns the search for improved technology to replace the low yielding traditional system of fish production. This could be in the area of new and improved breeds of fish, fish meals, fishing gears and crafts such as canoes, bouys, floats, nets, fish chemicals and mechanization with the use of outboard engine. In this regard, the Federal Government through the National Institute of Oceanography and Marine Research (NIOMR) and the Ministry of Agriculture, sought under the fishing law to increase fishing in the coastal area through improved techniques especially the outboard engine (Supplement, 1984). This attempt was to prompt the fishermen to vacate the inland waters for the open sea where there are bigger and more species of fish so that they could record higher landing rates. It is therefore imperative that the Outboard engine is examined as a means to mechanizing the artisanal fishing craft in Nigeria.

1.6 The Outboard engine

The Outboard engine which was initially developed to motorize pleasure crafts with little regard to the economy (FAO, 1972); has been a tremendous success even in the fishing industry. It is simple, easy to handle, safe and light (FDF, 1980). Earlier, heavy-duty engines were developed and tried out in the fishing industry, but the introduction of the Outboard engines in the sector in countries like Jamaica, Trinidad, Malaysia, Uganda and Ceylon were recorded to have caught on more successfully (FAO, 1982). The advantages of the Outboard engine in general as presented by Trung (1967) are as follows:-

a) The boat is considerably lighter, and can therefore carry more fish and gears.

b) There is more space for fishing operation.

c) The boat construction is simplified without the engine bed, shaft log and rubber installation.

d) The installation cost is low.

e) The cost of the engine is only a fraction of the cost of diesel engine.

f) As the combination of engine and stem gear is "factory made", there is less possibility of stem gear troubles.

g) The boat does not have t be beached when repair work is needed on the engine, stem gear or rudder.

h) The fishing time lost for repairs is reduced to almost nothing by replacing the outboard engine by another in a matter of minutes.

i) If the engine is well insulated from copper sheathing, the chances of galvanic action may be reduced.

j) The propeller acts as a rudder, which affords the boat better manoeuvrability when going through surf.

k) With Outboard engine installation, the possibilities of the craft sinking are greatly reduced because of the reduced weight of the hull and engine. The engine could also be jettisoned in an emergency. This eliminates the need for having the boat decked from a safety point of view.

l) The water flow to the propeller is more even than with inboard installation.

With these advantages, it is clear that the use of mechanical propulsion or motorization confers superior mobility; the vessel is much less at the mercy of wind and current and also allows for higher speed (Eddie, 1983). Motorization also reduces the physical effort required during the handling of the fishing gear and the catch, and improves manpower productivity (FAO, 1980).

However, various models of the Outboard engine are available including: Yamaha, Tohatzu, Even-rude, Suzuki, Marina, etc. Among these models, there are also varying horse powers (HP) ranging from 2Hp to 175Hp for instance in the case of Yamaha Outboard engine (YMN, 1989). The Yamaha Outboard engine is essentially the most popular make in Nigeria with a claim to about 90% of the Outboard market (YMN, 1985; FDF, 1971). The Yamaha 25Hp Outboard engine is however the most widely used in the fishing sector because it is specially suited due to the following characteristics it possesses:-

a) Pointless electronic ignition system:

This assures starts that are quick, easy and smooth everytime. Also, the absence of mechanical points helps to eliminate trouble and a sure, powerful spark is provided for every start.

b) Loop-charge intake system:

The engine is equipped with a unique loop-charge intake system, which uses dome-shaped pistons and cylinder heads to supply more fuel to the combustion chamber and expel more efficient combustions, as well as high power and low fuel consumption.

c) Special keystone rings:

These rings provide more power to the crankshaft and yet, with less energy loss, and also prevent stricking piston rings thus giving a significant improvement of combustion efficiency as well as durability and more over helping to reduce consumption.

d) Overheat protection:

A constant supply of water is assured by the dual intake water cooling system even if one of the parts becomes obstructed.

e) Water-cooling system:

A displacement-type rubber impeller that pumps in accordance with engine power is used in the water-cooling system, thus providing high performance even under grueling conditions.

f) Stainless steel water pump housing:

The stainless steel water pump case ensures longer life and increased value because of its durability and corrosion resistance.

g) Through-prop-hub exhaust:

This feature greatly improves exhaust efficiency, as well as increasing combustion efficiency and acceleration. Power losses are reduced, and superb high-speed cruising characteristics are provided.

h) Centre tiller handle:

The centre tiller handle is equipped with the control as well as the gear shift, throttle tension adjuster, and push-type-engine-stop switch, thus providing a centrally located cluster of most operations close at hand.

i) Easy handling:

A steering adjuster makes steering weight adjustments possible with high output coil for convenient battery charging and an electric choke. This assures the easy and convenient operation of the engine.

j) Corrosion resistance:

Bolts, nuts and washers are coated with Dacro; and more than one zinc anode are installed to the lower part of motor. Zinc anodes are also installed on brackets and all components are connected by wires. As a result of this overall use of zinc anodes, corrosion resistance is outstanding.

k) Shallow-water drive:

The shaft angle can be changed, if necessary, in shallow water or near shoals or rocks, thus protecting both the propeller and the motor.

l) A wide variety of propeller types:

In addition to the standard propellers, there is also a stainless steel prop as optional equipment. There is a line of heavy-duty, thick-bladed propellers for extra endurance as well as a highly efficient propellers (Yamaha Outboards, 1989). The

Yamaha 25Hp Outboard engine is one of the best designs, making full use of computer aided design (CAD) (YMN, 1990).

Despite the overwhelming qualities of the Yamaha Outboard engine, the transfer to the fishing population by the Federal and State Governments through the Almarine (a division of John Holts) has been limited to only the material transfer level. YMN (1983) had it then that, the transfer of Outboard technology into developing fisheries could not go beyond the material level because of the attendant problems prevalent in most of the receiving fisheries. This is supported by the Nigeria situation where majority of the fishermen still use the paddle and fish the inland waters. This according to Tabor (1984) has to do with the transfer system since a good system will ensure good dissemination and utilization of technology. An efficient transfer system will aid the pace of absorbing research findings into national fisheries development processes (RSTRS, 1985). Also, FAO (1985), had it that a good transfer would ensure that the technology is put into its right use and increased manpower productivity is achieved. Increase in catch or landings of the artisanal fishermen could only be achieved through an efficient transfer system of introducing new findings to them, and identifying their problems in the usage of the new package.

1.7 Problem of study

There is no doubt that improved production technology, amongst other factors is imperative for increased fish production in Nigeria. Evidences abound, that increased productivity can be obtained by using improved technology (NIOMR, 1986; FDF, 1986; FAO, 1984; Tobor, 1962). Hayes and Norman (1972) for instance, reported a production of 50,000 tonnes of fish in Venezuela under improved practices as against 25,200 tonnes under the traditional production technology.

In the attempt to increase the production rates the Yamaha 25Hp Outboard engine was introduced into the artisanal fisheries by the coastal State government and the Federal government. The technology, though foreign to Nigeria fisheries, has been transferred at the material level into the country by the Almarine (a sub-division of John Holts). The design and capacity transfer of the technology from the home-firm in Japan has not been accomplished for most developing countries (FAO, 1987). However, at the material level of the transfer of the technology, records from the statistics section of the Federal Department of Fisheries (1988) support the fact that majority of the artisanal fishermen still do not have the Outboard engine and still fish the over-exploited lagoon resulting in low catch rate. Pellegrine (1980) was of the view that the transfer system must be free of constraints if the artisanal fishermen are to adopt the mechanization of their craft and vacate the lagoon. Haiestein and Robenson (1984) agreed that a solution to the problem of low fish production in developing countries is to ensure that the transfer system for the imported technology is efficient and that experts should try and relate the package to productivity so as to measure the appropriateness. The questions that arise from this therefore are:-

a) What are the constraints to the transfer of Yamaha 25Hp Outboard engine to the artisanal fishermen?

b) Which of these constraints predict the use of Y25Hp by fishermen and how do they cluster?

c) What are the determinants of the utilization of Y25Hp by Outboard engine, knowledge of technology, and catch of the fishermen?

d) How are the constraints categorized at the utilization level?

e) What are the other sources of supply of Y25, type of gears and crafts used by the fishermen?

f) What is the attitude of the fishermen to the Y25Hp Outboard engine?

1.8 Objectives of the study

The overall objective of this study is to analyse the constraints to the transfer of Yamaha 25Hp Outboard engine and the production of fishermen using the outboard engine in three coastal states of Nigeria.

The specific objectives are:-

1)a To describe the demographic characteristics of the artisanal fishermen using the Yamaha 25Hp Outboard engine; age, educational level, marital status, number of children, number of wooden canoes owned, average number of crew, number of wives, fishing place (coastal or deep sea) etc.

b) To ascertain whether significant differences occur in the selected demographic characteristics of users and non users.

2) To categorize the constraints factors at the utilization level, to the transfer of the technology.

3) To ascertain the constraints at the extension, supply and multinational company levels to the transfer of the technology.

4) To identify the various sources of the supply of the technology to the fishermen.

5) To investigate the attitudes of the fishermen to the technology.

6) To identify the type of gears and crafts used by fishermen using the outboard engine.

7)a To ascertain the determinants of Y25Hp utilization knowledge about technology and landings.

b. To determine which constraint predict Y25Hp use and clustering.

1.9 <u>Hypotheses</u>

The following hypotheses will be tested in the study:

1) There is no significant difference in the selected personal, demographic and occupational characteristics of artisanal fishermen users and non-users of Y25Hp Outboard engine in the three states.

2) There is no significant difference in the attitudes of users and non users towards Y25Hp across the three states.

3) There is no significant contribution made by selected independent variables to the knowledge about technology, and the utilization of the technology, in the three states.

4) There is no significant difference in the means of constraints across the three states and the different fishing locations.

5) There is a significant difference between the landings of Y25Hp users and those of paddle users in the coastal areas of the three states.

6) There is no significant contribution made by selected constraint factors to the utilization of Y25Hp in the three states.

1.10 <u>Justification for the study</u>

There are several reasons why available technology is not being utilized at a level that has appreciable impact on the nation's food balance sheet. Among these reasons are characteristics of the technology itself, and the operational modes of its transfer (FAO, 1986). Also, the new technology may be applicable and relevant but the attributes at the field level may not be significant to attract fishermen's attention. It is lack of information on various parameters of the Yamaha 25Hp Outboard engine transfer and utilization that warrants this study. There is need for a systematic analysis of the technology flow process so as to sieve out the constraints. This will no doubt help policy makers in their attempt to bring new technologies into the fishery sector and the selection of appropriate technology for the sector in Nigeria.

1.11 Definition of some terms in the present study:

1) Constraints:

Any variable that retards the activities in the transfer process.

2) Technology transfer:

The transfer of "hardware" for use in developing fisheries i.e. the technology needs for productive use.

3) Artisanal fishermen:

Small scale fishermen.

4) A fishing boat:

A floating platform used to transport the crew, gear and cargo to and from fishing grounds and to support crew during fishing operation.

5) Outboard engine:

Engine fixed to the back end of a canoe for faster propulsion (Appendix C, Picture 6).

6) Coastal fishing:

The art of catching fish in the coastal areas (within 30 fathoms).

Off-coastal fishing: The art of catching fish in the off-coastal area (above 30 fathoms up to 100 fathoms)

7) Fishing:

The art of catching fish.

8) Fishing Gear:

Any implement used in catching fish.

9) Canoe fishing:

A long light narrow boat, pointed at both ends for fishing (Appendix 3, pictures 1, 2 and 3).

10) Craft:

Canoe used in fishing by the artisanal fishermen.

11) Crew:

All the people working on a fishing canoe.

12) Fishery:

The act of catching fish.

13) Sea:

The great body of salty water that covers much of earth's surface (picture 4).

14) Lagoon:

A lake of water, partly or completely separated from the sea, as by banks of sand (picture 5).

15) Motorized canoe:

A long light narrow boat pointed at both ends and made of wood propelled by the Outboard engine.

16) Non-motorized canoe:

A long light narrow boat pointed at both ends and made of wood, propelled by the paddle (picture 3).

17) Paddle:

A short pole with a wide float blade at one end or both ends, used for pushing and guiding canoes in water.

18) Bouy:

A floating object fastened to the bed of the sea to show canoes and ships where there are nets.

19) Lead:

A thin rope with a mass of lead fastened to one end towered to measure the depth of water.

20) Life Jacket:

An air-filled garment that is worn round the chest to support a person in water.

21) Fishing village:

A settlement principally of fishermen and their families.

22) Landing site:

A physical location on the sea coast where fishermen set out to fish and return to land their catch.

23) Fisherman:

A fisherman is defined as one who derived greater part of his living from fishing activity, or who spends greater part of his time in fishing activity or who regards fishing as part of his primary occupation during the course of a year.

CHAPTER TWO

LITERATURE REVIEW

2.1 Technology transfer

Social acculturation has played and still plays an important role in the history of mankind. This continuous exercise involves co-opting, borrowing, adapting and developing social values from another society. Institutionalizing foreign ideas has been going on throughout the annals of human existence and interaction. It entails borrowing and employing exchangeable phenomenon, a process often referred to as transfer of knowledge or ideas. This process is noticeable in all facets of human living and in all phases of the economy of any society, especially in agriculture.

Transfer of agricultural technology on an international scale is not new. Classical studies by Sawer and Varilov (1970), on agricultural origins and dispersals pointed out that transfer of cultivated plants, tools, and the various husbandry methods were vital instigators of development in pre-historic civilizations. More recently, the transfer of crops to Europe from the America had a dramatic impact on European agriculture. The technology bases for the staple exports from Third World countries occurred as a result of an initial international transfer of crop varieties. Before agricultural research and extension were institutionalized, transfer of technology and ideas had taken place as a by-product of travel, explorations and communication, undertaken solely to achieve other purposes (Ruttam, 1973). Long periods of gestation often running into several decades and even centuries, were often required before exotic plants, animals, equipment and techniques could be adapted to local conditions.

In the fishery subsector in Nigeria, the outboard engine stands out as the most important fisheries technology ever transferred to Nigeria, in the last two decades.

2.2 Typology of technology transfer

Vernon (1973) distinguished three but often serialised phases of agricultural technology transfer.

a) Material transfer

This is often the initial stage of technology transfer and is characterized by simple transfer, importation or absorption of new materials such as machines, equipment, animals, seeds or plants and associated management methods. Local adaptation comes through systematic selection of superior types. The "naturalization" of the imported technology tends to occur primarily as a result of trial and error by the users. Much of the technology transferred from the industrialized World to Third World or developing countries are often limited to, and stop at the material transfer level.

b) <u>Design transfer</u>

This involves the transfer of information often in the form of blueprint, formulae, journals, books and related soft wares. During this state, the imported technology (exotic plants, materials, animal breeding stock, prototype machines) are tested to obtain genetic materials, or in order to copy their designs. They are later modified or in the case of plants and animals, hybridized to adapt them to local ecological conditions or to different tasks.

c) <u>Capacity transfer</u>

Refers to the transfer of scientific and technical knowledge and capacity; with the aim of institutionalizing local capacity for invention and the subsequent innovation of a continuous flow of locally adapted technology. Machine designs therefore become less dependent and defer in varying degrees from initial prototypes imported or developed elsewhere.

In this vein, local agricultural methods and technological capacity are strengthened, novel biological as well as mechanical technologies adapted precisely to the ecological conditions and factor endowment of the area are enhanced.

A crucial ingredient in the process of international capacity transfer is the movement of various physical elements from the parent economy. The elements include scientists and engineers, the building of institutions for advanced research and training capacity development. Inspite of advances in communication however, diffusion of information on concepts and tools of agricultural science and engineering seem to depend heavily on personal contact and association. It is, however, incumbent to always view and evaluate international agricultural aids extended to developing economies, against the ultimate objective of speeding the entrance of these developing economies into the capacity transfer state.

The gamut of technology transfer as viewed by this model can be represented thus:-

Material transfer $\longrightarrow$ Design transfer $\longrightarrow$ Capacity transfer.

Harry (1975) classified technological transfer process into the following stages:-

a) Technological hardware transfer

This stage like Venom's material transfer stage involves the importation of materials through multinational companies and other agencies. Local adaptation is however, not effected at this stage. The technology is only transferred for the users to keep trying it.

b) Technological mastery

At this stage technology is effectively utilized through continued effort to assimilate, adapt and/or to make it better suited to local circumstances either by altering output characteristics to reflect prevailing needs of the area or by modifying input specifications to allow the utilization of materials and resources of the locality.

c) Technology diffusion

This involves further development and spread of imported technology that has been in use in the particular area to other areas of application. At this stage, the recipient economy no longer requires help from the mother firm. Diffusion is however said to be matured when the technology has been mastered, adapted and eventually becomes a dorminant technology in the economy of the new users.

d) Technological institutionalization

This refers to the ultimate development of indigenous technological capabilities through the integration or absorption of foreign technology, thereby enhancing self sustaining local innovations. This state in an economy mirrors total absorption of skills, institutional framework and the building of the self confidence needed to meet its technological requirements. This is the bed-rock for the subsequent acceptance into the world market through indigenous companies. Countries like India, South Korea as well as Brazil are the latest entrants into this international scene. Institutionalization is also said to have occurred when imported contents of technology are now locally sourced or manufactured solely with local raw materials. This stage of development measures the degree of technological linkages which emerge and the frequency of innovations.

Huybrechte (1979) posited a transfer process involving six steps in order that a recipient economy can acquire technological capabilities to enhance its productivity horizon.

a) Identification of needed technology and possible alternatives

This stage is often preceeded by a situation in which prevalent local technology can no longer sustain the demand for the products generated by that technology. Production at this level is at a plateau with demand soaring much higher than supply. Hence the dire need to galvanize production level through the importation of a technology that have proved successful in like situations. There is also the possibility of looking inwards for alternative technology through the development of indigenous methods to accomplish the same goals of enhanced productivity thereby de-emphasizing transferred technology.

b) Selection of the most appropriate technology

The choice of a technology as being appropriate for a particular economic undertaking is the culmination of a series of study (organised and unorganised). Selection may range from a totally new technology that is wholly foreign to the economy, to an indigenous technology with an exogenous base.

c) Negotiation for the acquisition of the chosen technology

This is the stage where discussions are generated on the selected technology and agreements are fashioned to the mutual benefit of the manufacturers and the importers. Areas of deliberation often include specifications, finance, maintenance arrangements (including spare parts) and mode of transfer. This stage is usually characterized by undue delay on the part of manufacturers and especially, multinational companies, who usually acquire sole rights to transfer these technologies to the developing world (Igben, 1987).

d) Utilization of the transferred technology

This involves actual usage of the imported technology by the recipient economy and in the local environment for which it was deemed appropriate. The ultimate goal is the substitution of former means of production by the new technology to enhance productivity. It is however pertinent to state that the departure from the old ways is not characterized by a clean and sudden break but a gradual disengagement through trial and error. This is the point where constraints of varying degrees and types are often noticed. They range from economic, and socio-cultural, to transfer system and, unsuitable sites for the technology (Mailo, 1978).

e) <u>Development of local staff on the workings of the technology</u>

This implies training of users especially extension and maintenance staff in order to assimilate the manipulation and working of the technology. The exercise takes place either within the recipient system through the agent, or at the mother firm.

f) <u>Further development on the imported technology</u>

Development is either by way of improvement on the technology due to newly discovered problems or constraints, or indigenous manufacture of components or complete building of the technology. This development often starts from reducing foreign content of the technology, to the final acquisition of the capability to forge totally indigenous replica.

The three authors (Vernom, 1973), (Harry, 1975), (Huybrechte, 1979) seem to concur that the transfer typology they individually highlighted, are not often systematically adhered to, since advanced economies like Japan, and some European countries took off from the design transfer. However, the need to increasingly tap hitherto dormant technological potentialities to enhance gross national product has been noticed (Theodore, 1987). This arousal has heightened the rush for material transfer from the developed world in recent times.

With reference to its history in Nigeria, one can safely slot the Yamaha 25 Horse power into the material transfer stage using the phases typology earlier outlined. Its entry into the Nigerian fishery development scheme in the mid 1970s was through John Holt and its subsidiary company, Almarine. Every effort to progress beyond the hardware transfer stage have been fruitless, thereby further entrenching importation from the mother firm in Japan, as the only mode and extent of technological transfer.

2.3 Variables influencing the form and extent of technology transfer

Various researches conducted on the nature and extent of technology transfer seem to be concerned with:-

a) The form and characteristics of the technology in view

b) The terms and conditions of transfer

c) Organizational characteristics of the firms involved in the transaction

d) The attributes of the recipient country.

The form and characteristics of the technology in view

The term technology is often used to refer to, day-to-day implements with which most of human activities are carried out. It is the totality of the means of material culture and "the scientific" method of doing and making things work quicker, cheaper and better. Rosenberg (1987), viewed technologies as being more complex than pieces of dismembered hardware. He held technologies in the form of function within social matrices in which their application is hinged upon managerial competence, organizational structures and, the operation of appropriate incentive system. While Root (1968) discerned technology as the body of knowledge applicable to the production of goods and the creation of new ones, Baranson (1969) viewed it as the knowledge needed to process and or fabricate techniques to produce industrial materials, quality control procedures and allied technical information. Johnson and Hull (1970) in their study of the transfer of the United State of America Aerospace technology to Japan, distinguished between general, system specific and firm specific technology. They defined general technology as being the information common to an industry or trade, while they held firm specific technology as that specifically attributed to an organization's experience and activities, excepting that which may be associated with any specific items it produces. System specific technology, they posited comprises attributes of firm specific technology except that such information is usually available for other firms to acquire. Teece (1977) also differenciated between embodied and disembodied technologies. The former he identified as those encapsuled in physical terms like capital goods, blue-prints and technical specifications, while the latter includes methods of organization and operation, quality control and various manufacturing procedures.

The United Nations Conference of Trade and Development (UNCTAD) (1984) held technology as a vital input of production and as such could be purchased and sold in the World market as a commodity embodied in any of the following forms:

1. As capital goods or sometimes as intermediate goods bought and sold in market particularly to carry out investment decisions.
2. As human labour in which qualified and specialized manpower with capacity to make correct use of equipment and techniques and, to master the problem solving and information producing apparatus.

3. As information, whether technical or commercial in nature provided either in markets or kept confidential as part of monopolistic practices.

Dunning (1982) on his part highlighted the difference between technology of innovation and that of production. The former according to him reinforces the recipient country's capacity to create new technology while the latter incorporates all states in the production process from the extraction of minerals, raw materials and agricultural undertakings, to the marketing of final product and process technology, innovation and production technology, human, material and knowledge technology.

These definitions reveal that technology is a market product and not value-free. However, as an entity, technology has in recent, years assumed some relevant attributes that require discussion.

1) Choice of technology

The issue of the type of technology to adopt by a manufacturer in the production of a particular good is highly dependent on the targetted markets. For the producer with the home market in mind, and engaged in final product that are aimed at substituting imported ones, he is more likely to enjoy a wide range of protective measures from the government, thereby limiting competition as well as having a fair range of technological alternatives. The opposite situation in which a manufacturer is interested in producing for export market with high technology industries, limits the choice of production techniques available to him. This is sequel to high quality specification usually required for the product to stand international competition. There is also the prerequisites demanded by recipient countries to ensure the diffusion and assimilation of the procedure of the technology. These include the existence of industrial and personnel capabilities to use the imported technology, as well as guiding government policies. It is therefore evident that the final product, the target market and, the recipient countries industrial capacity are vital variables in the choice of imported technologies.

2. Appropriateness of technology

This is determined by such variables as, the size of firm, its ownership, organization, strategies, economic viability, the degree of skilled manpower and, innovations within the production system. Also important are variables beyond the control of the firm such as, the host country's policies, resource endowment as well as environmental variables.

Taken as a whole, these factors help to determine the appropriateness of the technology chosen. Much of the literature on this important area of technology transfer have neglected these factors and limited the variables to selected factors like labour and capital, as the ultimate determinants for appropriateness of technology selected for developing countries. Eckaus (1977) noted that the determinants of appropriate technology must be closely related to the goals of development. Quite often, these goals are not only concerned with increasing production level and generating income but also with the process and the way they are produced and distributed among the population. Net output maximization and cost minimization are the most commonly applied criteria for choice of technology. In operations management, employment is an essential criterion of technical choice because it is a vital ingredient in optimum output generation, income distribution, social recognition, personal satisfaction and in taxation (Hymer, 1970). Other criteria include:

a) Balance of payment relief

b) Regional development which emphasizes particular sectors and particular types of technologies.

Warnecks (1979) highlighted three distinct types of technology which must be considered before deciding on which technology to import, these are:

a) Energy technology, processing and manufacturing technologies. He considered appropriate technology as those that employ the manpower and material resources in making up its gross domestic product for its economic and social development. But when critically viewed with respect to its contribution to industrialization, energy and processing technologies may be the most appropriate inspite of their relatively higher capital involvement. On the other hand however, an option for criterion presents a choice between labour intensive and capital intensive technology. A combination of the two is however more effective, especially with regard to manufacturing technology.

Smith (1979) defined "appropriate technology" as those technologies which strive for solutions to problems in procedure and products, that are in accord with the availability of manpower and material resources in a given area and that ensure optimal economic and social progress. In other words, these are technologies which, following a process of selection and adaptation in the respective conditions, have been found very suitable. In this vein, "appropriate technology" may be wholly indigenous, second hand, intermediate, or alternative industrial technology.

Tauber (1974) presented a crucial point confronting appropriate choice criteria. He called this the "dilemma of appropriate choice". This is concerned with opting for either labour intensive or capital intensive production methods. The former techniques are adaptable to conditions prevalent in developing countries and may help in the shortrun, to lower unemployment. Capital intensive technologies on the other hand often result in large unemployment but help to foster economic growth and competitive capacity. It also helps to introduce into the economy, industrial enterprises vested with up-to-date techniques, and improve the performance of the labour force. What then is the actual dilemma? It is between short-term advantage of lowering unemployment by adopting labour intensive technologies and the long-term advantage of achieving rapid economic growth through using capital intensive technologies.

Stewart (1978), viewed technical choice as a complex phenomenon and each technique has a vector of characteristics consisting of such things as product type, quality, scale of output, resource used and so on. These come as a package with components designed to be operated within a particular technological system. He posited that the adoption of one technique from an alternative system is, more often than not, efficient, if corollary parts of that technological system are adapted either through local production or through importation.

A review of the criteria used by multinational companies in the choice of technology to import revealed that labour factor does not determine or strongly influence the choice. The most important determinants seem to be,

a) The economic constraint facing the firm especially the subsidiary concerned with the area in question.

b) The technical specification and standards set by the parent company and,

c) The firm's internal innovation drive.

More often than not, other interests apart from maximising output and keeping cost at a practicable minimum, are higher on the priority list of the host country, and these interests constitute major determining factors for the entrepreneur. On the national level, the situation is at cross roads because policy makers often have to make a choice between limiting dependence on imported technology and expending scarce foreign exchange, and promoting economic development through improved technological capability derivable from imported technology.

2.4 Transfer variables

Transfer of technology is a complex operation carried out under mutual agreement between interested parties. Contact are usually official and are generated by the intending recipient of scientific methods of production from a cooperative exporting country (International Labour Organization (ILO), 1984). The contents of the transferred technology come in form of hardwares of production and software, in form of the know-how. Taking a developing economy like Nigeria, several methods of technological transfer can be employed:

a) Turn-key plants

b) Technical and/or management contracts.

c) Supply, service and repair contracts.

d) License contract and granting franchise.

e) Minority joint ventures contracts.

f) Majority joint ventures contracts

g) Arm's length licensing.

h) Wholly owned subsidiaries.

The phenomenon of technology transfer has been on in Nigeria for a very long time and the exercise has taken place in the following forms:

a) Feasibility studies

b) Product design

c) On-the-job training

d) Machinery and equipment direct supply.

Other methods have been employed in various transactions all over the world including Nigeria. These include,

a) International and inter-regional sub-contracting

b) Movement of skilled manpower from one place to another.

c) International trade in manufactured goods.

Recent transfer agreements reached between Nigeria and the industrially developed countries have been in the shape of turn-key projects and joint ventures. These strategies were prevalent during the military interregnum of 1966 to 1979 and carried on by the civilian regime of the Second Republic (1979 - 1983). It was during these periods that the Nigerian Investment Committee and the Joint Agricultural Consultative Committee (JACC) were set up. It is imperative at this stage to highlight some of these common features as used in Nigeria.

a) <u>Joint venture</u>

This is synonymous with partnership an operational approach by which two or more enterprises create an entity to carry out a productive economic activity (Singh, 1984). The operation requires active participation of both partners in decision making and financial involvement. A dynamic joint venture structure must exhibit balanced desired benefits accruable to the progenitors. This is usually the initial objective and guiding philosophy in the agreement to cooperate with one another. Like a limited liability establishment, joint venture presupposes sharing of cost and other functions and this is reflected in the structure of the new organisation in form of extent of control usually proportionate to shareholders' contribution (Harrigan, 1984).

In Nigeria, shareholders' input in a joint venture does not primarily determine the organizational structure neither does it strengthen its bargaining power in the new outfit. In some cases, major financiers have assumed the rather weak role of "a Sleeping Partner."

b) Migration of skilled workers

This is another form in which technology transfer takes place and is an instrument that had been identified and used for a long time (Vernom, 1973). Through this strategy, both technology in the form of expertise and appropriate climate for the development of imported technology, is enhanced. This form of transfer is implemented either by the movement of skilled manpower from the foreign partners or from the formal sector and technical institutions to the manufacturing sector. Sigurdson (1971) explained that personnel movement has been a major form of technology transfer in Nigeria. It has been a method through which manufacturing establishment supplement technical and managerial skills lacking within their set-up.

Licence contract

This is another major form by which production process is transferred internationally and of which Nigeria has been its fair share. Licensing takes the form of a manufacturer within a recipient economy, production a good with the consent or covered by an exclusive right, given by the owners of the know-how. The legal rights are in the form of licence issued to the recipient firm, here referred to as licensee, by the licensor (mother firm), to make use of parts or whole of the process of manufacturing a good. It also offers the licensor a marketing alternative in that finished goods that would have been exported to the licensee's country is now being manufactured within the host economy. This way, the original or mother firm is saved the rigours and risks involved in shipping finished goods to meet the demand in the licensee's country, while at the same time offering the recipient economy opportunities to develop technologically.

Licence agreements may take either of the following forms:

a) Once-and-for-all transfer of know-how in which the licensor get a lump sum payment. The calculation is based on installation capacity rather than output. The license in this form of transaction is of non-exclusive standard and as such the licensor has the right to grant similar rights to any other requesting enterprises.

b) Another form of licensing is one in which the licensee is granted the exclusive right to use the technology in a specific geographical area. Its under this type of agreement that trade marks and brand names of the mother firm are still used by the new manufacturer.

Subcontracting contract agreement

In subcontracting, satellite firms are established to produce goods of given specifications which are supplied back to the parent firm. In involves an intricate form of division of labour, interaction or linkage relationship with the parent firm. Through this, an outlet for the products of the smaller firms or subcontractor is not only guarantied but gives the subcontractor access to the skilled, technological, financial and information back-up supplied by the contracting firm. To the larger partner, it offers the opportunity of expanding production capabilities, diversifying its services, relieving pressure on its manpower as well as offering employment opportunities to the different localities through backward linkages.

CHAPTER THREE

CONCEPTUAL FRAMEWORK

This chapter, discusses the concept of fishing technology and functions, models of Agricultural Development and technology transfer, constraints, and the conceptual framework for the study.

3.1 Fishing technology

Fishing technology is the discipline dealing with the study, development and application of natural science and technology for optimizing fish capture and fishing operations (FAO/FTV, 1980). It involves applied research and development, serving practical purposes. The measure of its success or failure is the degree of profit and benefits derived by artisanal fishery, the fishery population and the national community as a whole (FTU, 1982). Technology in general and particularly fishing technology, rely on a variety of scientific and engineering disciplines.

Grofit (1980), held that the scope of fishing technology, embraces virtually all the devices and operations related to fish capture, hunting and harvesting of fish. Fishing technology therefore is concerned not only with the gears, methods or vessels but also with aspects in a wide spectrum of biological and environmental phenomenon, their interrelations as it affects accessibility to fish population and the opportunities for the development of fishing as a whole (FAO, 1979).

3.2 Functions of fishing technology

The scope and functions of fishing technology could be grouped as follows:-

Direct means of capture

This incorporates fishing vessels, gears auxilliaries, and instrumentations, which together form operational fishing units and these could come in a wide range of designs, performance characteristics and under a variety of specifications (FTV, 1988).

a) Fishing gears and materials

Since man discovered aquatic foods as supplement to land based means of survival, his implements had continued to change until the present time. Fishing gears now represent one of the most complex subject to examine because of the many types and the diversity of purpose of their usage. The development of new gears and vessels connotes an improvement on an existing technique in usage either in a particular area or elsewhere. Quite often, the process of development and adoption of a particular technique (gears and materials) may take the form of adapting to local needs and conditions such fishing gears and materials that had been successfully used in other established fisheries of similar needs and conditions (Grofit, 1980). The final acceptance of a given fishing method or gear depends not only on its environmental appropriateness or superior catching efficiency but also other factors such as:-

a) Could it be operated by the existing fishery and vessels or would it require substantial changes?

b) What effect would it have on the fish stocks?

c) How would it affect employment and social structures? (FAO, 1980).

Also crucial is the selection of materials for fishing gears and its components, the development of which depends on fishing technologists who could offer advise to manufacturers on material development. Subsequently, fisheries suppliers could be better advised on types, and specifications of netting materials to use and, on the increase in volume of business to expect as a result of the introduction into commercial fishing of a type of gear (FAO, 1979).

b) <u>Fishing crafts, engines and auxiliaries</u>

Fishing crafts and vessels are integral parts of fishing operation. Characteristics like size, propulsion system, deck lay-out, fish hold capacity, auxiliary equipment, and so on, help to ascertain their effectiveness as fishing platforms or the mode of deployment. Here, the fishing technologist is concerned only with supplying the designer and builder with data on the fishing methods and the conditions for which the craft is intended. These data include towing power required, the speed, manouvrability, sea-worthiness, and range of operation or usage. Specifications are also requested on auxiliary machinery, engine, position of superstructures, wheel house arrangements, deck lay-out, size, navigational and other instrumentations (FTV, 1984). As corollary to this, a fishing technologist may advise on better devices for meeting special requirement or a simplified design so as to make local manufacture possible.

c) Fishing methods and operations

The choice of the approach to exploiting most efficiently a certain fish stock under a given set of circumstances is determined not only by the catching efficiency of the employed fishing technique using a certain class of crafts but is also dependent on economic, geographical and sociological factors (FAO, 1984). Capital investments and operating expenses in relation to the value of the expected catch, net benefit, availability or the scope for the development of competent manpower and of supporting infrastructures, as well as the impact on other fisheries exploiting the same stock and on the other fish species sharing the same habitat must be considered (FAO, 1982). Although some of these aspects are outside the scope of fishing technology proper, cooperation with other fisheries disciplines is nonetheless highly desirable.

Indirect means of capture

a) Fish detection

The actual detection of fish has always been an essential part of the art of fishing. It has been going on for ages and is still being done either by direct visual observation of fish or indirectly by interpretation of certain signs, such as behaviour of aquatic birds, bioluminescence in the water, gas bubbles or oil slick on the surface and so on. The validity of these age long methods is undisputed. In modern times, the accuracy of visual detection has been considerably improved through air-borne remote-sensing technology such as image amplification, low light intensity television and photography. These however remain essentially restricted to close-to surface and above water phenomena (FAO, 1981). This limitation does note apply to acoustic detection techniques, using echosounder, sonar and net sounder of which a larger choice of instruments with a wide spectrum of performance characteristics and varieties abound in the market. The selection of the most suitable instrument is not only determined by on-the-job requirements, but also on purchase and operational costs, availability of maintenance services and skill of the fishermen. It requires that the fishing technology unit assess the characteristics of the various types and models to advise on their selection for different local requirements to introduce them into commercial fishing. Expertise is also crucial in order to ensure that they are used properly, not only for fish detection and observation, but also with regard to measuring water depth, assessing bottom conditions, monitoring gear performance, as applicable (FTV, 1980).

As such fishing technology provides essential inputs on selection and monitoring of fishing gears and engines, operational performance and on appropriate use of complementary technology for fish detection including the assessment of fishing conditions in the widest sense.

b) Location of fish stocks

Most fish detection techniques such as visual observations and echo sounding allow for actual sighting of fish (FAO, 1980). It is however possible in certain instances to estimate and locate the likely presence of fish by the analysis of suitable environmental and biological factors on which the distribution of fish is largely dependent. The aim would be to identify the interrelations between fish species, size, age, spawning, feeding, migrations on the one hand with environmental conditions such as availability of food, access to spawning grounds, water salinity and temperature, light conditions, transparency and others (Simrad, 1971). Such interrelations and their influence on fish distribution and vulnerability to catch, have for ages been observed and utilized by fishermen. More recently, some physical factors like water temperature, depth of thermocline, salinity, oxygen content, water colour and transparency have become important indicators for certain commercial fisheries (e.g., for tuna, sardines, some demersal species) which could be measured easily by applying sophisticated observation technique of remote sensing. Although systematic investigation and usage of such interrelation is more common in fisheries biology and hydrography (Grofit, 1980), the fishing technology unit must however assess and apply the findings to commercial and production-oriented exploration fishing and also for the design and testing of fishing gears.

c) Study of fish behaviour

Fishing technology is concerned in this context only with the study of fish behaviour in relation to catch. The most commonly asked questions include the following:

a) How do fishes react to trawl, purse seine or gillnet, to lights of various colours and intensity, to noise or crafts, vessels or gears or to artificial sounds, to airbubble screens, and to electric fields.

b) What bait or lure do different fishes prefer and when?

c) What is the gear escapement behaviour?

d) What percentage of fish is actually being caught by different gears?

e) How does gear selectivty work? (FAO, 1979).

Some fish behaviour pattern can be checked for their local validity by comparative fishing trials. For instance, with different nets, made of different netting yarn types (multifilament versus monofilament) design features, colour and sizes, with underwater or surface lights of different colour and intensity for fish attraction (FTV, 1980).

d) Increase of production

Fishing technology is quite essential for increasing fish production and fishing efficiency and this should be the goal of any developing fisheries. National priorities as well as economic necessities are also crucial determinants government policy formulators should consider when setting production targets in the industry. Realistically, such targets have to be based not only on the availability and the state of resources, but also diverse technical as well as economic requirements necessary for achieving set targets. This bestows on fishing technology any advisory role for administration in developing planning with regards to the identification and technical evaluation of fishing opportunities suitable for development, in programming, as well as the implementation of actual development projects and ventures.

e) Improving the lots of fishermen

This is a vital aspect of fisheries development that has been neglected by fishing technology development. Efforts have been through raising of the fisherman's production capacity, improving his working conditions and reducing risks at sea. Fishing technology development also ensures increased catch per unit effort, expansion of operations and instigates increased returns through capture of higher priced species. The technology unit would also advise the individual fisherman on the cost/benefit relationship of a new technology since new technologies do not automatically lead to higher net income (NIOMR, 1978). This should be considered particularly in small scale fisheries where the operators are less capable of taking economic risks.

f) Advisory function

With fishing technology, very current intelligence on development (literature, periodical, conference, exhibitions, correspondence and so on) and group contact with experts, institutions, industries, within an economy and abroad, would be maintained. This is a vital input in systematic research and development of existing technology and know-how and are to be put to maximum advantage. It is particularly important in rapidly developing fisheries where high investment in vessels and gears may be at stake (FTV, 1981). The main area of focus of advise to policy makers include development policies, planning, loan schemes, joint venture, fisheries regulation and management, specific investigations and development programmes and projects. The fishing technology unit should cooperate and offer advise to all levels through demonstrations, on the job instructions, informative publications, discussions and meetings (e.g. fishermen forum, open-house exhibition and so on). Another area of cooperation are fishermen's training through short-courses on specific areas of fishing technologies (Grofit, 1980). Fishing technology could also extend to continuous contact with suppliers on sources, quality and pricing as well as keeping in touch with supplying industry in order to advise suppliers on what fisheries want and need. This involves aspects of comparative quality and performance characteristics of textile and other materials including finished products of various fishing gears, design, and construction of vessels characteristics, deck layout, and auxiliaries, navigational aids, acoustic equipment, means of propulsion, as well as maintenance and repairs (Fishery Technical Unit (FTU), 1982).

g) Training and extension

Most training programmes for fishermen suffer from lack of competence in the field of technology (NIOMR, 1982). Fishing technology unit could be of assistance in the preparation of teaching programmes, Curricula, teaching aids, giving lectures, providing technical advise and training extension agents and instructors. FAO (1984) identified the lack of competence of fisheries extension staff in translating better fishing technology into practice. Also, cooperation between the extension unit and the technology unit, through subject-matter upgrading and technical advise would be of mutual benefit to the extension worker on the one hand and to fishing technology on the other hand. This cooperation will help in finding the right partners between the fishermen for testing or demonstrating innovations, and for the monitoring of fishing activities including the overcoming of teething problems, characteristic of the initial phase of technology introduction.

Having examined the role fishing technology can play in the development of a nations' fishery, it is imperative to examine the Yamaha 25Hp Outboard engine technology ad its relevance in the Nigerian fisheries.

3.3 The relevance of the Yamaha 25 horse power Outboard engine

NIOMR (1986), FAO/UNDP (1980) had stressed the need for the Outboard engine in the Nigerian fisheries. Their conclusion was however not based on results of studies specifically carried out on the Nigerian fisheries but from a world wide study to ascertain the advantages of motorization over paddle. Yom (1989) also went further to discuss the advantages of the Yamaha 25Hp Outboard engine over the paddle as a means of propulsion as follows:-

a) Increased actual fishing days per annum

The Indian small-scale fishermen reported that the use of Y25Hp Outboard engine enabled them to double the number of fishing days recorded in a year. They claimed that all the drudgery associated with the use of paddle-gas was removed. The actual fishing days recorded with the use of the engine was between 220 and 240 days as against 150 to 156 days for the paddled canoe.

b) Reduced hours per day to and from fishing grounds

With the engine installation, small-scale fishermen in Pakistan recorded fishing hours per trip. This enabled them to make more than one fishing trip per day and to set more fishing gears.

c) Increased net carrying capacity

Reported also in Pakistan was the increased net carrying capacity of the canoe. The use of the engine had resulted in a reduction in the number of crew to propel the craft as well as more room to carry gears. With the paddle, only 50 nets were carried while the engine installation enabled them to carry up to 70 nets.

d) Increased weight saving available for cargo

Canadian fishermen were interviewed o the cargo carrying capacity of their canoe using the engine and inboard installation respectively. There was the unanimous agreement that with the engine, the space available for cargo increased drastically. For instance, an 8.4 metre fishing boat was reported to have carried cargo weighing between 500 and 600 kg while with inboard engine, it was only 150 and 250 kg (Trungs, 1967).

e) Increased catch and landings

Motorized boats had on the average larger output than non-motorized boats in the Phillipines Municipal fishery (2,560 versus 1,118 kg/year) (Panayotou, 1988). The low production of non-motorized boats was attributed to the small size of the boats, all less than 0.50GT, which was a severe constraint on their operations. It was also noticed that among motorized boat users, production varied according to the horse power of engine used. Production grew with increasing horse power (H.P.), catches ranged from 1,472kg/year for 3-8 Hp category, and up to 3,233 kg per year for the 25 Hp category. The positive association noticeable between catch and motor power may be explained by the ability of fishermen with more powerful engines (and larger crafts) to exploit the farther and more productive, or less exploited fishing grounds.

f) Large craft/canoe size

The engine enables fishermen with big canoes to propel them more easily and faster. The Indian fishermen explained that the engine had made it possible to use larger craft carry more nets and catch. In support of this view, NIOMR (1987), reported that fishermen with Outboard engines were using larger crafts then those without in the sampled fishing villages of Lagos, and River States of Nigeria.

With these attributes, one would expect the transfer of a fishery technology like the Yamaha 25Hp Outboard engine to be constraint free in a developing fishery like in Nigeria. However, it is incumbent to examine the issue of technology transfer in fisheries and the associated models.

3.4 Transfer of fishery technology

From earlier review it is evident that most of the advances in marine science and technology available to the fishing industry are capable of bringing about remarkable improvements in catch rates, and subsequently, more profit for individual fishermen or firms that decide to take advantage of them. For such technology to enhance fishery development and be functionally relevant, it must be made available to the ultimate users (FAO, 1980). It follows then that a technology tagged as being appropriate in whatever dimensions and situation is meaningless until translated into functional use. The genesis of functional utilization is the transfer of such production and related processes from source of development to point of utilization (NIOMR, 1987).

Tobor (1984) for example, regarded transfer of technology as incorporating the transmission of technical and scientific software through formal and nonformal (acculturation), technical education and scientific practical training. It is imperative at this stage to review some of the agricultural technology transfer model.

3.5 Agricultural technology transfer models

FAO (1987) viewed technology transfer as a process through which research information in the form of improved gears and strains/ species of fish, improved management and motorization, storage and processing methods become directly available and productively operative at the level of the fishermen farmer. Three issues are involved.

1. <u>The originators</u>

This consists of a team of scientists (engineers/technologists) who have developed some aspects of fishery technology and formed the source end of a transfer model of a characteristic technology-transfer-application system.

2. <u>The transfer agencies</u>

These are the bodies through which transfer of technology into a new economy is effected. Such agencies include corporate bodies, organisations and institutions. In Nigeria, we have agencies like the Federal Department of Fisheries (FDF), National Accelerated Fish Production Programme (NAFPP); Institutions like Nigerian Institute of Oceanography and Marine Research (NIOMR), Departments of Fisheries in the Universities, Schools of Fisheries, and Federal and State Fishery Division of the Ministry of Agriculture and Natural Resources and Agricultural Development Projects.

3. <u>The ultimate-users</u>

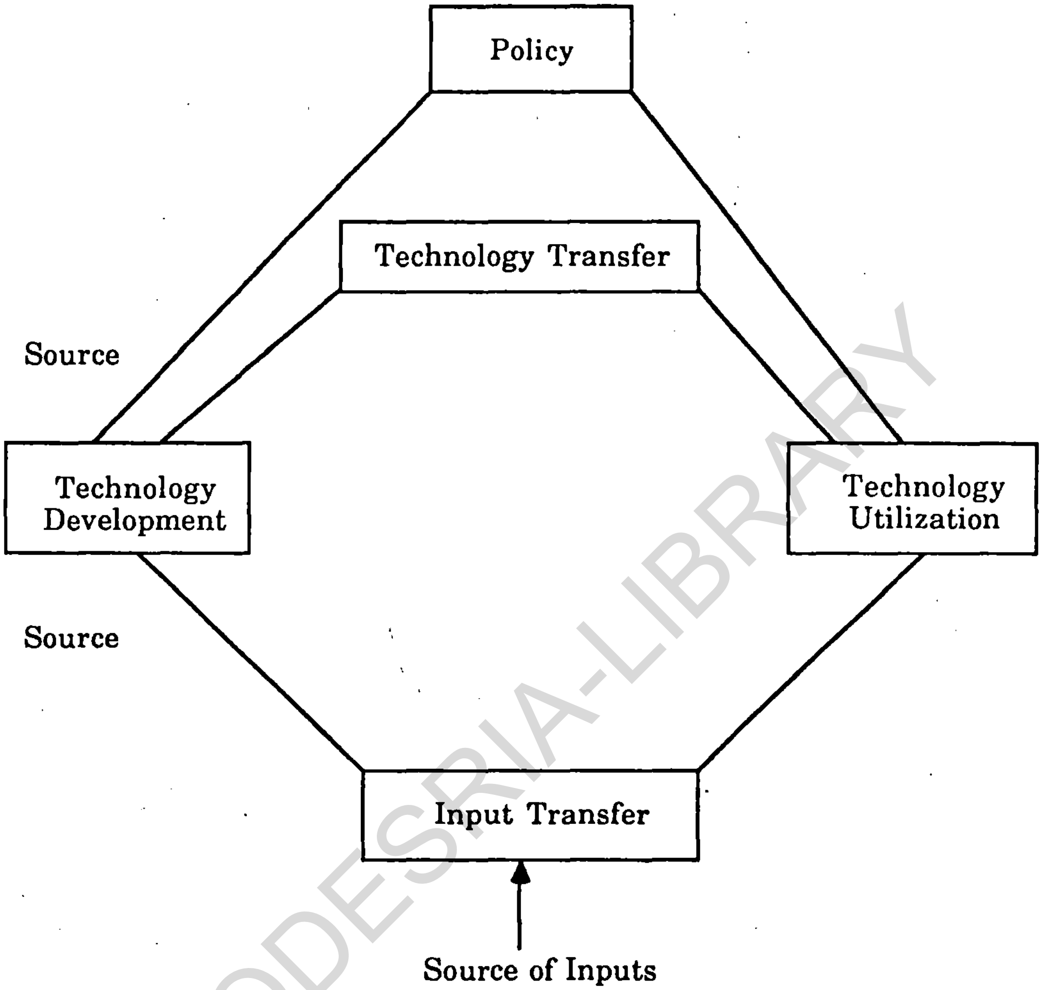
These are the functional users of the new technology and they occupy the receiving end of the system. This model can be illustrated thus.

RESEARCH———————→TRANSFER—————————→USERS

	(Agencies e.g. Extension agents of MANR)	(e.g. Fishermen or receivers)

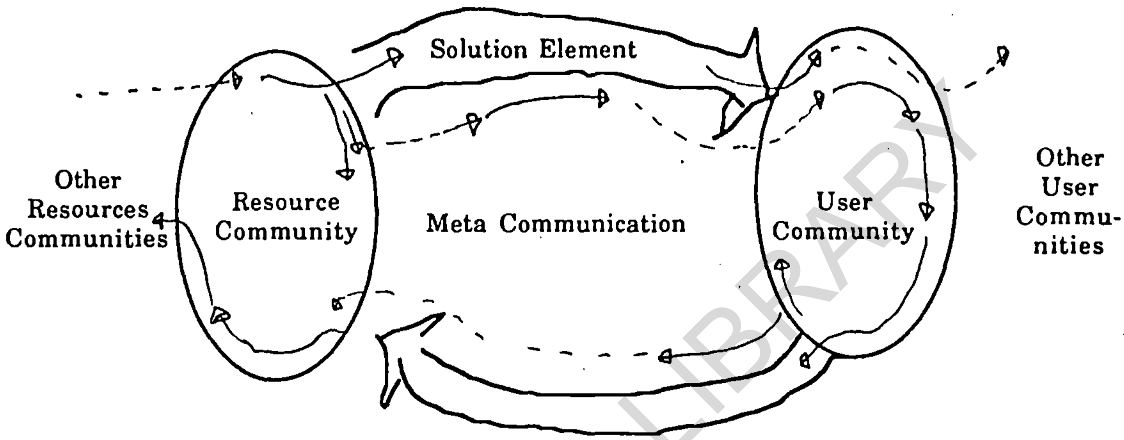
Source: FAO Model

FIGURE 1: FAO model



Source: Swanson, (1985)

FIGURE II: The Interpaks Model



Source: Havelock (1986)

FIGURE III: Two way model

b) The one-way model

Also known as the transfer of technology - "TOT" model, is one of the most widely used of the Agricultural Knowledge and Information Systems. The model starts off with researchers making "break throughs" which are then "transferred" through agents for "delivery" to eventual "Users." The International Programme for Agricultural Knowledge System (INTERPAKS) developed a frame work along this line.

c) Two-way model

This model does not enjoy wide patronage like the "TOT" model. Havelock (1986a, 1969) developed a two-way model which shows a distinction between those who generate technology (resource community) and those who implement it (user community). However, the model indicated the need for exchange of information between the two communities to enhance fruitful generation and effective transfer of technology.

Havelock's model also highlighted the possibility of exchange of roles. As such resource communities may become users and vice-versa. The need for the establishment of prior communication between the two communities is however essential in form of agenda, ground outes, channel of communication, a proper grasp of the internal processes as well as contextual factors.

d) Engel's model

Engel et al. (1989) looked at technology transfer from a functional usage perspective and described it as incorporating activities in the process of technology development and delivery. they held that these activities covered technology production, transfer of technology to users as well as, monitoring and evaluation of their utilization.

This model is as illustrated on Figure IV:

Technology production stage as indicated, involves the physical production of inputs or information materials for distribution through transfer agents.

Technology delivery stages is the point where these materials are promoted and later distributed to the consumers or users. This aspect of the system is subdivided into input supply subsystem and the extension subsystem. It is pertinent to highlight that information which guide users are not often got from one source at a particular time but come from various channels and over a period of time.

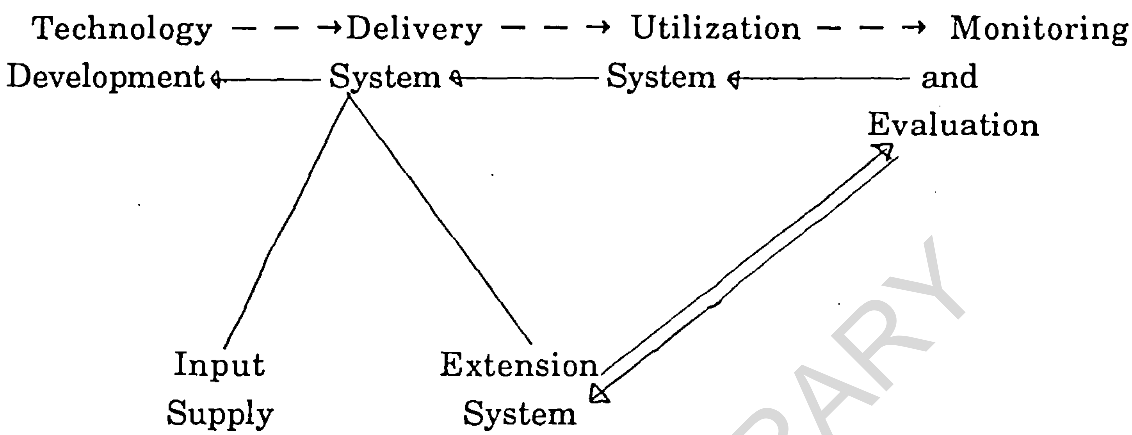


FIGURE IV: Engel's Model

The Monitoring and Evaluation stage measures whether fishermen or users have acquired and decided to fully or partially adopt, adapt or reject the introduced technologies and the reasons for their decision noted.

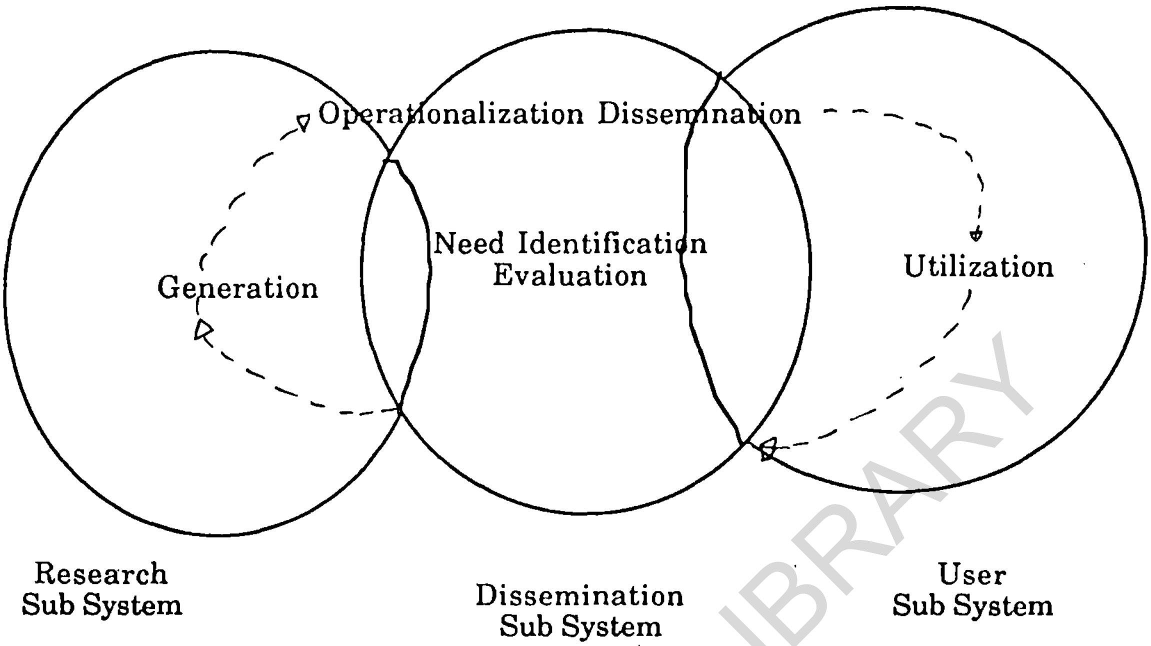
e) <u>Nagel's model</u>

Nagel's concept tried to establish viable institutions to produce and safe-guard a stream of new technological knowledge and a flow of industrial inputs in which the new knowledge is embodied, complemented by investments in general education and in production education for users and by efforts to transform institutions to be consistent with the new growth potentials (Roling, 1988). The system includes:-

1. A research sub-system
2. A dissemination sub-system and
3. A user sub-system (Nagel, 1980).

The system according to Nagel must perform these functions in order to ensure initiation and perpetuation of the information flow process:-

1. Identification of knowledge needs at the producer level
2. Generation of innovations



Source: Nagel (1980)

FIGURE V: Nagel's model

3. Operationalisation of utilization
4. Dissemination
5. Utilization
6. Evaluation of experiences

The model is interactive and not a one way flow.

Before synthesizing these models, it is necessary to examine the components of the Agricultural Knowledge and Information System that could affect transfer of technology at the national level.

Roling (1989) held that the following should be taken into consideration:-

a) The policy environment
b) The structural conditions
c) The political and bureaucratic structure
d) The external sector.

The policy environment is very crucial in any transfer system since its efficiency is a function of predominating policy goals and support. Policy environment may also serve to correct any default condition in the transfer system. It is within the environment that laws and incentives that influence agricultural performance are formulated.

The structural conditions are vital since the coordination of development and information transfer of technology with the other elements such as input distribution, provision of infrastructure, credit and others necessary for agricultural development are ensured.

The political and bureaucratic structures are also very important factors. The forms of bureaucracy used and the ways in which the forms are linked, as well as the historical stage of evolution reached by the different organizations involved, are all important factors (Röling, 1989).

Lastly, the external sector comprises donor agencies, international agricultural research centres, commercial firms which could act as sources of technology and information in any transfer system.

3.6 Synthesis of the models

The one-way model and the FAO model of technology transfer could be seen as an effective top-down systems that allow them to push technologies to users rapidly. The models assumed a linear, one-way process starting with the break through at international level and ending on the farm or fishing ground with an adapted innovation if institutionalized. It usually succeeds in delivering technology only to the progressive farmers/fishermen (Röling, 1989). The model reflect inadequate understanding of knowledge systems. It did not reflect some flow of information and influence from technology users to other parts of the system. Some degree of user-participation is however needed if a system is to function. However, the model's one-way nature could be defended on the basis that, although fishermen/users initiated innovation is important, the essential process in the modernization of agriculture is a science-based innovation.

The two-way model in a global perspective is an explanation of the failure of foreign technology in rural areas of developing economies. At micro-level, it emphases the need for users involvement not only in technology utilization but also in the process of generation. It indicates the beginning of the realization that technology development could be seen as a process of problem solving through which, those who face the problem can articulate and communicate to research scientists their needs for compatible knowledge. In this context, the traditional view that labour and management are merely factors of production, are gradually being abandoned (Shaw and Owen, 1972). The notion that the well-beng of people has validity along-side national goals, is gaining prominence, coupled with the view that users, and not just scientists, may generate information and technology.

However, Ray (1972) was of the opinion that no technology transfer model can be perfect, and that the relevance of any model should be seen in terms of the stage of the transfer process and its capability to give a good comprehension of the process in specific situation.

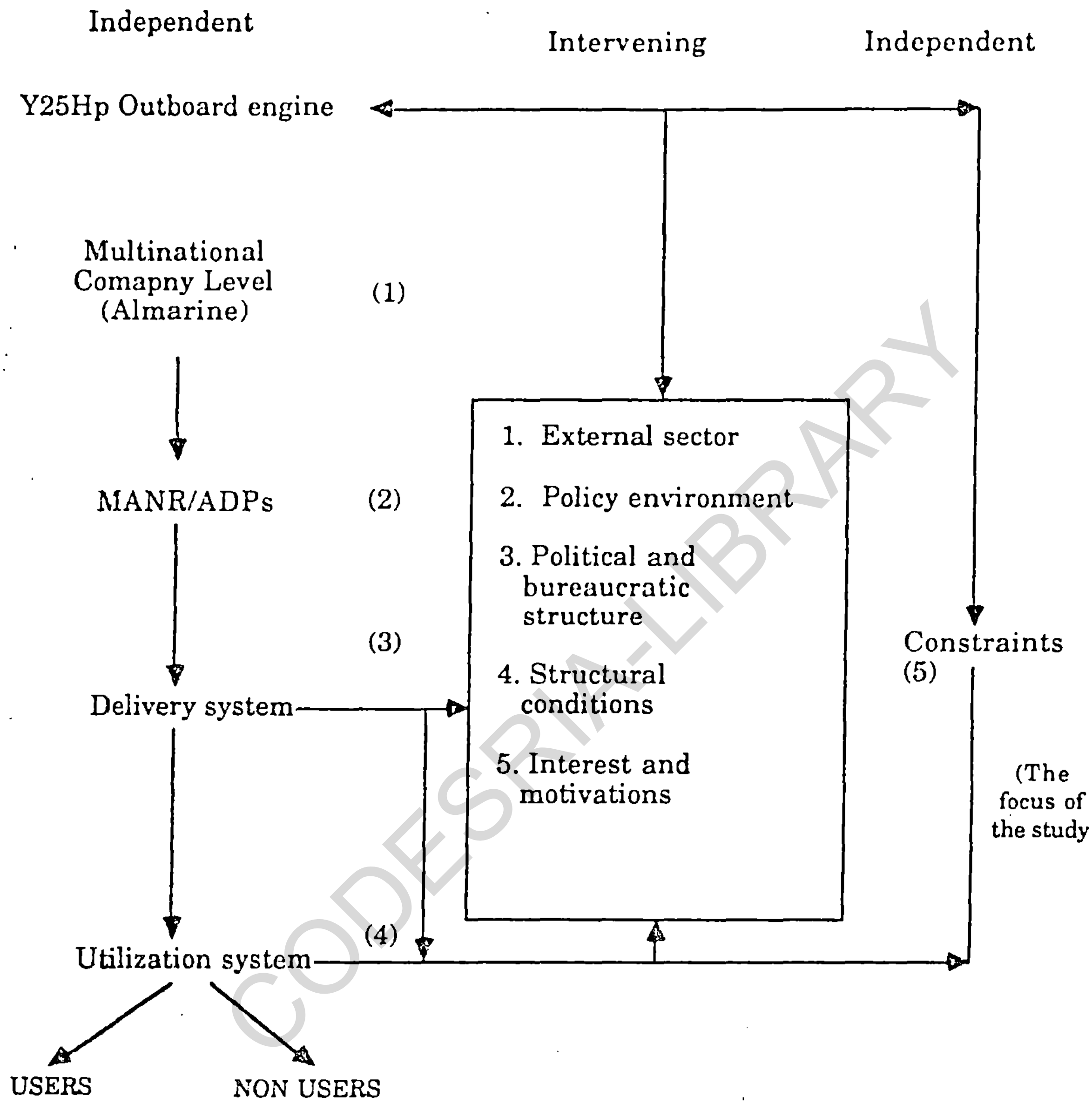
3.7 Theoretical orientation of the present study

The theoretical orientation of the study draws from the concepts of the technology-transfer process, review of research studies into the technology transfer and the constraints identified in various studies around the world. The present study is however specifically concerned with identifying the constraints that influence the transfer of Yamaha 25 horse power Outboard engine to the fishermen.

Ideally, the list of constraints cannot be exhaustive and will in fact vary from place to place and from time to time. The theoretical orientation of this study however, has been limited in scope due to the constraint of time and financial resources and has therefore been able to accommodate in the model constraints at the utilization, extension and supply, and multinational firm levels and their degree of influence on the transfer of the engine.

The availability of the engine at the Ministry/ADP level would be influenced by such variables (internal and external) affecting the firm such as costs, manpower, governments" policies, fisheries policies, availability of substitutes, home firm cooperation and fishermen preference.

The supply and extension system and the utilization system would also be influenced by varying degrees of constraints as discussed after the model. The constraints will be classified into general and specificts. However, the focus of the study in the model is also such that hypothesis could easily be derived, as well as the empirical tests or relationships among variable considered.



Source: Survey data, 1990.

FIGURE VI: Theoretical framework of the Y25Hp Outboard engine transfer and constraints

3.8 Constraints

a) Utilization level

Panayotou (1980), NIOMR (1978), Bell (1976), NEI (1975), Baron (1975), IPCF/FAO (1970) agreed that the following constraints factors would influence the utilization of the Outboard engine by the small scale fishermen.

b) The species being fished

Some fishermen catch species that are available in the rivers, brackish water and lagoons that would normally not require the use of the engine. Those fishing the fresh water frequently use passive gears that would not catch as much as the active gears used in the open sea.

c) Individual value

Depending on the way in which fish is processed, and marketed, a type of fish may have a high, medium or low individual value, the worth of the same species varies considerably in different parts of the world in accordance with local traditions, habits and preferences (Sainsbury, 1971).

d) Economic consideration

Trung (1970) agreed that economic considerations were of prime importance since the fishermen would consider whether, with the engine, they could catch and bring to market sufficient quantities of fish to make the operation economically viable. If several techniques appear technically acceptable, the one estimated to provide greatest economic return is usually the fisherman's choice. Poor technology prevalent among fishermen in development countries do have economic basis (Barm, 1975). Fishermen would want to buy any technology, but would want it at the lowest feasible percentage of their income, since there are other alternative opportunities for their money.

e) Social considerations

Basic securities are involved when the introduction of the outboard engine threatens to deprive crews of their maintenance. The case of the opposition encountered by one of the major outboard engine firms in the United Kingdom when it commissioned a boat with outboards which made substantial crew reduction possible is an example (FAD, 1965). Mechanization of craft may mean loss of social status, loss of skill monopoly, or simple loss of freedom of action to the independent fishermen (Trung, 1970).

f) <u>Cultural factors</u>

Great emphasis should be placed on the essentially conservative nature of the fisherman which makes him bold on the uneconomic techniques and out-moded methods, even when he is not entirely unaware that they are responsible for the miserable conditions in which he lives. The poorer fishermen in Ceylon viewed the outboards with suspicion and even hostility (IPFC, 1969). They would seldom consider any deviation from the fishing methods their fore-fathers had used for generations. The introduction of more effective type of fishing gear or craft into a particular area is usually deemed to be tampering with fishing in that area and the innovators take the risk of bodily harm and damage to the innovation (De Silva, 1971). In Vietnam fishermen are too poor and unwilling to abandon the traditional paddle and methods (IPFC/FAO, 1972).

Some African communities, according to Carleton (1982), still believe that it is wrong to take from nature more than one's immediate requirements, such communities, presumably, have no experience of winter, or of the problems of preserving a shoal of herring when these represent more food than the local community is capable of consuming in the immediate future. Gillet (1978) also observed that "Mechanization of fishing operations implies a basic change in the pace of activity." Fishermen operating non-mechanized craft work less during the "peak season", cover their needs and enjoy life; it is the time for social functions, their marriage season, entertainment and pilgrimage. During the lean season however, these same fishermen work very hard to earn the little money needed for their sustenance. Mechanization requires a different attitude, one has to work hard during the "peak season" to have good returns for the capital invested, but all activities may have to be stopped during "lean season" due to the inability to cover cost of fuel and other costs.

Vonneste and Hovart (1973) attributed the conservative attitude of the fishermen to the following factors:

a) <u>Poverty</u>

Traditional preference for species, relative preference of fishery versus substitute food products, religious attitudes, consumption taboos, all have contributed to poor living, standards of the artisanal fishermen.

b) <u>Geographic isolation</u>

Most of the fishing villages are very far from the urban centres with no road linking them. Fishermen have to trek long distances before getting to towns. This has made it difficult to develop most of the facilities in these villages.

c) <u>Age</u>

The resigned attitude of the older fishermen was alloted some of the blame for the stagnation of coastal fisheries motorization (in Belgium for instance) (Trung, 1967).

d) <u>Lack of education</u>

This was found largely responsible for the lack of necessary initiative, knowledge and imagination by fishermen in Newfound land who failed to grasp the opportunity of motorizing their crafts (Copes, 1971)

In many parts of the world, fishermen adhere to the belief that their actions have no causal effect upon their future. A corollary of this fatalistic attitude is that fishermen try to adapt themselves to what they find rather than try to change anything in the environment (Mead, 1970). In Hong Kong for instance, most of the small scale fishermen believe that their gods or goddesses will protect them and bring them good fortune. Instead of purchasing outboards, they were reported to prefer "buying and burning incense to honour the gods and worship the ancestors, and paper clothes to placate the evil spirits since they believed that they could meet disaster if they displayed any sign of lack of confidence in protective or destructive supernatural powers (Trung, 1976).

e) <u>Lack of skill in outboard operation and maintenance</u>

The fishermen often lack the necessary training and skill to cope with mechanical troubles commonly encountered with the outboard engine. Fishermen in India were reported to have packed up the engine because they could not mix the fuel gasoline ratio properly and that the fuel was too expensive (Eddie, 1983). Also, in the Phillipines, fishermen willing to purchase the engine were more reluctant to do so because they had no knowledge about its operation in the early stages of the innovation (Steinberg, 1980).

f) Cost of the Outboard engines

The cost of the engine was considered too exhorbitant for the small scale fishermen in the developing countries. This view was attested to by the Food and Agricultural Organization (1975) in the United States, when it suggested that the government of the developing countries should supply the engines to fishermen at subsidized rates.

Constraints associated with the Outboard engine

Eddie (1983), FAO (1975), FAO/IPFC (1972), Trung (1967) were able to come up with the following factors retarding the use of the engine. The factors were termed "Outboard inherent factors."

These are:

a) High specific fuel consumption

The Outboard engine was reported to have consumed twice the fuel for an inboard engine. NIOMR (1982) supported this view when it was found out that the Outboard engine consumed 8.5

litres per hour while the inboard engine consumed only 5.02 litres per hour. With the price of fuel rising these days, fishermen would find it difficult to fuel the engine.

b) Maintenance cost

Fuel costs were giving less cause for concern to some fishermen in the developing countries than the costs of repairs and maintenance, especially the virtual losses arising from the loss of fishing time occasioned by breakdowns.

c) Reliability and durability

The life span of the Outboard engine is very short (FAO, 1972). There is need for mechanical equipment that is more reliable and that is capable of being rapidly dismantled, repaired and re-assembled, using simple, locally available skills and facilities.

d) Limited propeller selection

The propeller was not designed that it could be changed with the minimum use of tools in order that propellers of different pitches could be easily interchanged when going to fishing grounds and returning (Trung, 1967).

e) Absence of a power-take-off

Over the years, it has not been possible to develop a power take-off for the Outboard engine and the craft. This according to Dunns (1981) would go a long way to ease the problem of engine installation.

Constraints at the service level

Extension services help rural fishing families and other categories of fishermen in the application of scientific and technological innovations in order to enhance fish production. Fisheries extension enables the fishermen to benefit from research and technology with the ultimate aim of improving their standard of living. This extension extends knowledge of improved practices to the fishermen to effect the transfer of technology. This could be done through a variety of methods, techniques and processes. The choice of which method to use depends on a number of factors, such as the general level of literacy of the fishermen the subject matter, type of technology, resources available and the stages of infrastructural development. In general, there are three types of extension methods for the effective communication of new and improved practices for enhanced fish production (Tobor, 1984). These are:

1. Individual contact method.

CHAPTER FOUR

THE STUDY AREA

The chapter gives a general description of the main features of the three states with respect to location, climate, soils, vegetation, fishing villages and fishing activities.

4.1 Area of study

The study covers three of the twenty-one (21) states of Nigeria (Fig. 7). The states are Lagos, Ondo and Ogun.

4.2 Location

These states occupy the Western section of the southern zone of the country. Lagos State lies in the South-Western part sharing boundaries with Ogun State both in the North and East, bounded in the West by the Republic of Benin. Ondo State also shares boundary with Ogun State in the East. The three states enjoy coastal advantages by being bounded by the Atlantic Ocean in the South. The states fall between longitudes 2°40'E - 6°40'E and latitudes 4°40'N - 9°15'N (Giant, 1989).

4.3 Climate

The three states and, Nigeria as a whole, lie within the tropics. The climate is characterised by two seasons namely,

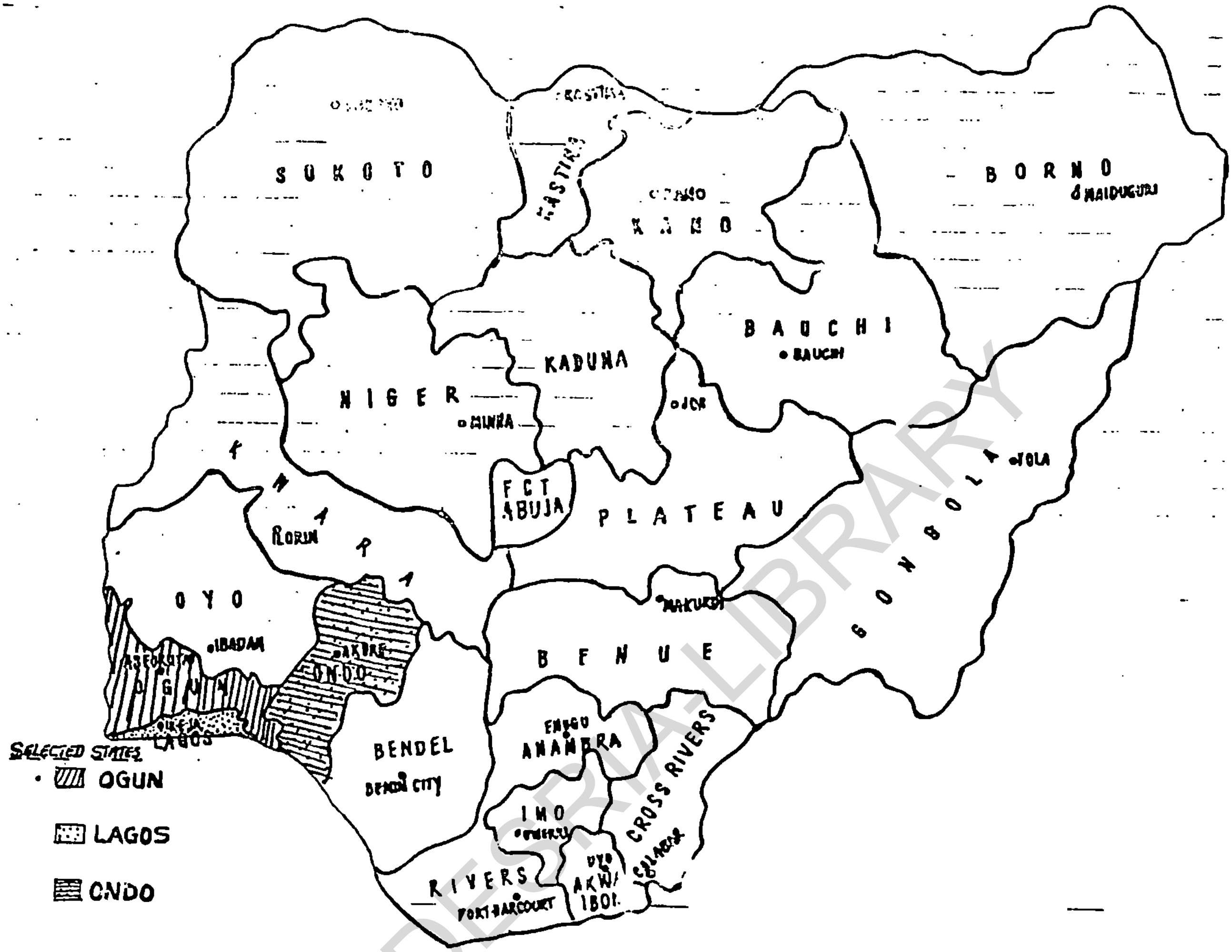


Figure 7: Map of Nigeria showing the selected states

1. the dry and
2. the rainy seasons.

The dry season is experienced between November to April. The period December to February, is usually market by the relative cooler harmattan caused by the north-east trade wind. The rainy season, commences about late March or early April and lasts till October with a brief dry period in August generally referred to as the "August dry spell". Rainfall ranges from 30000mm in the coastal areas to between 1000 - 2000mm in the extreme North (NIOMR, 1987). The three states enjoy double peak or maximum rainfall, one in June/early July and another in September (Know Nigeria Series, 1990). There is rainfall in most parts of the three states but the amount, intensity and length of the period of rainfall decrease progressively from South to North, with the Northern parts having marked dry season. On the whole, the climate conditions promote high biological activities.

4.4 Vegetation

There are three main vegetation types in the study area viz: Mangrove swamps, the tropical rainforest and the decidous forest of the North. The mangrove forests predominate in the coastal regions.

4.5 Description of the states

Lagos state

The state is one of the main maritime states in Nigeria where fishing is the major occupation of the indigenous population. In the South, it stretches for 180 kilometres along the coast of the Atlantic Ocean (Lagos State Hd. Bk., 1987). The state occupies an area of 3,577 sq. km, 22 percent (787 sq. km) of which lie under water in the form of lagoons and creeks (Lagos State Progress Report, 1984/85).

Fauna:

Amphibious vertebrates like the toad, frog, river turtles, crocodiles, water snakes and other marine animals abound in Lagos lagoons and creeks.

Crustaceans like the sand crabs, ghost crabs, hermite crabs and the hairy mangrove crabs are also found in these areas. Various species of fresh and salt water fishes can be found in the state's inland and Atlantic Coastal Waters (Aremo, 1968).

Demographic characteristics

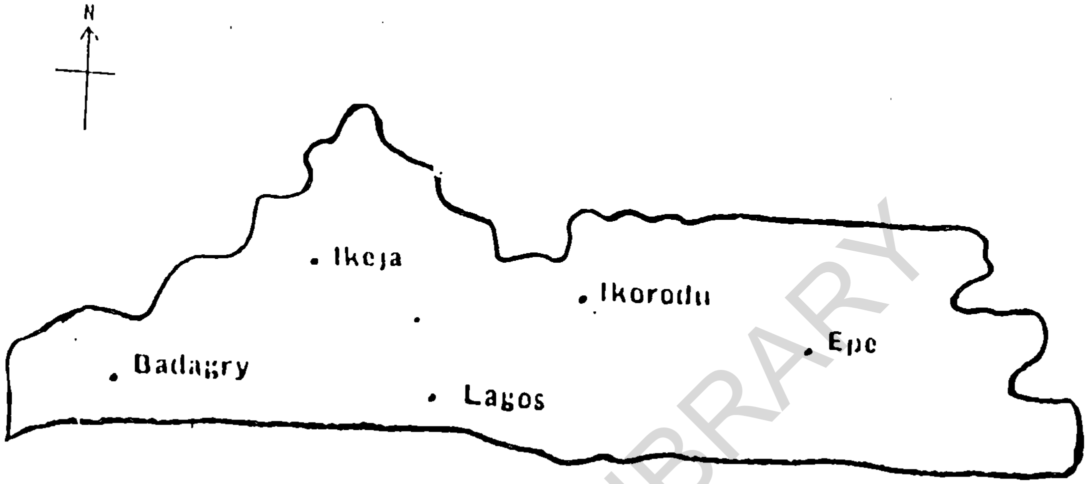
The population of Lagos State was put as 1,443,568 according to the 1963 national census. The state was estimated to have 7.3 million inhabitants by the end of 1985 using an annual growth rate of 8 percent in the thickly populated areas, and 2.5 percent per annum in the rural areas with their characteristic sparce population (LSPR, 1986/1987). As a result of the high rage of rural-urban migration in the country, the state was estimated to receive a total of 300,000 persons per annum, or 25,000 per month or 833 daily at the rate of 34 per hour (Lagos State Progress Report) (LSPR), 1985/86)

Geographical divisions of Lagos State

Lagos State is divided into five main divisions namely: Badagry, Epe, Ikorodu, Lagos and Ikeja divisions. All the divisions are important for the study because they all have lagoons, rivers, swamps and creeks within their territories. Also, the fishing villages are scattered around all the divisions. (See, Figures 8 and 9).

Badagry division

This division lies in the Western part of Lagos State sharing its western boundary with the Republic of Benin and having as its southerly limit the coastline running parallel to the Atlantic Ocean. It has as its principal urban area, the ancient city of Badagry situated 57 km by road from Lagos (Lagos State Series (LSS), 1988). The area enjoys the characteristics of the climate of coastal areas of Nigeria with rainfall ranging from 1117.6 mm to 1524 mm annually



—— State Boundary

. Division

Figure 8: Map of Lagos State showing the division

Source: Lagos State Ministry of Agriculture and Natural Resources, Fisheries Section, Lagos.

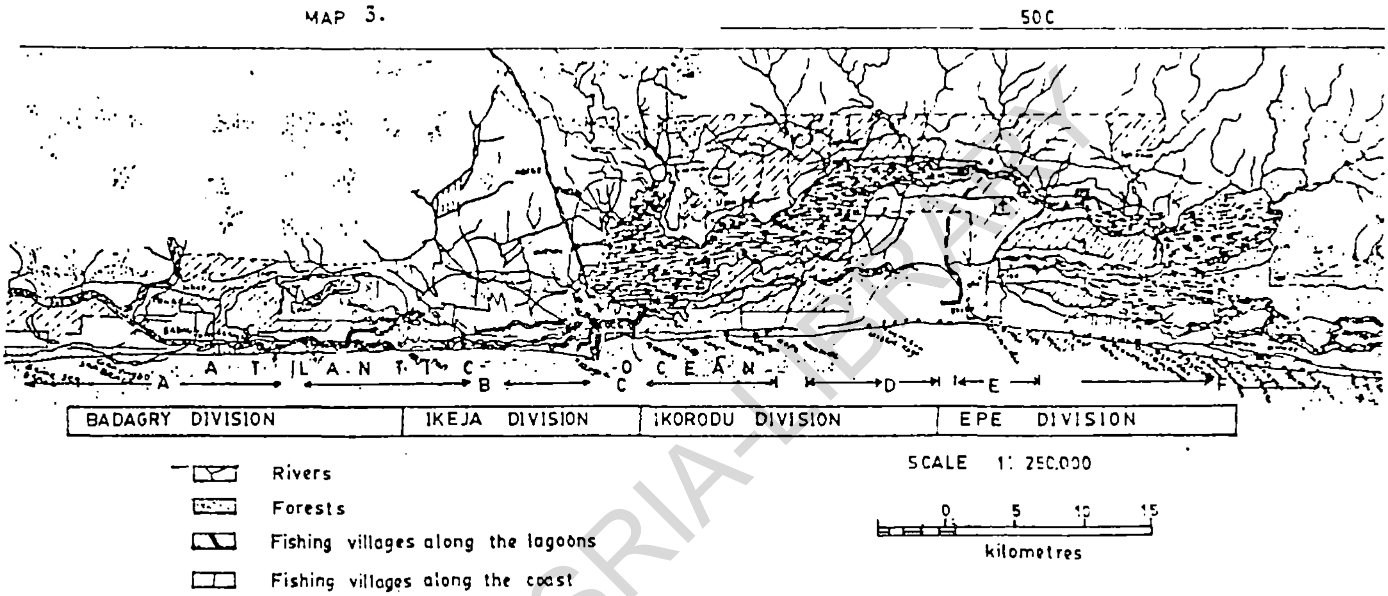


Figure 9: Map of Lagos State showing the fishing villages

Source: Lagos State Ministry of Agriculture and Natural Resources, Fisheries Section, Lagos from late March to October and a harmattan punctuated dry season lasting from mid-October to March. The soil is generally sandy. Fishing and boat making are some of the predominant occupations of the people.

Epe Division

Epe derives its name from Iremepe, a fisherman who was the first person to settle in the area. Epe town itself lies almost 90 km from Lagos and is on the eastern part of the state. The area enjoys a climate typical of coastal regions and has several inlets in form of creeks and lagoons. Along the sides of these water bodies are popular fishing villages like Debajo, Igando, Ejirin, Eredo and Ibeju-Lekki. Fishing is the most important occupation of the people.

Ikeja division

Located some 20 km north of Lagos and covering an area of about 300 sq. km (IKS, 1989), Ikeja is the state capital. There is concentration of large and small scale industries in the area but farming and fishing remains the major occupations of its rural population. Settlements in this division include Oregun, Shasha, Isheri, Ogba, Aguda, Agege, Akowonjo, Abesan, etc. Some of these settlements are fishing villages.

Ikorodu division

Ikorodu lies approximately 35 kilometres North of Lagos and covers an area of 100 sq. km (Ikorodu Division Series, 1988). It serves, by virtue of its position as a "gateway" to the country's hinterland and is thus a bubbling commercial centre. Fishing villages in Ikorodu include: Imota, Agura, Igbosu, Ajegunle, Ijede, etc.

Lagos division

This is a thickly populated area and is a fusion of Ebute Metta/Yaba, Surulere, Coker, Aguda, Lagos City, Ikoyi, Eti-Osa and Apapa. There are many fishing villages in this division coupled with the presence of popular markets like Oyingbo, Yaba, Iddo in the locality. The indigenous rural population are mainly fishermen.

Fishing activities in the State

Lagos State being one of the maritime states in the country is endowed with 198 km coastline as well as a network of inland waters made up of creeks and lagoons (LSH, 1987). About 757 sq.km of the state is covered by water mainly the Lekki Lagoon, Badagry, Lagos and Epe (FDRD, 1981).

The ecological location of the state makes fishing activities possible throughout the year in creeks and the coastal areas. Unlike states in the hinterland, fishing is the prime occupation of the indigenous population of the state. Federal Department of Fisheries (FDF) (1988) estimated that there were about 50,000 fishermen in regular employment in the state. Fishermen in Lagos State could be classified into (a) Artisanal, (b) Industrial, (c) Aquaculturists, with the artisanal group constituting the majority. The small-scale fishermen are organized into cooperative societies in the state. There are 152 fishermen cooperative societies scattered all over the state (FDF, 1990).

The men are involved in fishing while the women are mainly in fish processing and marketing in the state (Williams, 1987).

Ondo State

The state was created in 1976 with an area of 20,595 sq. kilometres (Giant, 1989). Ondo State is bounded in the North by Kwara State, in the West by Oyo and Ogun States, in the East by Bendel State and in the South by the Atlantic Ocean (see Figure 10).

Location

It lies between longitudes 4°30' and 6°00 East of the Greenwich Meridian and latitude 5°45' and 8°15' North of the equator (OSS, 1990); Ondo State is entirely within the tropics. Going by the Nigerian Census of 1963, the population of the state is 2,729,690, but according to the 1988 projection, the population of the State is 5,980,700.

Physical Features

Topographically, the area is composed of low lands and rugged hills with granite out-crops in several places. The State can be divided into two land forms zones, namely; upland and the lowland. The upland zone, which forms a major part of the state lies wholly within the area underlain by metamorphic rocks of the basement complex. The land surface is generally undulating and the characteristic landscape consists of old plains broken by steep sided inselbergs in prominent areas like Idanre, Efon-Alaaye, Oka, Ikare, Ondo, Ijare and Okemesi. Generally, the land rises from the coastal part of Ilaje/Ese-Odo areas in the South to the rugged hills in the Northern parts of the State. Notable among the hills are Idanre hills, Ikere-Ekiti hills, and Efon-Alaaye hills.

Fishery Activities

The state is one of the best endowed in the Federal Republic in terms of water resources. The numerous rivers include Oni, Owena, Oluwa, Ala, Ofara, Ofosu, Ose, Ominla, Ero, Ogbese and

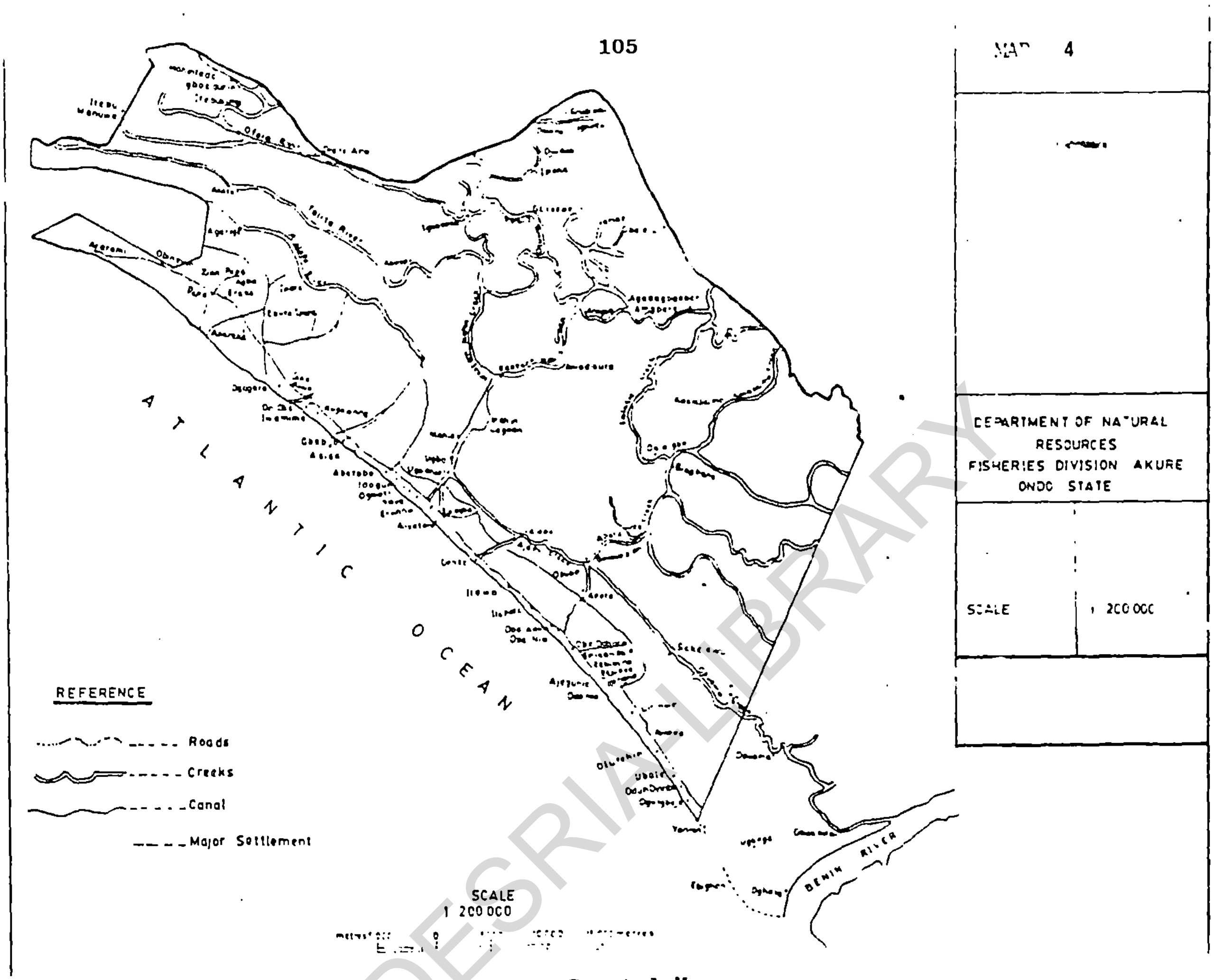


Figure 10: Ilaje-Ese Odo Coastal Map

Osun. The drainage is southwards to the Atlantic Ocean. Fishing is concentrated mainly in the Ilaje Ese Odo Local Government Area (L.G.A).

Fishing villages along the lagoon and the Atlantic Ocean include Ilowa, Ilepete, Idiogba, Ogboti, Igbokoda, Orioke, Obiogbaro, Imulomo, Aiyetoro, Ikoriho, Opuba etc. Fishing is the main occupation of the indigenous population in this part of the local government area of the state. There are also under-ground water resources particularly in the area of sedimentary rocks found in the Southern parts of the local government area.

The local government consists of three ethnic groups namely: The Ilajes, the Apois, and the Arogbos.

a) The Ilajes

The people live in the riverine areas of the state and their primary occupation is fishing. The Ilajes speak a dialet which is very similar to that of the Ikales. Their main food is 'pupuru' and fish.

b) The Apois

The Apois are Ijaws, who speak a dialect distinct from that of the Ilajes, their neighbours. They live on the swampy lands in the riverine areas of the southern part of the state and they are good swimmers, while their main occupation is fishing. They live in between the Ikales, to the north, and Ilajes and Arogbos to the south.

c) The Arogbos

The Arogbos are also Ijaw speaking people who live in the riverine areas of the state close to the south western part of Bendel State. Their paramount ruler is Agadagba of Arogbo. They are good swimmers and their main occupation is fishing.

Ogun State

The state is situated within the tropics and covers some 16,400 square kilometres (Giant, 1989). It is bounded in the West by the Republic of Benin (Dahomey), in the South by Lagos State and the Atlantic Ocean, in the East by Ondo State and in the North by Oyo State.

Population

The state is a homogenous state, peopled predominantly by the Egbas, Egbados, Ijebus, Ijebu-Remos, Aworis and Eguns, who, in the main, belong to the Yoruba ethnic group. The current estimated population of the state is 2,773,594 (OSS, 1987). This figure is based on a projection of the 1963 census which put the state's population then at approximately 1.5 million.

Climate

The climate takes the usual tropical pattern with the rainy season starting about March and ending around November, followed by a dry season. Its natural resources include extensive fertile soil suitable for agriculture, rivers, a lagoon, rocks, mineral deposits and an ocean front.

Fishery activities

The fishing population is concentrated in the Ogun Water Side Local Government area of the state. The presence of the lagoon and rivers like Saga, Mosafejo, Sosa and Sumoge, coupled with the sea terminal makes fishing possible in the area. The lagoon runs from Makun-Omi down through Ode-Omi to Lagos State. Important fishing villages along the coast include: Igbeki, Ojuelu, Ajimo, Iseki, Isekun, Oke, Ilete, Oke-Oso, Olosumeta, Igbosere, Iro-Awodikoro, Akede, Elefon, Enuwaya, J.K. Camp, Aba-Golu, Aba Olori, Araromi. Both lagoon and sea fishing abound in the area. Fresh water fishing also takes place in Iwopin area because of the nearness of the Lekki lagoons and the rivers. (See Figure 11 and 12).

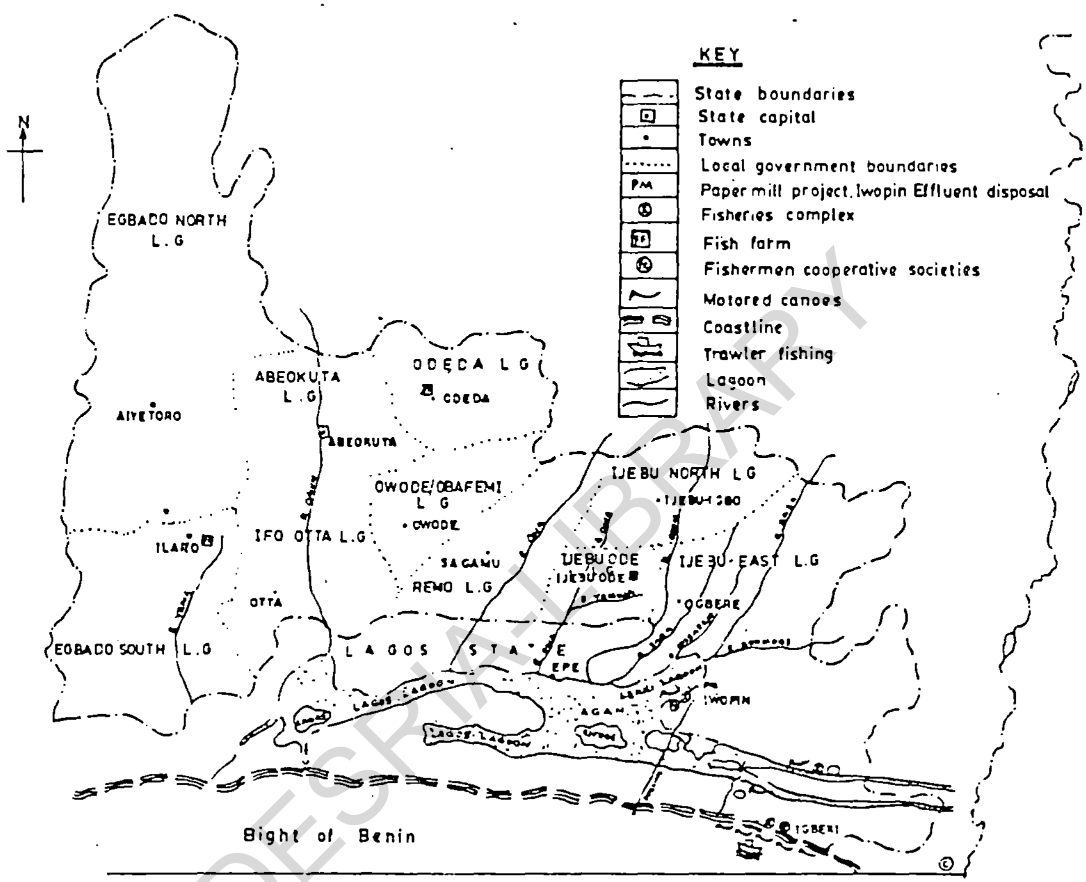


Figure 11: Map of Ogun State showing fisheries activities

<u>Source</u>: Ogun State Agricultural Development Project, Abeokuta.

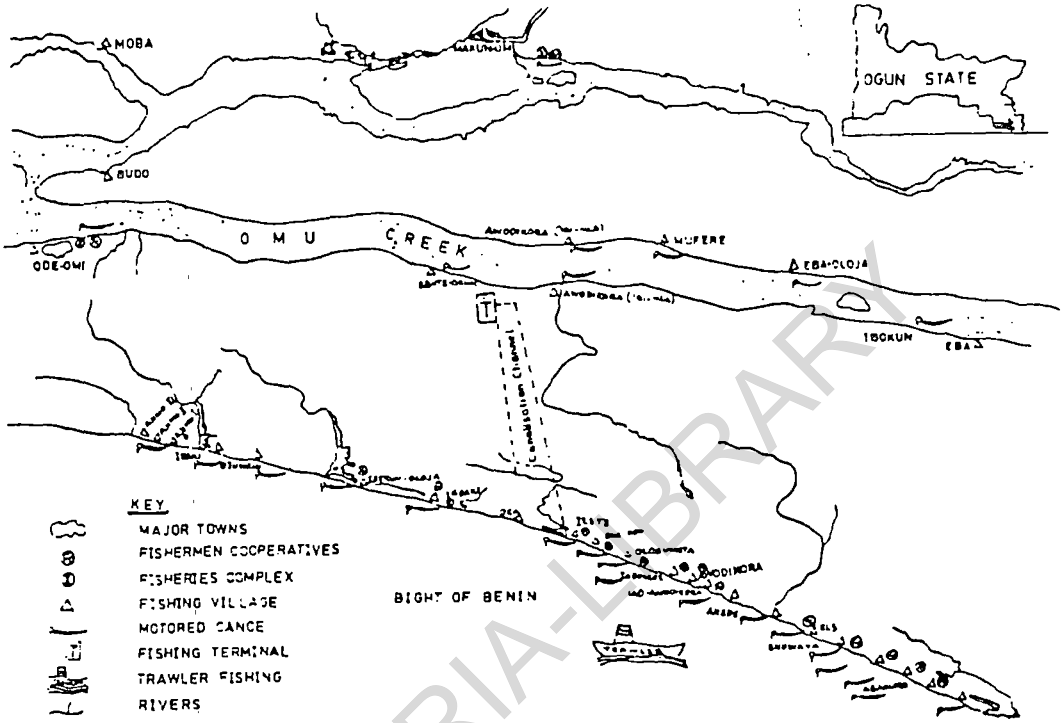


Figure 12: Map of Ogun State showing the Marine/Lagoon locations

Source: Ogun State Agricultural Development Project, Abeokuta.

CHAPTER FIVE

METHODOLOGY

5.1 Population choice

The selection of Lagos, Ogun and Ondo States for the study was based on the following criteria:-

a) The three states enjoy coastal advantages because they are bounded by the Atlantic Ocean in the South.

b) The indigenous fishing population use similar gears and crafts (FDF, 1984).

c) They are Yoruba speaking states and share boundaries with one another. This would make data collection and interpretation easier.

d) Various forms of inland waters abound in the states in the form of lagoons, rivers, creeks, brakkish waters and swamps. This situation has made it possible to have two main fishing locations for the fishermen in the three states namely:- the inland waters and the sea.

e) The fishermen are all organized into cooperatives in the three states.

5.2 Sampling procedure

The sampling procedure for each of the states was as follows:-

a) Lagos State

A list of the registered fishermen cooperative societies was obtained from the statistics section of the States' Ministry of Agriculture and Natural Resources, Fisheries Division.

A multistage disproportional stratification method was used to obtain the sub-populations from the frame as follows:-

i) The frame was stratified into two sub populations namely:

   a) Sea Fishermen Cooperative Societies (F/C/S)

   b) Inland Fishermen Cooperative Societies.

   From the classification, a total of 47 sea group and 54 inland group were obtained.

ii) The 47 sea fishermen cooperative societies and 54 inland water fishermen cooperative societies were scattered throughout all the five divisions of the State. The societies were again stratified into two divisions as follows:

a)

Division	Sea F/C/S	Inland F/C/S
Ikorodu	10	11
Ikeja	12	10
Epe	8	12
Badagry	7	11
Lagos	10	10

With the use of a proportional random sampling, 10% was selected from each group for each division. A total of five inland F/C/S and five Sea F/C/S were selected making a total of 10 F/C/S.

Phase II

A list of members in the five inland F/C/S was obtained from their secretaries. The total numbers of fishermen in the societies were as follows:-

Division	Society	No. of members
Ikorodu	Offin Ifesowapo	28
Ikeja	Irewolo Odo Ogun Oniyanrin	25
Epe	Oritonise	23
Badagry	Boglo	20
Lagos	Ogo Oluwa	40
	Total	120

A total of eight (8) members were each randomly selected from each society to give a total of 40 members for the inland water fishermen sample size.

The number of members in the sea F/C/S were as follows (users and non-users of Y25Hp):

Division	Society	Membership
Ikorodu	Iwajowo	32
Ikeja	Ire-Olokun	63
Epe	Lekki Owonigba	90
Badagry	Wharako Whekaneh	50
Lagos	Oju Olokun	37
	Total	272

Members in these societies were further stratified into two groups namely:-

1. Coastal (Users and non-users of Y25 Horse power).
2. Off-coastal (Users of Yamaha 25 Horse power)

Society	Coastal	Off-coastal
Iwajowa	10	19
Ire-Olokun	21	42
Lekki Owonigba	56	42
Wharakoh Owonigba	31	12
Oju Olokun	21	15
Total	139	130

A total of 40 members were randomly selected from each ground using a table of random numbers. Altogether, 120 fishermen were selected from Lagos State.

5.3 Ondo State

The fishermen cooperative societies in Ondo State were found to be organised into unions. Altogether, there were 21 unions in the state, with each one having an elected secretary. All the unions join together to form the Ondo State Fishing Association with headquarter at Igbokoda and a paid secretary.

Sampling Procedure

The list of Fishermen Cooperative Societies under each union was obtained from the secretary of the Union. There was a maximum of 30 Cooperative Societies per Union. Three (3) societies were randomly selected from each union which gave a total of 33

Fishermen Cooperative Societies. The membership range for all the societies was between 26 and 30 respectively. The Fishermen Cooperative Societies selected were stratified according to fishing location and the use of Yamaha 25 Horse power Outboard engine as follows:

Fishing locations:

	Inland (with Paddle)	Coastal (Paddle and H24Hp)	Sea and Coastal with Y 25Hp
Societies:	13	8	9

The remaining 3 societies were users of other models of Outboard engines and of varying horse powers. The 13 Fishermen Cooperative Societies fishing the inland waters had 394 members out of which a sample of 40 was randomly taken. The Fishermen Cooperative Societies fishing the coast had a total of 378 members from which 40 members were randomly selected for the study. Those fishing the coast and the sea with Y25Hp Outboard engine had a total of 399 members and 40 members were randomly selected. This gave a total of 120 fishermen or respondents from Ondo State.

5.4 Ogun State

Fishing activities in the state was found to be concentrated in Ogun Water Side Local Government Area. The fishermen

Cooperative Societies were also organised into Unions. There were 16 registered unions in the State Fisheries.

Sampling Procedure

The list of all unions and their affliated Fishermen Cooperative Societies was obtained from the Fisheries Section of the State's Ministry of Agriculture and Natural Resources. All unions had between 20 and 30 Fishermen Cooperative Societies. A 10 percent random selection of Fishermen Cooperative Societies from each union gave a total of 38 societies from all the Unions. The 38 Fishermen Cooperative Societies were then stratified disproportionately into their different fishing locations according to information got from their secretaries and the fisheries extension officers in charge of the Local Government Area. There were eleven (11) societies in the inland waters while the other 27 societies fish the sea. A total of 361 were found to be registered in the 11 inland Fishermen Cooperative Societies out of which 40 members were systematically selected using random sampling.

The 27 societies fishing the sea were further stratified into coastal and off-coastal fishing. Thirteen societies fish the coastal water with paddle and a total membership of 401. With systematic random sampling, 40 members were selected from the group. The remaining 14 Fishermen Cooperative Societies fish the coastal areas and the off-coastal using the Outboard engine and a total membership of 434. Out of this, 41 fishermen use other models of Outboard engines and Horse powers while the others (393) use the Y25Hp Outboard engine. From the 393, 40 members were selected using the systematic random sampling method.

5.5 Species data

The second phase of sampling was carried out for the species data collection. The catch data was collected to identify the species of fish present in the haul of fishermen fishing the sea based on Tobor and Ajayi (1969), and Tobor (1968) classifications. The catch species were then weighed with a weighing scale.

Sampling procedure

Five full-time fishermen were randomly selected from those fishing the coast with paddle and 5 from those fishing the coast with Y25Hp Outboard engine and those fishing off-coast with Y25Hp Outboard engine. This gave a total of 15 respondents per State and 45 from the three states. The catch data was collected from January to March in the dry season and from May to July in the rainy season. Data were collected for 7 days/month/state respectively. The states were,

States			Month	
			January	
Dates	1 - 7	8 - 14	15 - 21	22 - 28
States	Ondo	Rest	Ogun	Lagos
			February	
Dates	1 - 7	8 - 14	15 - 21	22 - 28
States	Lagos	Ondo	Rest	Ogun
Dates	1 - 7	8 - 14	15 - 21	22 - 28
States	Ogun	Lagos	Ondo	Rest

The same rotation was continued for the rainy season period.

Design for the species data

For the purpose of this design, a fish landing site was defined as a physical location on the sea coast where fishermen set out to fish and return to land their catch. It should be noted that a fish landing site might not necessarily be synonymous with a fishing village. If all the fishermen of a fishing village do their landing at one point about the village, their landing site's name could coincide with the name of the village. If on the other hand, it was found that the respondent fishermen in a village were landing at more than one point about the village, this would be a case of a fishing village with many landing sites. In such a case, each site was named with relation to the direction of the site to the village (e.g. Igbeki-North, Igbeki-South, Okun Elefon North, and South).

The first step was to compile the list of fishing villages of selected respondents and their landing sites for the three groups of fishermen considered. In the selection of the fishermen, efforts were made to ensure that they used the same type of gears in each of the states. Since the landing sites were the same for both motorised and non-motorised, it was not desirable to stratify the fish landing sites into two groups. However, landing sites were not the same for all the respondents in each state. The following landing sites were used in the state:

Ogun State	a) Igbeki-North	b) Igbeki South	
Ondo State	a) Aiyetoro	b) Orioke	c) Iwamimo
Lagos State	a) Badagry-Topo	b) Okun Ibeju	c) Orimedun

Twenty-eight enumerators were employed for the catch data collection. Four enumerators were stationed at each landing site with the researcher going round the landing sites for the duration to monitor their activities. Weighing scales were collected from the Federal Department of Fisheries officials in each state. Cost and returns data were also collected from the fishermen.

5.6b) Fisheries extension agents and supply officials

The fisheries extension agents were purposively selected for this study. Forty-eight extension agents were interviewed in Lagos State, while 12 and 8 agents were interviewed for Ondo and Ogun States respectively.

Also, using purposive sampling, only 7 (seven) supply officers were interviewed in the three states.

5.7c) Almarine officers

Six (6) officials of the firm were interviewed purposively for the study. This includes 5 heads of sections and the Director for the Lagos Branch.

5.8 Instrument for data collection

1) Primary data:

a) Instrument for the artisanal fishermen

Structured interview schedule was constructed with which data were collected for the study. The instrument was divided into sections concerning the following:

i) Personal and demographic factors

ii) Fishing factors, landing and fishing income.

iii) Yamaha 25 Horse power Outboard engine factors

iv) Extension Agents factor

v) Knowledge test concerning Y25Hp Outboard engine specific instructions

vi) Attitudinal factor

vii) Constraint factors and variables

viii) Transfer process.

b) Instrument for the extension

Items in the questionnaire could be divided into the following sections:

1) Personal factors (2) Constraint factors.

5.9 II) The supply and almarine officials

The data from these officials were collected with the aid of an interview schedule consisting of questions on the following sections:

1) Constraint at International level (for Almarine official only).

2) Constraints at National level (for Almarine official and supply officials).

3) Constraints at State level (for supply officials)

4) Suggestions for the improvement of transfer.

5.10 Secondary data

Other necessary data were collected from relevant resource persons (interviews, discussions, etc) as well as from official records in files, chart and other literature sources. Such data were related to the number of registered Fishermen Cooperative Societies from the Ministry of Agriculture and Natural Resources and the State Agricultural Development Projects, number of fisheries extension agents and areas of operations, Yamaha 25 Horse power Outboard engine distribution and the requirements of the State Ministry of Agriculture and Natural Resources and the Agricultural Development Projects (ADPs) at the state levels.

5.11 Variables and their measurement

The independent variables were measured by scales developed or adapted as follows:

Variables	Empirical Measures
1. Age	Actual chronological age of respondents
2. Wives/Children/ Dependants	Actual number possessed by the respondents.
3. Education	Index developed for the study.

4.	Fishing Inputs	Measurement developed for the study.
5.	Attitude towards Yamaha 25Hp Out-board engine.	Measurement adapted from Trung (1967) and developed for the study.
6.	Fishing Income	Actual sales made per day minus expenses.

7. Measurement of the constraints:-

A scale was developed and standardized for measuring the constraints at the utilization level for this study. The items considered for the measurement of the constraint scale included those selected from the review of literature and consultation with Agricultural (Fisheries) extension staff of the National Institute of Oceanography and Marine Research, the States' Ministry of Agriculture and Natural Resources, and the Agricultural Development Project at the state level. One hundred and forty items of constraints were initially developed from literature, 81 items of constraint significance were retained after the pre-test stage at which ambiguous items were dropped. During data collection fishermen were asked to give information as regards the existence of the 81 constraints items. However, 59 items were finally selected for the scale and the constraint score for each fishermen was calculated using his responses on these 59 items.

5.12 Validity of the constraint scale

Validity of a scale is the ability of the scale to actually measure what it claims to measure.

Content Validity

This relates to how well the scale covers the information required in measuring the concept i.e. constraints in this study. The content of the scale was taken as being representative of the concept being measured having been collected through consultation with fisheries extension staff in NIOMR, Ministries, Agricultural Development projects, and review of literature.

Reliability of the constraint scale

Reliability of a scale is the ability of the scale to consistently produce the same results when applied to the same sample. In this study, the 'test-retest' method was used in determining the reliability of the constraint scale in the following manner.

The scale was administered to 60 respondents from 5 fishermen Cooperative Societies in Bendel State. The total score of each fisherman on the 39 selected items on the constraint scale were calculated on two administration of four weeks interval and compared. The reliability of the scale, represented by the extent of agreement of constraint scores of fishermen on two administrations of the scale to the fishermen after four weeks interval was determined by the Pearson R coefficient of 7.23 which indicated that the scale was quite reliable (see Appendix B_2 for the procedure used in determining the reliability tests).

5.13 Knowledge Scale

The level of knowledge of the fishermen as it pertained to recalling of the main instructions for the efficient operation of the technological package transferred was measured by the administration of a test in which fishermen were asked questions on the following:-

a) Type of fuel and lubricants.

b) Starting system

c) Engine operation.

d) Schedule of operation.

The items for this scale were selected from the instruction manual of the Yamaha 25 Horse power Outboard engine.

Validity of the scale

The content of the scale was taken as being representative of the theoretical universe of content of the technology; having been collected from the instruction manual of Y25Hp Outboard engine, and through consultation with officials of Almarine.

Reliability of the knowledge test

The test-retest method was used in determining the reliability of the knowledge test. The reliability of the knowledge test which represented the extent of agreement of knowledge scores on two administrations of the test to the same fishermen after four weeks interval was determined by the Pearson's R Coefficient of 0.84 which indicated that the knowledge test was highly reliable. (See Appendix B for the knowledge test items and Appendix (B_5) for the scores used in the determination of the reliability of the knowledge test.)

5.14 Attitude test

Likert type of summated ratings was employed in developing this scale. Scales of the Likert type present a number of positive and negative statements regarding an attitude object (Child, 1980). In responding to the items on this scale the respondents indicated whether they strongly agree, agree, were undecided, disagree or strongly disagree with each statement. In this scale, a value of 2 points was assigned to each response indicating strong agreement with favourable statements, a value of one for agreement with these statements, zero for indecision, minus one, for disagreement, and minus two for strong disagreement. For the negative statement, the scoring was reversed since disagreement with an unfavourable statement was assumed to be psychologically equivalent to agreement with a favourable statement. The attitude test items were developed by first pretesting selected items and then carrying out items analysis to reject those items that did not discriminate between fishermen who were users and non-users of the Yamaha 25 Horse power Outboard engine. The number of items finally selected was 24 out of 30.

Validity of attitude scale

Concurrent validity test was carried out to determine the validity of the attitude scale. The + - value from the test of comparison of the two groups of fishermen i.e users and non-users of the technology was found to be 3.89 significant at the 0.01 level. This meant that the scale was able to discriminate between fishermen using and those not using the technology.

Reliability of the attitude scale

The 'test-retest' method was used in determining the reliability of this scale. The reliability of the scale represented by the extent of agreement of attitude scores on two administrations of the scale to the same fishermen after four weeks interval was determined by the

Pearson's r Coefficient of 0.71, which indicated that the scale was quite reliable. (See Appendix B_3 for the attitude scale items and for the scores used in determining the validity and reliability of the scale B_4).

5.15 Yamaha 25 Horse power transfer process

Respondents were asked to indicate how many times they have been able to get their supply of the engine and spare parts from the Ministry/ADPs. The response to these questions were reported in number of times.

Secondly, respondents were asked to evaluate the transfer process based on difficulty level and to suggest ways of improving the system. A three-step ladder was developed where the 1st step represent no difficulty and the 3rd step represent much difficulty.

5.16 Extension agents

Fishermen were asked to rate their extension agents in terms of

a) Frequency of contact

b) Knowledge of Y25Hp Outboard engine problems

c) Extension method

d) Interest in increased output

e) Knowledge of gears.

5.17 Y25Hp Outboard engine

Respondents were asked to give reasons for their preference of made of engine, horse-power and alternative uses; and gears used along with the engine.

5.18 Second instrument (For extension agents)

An instrument was developed for the extension agents based on the following:-

1. Constraints: This scale was developed initially with 28 items, which was given to extension officers on the field for vetting. From the list, 12 items were finally selected.
2. Demographic data: Variables like age, educational level, marital status, and years of experience were included in this section.

5.19 Limitations to the study

The scope of this study was limited by both time and finance. The study could not cover the non-Yoruba speaking coastal states of Nigeria. Also, there were not many books and research studies on the topic within the country, which had limited almost all the literature reviewed to International journals and foreign research studies.

Lastly, the limitation of the Yamaha 25 horse power Outboard engine to the material transfer stage had made it extremely difficult to measure the extent of adoptability of the technology and how much of it had been assimilated within the system.

5.20 Statistical Analysis used in the study

Data collected for this study were analysed using the SPSS (Statistical Package for the Social Sciences) computer package of the Obafemi Awolowo University, Ile-Ife.

The analysis involved the use of the following statistical tools:

1. Frequency counts, model, median, mean, percentages, standard deviation and cross tabulations were all employed in the description of the data.
2. Chi-square was used to determine if significant associations exist among certain variables.
3. The t-test was used to test for the difference of means for some hypothesis.
4. Analysis of variance (one-way) was also used to determine if significant relationships exist among variables.
5. Multiple regression was employed to ascertain the predictability of selected independent variables on the dependent variables.

6. Discriminant analysis was used to assign constraint factors into the different groups and to determine the clustering and coefficient in the groups.

7. Path Analysis was used to establish relationship among constraint variables.

5.21 Problems encountered in data collection

Means of transportation to the fishing villages was a major problem in almost all the States visited for data collection. This became very serious during the rainy season when most of the roads were not motorable. In Ogun State for instance, the inland fishing villages were removed from the coastal fishing villages by some kilometres of unmotorable sandy road which was usually too hot for the foot during dry season. In Ondo State, transportation costs escalated during the rainy season while in Lagos State, it was also extremely costly to get to the fishing villages during the rains.

Secondly, some of the fishermen were not willing to allow the enumerators and researchers measure their catch since they thought they were from the Ministry, and the knowledge of their catch, sales and returns would make the Ministry/ADP increase their requirements of fish supply before engines could be made available to them.

CHAPTER SIX

ANALYSIS AND FINDINGS OF THE STUDY

This chapter is organized into six major sections, presented in the first sections are the findings in respect of demographic, personal and other characteristics of the fishermen. The second section presents the occupational characteristics of the respondents, while the third section highlights the results of the test of association between and within the three states, and the three fishing locations with regard to some selected characteristic of the fishermen. The fourth section presented the result of Multiple Regression analysis which showed the contributions of various selected independent variables in predicting the utilization, the knowledge of technology and fishing income of fishermen. Moreover, findings of the discriminant analysis which ascertained the weights of constraint factors to the transfer of technology at the utilization levels, and path analysis are given in section five. The results of the constraints at the extension, supply and multinational level are presented in section six.

Highlighted in the last section are the result of the costs and returns to the traditional and the mechanized fishermen fishing the coastal and the off-coastal locations in the three states.

SECTION ONE

Characteristics of fishermen

The section presents description statistics on:

a) Demographic

b) Personal characteristics of fishermen in the form of frequencies, relative frequencies, range, mode, mean and standard deviations of the distributions.

6.1 Demographic characteristics

Data were obtained on the following characteristics of the fishermen in Lagos, Ogun and Ondo States respectively:

a) Age

b) Gender

c) Marital status including number of wives

d) Religion

e) Tribe

f) Education

g) Literacy

h) Children

i) Dependants.

A) <u>Age</u>

1. <u>Lagos state</u>

The modal class of age categories was between 41-50 years which represented 37.5 percent of the respondents. About 39 percent of the respondents fall within 51-60 years of age category. None of the sampled fishermen were below 20 years of age while 15.8 percent were less than 41 years. About 9 percent of the respondents were between 61 and 70 years of age, while only 1.7 percent were above 71 years. The mean age of respondents in the state was 50-75 years. (See table 6.1).

2. <u>Ogun State</u>

The age of fishermen respondents ranged from 24 to 70 years while the mean age stood at about 49 years. Only about 4 percent of the respondents were below 31 years. The 51 to 60 years age category had the highest frequency of 32.5 percent. 20 percent of the respondents were above 50 years, out of which 0.8 percent fell within the 71 years and above age category. Like in Lagos State, none of the fishermen was below 21 years in Ogun State. (See table 6.1).

TABLE 6.1

Distribution of respondents according to certain demographic characterstics of fishermen in Lagos, Ogun and Ondo States

SERIAL NO.	CHARACTERISTICS	LAGOS STATE				OGUN STATE				ONDO STATE				TOTAL	
		Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%
1.	AGE (Years)														
	20 years and below									3	2.5			3	0.8
	21 years - 30 years	2	1.7			5	4.2			15	12.5			22	6.1
	31 years - 40 years	17	14.2			15	12.5			36	30.0			68	18.9
	41 years - 50 years	45	37.5			37	30.8			27	22.5			109	30.3
	51 years - 60 years	43	35.8			39	32.5			24	20.0			106	29.4
	61 years - 70 years	11	9.2			23	19.2			9	7.5			43	11.9
	71 years and above	2	1.7			1	0.8			6	5.0			9	2.5
	Total	120	100.0	50.75	9.18	120	100	48..6	10.8	120	100.0	45.8	12.92	360	100.0
2.	GENDER														
	Male	118	98.34			108	90			94	78.34			320	88.8
	Female	2	1.66			12	10			26	21.66			40	11.11
	Total	120	100.0			120	100			120	100			360	100.0
3.	MARITAL STATUS														
	Single									4	3.33			4	1.11
	Married	120	100.0			120	100			116	96.67			356	98.89
	Total	120	100.0			120	100			120	100			360	100.
4.	NUMBER OF WIVE(S)														
	1	30	25			2	1.85			39	43.3			71	22.5
	2	54	45.76			92	85.18			42	46.7			188	59.4
	3	30	25			10	9.26			2	2.22			42	13.29
	4	3	2.54			1	0.96			3	3.33			7	2.20
	5	1	0.85			2	1.85			2	2.22			5	1.58
	6		.	2	0.71	1	0.96	2	.09	2	2.22	2.0	1.01	5	1.58
5.	TRIBE														
	Yoruba	112	93.3			94	78.3			105	87.5			311	86.388
	Ijaw	3	2.5			25	20.8			15	12.5			45	12.5
	Urhobo	3	2.5			1	0.8							4	1.111
	Total	120	100			120	100			120	100			360	100.0

Source: Survey data, 1990.

3. Ondo State

Unlike in Lagos and Ogun states, about 3 percent of respondents from Ondo State were below 21 years. About 13 percent were above 50 years but below 61 years. The modal age category was 31 to 40 years which had 30 percent of the respondents. Next to the modal group was the 41 to 50 years category which had about 23 respondents. Altogether, about 68 percent of fishermen in the state were below 51 years. The mean age of respondents from the state was about 46 years, while the minimum age was 18 years. The oldest fisherman respondent was aged 75 years. (See table 6.1).

B. Gender

1. Lagos State

All the respondents in the state fishing the sea were males only 2 percent of respondents fishing inland waters were females.

2. Ogun State

Ten percent of respondents in the state were females. The other respondents were all males.

3. Ondo State

Female respondents were present in both the inland water fishing category (about 8.0 percent) and in the coastal fishing group (2.4 percent). All those fishing off-coast were males (Table 6.1).

C. Marital status including number of wives

(Only the male respondents were considered).

1. Lagos State

All the fishermen interviewed in the state were married including the female respondents. Thirty or 25 percent of the fishermen claimed to have only one wife and about 75 percent had more than one wife. The mean number of wives per fisherman in the state was 2.0 wives. The number of wives of fishermen interviewed ranged from 1 to 5 wives per fisherman.

2. Ogun State

Both the male and female respondents in this state were all married. However, out of the 108 fishermen, only 2 claimed to have one wife, while the rest have more than one. The mean number of wives per fisherman was 2 like in Lagos State. The range was between 1 and 6 wives per fisherman.

3. Ondo State

Out of the 94 male respondents 90 were married while 4 were single. The female respondents were all married. The number of wives per fisherman ranged from 1 to 6 with a mean of about 2 wive(s) per fisherman (Table 6.1).

D. Religion

1. Lagos State

About fifty six percent of the fishermen were Christians while about 43 percent were Muslims. Only one respondent (0.8 percent) claimed to be a traditionalist.

2. Ogun State

About 7 percent of respondents were traditionalists while about 46 percent were Christians. The Muslim group had about 48 percent.

3. Ondo State

All the respondents in this state were Christians except about 2 percent that claimed to be traditionalists. There were no Muslims among the fishermen.

E. Tribe

1. Lagos State

The non-Yoruba fishermen in the state were only about 7 percent. This consisted of the Ijaws (about 4 percent) and the Urhobos with about 3 percent.

2. Ogun State

Only one of the fishermen was an Urhobo man while 25 were Ijaws. The Yorubas were about 78 percent of the respondents.

3. Ondo State

The Yorubas constituted the majority in this state with a claim of about 88 percent. The remaining respondents were Ijaws (Table 6.1).

F. Education (Table 6.2)

1. Lagos State

About 67 percent of the total respondents in Lagos State have never been to school. Grouped into the various fishing locations, 36 respondents or 90 percent fish the inland waters, while 24 (60 percent) ventured into the coast and 20 or 50 percent stayed off-coast.

TABLE 6.2

Distribution of respondents according to their educational level in Lagos, Ogun and Ondo State

	LAGOS STATE						OGUN STATE						ONDO STATE							
	Inland		Coastal		Off-coastal		Inland		Coastal		Off-coastal		Inland		Coastal		Off-coastal		Total	
Characteristics	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
No formal education	36	90	24	60	20	50	38	95	32	80	30	75	22	55	18	45	13	32.5	233	64.7
Literacy Adult education	1	2.5	6	15	3	7.5			1	2.5	3	7.5	10	25	8	20	3	7.5	35	7.72
Some Primary education	2	5	3	7.5	4	10	2	5	4	10	1	2.5	4	10	2	5	2	5	24	6.67
Completed Pry School			6	15	3	7.5			3	7.5	2	5	4	10	6	15	3	7.5	27	7.5
Modern Sec. School			1	2.5	2	5									4	10	5	12.5	12	3.33
Some Sec. education					2	5					2	5			1	2.5	2	5	7	1.94
Completed Sec. School					5	12.5					2	5			1	2.5	8	20	16	4.44
Post Sec. education					1	2.5											4	10	5	1.39
No response	1	2.5																	1	0.20
Total	40	100	40	100	40	100	40	100	40	100	40	100	40	100	40	100	40	100	360	100

Source: Survey data, 1990.

About six percent of the total respondents have had literacy adult education consisting of 2.5 percent inland fishermen, 15 percent coastal and about 8 percent off-coastal fishermen.

Only 7.5 percent of the total respondents had some primary education and the same percentage completed primary school education. About 3 percent of the total respondents went through modern secondary school. While two percent of the respondents had some secondary education and only about 4 percent completed secondary school. Only the fishermen venturing into the sea were in this category. Approximately 1 percent of the respondents had post secondary education.

2. Ogun State

Ninety-five percent of the fishermen in the inland waters had no formal education. Also, 82 percent in the coastal areas and 75 percent in the off-coastal region have never been to school. These added together would make about 83 percent of the total respondents from the state. None of the fishermen in the inland water had any literacy adult education but about 5 percent of those fishing the sea had some. About 6 percent of the total respondents had some primary education and about 2 percent with some secondary education. There were no respondents in the category of those that completed the primary school in any of the locations. Five percent of the fishermen fishing off-coast had completed secondary education which constituted only about 2 percent of the entire fishermen respondents in the state. None of the respondents had post secondary education.

3. Ondo State

Fifty-five percent of fishermen in the inland waters, 45 coastal fishermen and about 33 percent in the off-coast area had no formal education. These added together would make about 44 percent of the entire respondents in the state. About 18 percent of the total fishermen consisting of 25 percent in land fishermen, 20 percent coastal and 7.5 percent off-coastal had literacy adult education. Only 10 percent of those fishing the inland waters and 5 percent of sea fishermen had some primary education. These constituted about 7 percent of the total respondents. The data also showed that 10 percent of inland fishermen, 15 percent of coastal fishermen and about 8 percent of off-coastal fishermen completed primary school education. Ten percent of coastal and 12.5 percent of off-coastal respondents had modern school education. None of the inland fishermen had modern school education. About 3 percent of the total fishermen in the state had some secondary education which consisted of coastal (about 3 percent) and off-coastal fishermen (5 percent). Also, none of the inland fishermen had secondary education. Only 4 fishermen (10 percent) of those fishing off-coast had post secondary qualifications in the form of diplomas.

G. Literacy (Table 6.3)

a) Yoruba

Three hundred and thirty-three or about 93 percent of the fishermen in the three states could speak the language and 40 percent were able to speak and read Yoruba. About 24 percent could speak, write and read while almost 8 percent could not speak, read or write the language.

b) English

Majority of the fishermen in the three state, (about 82 percent) could not speak, write or read English, only about 18 percent could speak, while about 14 percent speak, read and write the language.

TABLE 6.3

Distribution of respondents according to certain demographic characterstics variables in Lagos, Ogun and Ondo States

SERIAL NO.	CHARACTERISTICS	LAGOS STATE				OGUN STATE				ONDO STATE				TOTAL	
		Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%
6.	LITERACY														
a)	In Yoruba														
	1. Don't speak, write or read	5	4.166			12	10.00			10	8.33			27	7.5
	2. Speak	115	95.83			108	90.00			110	9.66			333	92.2
	3. Speak and read	40	33.33			20	16.66			84	70.00			144	40.0
	4. Speak, write & read	29	24.166			18	15.0			38	31.66			85	23.61
b)	English														
	1. Do not speak, write or read	104	86.67			110	91.67			82	68.33			296	82.22
	2. Speak	10	15.33			10	8.33			36	51.67			64	17.77
	3. Speak and read	15	12.50			4	3.35			34	28.33			53	14.72
	4. Speak, write and read	11	9.17			4	3.33			28	23.33			52	14.44
c)	Ijaw														
	1. Do not speak, write or read	115	93.85			96	79.17			105	87.5			215	87.5
	2. Speak	5	4.17			25	20.85			15	12.5			43	87.5
	3. Speak and read	4	5.33			20	16.67			12	10.0			50	12.50
	4. Speak, write and read	4	5.53			15	15.0			12	10.0			50	10.00
d)	Arabic														
	1. Do not speak, write or read	63	52.0			62	51.67			120	100			245	68.08
	2. Speak	57	47.50			56	46.55			-	-			115	51.94
	3. Speak and read	30	41.67			54	45.6			-	-			104	28.89
	4. Speak, write and read	30	41.67			52	43.53			-	-			194	28.81
e)	Urhobo														
	1. Do not speak, write or read	117	97.0			119	99.17			120	100			356	98.88
	2. Speak	3	2.5			1	0.82			0	-			4	1.11
	3. Speak and read	2	1.67			0	-			0	-			2	0.55
	4. Speak, write and read	2	1.67			0	-			0	-			2	0.55

Source: Survey data, 1990

c) Ijaw

A very high percentage of the fishermen in the three states could not speak, read or write the language.

d) Arabic

Only 29 percent of the respondents could speak, read and write the language in the states. These fishermen were from Lagos and Ogun States.

e) Urhobo

About one percent of the respondents speak, read and write Urhobo.

H) Children (Table 6.4)

1. Lagos State

Sixty nine or about 58 percent of the fishermen had between 1 and 5 children. Another 30 percent have between 6-10 children while 10 percent had well over 10 children. The mean number of children per respondent was 7.

2. Ondo State

About 10 percent of the fishermen refused to disclose any information about their children. Sixty percent of the respondents had between 1 and 5 children, while 20 percent

TABLE 6.4

Distribution of respondents according to the number of children and dependants in Lagos, Ogun and Ondo States

SERIAL NO.	CHARACTERISTICS	LAGOS STATE				OGUN STATE				ONDO STATE				TOTAL	
		Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%
A	NUMBER OF CHILDREN														
	None	3	2.5			6	5			12	10			21	5.8
	1 - 5	69	57.5			48	40			72	60			189	52.5
	6 - 10	36	30			42	35			24	20			102	28.3
	Over 10	12	10			24	20			12	10			48	13.33
	Total	120	100	7	2.3	120	100	9.0	3.1	120	100	6	2.8	360	100
B	NUMBER OF DEPENDANTS														
	10 and below	72	60			42	35			54	45			168	46.66
	Above 10	48	40			72	60			66	55			186	51.66
	No response					6	5							6	1.66
	Total	120	100	10	3.6	120	100	12	7.9	120	100	11	3.4	360	100

Source: Survey data, 1990

had between 1 and 5 children. Only 10 percent had more than 10 children. The mean number of children was 6.

3. Ogun State

Forty-eight fishermen or 40 percent of the respondent had between 1 and 5 children. About 30 percent had between 6 to 10 children while 20 percent had over 10 children. The mean number of children per fisherman in the state was about 9.

I) Dependants (Table 6.4)

1. Lagos State

The mean number of dependants per fisherman in the state was 10. About 60 percent of the respondents had below 10 dependants while the remaining 40 percent had well over 10 dependants. The range was between 4 and 41.

2. Ogun State

Thirty-five percent of the fishermen had below 10 dependants and 60 percent had over 10 dependants. The mean number of dependants was 12 with a standard deviation of 7.9.

3. Ondo State

Only 45 percent of the fishermen had below 10 dependants while 55 percent claimed to have over 10 dependants. The mean number of dependants was 11. The number of dependents ranged from 2 to 32.

6.2 Personal characteristics of the fishermen

a) Contact with extension worker

1. Lagos State

The distribution of fishermen according to their contact scores revealed that the minimum contact was 7 and the maximum score was 14. The mean contact score for the fishermen was 9 while the standard deviation was 2.

2. Ogun State

The contact score for the state ranged from 7 to 12. The mean contact score was 8 and the standard deviation was 3.

3. Ondo State

The mean contact score was 12 and the scores ranged from 10 to 14. The standard deviation was 1.

6.3 Information about Yamaha 25 horse power Outboard engine

a) Use of mass media (Lagos, Ogun and Ondo States)

Majority of the fishermen claimed not to have used the mass media to obtain information about the Yamaha 25 horse power Outboard engine. The mean of the use of mass media sources of technology information score was 4. The range of the scores was between 4 and 16.

b) Use of fishery extension officer

The fishermen's use of extension source score ranged from 6 to 16 with a mean score of 9 and a standard deviation of 2.7.

c) Use of cooperative societies

The mean score for this source was 13 with a standard deviation of 3.2.

d) Use of exhibition

Very few fishermen in the three states use the exhibition as a source of information. The mean score for this source was 6 and the standard deviation 2.

e) Use of friends, wives and relations

The score ranged from 7 to 16 with a mean score of 10.

f) Time of awareness about the use of Yamaha 25 Hp Outboard engine (Table 6.5)

1. Lagos State

Most of the fishermen agreed that they have heard of the engine for between 10 to 15 years. The mean number of years of awareness from the time of interview was twelve with a standard deviation of three.

TABLE 6.5

Distribution of respondents according to their fishing experience, total working time spent on fishing and occupational characterstics in Lagos, Ogun and Ondo States

SERIAL NO.	CHARACTERISTICS	LAGOS STATE				OGUN STATE				ONDO STATE				TOTAL	
		Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%	x	SD	Freq.	%
1.	ACTIVE FISHING YEARS														
	10 year and below	10	8.23			-	-			25	20.83			35	9.72
	11 years - 20 years	34	28.33			6	5			46	40.00			88	24.4
	21 years - 30 years	37	47.50			11	9.17			40	32.33			108	30.0
	31 years - 40 years	14	11.67			54	45			3	2.50			71	19.12
	41 years - 50 years	2	1.67			37	20.83			2	1.67			41	11.39
	Over 51 years	3	2.50			12	10			2	1.67			17	4.44
	No response	-	-			-	-			-	-			-	-
	Total	120	100	21	2.71	120	100	.26	4.02	120	100	19	6.13	360	100
2.	TOTAL WORKING TIME SPENT FISHING PER DAY														
	Less than 1/2	3	2.5			2	1.66							5	1.39
	1/4 to 1/2	8	6.7			7	5.83			8	6.66			23	6.4
	3/4 to all	109	90.83			111	92.5			112	93.33			323	92.2
	None														
	Total	120	100			120	100			120	100			360	100
3.	SEA DISTANCE (KM)														
	Less than 10 km	40	33.33			74	61.66			79	65.83			193	53.61
	10-20	30	25.0			38	31.66			32	26.66			100	27.77
	Above 20	49	40.83			8	6.67			8	6.67			65	18.055
	No response	1	0.833							1	0.833			2	0.555
	Total	120	100	23.1	8.1	120	100	10	4.84	120	100	11	2.98	360	100
4.	PRIMARY OCCUPATION														
	Fishing	119	99.167			111	92.5			120	100			350	97.22
	Others	1	0.833			7	5.83			-	-			8	2.22
	No response	-	-			2	1.67							2	0.55
	Total	120	100			120	100			120	100			360	100
5.	SECONDARY OCCUPATION														
	NAME	49	40.833			20	16.66			83	69.16			152	42.22
	Trading	67	55.833			41	34.16			20	16.66			120	35.55
	Fishing	1	0.833			5	4.16							6	1.67
	Boat building	1	0.833											1	0.27
	Carpentry	1	0.833			1	0.833							2	0.55
	Farming					48	40			16	13.33			64	17.78
	Tailoring					3	2.5							4	1.111
	Carving		0.833			2	1.67			1	0.833			2	0.55
	Transport business									1	0.833			1	0.27
	Total	120	100			120	100			120	100			360	100

Source: Survey data, 1990

2. Ogun State

Very few of the fishermen claimed that they have heard of the engine for less than 10 years while majority were over 15 years. The mean score was 13 years.

3. Ondo State

The mean number of years of awareness from the time of interview for fishermen in Ondo State was 10 years. The range was between 8 to 31 years.

g) Time first use the Y25 Hp Outboard engine

1. Lagos State

For the inland fishermen, majority claimed that they have never used the engine; while the coastal fishermen group had a mean score of 9 years with a standard deviation of 2. Majority of the fishermen in the off-coastal group claimed that they have been using the Y25Hp Outboard engine for over 15 years.

2. Ogun State

All the fishermen in the sea fishing location claimed to have used the Y25Hp Outboard engine for the first time for over 10 years. Few agreed to have used it for the first time over 15 years. The mean score for this group of fishermen was 12 years.

3. Ondo State

Majority of the fishermen in the coastal and the off-coastal zones in the state attested to have used the Y25Hp for the first time for over 15 years. The inland fishermen however claimed not have used it before.

6.4 Occupational characteristics of the fishermen

The following characteristics were considered:-

a) Primary occupation
b) Secondary occupation
c) Number of people employed in fishing
d) Crew members
e) Fishing trips
f) Active fishing years (Fishing experience)
g) Sea distance
h) Total working time spent fishing per day.

a) Primary occupation (Table 6.5)

1. Lagos State

Out of the 120 respondents, about 99 percent claimed fishing as their primary occupation. The remaining one fisherman engaged in trading.

2. Ogun State

About 93 percent fishermen had fishing as their main occupation while 5 others were in trading, the other two were farmers.

3. Ondo State

All the fishermen interviewed claimed fishing as their main occupation.

b) Secondary Occupation

1. Lagos State

About 41 percent of the fishermen had no other occupation apart from fishing, 67 (56 percent) were engaged in trading while only one had fishing as a secondary occupation. The other two fishermen were in boat building and carpentary.

2. Ogun State

Forty percent of the fishermen were in farming while another 41 respondents or about 34 percent were trading. Five people were in fishing, 3 in tailoring, and 2 in the carving business. Only one person was in carpentary and 20 people had no other occupation.

3. Ondo State

About 69 percent of the fishermen had no secondary occupation. Sixteen fishermen or about 13 percent were engaged in farming and 20 or 16 percent were in trading. Only one fisherman engaged in the transport business.

C) Number of people employed in fishing

1. Lagos State

Almost 50 percent of the people in the lagoon employ less than 5 people in their fishing business and about 100 percent were not employing more than 10 people in fishing. The mean number of people employed per fisherman was 3 and the standard deviation was one. About 70 percent coastal fishermen claimed to employ between 5 to 10 people while the remaining 30 percent employ more than 10 people. The mean number of people employed by this group was 8. Twenty percent of the off-coastal fishermen employed more than 10 people while 35 percent employed between 5 and 10 people. The other 45 percent employ less than 5 people. The mean number of people employed in fishing by this group was 6.

2. Ogun State

All the fishermen in the inland waters claimed to employ less than 5 people in fishing. The mean number of men employed by this group of fishermen was 2 with a standard deviation of 70. The majority of the coastal fishermen employ between 5 and 10 people with a mean number of 6. Those that fish off-coast had a mean of 5 with a standard deviation of 1.5.

3. Ondo State

The mean number of men employed by fishermen in the off-coastal was 9 with a standard deviation of 2. The coastal fishermen on the other hand had a mean number of 5 while the inland fishermen employed on the average 3 men.

D) Number of crew men

1. Lagos State

The average crew men per craft of the coastal fishermen was 11 while the off-coastal fishermen had a mean of 7.

2. <u>Ogun State</u>

The off-coastal fishermen had on the average, a crew membership of 9 and the coastal fishermen had a mean of 12.

3. <u>Ondo State</u>

The mean crew member of the coastal fishermen was 13 while the off-coastal fishermen had on the average 6 members.

E) <u>Fishing trips</u>

1. <u>Lagos State</u>

The average number of trips made by fishermen in the inland waters were 2 trips per day per craft per crew. The coastal fishermen made on their part one trip per day per craft per crew, while the off-coastal made the same one trip on the average.

2. <u>Ogun State</u>

The off-coastal fishermen made one trip per day per craft per crew on the average while the coastal had a mean of 2 trips per day per craft per crew. The inland fishermen had a mean of 3 trips per day per craft per crew.

3. Ondo State

Fishermen in the coastal area claimed that they were making one trip/day/craft/crew; while the off-coastal fishermen made on the average the same one trip. Those fishing the inland waters however agreed that they made two trips per day per craft per crew on the average like their counterparts in Ogun State.

F) Active fishing year (Fishing experience)

Lagos State

Most of the fishermen had relatively long years of fishing experience, in terms of the number of years they have been fully or partly engaged in fishing. About 92 percent have had well over 10 years of experience while only 8 percent had below 10 years of fishing experience. The mean years of experience was 21 years and the modal group was between 21 to 30 years of fishing experience.

Ogun State

About 41 percent of the fishermen have had well over 40 years of fishing experience. Approximately 14 percent had less than 21 years of fishing experience. The mean years of fishing experience was 36 years.

Ondo State

Only about 6 percent of the fishermen had over 30 years of fishing experience. Most of the fishermen had between 11 to 20 years of experience. Some fishermen in the state even had below 11 years of fishing experience. The mean years of fishing experience was 19 years.

F) Total working time spent on fishing activities per day

Almost 91 percent of the fishermen in the three states spend over half ($\frac{1}{2}$)of their total working time on fishing. Very few fishermen, only eight, spend less than half of their total working time on fishing. Seventy percent of the respondents spend almost all their total working time fishing.

G) Sea distance (Distance from the fishing village to the beach)

The mean sea distance from the fishing villages for Lagos State respondents was 23.1 kilometres, while that for Ogun State and Ondo State were 10 and 11 kilometers respectively.

6.5 Type and number of fishing craft and gears used by respondents (Table 6.6)

1. Craft

a) In all the three states, 352 respondents were using the wooden canoe. Only about 2 percent of the fishermen use the Ghana Banana type of canoe while none use the fibre glass canoe in the three states.

b) Length of craft

All the respondents fishing the inland waters had their crafts less than 7 meters while those in the coastal and off-coastal zones had their crafts up to 13 meters.

c) Number of crafts

Lagos State

Forty-five percent of the inland fishermen had only one canoe while 35 percent had more than one canoe. The mean number of canoes for this group was 2. The coastal fishermen on the other hand had a mean number of 2, also. Four fishermen in this group had less than two canoes. All the fishermen in the off-coastal group had more than two canoes. The mean for the off-coastal was 3.

Ogun State

The mean number of canoes for the inland fishermen was 2, while that of the coastal groups was also 2.

Ondo State

All the groups had a mean canoe number of 2.

TABLE 6.6

Distribution of respondents according to the number of fishing craft and gears owned by the fishermen in the three states

	LAGOS STATE						OGUN STATE						ONDO STATE							
	Inland		Coastal		Off-coastal		Inland		Coastal		Off-coastal		Inland		Coastal		Off-coastal		Total	
Characteristics	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
1. Length of craft																				
Less than 7ms	40	100	-	-	-	-	40	100	-	-	-	-	40	100	-	-	-	-	120	33.33
7 to 13ms	-	-	40	100	40	100	-	-	40	100	40	100	-	-	40	100	40	100	240	66.66
Total	40	100	40	100	40	100	40	100	40	100	40	100	40	100	40	100	40	100	360	100.0
No. of crafts																				
1	18	45	4	10	0	0	12	30	7	17.5	3	7.5	1	2.5	4	10	2	5	51	14.166
2	10	25	28	70	32	80	20	50	23	37.5	32	80	28	70	26	65	34	85	233	64.72
3	10	25	2	5	7	17.5	8	20	7	17.5	2	5	8	20	6	15	1	2.5	51	14.166
More than 3	2	5	6	15	1	2.5	-	-	3	7.5	3	7.5	3	7.5	4	10	3	7.5	25	6.944
Total	40	100	40	100	40	100	40	100	40	100	40	100	40	100	40	100	40	100	360	100
2. Type of Gears																				
Gill net	8	20	-	-	-	-	3	7.5	-	-	-	-	7	17.5	-	-	-	-	18	5
Drifting gillnet	10	25	-	-	-	-	5	12.5	-	-	-	-	1	2.5	-	-	-	-	16	4
Cost net	16	40	-	-	-	-	9	22.5	-	-	-	-	3	7.5	-	-	-	-	28	7
Clap net	2	5	-	-	-	-	3	7.5	-	-	-	-	5	12.5	-	-	-	-	10	2.7
Seine net	4	10	4	10	-	-	6	15	-	-	-	-	11	27.5	-	-	-	-	25	6.94
Lift net	2	5	3	7.5	-	-	12	30	-	-	-	-	15	37.5	-	-	-	-	32	8.8
Pot	10	25	-	-	-	-	14	35	-	-	-	-	10	25	-	-	-	-	34	9.4
Trammel net	3	7.5	-	-	-	-	32	5	-	-	-	-	3	7.5	-	-	-	-	8	2.2
Hooks and lines	7	17.5	2	5	3	7.5	10	25	3	7.5	1	2.5	2	5	-	-	2	5	30	8.3
Set net	-		40	100	40	100	-	-	40	100	40	100	-	-	40	100	40	100	240	66.66

* Will not add up to 100% because the respondents possess more than one type of gears

Source: Survey data, 1990

d) Age of Craft

Lagos State

The mean age of canoe was about 6 years while the modal age was 9.0 years. Only 18 respondents had canoes that were 1 year old. About 40 percent of the fishermen had canoes that were over 8 years old.

Ogun State

Majority of the fishermen had their canoes over 9 years ago. The mean age of canoe was 16 years.

Ondo State

About 30 percent of the fishermen had their canoes below seven years of age. Over 40 percent were above 8 years old while about 25 percent were above 10 years. The mean age of canoes was 11 years.

2. Gears

Inland water fishermen

Commonly used gears by the inland water fishermen in the three states were the following types: gill net, drifting gill net, cast nets, clap nets, seine net, lift nets, pots, trammel nets, hooks and lines.

Coastal and off-coastal fishermen

Majority of these fishermen use the set net while very few use the lift nets, seine nets and hooks and lines.

6.6 Yamaha 25 horse power Outboard engine

a) Number of Y25 Hp possessed by users

Lagos State

Most of the fishermen using Y25Hp had only one in the states (65 percent) while 30 percent had two and only 5 percent had more than two Y25Hp Outboard engine in the state.

Ogun State

About 80 percent of the users had only one engine while the remaining 20 percent claimed to have two.

Ondo State

Thirty percent of users in the state had more than one engine while the remaining 70 percent had only one engine.

b) Uses of Y25 Hp

All the users in the three state claimed to be using the Y25Hp for fishing only.

c) Preference for means of propulsion

Hundred percent or all the fishermen in the three states preferred the Y25Hp to the paddle. About 85 percent however prefer it to other models or types of outboard engine and horse power.

d) <u>Reasons for preference of Y25Hp over the paddle</u>

Among the reasons given by all the respondents for their preference of Y25Hp to the paddle were:

1. Y25Hp moves faster
2. Y25Hp is fitted outside the canoe and gives enough space
3. Less labourious
4. Enable them to fish off-coast
5. More fishing trips could be made per day.

e) <u>Reasons for preference of the Yamaha model to other models of Outboard engine</u>

The availability of spare parts and the durability of the Yamaha make of the outboards engine were among the reasons for preferring it to other makes by the fishermen.

f) <u>Reasons for preference of 25 horse power</u>

All the respondents using the Y25 horse power claimed that it was the most suitable for their type of fishing and not as costly as other high horse powers.

g) Age of Y25Hp possessed by respondents

Lagos State

The mean age of Y25Hp outboard engine possessed by respondents in the state was 4.5 years.

Ogun State

The average age for the state was 5.2 years.

Ondo State

The mean age was 3.1 years.

h) Mean age of Y25Hp before repair

The average age of the Y25Hp before it starts giving faults in the three states was 1.45 years.

6.7 Tests of association between demographic variables and the use of Y25Hp Outboard engine by fishermen in the three states (Table 6.7)

This was carried out with selected variables:- Age, Religion, Wives, Children education level, tribe, dependants for each of the states and for all the states pooled together.

a) Lagos State

1. Ages: A test of significant difference using the Chi-square was carried out between the ages of fishermen users and non-users of Y25Hp. The Chi-square value of 10.499 (df = 5) at 0.01 significant level indicated that there was no

significant difference between the ages of fishermen users and non-users of Y25Hp Outboard engine. The hypothesis stated in this regard was not rejected.

2) Wives: The Chi-square value of 3.988 (df = 3) at 0.01 significant level indicated that there was no significant difference between the number of wives of fishermen users and non-users of Y25Hp Outboard engine. the hypothesis stated in this regard was not rejected.

3) Children: There was no significant association between the number of children of fishermen users and non-users of Y25Hp Outboard engine. This was indicated by the Chi-square value of 10.093 with 4 (df) at 0.01 level of significance. The hypothesis stated in this regard was not rejected.

4. Dependants: Also, no significant difference was established between the number of dependents of fishermen users and the non-users of Y25Hp Outboard engine. Chi-square value of 2.897 with 2 (df) at 0.01 level of significance indicated this.

5. Religion: There was no significant difference between the religion of fishermen users and non-users of Y25Hp Outboard engine.

TABLE 6.7

Association between demographic variables and the use of Y25Hp Outboard engine

Serial No.	Age (years)	Users (%)	Non-Users (%)	Chi-square valu. X
Ogun State				
1.	21 - 30	1.3	0.0	
	31 - 40	6.3	2.5	
	41 - 50	10.0	12.5	
	51 - 60	13.5	22.5	
	61 - 70	20.0	6.3	
	71 years	0.0	1.3	
	Total	48.0	50.0	10.23 N.S, 2DF
2.	Wives			
	1	10.9	17.2	
	2	15.8	18.8	
	3	7.8	15.6	
	4	6.3	4.7	
	5	1.6	0.0	
	6	1.6	0.0	
	Total	43.8	56.3	3.941 N.S, 5DF
3.	Dependants	31.0	28.8	
		10.3	26.2	
		2.5	1.3	
	Total	43.8	56.3	7.707 NS, 2DF
4.	Religion			
	Muslim	40.0	37.5	
	Christian	3.8	12.3	
	Traditionalist	0.0	6.5	
	Total	50.0	50.0	3.536, N.S, 2DF
5.	Tribe	43.8	56.3	
	Yoruba	35.0	41.8	
	Ijaw	8.8	5.0	
	Urhobo	0.0	1.3	
	Total	43.8	56.3	5.77, N.S, 2DF
6.	Children			
	None			
	1 - 5	18.6	20.2	
	6 - 10	17.4	25.8	
	Over 10	7.8	10.8	4.08, N.S, 2DF
7.	Education			
	No formal education	24.3	28.2	
	Adult literacy class	2.4	8.8	
	Primary education	6.3	8.0	
	Secondary education	2.8	4.8	
	Post secondary education			3.53, N.S, 4DF
Lagos State				
1.	Age (years)			
	21 - 30			
	31 - 40	8.0	12.0	
	41 - 50	15.0	22.0	
	51 - 60	14.5	16.3	
	61 - 70	2.6	9.7	10.499, N.S, 5DF
2.	Wives			
	1	28.8	39.5	
	2	10.3	15.5	
	3	0.9	4	
	More than 3		1	3.988 (3DF) N.S
3.	Dependants	16	26	
	Less than 10	10.3	26.2	
	10 to 20	22	30	
	More than 20	3	4	2.897 (2DF) N.S
4.	Religion			
	Muslim	28	37	
	Christian	11	23	
	Traditionalist.	1		2.072 (2DF) N.S
5.	Tribe			
	Yoruba	28	56	
	Ijaw	1	2	
	Urhobo	1	2	3.116 (2DF) N.S.
6.	Children			
	None			
	1 - 5	11	24	
	6 - 10	21	35	
	Over 10	8	9	10.073 (4DF) N.S
7.	Education			
	No formal education	22	40	
	Adult literacy class	10	15	
	Primary education	6	5	
	Secondary education	2		
	Post secondary education			9.257 (4DF) N.S
Ondo State				
1.	Age (years)			
	Less than 20 years	8		
	21 - 30	22		
	31 - 40	10	3	
	41 - 50	2	10	
	51 - 60		21	
	61 - 70		20	
	70 and above		4	22.237 (4DF) S
2.	Wives			
	1	15	24	
	2	12	20	
	3	14	13	
	More than 3	1	1	3.058 (8DF) N.S
3.	Dependants	10	22	
	Less than 10	24	30	
	10 to 20	8	8	2.045 (2DF) N.S
4.	Religion			
	Muslim		2	
	Christian	42	56	
	Traditionalist	1		1.99 (2DF) N.S
5.	Tribe			
	Yoruba	40	56	
	Ijaw	2	1	
	Urhobo		1	3.578 (2DF) N.S.
6	Children			
	None			
	1 - 5	23	38	
	6 - 10	7	4	
	11 - 15	12	16	6.369 (4DF) N.S
7.	Education			
	No formal education		24	
	Adult literacy class		94	
	Primary education	10		
	Secondary education	22		
	Post secondary education	10		17.692 (4DF) N.S

Source: Survey data, 1990

6. Tribe: A Chi-square value of 3.116 with 2 (df) at 0.01 level of significance indicated that there was no difference between the tribe of fishermen users and non-users of Y25Hp Outboard engine in Lagos State.

7. Education: There was no significant association between education of the users of Y25Hp and non-users in this state.

b) Ogun State

No significant difference was established between the age, number of wives, number of children, number of dependants, religion, tribe, of fishermen users and the non-users of Y25Hp Outboard engine (Table 6.7).

c) Ondo State

There was a significant differences between age, educational level of fishermen users and the non-users of Y25Hp Outboard engine in this state. However, no significant difference existed between the number of wives, number of children, number of dependants, religion, tribe of fishermen users and the non-users of Y25Hp Outboard engine (Table 6.7).

6.76 Test of association between demographic variables and the use of Y25Hp Outboard engine by sea fishermen

a) Lagos State:

Age of fishermen, dependents, tribe, children, religion, wives, had no significant association with the use of Y25Hp Outboard engine by fishermen in the state. However the number of people employed in fishing had a significant association with the use of Y25Hp Outboard engine. Also, a significant association existed between the use of Y25Hp Outboard engine and the number of fishing trips made by fishermen per week. The number of canoe owned, active fishing years, and sea distance were not significantly associated with the use of Y25Hp Outboard engine at this fishing locations.

b) Ogun State:

No significant association was found between the age of fishermen, number of wives, children, dependants, tribe, religion, sea distance, active fishing years, number of canoe owned and the use of Y25Hp Outboard engine by the sea fishermen. However, there was a significant association between the number of trips made by fishermen per week, the number of people employed in fishing and the use of Y25Hp Outboard engine in the state.

c) Ondo State

A significant association existed between age, education and the use of Y25Hp Outboard engine by the sea fishermen in the state. Number of wives, number of children, dependants, tribe, had no relationship with the use of Y25Hp Outboard engine by the sea-fishermen. The number of people employed in fishing, number of fishing trips per week, were significantly associated with the use of Y25Hp Outboard engine by the sea fishermen. Sea distance, and the number of canoe owned by the sea-fishermen had no significant association with their use of Y25Hp Outboard engine.

6.8 Attitude of fishermen towards the Yamaha 25 horse power Outboard engine

Attitude affects behaviour, and represents a person's overall inclination towards an object (Child, 1977). The attitude of fishermen towards Yamaha 25 horse power Outboard engine were investigated in this study with the assumption that they could help explain in part, fishermens' actual usage of the technology. Twenty-nine (29) items were developed on the advantages and the disadvantages of the Y25Hp Outboard engine and administered to both the users and the non-users of the technology. The result of the test of association revealed the following:-

TABLE 6.8

Distribution of respondents according to their attitude towards Y25Hp Outboard engine across the three states

Items	Users Freq.	Users %	Non-Users Freq.	Non-Users %
Advantages				
1. Moves faster than paddle	190	100	169	100
2. Leaves more room for catches	171	89.53	169	100
3. Relatively cheaper to acquire	0	0	30	17.8
4. Longer life span	3	1.57	50	29.58
5. Easily available than paddle	0	0	0	0
6. More trips made per day	60	31.41	169	100
7. Open sea could be reached	32	16.75	169	100
8. Very light	60	31.41	169	100
9. Reduced crew size	10	5.24	169	100
10. Fishes of high economic value caught	23	12.04	160	94.67
11. Gears set faster	38	19.9	169	100
12. Catches brought home faster	69	36.13	169	100
13. Bigger sized canoes used	140	73.3	169	100
14. Increased actual fishing days/month	39	20.4	169	100
15. Reduced hours per trip	22	11.51	169	100
16. Possibility of craft sinking reduced	33	17.3	169	100
17. Little fishing time lost of repairs	49	25.65	169	100
Disadvantages				
18. Cost of repairs too much	180	94.24	107	63.3
19. Spare parts not easily available	141	73.8	162	95.85
20. Fake spare parts in market	131	63.6	137	81.065
21. Too costly to acquare	191	100	169	100
22. Cost of building canoe too much	165	86.39	93	55.03
23. High cost of fuel	132	69.11	152	89.94
24. Not suitable for the type of fishing in village	120	62.83	0	0
25. Breaks down too often	47	24.61	158	93.49
26. Life-span too short	100	32.36	141	83.43
27. Installation cost too much	0	0	0	0
28. Cost of employing experts too much	59	30.89	10	5.92
29. Family members trhown out of job	97	50.78	3	1.78

Source: Survey data, 1990.

From Table 6.8, it could be seen that the users of the Y25Hp Outboard engine had positive attitude towards the advantages while the non-users attitudinal scores were very low. However, the disadvantages were reacted to along the same range except that some of the non-users claimed that it was not suitable for the type of fishing in their locality.

A Chi-square test led to the rejection of the hypothesis that there is no significant difference between the attitudes of users and non-users towards the Y25Hp Outboard engines.

TABLE 6.9

Distribution of respondents according to their attitude towards Y25Hp Outboard engine

	Responses					
	SA	A	U	D	SD	Total
Users	140	9		20		169
Non-Users	70	20	5	85	11	191
Total	210	29	5	105	11	360

Df = 4, $P < 0.01$ Calculated X^2 = 14.012

Key:

SA = Strongly Agree

A = Agree

U = Uncertain

D = Disagree

SD = Strongly Disagree

Source: Survey data, 1990.

6.9 Determinants of the variation in the knowledge scores of fishermen and utilization of Y25Hp Outboard engine by fishermen in the coastal and off-coastal locations across the three states

In the analysis, an attempt was made to predict the dependent variables from a number of selected independent variables. Multiple regression may be viewed either as a descriptive tool by which the linear dependence of one variable on others is summarized and decomposed, or as an inferential tool by which the relationships in the population are evaluated from the examination of sample data (Nie et al., 1975). The Pearson r, was used in the correlation matrix table to indicate the strength of the independent variables on the dependent variables. In this analysis, the regression equation was defined as the path of the mean of the dependent variables Y for all combinations of $X_1, X_2, ..., X_k$. In other words, for every combination of fixed X's there will be a distribution of Y's. Each distribution would have a mean $\mu_y/X_1, X_2, ... X_k$ and a standard deviation $\sigma_y/X_1, X_2, ... X_k$, and it was assumed that these distributions were all normal and that the standard deviations were equal (homosce dasticy) (Blalock, 1988).

The findings from the first section was carried forward for stepwise regression analysis to ascertain the effect of the selected independent variables in predicting the knowledge of technology and utilization by fishermen as presented in table 6.10.

The multiple stepwise regression analysis was made to isolate a subset of available predictor variables that would yield an optimal prediction equation with as few terms as possible (Nie, et al., 1975). In the analysis, the variable that explains the highest amount of variation not explained by the variables already in the equation enters the equation at each step.

The regression equation for the predicted dependent variable Y, is given by,

$$Y = \alpha + B_1X_1 + B_2X_2 + \ldots\ldots + B_2X_k.$$

where α = Intercept

$B_1, B_2, B_3 \ldots\ldots B_k$ = regression coefficients

$X_1, X_2, X_3 \ldots\ldots X_k$ = the values of the independent variables.

In ascertaining the significance of the regression coefficients (B), the F values were calculated using the heirachical method (Nie et al., 1975) as follows:

F = Change in R^2 for the specific regression coefficient/ 1 - total R^2)/(N - K - 1).

Where (N - K - 1) degrees of freedom for F

K = total number of independent variables

N = number of fishermen considered

R^2 = Percentage variation explained.

The calculated F values were then compared with the tabulated F values with the degrees of freedom.

TABLE 6.10

Pearson Correlation Matrix showing relationships among independent variables

Variable Code	Name of Variable	V_1	V_2	V_3	V_4	V_5	V_6	V_7
1	Age	-						
2	Gross income from fishing	.41[b]						
3	Educational level	-.17	-					
4	Fishing experience	.57[b]	-.04	-.04	-			
5	Contact with Extension Agent	.33[b]	.29[b]	.50[b]	.42[b]	-		
6	Number of canoes	-.11	.61[b]	.12[a]	.022	0.06	-	
7	Type of gear	-.17	.49[b]	.25[b]	-.00	-.04	-.19	-
8	Fishing Place	.13[b]	.50[b]	.21[b]	-.11[a]	-.02	-.07	.12[a]

Note: a = $P < 0.05$
b = $P < 0.01$

Source: Survey data, 1990.

6.10 Determinants of the utilization of Y25Hp by sea fishermen in the three states

From the results obtained from the multiple regression analysis in table 6.11 the F-ratio of 4.2122, was significant at the 0.01 level, the multiple R was 0.43817 and the standard error of estimate was 0.898 while R^2 was 0.192.

It could be said, therefore, that the 8 independent variables included in the regression analysis jointly explained 19 percent of the variation in the Y25Hp Outboard engine utilization scores of sea fishermen. This was explained by age, gross income from fishing, educational level, fishing experience, contact with extension agents, number of canoes, type of gear and fishing place operating jointly. Thus, on the average, predicted Y25Hp Outboard engine utilization scores will deviate from the actual scores by 0.89 units on the Y25Hp Outboard engine utilization scale.

TABLE 6.11

Summary of regression analysis results of Y25Hp Outboard engine utilization scores with 8 dependent variables

N = 240, df = 1 and 231

Regression coefficient	Serial No.	Independent variables	Multiple R	R^2	Change in R	F-ratio
.618	1	Gross Income from fishing	1.012775	.133	.133	35.458^b
.9640	2	Fishing place	.618214	.134	.021	5.66^b
.27328	3	Educational level	.21982	.137	.003	0.8086 NS
.0236	4	Contact with vew	.0196	.140	.003	.8066 NS
.12708	5	Fishing experience	-.0296	.143	.003	NS
.0026	6	Age	.040449	.145	.002	NS
.0314	7	Number of canoes	.080449	.145	.001	NS
.00342	8	Type of gears	.020449	.146	.001	NS

Multiple R = 0.5131 R^2 = 0.192

Standard error = 0.89 Constant 3.175, b = P < 0.01, N.S. = P < 0.01

Source: Survey data, 1990.

As seen in table 6.10, out of the 8 independent variables, only two, V_2 and V_8, had significant B, i.e., only these two were important in predicting the utilization of Y25Hp Outboard engine of sea fishermen. The breakdown of their respective contribution was as follows:-

		% Importance
V2	- Gross Income from fishing	13.3
V8	- Fishing place	2.1
	Total	15.4

6.11 Determinants of the knowledge level of the Y25Hp Outboard engine by sea fishermen

The results of the multiple regression analysis in Table 6.12 showed that the F-ratio of 16.01802, was significant at the 0.01 level, the multiple R was 0.52847 and the standard error of estimate was 0.85238 while R^2 was 0.273.

This implied that the six independent variables included in the regression analysis jointly explained 27.3 percent of the variation in knowledge scores of sea fishermen. However, on the average predicted knowledge scores would deviate from the actual scores by 0.85 units on the knowledge scale.

TABLE 6.12

Summary of regression analysis results of Y25Hp Outboard engine knowledge scores with 8 dependent variables

Regression coefficient	Serial No.	Independent variables	Codes	Multiple R	R^2	Change in R	F-ratio
1	.697	Outboard utilization	V5	0.831	0.15132	0.15132	35.1906b
2	.3688	Educational level	V3	0.441	0.1002	0.04888	11.367b
3	.3712	Place of fishing	V1	0.5002	0.1401	0.0399	9.3b
4	.412	Fishing experience	V6	0.204	0.15508	0.01498	3.5b
5	.10594	Contact with VEW	V4	-0.5132	0.15610	.00102 (Neligible)	0.237 NS
6	.0211	Literacy level	V2	-0.0127	0.15679	.00079 (Negligible)	0.1837 NS

Multiple R = .52847 $R^2 = 0.273$

Standard error = 0.85238 Constant 6.721, b = $P < 0.01$, N.S. = $P < 0.01$

Source: Survey data, 1990.

As could be seen Table 6.12 of the 6 independent variables, only four (4), V_5, 3_5, V_1, V_0, had significant B, i.e., only these 4 were important in predicting the knowledge of sea fishermen about Y25Hp Outboard engine. The breakdown of their respective contribution was as follows:-

	% Contribution
Outboard utilization	15.132
Educational level	4.8
Place of fishing	3.9
Fishing experience	1.49
	25.282

6.12 Determinants of the fishing income of the inland and sea fishermen across the three states

a) Traditional fishermen

The result of the multiple regression analysis presented in Table 6.13 showed that the F-ratio of 12.6 was significant at the 0.01 level the multiple R was 0.54 while the standard error of estimate was 0.84, and the R^2 was .30.

This however indicated that the three independent variables included in the regression analysis jointly explained 30 percent of the variation in the fishing income scores of the inland fishermen. The average predicated fishing income scores would deviate from the actual scores by 0.84 on the fishing income scale.

b) Sea-fishermen

For this group of fishermen, the eight independent variables considered jointly explained 45.97 percent of the variation in the fishing income scores of the sea fishermen (R^2 = .4597). The result also showed that the F-ratio of 24.57 was significant at the 0.01 level. The standard error of estimate was .735 while the multiple R was .678. Thus the average fishing income scores of the sea fishermen predicted would deviate from the actual scores by 0.735 on the fishing income scale.

TABLE 6.13

Analysis of multiple regression of traditional fishermens' fishing income scores with 3 independent variables

Variable	Regression coefficient	R	Beta	R^2	R^2 change	F-values
Fishing gear	1.32	.5100	.039	.25	.25	33.44[a]
Labour	0.089	.534	.178	.285	.035	4.012[a]
Fishing place	0.20	.5352	.056	.2864	.0014	.30N.S

Constant = 8.198, Overall F-ratio = 12.6a, Multiple R = .54

a = .05, Std. error = 0.84, R2 = .30.

Source: Survey data, 1990.

TABLE 6.14

Analysis of multiple regression of the fishing income of sea fishermen scores with eight independent variables

Variable	Regression coefficient	R^2	Change in R^2	F-ratio	Remark
Gear	0.472	0.291	.291	62.477[a]	S
25Hp	0.420	0.320	.110	23.616[a]	S
Fishing place	0.237	0.342	.022	4.7233[a]	S
Labour	0.301	0.352	.010	3.2204[a]	S
Fuel	0.206	0.367	.015	2.5763[a]	S
Fishing time	0.069	0.379	.012	2.1469824[a]	S
Canoe number	0.007	0.389	.010	2.1469324[a]	S
Fishing distance	0.019	0.396	.007	1.5028877	N.S

b = $P < 0.01$

a = $P < 0.05$, R^2 = .4597, Overall F-ratio = 24.57b, Std error = .735

Multiple R = .678.

Source: Survey data, 1990.

6.13a Discriminant analysis of constraints at utilization level

The results presented in this section were concerned with the constraints associated with the transfer of Yamaha 25 Horse power Outboard engine at the utilization level. The first part presented the means of constraint variables under each constraint factor for the different coastal states. The test of difference of means across locations was carried out using a one-way ANOVA.

Following this, is the result of Discriminant analysis of the constraint factors on users and non-users of the Y25 Horse power Outboard engine. The mathematical objective of discriminant analysis is to weigh and linearly combine the discriminating variables in some fashion so that groups are forced to be as statistically distinct as possible (Nie, 1975). It attempts to do this by forming one or more linear combinations of the discriminating variables. The form could be:-

$Di = di_1Z_1 + di_2Z_2 + ... + di_pZ_p$. Where Di is the score on discriminant function i, the d's are weighting coefficients, and the Z's are the standardized values of the p discriminating variables used in the analysis.

a) <u>The mean score of constraint variables and rankings for the three states</u> (Table 6.15)

<u>Lagos State</u>:

The mean score for economic constraint in Lagos State was 3.57 while that of institutional constraint was 3.25, Socio-cultural constraint had a mean score of 2.096, and the Y25Hp Outboard engine constraint had a mean score of 3.546. Personal constraint had a mean score of 2.18, geographical/infrastructural constraint was 3.31, value/ specie/gear constraint had 1.84 mean score and supply constraint had a mean score of 4.04.

<u>Ogun State</u>

Economic constraint's mean score was, 4.49, institutional constraint had 3.95, socio-cultural constraint also had 2.69. Outboard engine constraint had a mean score of 3.87, personal constraint also had 3.01 and geographical/infrastructural constraint's means score has 3.57. While value/specie/gear constraint had 2.75, supply constraints had a mean score of 3.98.

TABLE 6.15

Mean distribution of constraint variables across the three states

Serial No.		LAGOS X_1	LAGOS X_2	LAGOS X_3	OGUN X_1	OGUN X_2	OGUN X_3	ONDO X_1	ONDO X_2	ONDO X_3
1	Economic	4.2	4.92	5.0	3.3	5.0	5.0	4.2	5.0	5.0
2		4.3	3.6	3.0	4.9	3.5	2.68	5.0	5.0	4.9
3		3.3	2.6	2.9	3.0	4.1	1.34	3.6	3.71	2.99
4		3.5	3.2	3.8	1.0	3.9	5.0	1.87	3.0	2.61
5		2.0	2.6	2.97	3.5	5.0	5.0	3.88	4.6	3.11
6		3.0	2.0	3.0	1.0	3.6	3.67	3.1	2.79	3.67
7		2.6	2.0	2.0	4.0	1.87	2.3	2.79	3.5	4.0
8		3.0	3.0	1.0	1.99	3.20	2.5	2.0	3.5	3.1
9		3.7	4.2	4.5	2.5	5.0	5.0	3.5	4.6	5.0
10	Institutional	2.0	5.0	5.0	5.0	4.89	5.0	4.9	5.0	5.0
11		4.6	3.5	4.3	5.0	4.0	4.5	4.7	4.0	4.0
12		2.6	3.5	2.4	2.78	4.0	4.0	4.0	4.1	4.5
13		2.3	4.1	2.1	2.5	4.0	4.0	4.7	4.8	4.0
14		2.5	3.0	3.0	1.97	1.34	4.5	2.37	1.02	4.2
15		3.2	3.1	3.0	1.0	2.0	4.5	1.0	1.1	4.0
16	Socio-cultural	3.6	2.0	1.0	3.0	3.0	1.0	2.67	2.62	2.0
17		3.0	1.20	1.0	3.12	2.3	1.0	2.92	3.1	1.0
18		3.0	1.91	1.0	3.97	2.4	1.0	2.81	1.21	1.31
19		3.0	1.88	1.0	3.79	2.0	1.0	1.0	1.0	1.0
20		2.0	4.1	1.0	3.0	1.89	1.0	1.0	1.23	1.21
21	Y25Hp	1.0	4.3	4.3	2.78	3.0	4.4	1.0	3.4	4.5
22		3.0	3.5	4.0	3.0	2.1	4.0	2.2	3.1	4.4
23		4.0	3.2	4.5	4.5	3.0	3.31	3.30	4.95	4.3
24		3.0	3.0	4.3	4.20	3.1	4.1	3.20	4.7	4.2
25		4.0	2.2	4.0	4.5	2.85	3.95	3.3	3.9	3.0
26	Personal	4.3	3.7	1.45	4.8	3.6	1.3	4.2	2.8	1.0
27		2.5	3.0	1.32	3.4	3.2	1.67	3.1	3.0	1.3
28		2.0	1.50	1.3	3.0	2.0	1.0	2.99	4.0	1.0
29		2.0	3.4	1.4	2.7	2.28	1.2	3.0	1.0	1.41
30	Geog./Infrast.	2.97	3.1	1.0	3.0	3.78	3.1	3.0	3.0	4.0
31		3.50	3.2	2.5	4.5	3.34	1.0	3.2	4.0	1.62
32		3.90	1.0	3.1	4.0	3.3	2.64	4.5	3.0	1.99
33	Value/Specie/Gear	4.5	2.1	1.0	4.0	1.0	1.0	3.50	1.0	1.0
34		3.0	1.0	1.0	1.0	1.0	1.0	3.6	1.72	1.0
35		3.0	4.5	1.0	3.24	1.0	1.0	22.0	1.0	1.0
36	Supply	1.0	4.2	4.3	2.2	4.2	4.5	4.3	4.6	4.7
37		1.5	3.1	4.2	1.6	4.1	4.12	4.5	4.5	4.0
38		2.0	2.2	4.0	2.1	4.5	4.3	2.0	4.2	4.4
39		4.0	4.5	4.0	3.3	4.0	4.1	4.5	4.5	4.8

Note: X_1 = Inland, X_2 = Coastal, X_3, = Off-coastal.

Source: Survey data, 1990.

Ondo State

As noted in the other two states, economic constraint had a high mean score of 4.5, institutional constraint, 3.5, socio-cultural constraint had 3.0 and personal constraint had 2.89. Geographical/infrastructural constraint had a mean score of 2.85, value/specie/gear constraint had 2.65 and supply constraint had a mean score of 4.65.

b) The result of the ANOVA for the analysis of constraint data establishing the relationships across the different fishing locations is presented (Tables 6.16a, 6.16b and 6.16c).

1. Lagos State

There was no significant difference in the means for economic and Y25Hp Outboard engine constraints across the three fishing locations while the other constraints were significantly different.

TABLE 6.16b

Summary of ANOVA results between some constraint factors, and fishermen's fishing locations in Ogun State

State		Interaction	Source of Variation	Sums of Squares	DF	Mean Square	F-Values	Remarks
OGUN	a)	Economic constraint	Between group	5.267	2	2.634	4.062	
		and fishing locations	Within groups	75.854	117	0.648		
			Total	81.122	119			
	b)	Institutional constraint	Between groups	16.535	2	8.267	8.939	S
		and fishing locations	Within groups	108.210	117	0.925		
			Total	124.744	119			
	c)	Socio-cultural constraints	Between groups	34.294	2	17.147	29.066	S
		and fishing locations	Within groups	69.022	117	0.590		
			Total	103.316	119			
	d)	Y25Hp O.E.* constraint	Between groups	28.500	2	14.383	22.288	S
		and fishing locations	Within groups	75.500	117	0.645		
			Total	104.266	119			
	e)	Personal constraint	Between groups	23.971	2	11.986	16.712	S
		and fishing locations	Within groups	88.812	117	0.717		
			Total	107.883	119			
	f)	Geog./Infrast. constraint	Between groups	44.447	2	22.223	20.972	S
		and fishing locations	Within groups	123.982	117	1.060		
			Total	168.428	119			
	g)	Value/Specie/ Gear Constraint	Between groups	23.578	2	11.789	17.946	S
		and fishing locations	Within groups	76.857	117	0.657		
			Total	100.435	119			
	h)	Supply constraint	Between groups	57.817	2	28.908	25.906	S
		and fishing locations	Within groups	130.561	117	1.116		
			Total	188.378	119			

*O.E. - Outboard engine

Source: Survey data, 1990

TABLE 6.16c

Summary of ANOVA results between some constraint factors, and fishermen's fishing locations in Ondo State

State		Interaction	Source of Variation	Sums of Squares	DF	Mean Square	F-Values	Remarks
OGUN	a)	Economic constraint	Between group	5.168	2	2.584	2.893	N.S
		and fishing locations	Within groups	104.524	117	0.893		
			Total	109.693	119			
	b)	Institutional constraint	Between groups	4.055	2	2.028	1.513	N.S
		and fishing locations	Within groups	156.815	117	1.340		
			Total	160.870	119			
	c)	Socio-cultural constraints	Between groups	19.695	2	9.847	8.703	S
		and fishing locations	Within groups	132.378	117	1.131		
			Total	152.073	119			
	d)	Y25Hp O.E. constraint	Between groups	6.100	2	3.050	3.931	S
		and fishing locations	Within groups	90.787	117	0.776		
			Total	95.887	119			
	e)	Personal constraint	Between groups	49.731	2	24.865	37.311	S
		and fishing locations	Within groups	77.974	117	0.666		
			Total	127.705	119			
	f)	Geog./Infrast. constraint	Between groups	16.997	2	8.499	26.993	S
		and fishing locations	Within groups	36.836	117	6.315		
			Total	53.834	119			
	g)	Value/Specie/ Gear Constraint	Between groups	39.419	2	18.209	35.745	S
		and fishing locations	Within groups	59.602	117	0.509		
			Total	96.021	119			
	h)	Supply constraint	Between groups	69.685	2	34.843	26.379	S
		and fishing locations	Within groups	154.540	117	1.321		
			Total	224.225	119			

Note: S = Significant at 95% level of confidence.
NS = Not significant

Source: Survey data, 1990

2. Ogun State

All the constraint factors were significantly different across the fishing locations.

3. Ondo State

Both economic and institutional constraints were not significantly different across the fishing locations in the state, while the other constraint factors were significantly different.

Table 5.16 shows the two possible sources of constraint to the transfer of Y25Hp Outboard engine at the utilization level i.e. users and the non-users of the Y25Hp Outboard engine. In addition, 10 constraints variables were also identified. However, in order to allow for proper diagnosis, these constraints were subjected to discriminant coefficient clustering method or mapping of groups into the discriminant space. The result was as presented in Tables 6.17 and 6.18.

Category 1:

Economic constraint (.91) with such variables like high cost of Y25Hp Outboard engine, lack of money, high cost of fuel, maintenance and spare parts are very important variables ranked first by the fishermen. Second, as important constraint variable was

TABLE 6.17

Results of the standardized Discriminant function coefficient for two possible constraint sources categories and ten identified constraint variables

Serial No.	Constraint variable	Possible sources of constraints: Category I Users	Category Non-Users
1.	Economic constraint	+.91	+.93
2.	Institutional constraint	+.90	+.87
3.	Socio-cultural constraint	-.41	+.57
4.	Y25Hp Outboard engine constraint	+.60	-.16
5.	Personal constraint	-.22	+.50
6.	Geographical constraint	+.30	+.55
7.	Specie/Value constraint	-.24	+.53
8.	Supply constraint	+.86	+.55
9.	Infrastructural constraint	+.74	+.46
10.	Gear constraint	-.35	+.69

Source: Survey data, 1990.

TABLE 6.18

Discriminant coefficient clustering variables on categories

Category 1: Variables related to Users

N-1	Economic constraint	.91
N-2	Institutional constraint	.90
N-4	Y25Hp Outboard engine constraint	.60
N-8	Supply constraint	.86
N-9	Infrastructural constraint	.74
N-6	Geographical constraint	.30

Source: Survey data, 1990

TABLE 6.19

Discriminant coefficient clustering variables on categories

Category 2: Variables related to Non-Users

N-1	Economic constraint	.93
N-2	Institutional constraint	.87
N-6	Geographical constraint	.55
N-5	Personal constraint	.50
N-7	Specie/Value constraint	.53
N-10	Gear constraint	.69
N-8	Supply constraint	.55
N-3	Socio-cultural constraint	.57

Source: Survey data, 1990

institutional constriant (.90) with the high interest rates charged by credit houses, inadequate credit facilities, as important variables. Supply constraint (.86) also made significant contribution to the problem or constraint facing the users of the technology. Following this was the infrastructural constraint (.74) and the Y25Hp Outboard engine constraint (.60) which also had negative effects on the users of the Yamaha 25 horse power Outboard engine.

Category 2: Economic constraint (.93) ranked very high among the variable that positively contributed to the non-utilization of the Y25Hp Outboard engine by the non-users. Second to this was the institutional constraint (.87) with such variables as noticed in category 1. Also, gear constraint (specificity), (.69), coupled with socio-cultural constraint (.57) and supply constraints (.55) were other important constraint limiting the use of the technology by the non-users. Geographical constraint (.55) such as (distance, transportation and specie/value constraints (.53) had negative net effect on the use of the Y25Hp Outboard engine by the non-users.

6.13b Path analysis of the relationship between the selected constraint variables and the utilization of Y25Hp by fishermen

Path analysis was employed in this analysis in order to establish casual relations. It is primarily a statistical method of decomposing and interpreting linear relationships among a set of variables by assuming that:

1) a (weak) casual order among these variables is known and
2) the relationships among these variables are casually closed (Nie, et al., 1975).

However, for the multiple regression analysis, five constraint factors that had positive coefficients in the discriminant analysis (Table 6.17) were selected. The results were as shown on Table 6.20.

All the selected constraint variables accounted for about 61 percent of the total variation in the fishing income of fishermen. However, the average predicted Y25Hp utilization scores could deviate from the actual scores by 0.62 on the Y25Hp utilization scale. The F-ratio of 34.61 was significant at the 0.01 level.

TABLE 6.20

Correlation of constraint variables

Constraints	V_1	V_2	V_3	V_4	V_5
V_1 (Economics)	1.000				
V_2 (Institutional)	0.404612				
V_3 (Supply)	-.1563	-0.2019			
V_4 (Infrastructural)	0.33306	.17104	.02275		
V_5 (Y25Hp technical)	0.2417	.31775	-.17415	.2314	

Source: Survey data, 1990

TABLE 6.21

Regression of utilization of Y25Hp on constraint factors

Independent Variables	Partial	Beta	B	R^2 Change	F
V_1	.6887	.65000	.214	.4018	34.6117
V_2	.3789	.52680	.139	.1609	15.096
V_4	.1778	.4000	.012	.0408	4.231
V_3	.0547	.3000	.002	.0100	1.091 NS
V_5	.0072	.2000	.0013	.0019	1.002 NS

Multiple R = .7830
R^2 = .6132 (.6132)
Standard error = .62202

Source: Survey data, 1990

Out of the three constraint factors that contributed significantly to the Y25Hp utilization, two were selected for the path analysis. In this Path analysis model it was assumed that the use of Y25Hp by fishermen would be affected by the two constraints variables.

To obtain path coefficients for the model, two multiple regressions were solved:

i) economic constraint as dependent variable (X_2) in Fig. 7, and institutional constraint as independent variable (X_3) in Fig. 7, and

ii) utilization of Y25Hp, as dependent variable (X_1) in fig. 7, and V_1 and V_2 as independent variables .

The total original bivariate correlation between pairs of variables, simple r, was decomposed into "Causal direct," "Causal indirect," and "non-causal" or "spurious" relationships as shown

u

X_2

X_1

X_3

A straight arrow represents the researcher's hypothesis of a causal effect: the arrowhead points toward the influenced variable.

The arrow from X_1 to X_2, for example, represents the verbal statement "X_2 is a cause of X_1," or "a change in X_2 produces a change in X_1." The double-headed, curved arrow represents a correlation, in this case between the exogenous variables X_2 and X_3, to which no causal interpretation is attached. That is, X_2 and X_3 are allowed to be associated for unknown reasons. The three variables, X_1, X_2, and X_3, are explicit variables which have names - such as income, economic, institutional, utilization, educational attainment etc. A fourth variable, u, in the model does not have an explicit name, it is called the "disturbance" or the "residual," or "error." It represents all other sources of variation in X, not jointly explained by X_2 and X_3. Such sources may include explicit variables not included in the model, deviations from linearity, random errors and the like. The expected value of the residual is zero, and the expected covariations of the residual with the independent (exogenous) variables, X_2 and X_3, are zero.

Path coefficients:

Path coefficients or quantitative estimates could be denoted by the symbol, Pij, where i represents the variable thought to be caused by j, that is, i is the dependent variable. Returning to the model, the sample correlation coefficients are σ_{12}, σ_{13}, and σ_{23}, and assume σ_{2u} = σ_{3u} = 0, and want to obtain estimates of P12 and P13.

Translating the picture or model into its corresponding equation thus:

$X1 = P_{i2}X_2 + P_{i3}X_3 + P_{iu}u + a.$

Decomposition of Bivariate Covariation

	Bivariate relation of concern	Econ, Inst X_2, X_3	Util. Inst. X_1, X_3	Util. Econ X_1, X_2
A)	Original covariation			
	= rij	.4300	.61284	.6500
	b_1 : Causal direct	.430	.360	.5880
	b_2 : Causal indirect	0	.25284	.0
B)	Total causal			
	= $(b_1) + (b_2)$			
	= Cij	.403	.61284	.5880
C)	Non-causal = (A) = B =			
	rij = cij	0	0	.062
	(Spurious relationship)			

The calculation of causal coefficients were as follows:

$C_{23} = P_{23} = .430$

$C_{13} = (P_{23})(P_{12}) + (P_{13})(.5880) + .360 = .61284$

$C_{12} = P_{12} = .5880$

Where C = causal coefficient, and

P = Path coefficients represented by the standardised regression coefficients (B values).

The pattern of data presented indicated that the relationship between economic constraint X_2 and institutional constraints, X_3, was taken as causal or genuine. Also, all the relationship between institutional constraint, X_3, and utilization of Y25Hp, X_1, was taken as causal, but this relationship was decomposed into that which was indicated by economic constraint and that which was not. For this relationship, path analysis helped to determine how much of the causal relationship between institutional constraint and utilization of Y25Hp was "interpreted" by the intervening variable economic constraint, (which was about 41 percent i.e., .25284 out of .61284 in this case.)

The relationship between economic constraint and utilization of Y25Hp was decomposed into causal and spurious components. Path analysis thus provide a partial test of the bivariate relationship between economic constraint and utilization of Y25Hp. It was found that given the assumptions, only about nine percent of the original association (.026) was spurious.

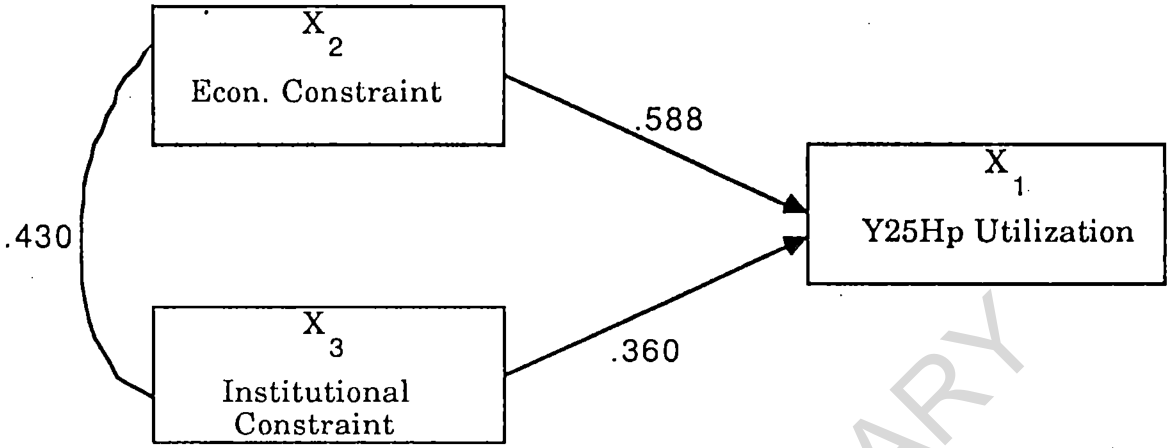


Fig. 13: Path Model of Y25Hp Utilization with Constraint Variables

6.14 Constraints to the transfer of Y25Hp Outboard engine at the extension level

For the purpose of this study, the extension agents (fisheries) at the field level were classified into three groups based on the coastal state for which they work. The means of the constraints were ranked for the respondents in each of the coastal states. In all there were 33 fisheries extension agents interviewed in Lagos State, 12 in Ondo State and 9 in Ogun State. The extension agents were asked to rate the constraining variables on a five-point scale and the means were calculated. Any constraint variable having a mean of 3 and above was taken as important and any variable with a mean below 3 was unimportant.

Lagos State

The high population of fishermen as compared to the few number of fisheries extension agents in the state was ranked number one constraint by the extension agents. Other constraints include the inadequate supply system, lack of funds, insufficient transportation to fishing villages, improper organizational communication flow, lack of facilities in fishing villages, inadequate training in Y25Hp technology and lack of contact with the manufacturers.

TABLE 6.22

Mean score of constraint variables associated with the transfer of Y25Hp at the extension level

Serial No.	Constraint Variables	Lagos State x	Lagos State Ranks	Ogun State x	Ogun State Ranks	Ondo State x	Ondo State Ranks
1	Inadequate training in Y25Hp technoloty	3.12	6	2.97	9	3.2	6
2	Lack of facilites in fishing villages	3.83	5	3.07	7	3.45	4
3	Improper organizational communication flow	3.02	7	3.2	6	2.95	8
4	Insufficient transportation to fishing villages	3.99	4	4.5	1	4.0	2
5	Lack of funds	4.0	3	4.4	2	4.25	1
6	Fisherman population too high for the number of extension agents	4.5	1	4.3	3	3.62	3
7	Use of improper methods of information dissemination	2.1	9	3.0	8	2.85	9
8	No contact wth Y25Hp manufacturers	3.0	8	3.3	5	3.12	7
9	Supply system inadequate	4.02	2	3.5	4	3.32	5
10	The fishermen lack of interest	1.6	10	2.0	10	1.24	11
11	Socio-cultural condition of fishing villages against the transfer	1.0	11	1.79	11	1.44	10

Source: Survey data, 1990.

Ogun State

The extension agents in this state ranked insufficient transportation to the fishing villages as number one constraint inhibiting the transfer of Y25Hp Outboard engine. This was followed by lack of funds, insufficient number of extension agents, inadequacy in the supply system, no contact with Y25Hp Outboard engine manufacturers, improper organizational communication flow, lack of facilities in the fishing village and the use of improper information dissemination methods.

Ondo State

The important constraints limiting the transfer at the extension level include the following:-

1. Lack of funds
2. Insufficient transportation of fishing villages
3. High fishing population
4. Lack of facilities in the fishing village
5. Inadequate supply system
6. Inadequate training in Y25Hp
7. No contact with Y25Hp manufacturers.

6.15 Constraint at the supply level to the transfer of Y25Hp Outboard engine

At the supply levels across the three states, eleven officials were interviewed as to the likely constraints limiting the transfer of the Y25Hp Outboard engine in their different states. The constraints identified were as shown on Table 6.22 in their order of importance.

The rankings of the supply officers were nearly similar in the three states. The policy of the Federal and State Government was rated as a major constraint to the supply of Y25Hp Outboard engine in the three states. The high import duties and the high cost of Y25Hp were other important constraints identified.

6.16 Constraints at the multinational company level to the transfer of Y25Hp Outboard engine

The major constraints at this level had to do with the following:

1. Lack of local control
2. Restrictive transfer practices
3. Price
4. Government control
5. The restrictive clauses incorporated into the contract agreement.
6. Administrative and services clauses
7. Payment clauses.

TABLE 6.23

Constraints variable at the supply level across the three states

Variable	Lagos (Ranks)	Ogun (Ranks)	Ondo (Ranks)
Administrative bottle neck	5	6	5
Government policy	1	1	1
High import duties	3	2	2
High cost of Y25Hp	2	3	3
Fisherman's low income	4	4	4
Fisherman's lack of credit facilities	6	5	7
Irregularity of supply	7	7	6

Source: Survey data, 1990.

6.17 Productivity, Cost and Earnings:

This section analyses the costs of and returns to fishing operations which was based on costs and production data collected from 90 fishermen fishing the sea in the three States considered for this study. The sampled fishermen were then studied on a 7 day/month/state basis for 3 months in the dry season and 3 months in the rainy season. Data were generated on fishing specie types current costs composition, weight and value of catch, type of gears, and crew size. There were three groups of fishermen sampled in each States and they were:

1. Coastal fishermen with paddle (CP)
2. Coastal fishermen with Y25Hp Outboard engine (CY25Hp)
3. Off-coastal fishermen with Y25Hp Outboard (OCY25Hp)

a) Fishing methods/gear for cropping

The two methods of fishing identified among the sampled fishermen across the three States were:

A) 1) Traditional fishing

2) Canoe-mechanization (using Y25Hp Outboard engine)

1) Traditional fishing: This involved the use of dug-out wooden canoes (8-12 metres long) which are manually

paddled and sometimes aided by sails. The average crew size for this group was 6 men.

2) Canoe mechanization: The wooden canoe ranged between 12-14 metres in length and were powered by the Y25Hp Outboard engine.

B) The gear(s):

a) The commonest gear used by the fishermen studied was the bottom set netting. This technique was locally known as sokobi or ijanomi in some areas. A typical bottom set gillnet used by these fishermen had lead sinkers on the headline to keep on the bottom and was set in one place by having anchors on both ends. The anchors carry stakes on top of which were flags. In addition to the floats along the line were indicators bouys and some locally made bouys on the top of which hurricane lanterns were tied. The lanterns were to prevent trawlers from removing or damaging the nets by illuminating the site of the net.

The nets were set towards evening and then left till the following morning when the catch were to be removed together with all the nets. The total length of net usually set by a fisherman per trip ranged between 1000 - 16000m.

b) Purse-seining: Seine-net fishing was carried out in Lagos and Ogun state coastal areas with lead and floats on the lead-line and floatline respectively. The crew members had to divide themselves into two groups; one team set the nets in the ocean while the other team would be in close to the shore standing at a depth between 1 - 1.5m. Ropes were tied to the ends of the nets with which the standing fishermen drag them ashore and empty the catch out on the coast.

C) Fish types: The survey revealed that the respondents catch were multispecies in nature. Out of the fishing techniques identified in these areas, none was practiced by a single fisherman. They operated the different methods depending on the type of fish they catch. However the marine fish species caught by the sampled fishermen across the states during the survey period included:

English Name	Scientific Name	Lagos State	Ondo State	Ogun State
Cracker	Pseudoplithus spp	-	-	-
Sea catfish	Arius spp	-	-	-
Sole	Solen spp.	-	-	-
Stingray	Tragon pestinaa	-	-	-

English Name	Scientific Name	Lagos State	Ondo State	Ogun State
Shinynose	Polydectylus quadrifelis	-	-	-
Barracuda	Sphyraena spp	-	-	-
Mullet	Mugil spp	-	-	-
Spade fish	Drepance africana	-		-
Snapper	Lutjamus spp	-	-	
Soles	Cynoglossue spp.	-	-	-
Bigeye	Brachydentenus aritus		-	-
Els	Conger conger	-	-	-
Marckerel	Scon beromerarus tritor	-	-	-
Shark	Squalidae	-	-	-
Silverfish	Chrysichthys spp.	-	-	-
Ray	Rajide dasyatis	-	-	-
Shine nose	Polynenudae decadacftylus	-	-	-
Snake head	Ophiocephalus obscunis	-	-	-
Guiter ray	Rhinobatidae rhinobatus	-	-	-
Tarpa	Megalopidae atlanticus	-	-	-
Horse mackerel	Carangidae punctatus	-	-	-
Bongo fish	Ethmalosa fimbrialo	-	-	-
Dog fish	Seyliorlinus camadus	-	-	-
Miscellaneous		-	-	-

Source: Field Survey, 1990

The names given were in line with National Statistical Standard Classification, Nigeria and Fisheries Statistics of Nigeria.

6.18 Analysis of cost of production

For effective comparison of fishing activities of the traditional fishermen and the mechanized or modern fishermen an analysis of current cost of production per month was considered. Fishing operating costs were defined to include the cost of repairs and maintenance work done by others as well as the cost of fuel, labour and lubricants. Capital was specified in terms of the flow of services rendered. The price of capital services was defined as the current value of each investment good (canoe, Yamaha 25 Hp Outboard engine and gears) multiplied by the rate of return on all capital (assumed to be equal 30 percent.) On an annual basis, the value of capital services $(K)^n$ was computed thus, where K was the current acquisition cost of capital stock,

$$K^n = \frac{rk}{1 - (1 + r)^{-n}}$$

r was the rate of discount and n the life expectancy of the capital good (Mabawonku, 1978/1979). The monthly charge to capital services was obtained by dividing the annual value by twelve. The current prices of capital or assets were used over the initial cost or purchase price because:

1. The fishing assets have different economic lives, and as a consequences their times of purchase do not always coincide.
2. Different fishermen had purchased their fishing assets at different times and had since made varying improvements on them.
3. The high rate of inflation, made it necessary to establish a common time of reference for all fishing units.

Labour was defined to include the fisherman's labour effort, the labour input of his family members and that of hired workers, each measured in hours of fishing per month.

From the traditional fishermen and for fishermen operating mechanized canoes, the expenditures on lanterns, knives, ropes, pans, and transportation were put as others.

From the data presented in Tables 6.24 and 6.25 the monthly cost of production per traditional fisherman was lower than that of the fisherman operating motorized canoe. This was due mainly to the current high cost of the Y25Hp Outboard engine, which accounted for a high percentage of the total costs in the three states. For the traditional fisherman, the total cost was highest in Lagos State and the lowest was recorded in Ondo State. However, the lowest

TABLE 6.24

Current monthly cost of production per coastal traditional fishermen in the three states

		Lagos State (₦)	Ogun State (₦)	Lagos State (₦)
A.	Fixed Cost Items			
	Canoe	52.895	43.1601	44.323
	Fishing gears(s)	41.382	42.066	41.6211
	Sub-total	94.277	85.2661	85.9441
	Source: Constraint Data, 1990			
B.	Variable Cost Items			
	Fuel	27	27.5	27.3
	Repairs and maintenance	8.7	5.4	6.1
	Labour	162	167.5	162.33
	Others	19.2	17.01	17.5
	Sub-total	223.74	223.61	219.95
	Grand total (A+B)	318.017	308.8361	305.9941

Source: Survey data, 1990

TABLE 6.25

Current monthly cost of production per fisherman operating canoe mechanization

		Lagos State (₦)	Ogun State (₦)	Lagos State (₦)
A.	Fixed Cost Items			
	Fishing gear	203.525	117.03	119.25
	Canoe	49.59	48.222	46.17
	Y25Hp Outboard engine	661.36037	495.810	645.361
	Sub-total	814.47337	661.062	810.781
B.	Variable Cost Items			
	Fuel and lubricant	219.74	239.31	240.693
	Repairs and maintenance	154.25	162.608	157.56
	Labour	179.66	176.025	176.53
	Others	42.5	36	35.67
	Sub-total	596.15	613.943	610.453
	Grand total (A+B)	1410.6234	1275.005	1421.334

Source: Survey data, 1990

total monthly cost per fisherman operating canoe mechanization was recorded in Ogun mainly because of the 25 percent subsidy granted the fishermen recently by the state government.

Catch data and analysis

The catch data were obtained for the three groups of fishermen considered for the survey. The means were however presented for the two seasons and compared using the t-test of difference of means (Table 6.27).

A series of tests of difference of means using the t-test indicated that there were significant differences between the mean catch for the two seasons for the three states except for the off-coastal Y25Hp for Ondo state that indicated no significant difference of means for the two seasons (Table 6.27).

Also, the t-test of mean difference between the total mean catch for the traditional fishermen and (1) the CY25Hp, (2) OCY25Hp, indicated significant differences across the three states (Table 6.28). The hypothesis stated in this regard was therefore rejected.

TABLE 6.26

Mean monthly catch per fishermen per month (in kg)

	Lagos State			Ogun State			Ondo State		
Month	CP	CY25Hp	OCY25Hp	CP	CY25HP	OCY25Hp	CP	CY25HP	OCY25Hp
Dry season									
January	60.308	381.979	320.240	50.843	106.785	108.6575	100.008	236.212	392.201
February	146.240	264.740	134.341	36.244	70.8775	100.5142	203.222	200.226	394.333
March	142.349	84.560	220.280	40.654	82.700	260.943	90.621	215.341	356.201
Rainy season									
May	120.209	294.280	354.897	58.299	194.45	118.9428	110.601	332.421	394.212
June	160.134	266.712	340.897	72.134	324.667	208.8285	240.046	536.102	372.723
July	162.206	302.230	354.589	68.49	266.1671	344.123	228.312	394.312	324.316
Total	791.446	1492.501	2621.329	326.66	1045.64	1142.01	1053.88	1817.614	2443.776

Note: CP = Coastal Paddle, CY25Hp = Coastal with Yamaha 25Hp, Outboard engine, OCY25Hp = Off-Coastal with Yamaha 25Hp Outboard engine.

Source: Survey data, 1991.

TABLE 6.27

Mean catch difference between seasons in the three states

State	Number of cases	Degrees of freedom	T-value 2-tailed)	Remark
Lagos				
1	30	28	-9.62	S
2	30	28	-10.42	S
3	30	28	-6.79	S
Ogun				
1	30	28	-4.19	S
2	30	28	-5.65	S
3	30	28	6.89	S
Ondo				
1	30	28	5.15	S
2	30	28	3.40	S
3	30	28	-1.17	N.S.

S = Significant

N.S. = Not Significant

Source: Survey data, 1990

TABLE 6.28

Mean catch differences across the three states

State	Number of cases	Degrees of freedom	T-value 2-tailed)	Remark
Lagos				
1	30	28	-15.04	S
2	30	28	-16.21	S
Ogun				
1	30	28	-7.21	S
2	30	28	-13.48	S
Ondo				
1	30	28	-18.68	S
2	30	28	-20.26	S

$P < .05$, S = Significant, 1 = Coastal Paddle versus CY25Hp,

2 = Coastal Paddle and OCY25Hp

Source: Survey data, 1990.

6.19 Analysis of Returns (Table 6.30)

The total monthly revenue from fishing for the fishermen was calculated as the sum of the value of gross sales and the value of consumed fish during the production month. Where the total monthly revenue was less than the total cost, the net revenue would be negative which represented a loss. Monthly total cost was deducted from monthly total revenue to estimate the total profit earned by an enterprise.

To ascertain which fishing method was more profitable than the other, the comparative analysis of costs and returns, and net revenue between the three production locations and the two technologies should be studied.

Results from Table 6.30 also showed that the average monthly fishing income differed significantly between seasons. The mean monthly income for the rainy season was more than that for the dry season. This was however evident, from the catch data on Table 6.28 which was higher during the rainy season. Though the fishermen claimed to fish more during the dry season, but the rainy season catch from the coastal areas tend to be more. The spawning of most of the fish species during the rainy period could be one of the reasons for this.

TABLE 6.29

Average monthly costs, returns and net revenue per fisherman (N) in the three states (1990)

	Coastal Paddle			Coastal Y25Hp			Off-coastal Y25Hp		
Items	Lagos	Ogun	Ondo	Lagos	Ogun	Ondo	Lagos	Ogun	Ondo
Gross sales	998.78	847.43	980.42	2492.50	2045.60	2484.3	3129.60	2725.33	3277.11
Value of Income from consumed fish	134	113.417	127	136.804	112	131.64	163.6	136.86	134.76
Total Revenue	1132.78	960.84	1107.42	2629.304	2157.6	2616.94	2393.2	2862.19	3411.4
Fixed costs	94.277	85.2261	85.9441	814.5	661.1	810.8	814.5	661.1	810.8
Variable costs	223.74	223.61	219.95	596.15	613.943	610.435	690.12	679.5	682.3
Total Costs	318.02	308.84	305.87	1410.65	1275.043	1420.92	1504.62	1340.6	1493.1
Net Revenue	814.76	652	801.53	1218.654	882.557	736.68	1788.58	1521.59	1918.3

Source: Survey data, 1990.

TABLE 6.30

Mean difference of returns between seasons across the three states

	Number of cases	Degrees of freedom	T-value 2-tailed)	Remark
Lagos State				
CP	30	28	-12.03	S
CY25Hp	30	28	-15.12	S
OCY25Hp	30	28	8.72	S
Ogun State				
CP	30	28	9.13	S
CY25Hp	30	28	-11.21	S
OCY25Hp	30	28	-12.17	S
Ondo State				
CP	30	28	-16.02	S
CY25Hp	30	28	8.92	S
OCY25Hp	30	28	-12.74	S

P < .05, S = Significant

Source: Survey data, 1990.

CHAPTER SEVEN

DISCUSSION OF MAJOR FINDINGS

This chapter has been organised into two major sections. The first section presents the discussion of the major findings highlighted in the preceding chapters. The discussion has been confined to the aspects of the investigation which attempt to provide answers to the objectives of the study against the background of the theoretical framework for this study.

In this regard, the major focus has been on the discussion of findings of the constraints affecting the transfer of Yamaha 25 Horse power at the utilization, extension, supply and multinational company levels. The overall scenerio in the use of the technology would be more adequately understood with the aid of a discussion of the findings of the fishermen's socio-demographic profile as they vary between users and non-users and their fishing locations. Also, the results of the findings with respect to the knowledge and utilization of technology and the determinants are also discussed.

Moreover, the findings of the current costs and returns to fishermen in different fishing localities in relation to the use of the technology and the paddle are also discussed in this section. The second section of the chapter discusses the various implications of the findings of the study.

7.1 Constraint Profile at the utilization level of the technology

7.1.1 Economic constraint

The result of the discriminant analysis on the coefficient and clustering of variates on the user and non-user, rated the economic constraint first in both groups. Table 6.15 presented the means of variables contributing to the economic constraint factor with the high cost of the engine, poor financial stand of the fishermen, poor catch rate, high cost of repairs, spare parts, fuel, labour and maintenance, coupled with the low profit margin as important variables across the three states. It was evident from the result that the poor technology prevalent in the artisanal sector does have an economic basis. Although the average monthly income per traditional fisherman as shown on Table 6.28 was as high as ₦814.76, it was however observed from the demographic data that majority of the fishermen were polygamous having up to six wives, and that the number of children and dependants was on the high rate; catering for these people at the present high cost of living and poor farm land as observed in most fishing villages like Aiyetoro, Lekki, Orioke-Ihamimo and Igbeki would mean spending even more than they realize from their fishing activities. According to most of them (through personal interview) there was always virtually nothing left for savings rather, they even buy foodstuffs on credit so as to save their family from starving. The high monthly cost of operation incurred by fishermen operating canoe mechanization - Table 6.28 as compared to those on traditional fishing was due to the current cost of the outboard engine. Apart from this, the high cost of fishing gears (Table 6.28) was also very important.

This finding was however supported by NIOMR (1985) in which economic constraint factor was found to be the most important factor influencing the adoption of mono and multifilament fishing gears by the artisanal fishermen. The result of the study shows that the fishermen lacked the necessary funds to purchase the engines, gears and some major inputs of the right type, quantity and at the appropriate time. This could result in the adoption and utilization of unconventional fishing practices which are totally incompatible with modern fishing.

7.12 Institutional constraint

Inaccessibility to credit facilities, lack of assistance in form of grants and loans, high interest rates charged by credit houses, complex requirements of credit houses, and mismanagement of funds within the cooperative societies were rated high as important variables contributing to the institutional constraint factor (Table 6.15). It was revealed from the study that majority of the fishermen have never benefited from government programmes and other institutional arrangements such as input subsidy, grants and loan facilities. In Ondo and Lagos States for instance, the subsidy on the outboard engine has been removed by the State governments. In Ogun State, the fishermen were also given only seventeen percent subsidy (Table 6.25). Personal interviews with most of the fishermen in the three states revealed that they do not benefit from credit facilities given by most banks unlike their counterparts in crop or animal farming. This according Emokpae (1980) could be as a result of the discriminatory attitudes of most credit houses against the artisanal fishermen coupled with the high interest rates, charged with heavy requirements totally hinder the adoption of technological innovations and invariably limit fishermen's productivity.

7.1.3 <u>Yamaha 25 Horse power Outboard engine</u>

This constraint was ranked third by the users of the engine. Their major problems were based on the following technical points:-

a) Fuel consumption too high.

b) The life span of the engine is short.

c) Spare parts problem.

Apart from the high rate of fuel consumption and the exhorbitant price of fuel and lubricants, the fishermen also complained of the short life-span of the Y25 Hp Outboard engine. They claimed that the recent ones in the market were not as durable as the previous ones. Also, the premature failure of engine coupled with the high costs of repairs were common problems. These problems according to Mua (1988) had to do with the use of inferior or unsuitable materials or combinations of materials, leading to early corrosion and breakdown, poor workmanship in installing the stern gear and engine or to lack of follow-up checks during the first critical weeks. .He went further to explain that some materials which had proved satisfactory in the temperate waters of the home or mother firm would not always stand up to the higher temperatures and possibly greater salinities that they would be subjected to in the developing fisheries of the tropics. The rate of chemical reaction would roughly double with an increase in temperature of 10° centigrade. Operations in waters 25°F to 35°F or 15°C to 20°C warmer than the home seas would lead to corrosion rates 3 to 4 times greater, and the original reasonable life span would be unattainable (Yamaha Outboard Motors (YOM), 1971).

Stoneman (1972) in his own explanation to the Trinidad fishermen who had similar complaint, attributed it to the poorly designed or selected propellers and, gear box difficulties.

Most indigenous crafts have lines very different from the boats considered normal by the engine manufacturer, which usually result in overloading and engine bearing failure. Gearbox troubles usually occur due to maladjustments and the use of undersized gear boxes, not taking into account the rough treatment that they would inevitably be subjected to in the high seas. Another chronic trouble with many gearboxes is the difficulty in obtaining a positive neutral position, which for fishing operation, is further hindered by the continuously rotating propeller. The likely cause of this as explained in YOM (1989) is that the engines are often stored for long periods under tropical conditions before being installed, and the gear box oil becomes gummy, causing the clutch plates to stick. The simple remedy of thorough flushing is usually not carried out, with the result that from the first day, the fisherman suspects that he has received a defective piece of engine.

Another variate contributing to the technical problem experienced by the users of the Y25Hp Outboard engine was the spare part problem. Most of the users through personal interviews claimed that the superior or "original" spareparts were too costly in the market. Aside from this, it was very difficult for them to obtain skilled help to undertake repair work, because of their remote location and the high charges of an experienced mechanic or repairer, who in most cases would use fake spareparts for them.

7.1.4 Supply constraint

The users and the non-users of the Y25Hp Outboard engine in the three states claimed to be hindered by poor supply system. Important variates supporting this claim include,

1) Inadequate supply from the Ministry/ADP
2) Requirements of the Ministry/ADP too much
3) Removal of subsidy.

In the three states, the fishermen complained not to have had a regular supply of the engine from the Ministry/ADP. Also, records of the cooperative societies showed that they had never been supplied enough number to go round each member of the cooperative. For instance in Ondo State, the Cooperative Unions were supplied only 29 Yamaha 25 horse power Outboard engine in 1987 which were distributed among 30 societies each consisting of about 25 members each. In Lagos State, most of the fishermen also claimed that the last time they were supplied Yamaha 25 horse power Outboard engines in large number was 1985. In the case of Ogun State however, the fishermen were summoned to Iwopin to be supplied by the State Governor that they had to pay about ₦14,000.00 for an engine. (These were information collected or got from the Ministry/ADP). This ceremony, the fishermen concluded was just to celebrate the State Governor's second year in office and not meant to supply them any engine.

The second variable contributing to the supply constraint factor was the requirements of the Ministry/ADPs before supplying the fishermen the Y25Hp Outboard engine. In Ogun State for instance, for the 1990 supply, each fisherman was to supply 35 baskets of fish to the Ministry at Abeokuta while in Lagos State, it was 25 in 1986 and in Ondo State, each was required to supply 30 baskets in 1988. (Information from the Ministry/ADP). The inability to meet up with the requirement would automatically remove the name of a fisherman from the list of those to be supplied the engine in the three states.

Another variable that made significant effect on the supply constraint factor was the removal of subsidy by the state governments. This finding is supported by Ayodele (1983) and Utong (1986) who also concurred that the removal of subsidy was an impediment to the utilization of fishing inputs by the fishermen in Ondo and Rivers States of Nigeria.

7.1.5 Infrastructural constraint

Lack of basic infrastructure such as good road, electricity, landing jetties, drinking water, medical and health care facilities, improved fishing equipment, storage facilities and good processing units, are important limiting variables across the three states especially on the part of the users of the technology. This claim is supported by Chebe (1982), Aderonmu (1983) and Essien (1982) who agreed that the poor infrastructural development in most of the rural fishing villages of Nigeria hindered the development of the artisanal fishery sector.

The users of the technology in Ogun State for instance had to walk a long distance to fish the sea and to get their catch to the market. The fishermen claimed that the roads were unmotorable during the rainy season because of flood and poor drainage since the proposed channelization project had not been attended to by the State government. Also during the dry season, the roads, being very sandy, could be too hot for the fishermen to trek on (Researcher's personal experience). Other facilities like schools, dispensaries, landing jetties were not available. This according to them had caused the drifting of fishermen from the remote fishing settlements to urban areas and the unwillingness of the fishermen to encourage their offsprings to take up fishing for a living.

In Ondo State, the lack of storage facilities needed for the handling and preservation of fish, poor health facilities, lack of good drinking water and poor transportation were important limiting variables. For drift netting, fishermen travel from Igbokoda to Aboto area at times paddling which could be very physically demanding. In Lagos State, lack of storage facilities like cold rooms and ice making units were important limiting variables in most of the fishing villages. Poor roads making most of the fishing villages in Epe division and Lagos division inaccessible during the rainy season rated high as limiting the performance of the fishermen.

7.1.6 Geographical constraint

Most of the fishermen across the three states live in very remote villages. This geographical isolation according to Copes (1971), could be the cause of the static life in most of the fishing villages in Nigeria and is said to be the reason why opportunities for improving facilities and techniques are not grasped by the fishermen who "lack the necessary initiative, knowledge and imagination." Lawal (1974) blamed the conservative attitudes of the fishermen mainly on their geographical isolation. According to him, this often resulted in the development of resigned attitude especially of the older fishermen.

Due to the surf-beaten coasts, landing is usually difficult at certain times of the year for the users of the engine. The bigger canoes used with the engine are directly linked with geographical, wave and beach conditions (Barron, 1972). Rocky coasts with harbours, sheltered bays and creeks, also tend to distance fishing grounds. The non-users claimed that they are not used to fishing the open sea. The waves which occur unpredictably in the oceans, except in those areas and times when the sea's surface is motionless during long periods of calm, is the main cause of their attitude. According to them, eve on calm days, it is not uncommon for large waves to pound the shore, rolling up out of the ocean, seemingly from nowhere, usually caused by storms many miles away.

7.1.7 Gear and Craft constraint

The non-users of the Y25Hp Outboard engine fishing the inland waters had the gear and craft constraint based on the following:-

a) Inheritance and species being fished

b) Fishing location

c) Cost of gears and crafts.

Majority of the fishermen claimed that they could not part with their long inherited fishing methods. Changing from craft and gears handed over to them by their fathers would mean parting with their birth rights. This finding is supported by Soublin (1974) who stated that the Pakistani fishermen at the artisanal level rejected the nets supplied by the government because they would have to fish another location which might mean parting with their long inherited gears and crafts. Also, some of the fishermen claimed that they fish for the fresh water species only, which would not require the use of the engine. At the same time, most of them tended to use very passive gears that are not as costly as the active ones. Fishing the sea with the use of Y25Hp Outboard engine would mean the construction of a new and bigger craft, purchase of new gears apart from the procurement of the engine. This to them would be unnecessarily costly for the fishermen.

Some of the fishermen also claimed that they were not trained to fish the open sea. As explained under the geographical constraint, the sea is very rough when compared to the inland waters. According to the fishermen, venturing into the sea without the initial training in sea fishing could result in loss of crafts, gears and even lives.

7.1.8 Socio-cultural constraint

The socio-cultural environment of the fishermen was also an important constraint limiting the non-users of the technology. This refers to specific variables such as the community structure, and organisations, system of norms, values, and beliefs, as well as traditional practices (custom and tradition). The socio structure of a fishing community for instance is of great importance in the process of technology transfer among fishermen in such areas. Interpersonal and cross cultural communication are central to decision making with respect to the utilization, moreso where uncertainty is involved, since they influence the individual fisherman's perception of the effects of the new technology. Spicer (1973) affirmed that the individual's response to a new package is determined in part by the culture within which he lives. The most serious mistakes made by technical experts from the developed fisheries on their first contacts with users in developing fisheries, result from their assumption that goal direction and reaction to new technology are the same as those of users in the fisheries from which they come (FAO, 1982). Desire for material possessions and economic independence, and other traits of the "home economics" are not always present in the same degree, as in developed countries (Szcepanic, 1970).

The non-users across the three states are affected socio-culturally in the following ways:

a) Fishing location
b) Attitude towards work and
c) Availability of labour.

The females among the inland fishing group in Ondo and Ogun States are restricted by their culture to fishing in the open sea, most especially during child-bearing age. In Ondo State for instance, few of the women who are users of the engine had to hire labourers to fish the sea for them. Women fishing the inland waters in Ogun State for example, are not allowed to venture into the sea because their religion forbids them from doing so, since they are mostly

Muslims. Apart from religion, they also claimed that they could not be allowed to stay the whole day and night fishing the sea because of their husbands, children and other social-engagement in and outside the fishing village.

The men (through personal interview) however claimed that it had been the culture in some of the villages to fish only the inland waters and for particular species of fish, which if they should part with would mean going or imbibing other people's culture. This to them may tag them as out-cast within their own culture. Apart from this, the tie to the extended family in terms of occupation and fishing grounds, are other hindrances to the use of the technology. Most of the inland water fishermen employ their family members in fishing and processing activities which might be changed with the use of the engine since they would have to reduce the crew size which might mean loss of job to the dependent fisherman in his family. Also, most of the fishermen are already used to the seasonal variation in their fishing patterns. During the off-season period of the particular specie of fish of their choice, they concentrate on their secondary occupations and in mending their nets. This, according to them, has been the routine for years which would be very difficult to change now that they are old.

7.1.9 Specie/Value constraint

This is closely linked to the socio-cultural constraint factor explained earlier. Most of the fishermen across the three states that are not using the engine explained that the particular specie of fish they hunt for would not require the use of the engine. Certain species of fish are available in the inland waters which though available in the Open Sea, might not be of the same "quality." Quality of fish in terms of "Sweetness" to some of their customers, could be very important. The Lagos State inland water fishing group through personal interview even claimed that some of the buyers specifically demand for shrimps and fish species from the lagoon as against that from the open sea. Also, the fishermen claimed that most of the species are highly valued though smaller in size than the species from the sea. All these have over time, made them stick to their gears and less costly fishing crafts.

7.1.10 Personal constraint

Aside from all the other constraints discussed earlier, age and education are listed most frequently as the underlying causes of the conservative attitude of fishermen.

The majority of fishermen in the inland waters lack education and tend to be older than those in the open sea. This, coupled with poor medical facilities in the fishing villages, contribute greatly to their poor attitude to the engine. Also, most of their children that are educated run to the cities in search of jobs, leaving them to stick on to their old ways. A corollary of this, is that the fishermen try as much as possible not to change anything in their environment with the feeling that "nothing can be done about it or that "all is in the hands of God."

7.2 Constraints at the extension and supply levels.

Technology development, its transfer and possible utilization, is largely dependent on the quality of extension work. The bench mark of improved technology, irrespective of how it was developed lies in the extent to which it has popular acceptance and application. This in turn is dependent, among other things, on how such technology is communicated to the fishermen users.

It has been widely recognised that a wide communication gap exist between the technology development (research) and utilization (fishermen) sectors because of constraints experienced at the extension and supply levels, with rather discouraging consequences.

Analysis of the constraints at the extension level revealed the inadequacy in the number of extension agents at the field level as an important constraint. Idachaba et al. (1981) found out that Nigeria was faced with acute shortage of extension staff as defined by extension worker/farmer ratio in some states of Nigeria. In Lagos State for instance, there were only 3 extension workers at the field level in most of the divisions. In Ogun State, there were only 2 (two) field level officers in charge of the fishermen in the whole of the coastal fishing area of Ogun State water side local government area.

Effective technology transfer and application requires an adequate supply and logistic back up by way of all time input supply and their accessibility to fishermen. The importance of the regularity of the supply system could be seen in its popularity, even at the utilization level of the technology transfer process. A close observation reveals that the combined effect of available inputs and low cost of such, obviously could lead to mass acceptance of innovation. It is evident therefore, that for an effective extension strategy for the transfer of technology to fishermen, uninterrupted supply of the technology and the input components must as matter of policy be provided for. this is not to say that supply is the most important job of the transfer agents, but that some effective and coordinated operational relationships could be established between the extension and the supply systems. This, in essence would help to ensure that the right type of services and inputs were available in the right place, at the right time, in the right quantity or number and at reasonable prices for fishermen. According to the extension agents across the three states, the supply system was highly deficient.

The importance of good infrastructural facilities and adequate funding in enhancing the efficiency of extension workers cannot be ruled out. In most cases however, the extension worker lacked the necessary inducement and material benefit which could induce good work performance. Across the three states for example, none of the extension agents had a boat or speedboat assigned to him for his extension work. Coupled with this was the poor allowances they got in return for their services. In the fishing villages also, facilities were not provided for them to work with which eventually led to the use of improper methods of information dissemination to the fishermen.

The feelings of frustration and resultant inefficiency due to the organizational structure was another important constraint at the extension level. No room was given to the field extension staff to participate more actively in the planning of extension activities in the conventional Ministry Extension system. The organization tended to work in a manner common to bureaucratic organisations (Olayide et al., 1975). There is authoritarian control, and the basic lines of communication are from the top downwards. The result is that the surbordinate officials may have very little initiative to advance the goals of the extension services since in most cases, they consider their efforts to be inadequately appreciated by senior officials.

Inadequate training in outboard engine technology and lack of contact with the manufacturers were other important constraints. Training is necessary because the quality of the agent is an important factor determining how effectively he can accomplish his functions. The fisheries extension workers across the three states did not understand thoroughly the meaning of Y25Hp Outboard engine in terms of its technical and economic implications and the adjustments that must be made because of it. Coupled with this was the lack of contact with the manufacturers to whom they could have journeyed back to for crash training, due to distance and other factors.

At the supply level across the three states, the policy of the government played a leading role. This was so because what, when and how to order for the Y25Hp Outboard engine would be highly dependent on the fisheries policy of the government. This was followed by the high import duty coupled with the high cost of the engine. In Ondo State for instance, the engine was supplied for

₦17,750.00 in 1990 as against ₦650.00 in 1981. The high cost automatically distanced them from the fishermen. Lastly, fisherman's low income and lack of credit facilities together with other administrative bottleneck, also hindered the supply of the engine in the three states.

7.3 Constraints at the multinational company level

The various forms of government controls (e.g. tax, patent) affect the transfer process adversely. In as much as freedom is needed from unnecessary government interference, government protection at the recipient level is needed for effective performance. In Nigeria for instance, too much government control in form of license and duty hamper the operation and reduces the effectiveness of the firm. This sprouts from the urge to have control over the society and the use of her productive resources (Sagafi, 1981).

Lack of local control and restrictive transfer practices are usually the result of the impetus of supplier firm to have control over their technology and how it is utilized so as to maintain their competitive position and improve upon the technology. Often times, the technology is their most valued asset (UNIDO, 1974). It is very difficult for a private firm in the suppliers country who has spent millions of dollars and resources on developing a technology to forfeit its right to control completely. Nigeria is but one of the many recipients of the technology which emphasises the need for suppliers to maintain control. At the same time the Nigerian government would like to have control over any imported technology so as to improve the science and technology position within the system (Pelmutter, 1981.) The price of of the technology is always subjected to laws of supply and demand. In this case, buyers and sellers are mature and can agree without government interference. The suppliers have spent so much time and money that they would want to get the right price in the market (Morris, 1973). The recipient fisheries would expect marginal cost of technology to be charged by the suppliers since their markets were not the prime motive for the initial development of the technology.

Administrative, services, and payment clauses were other constraints at the multinational company level. The suppliers often want to dominate the key management positions in the recipient countries multinational firm. This could generate conflicts within the system. Also the supply of service agents, skilled workers and spare parts from the home country could be very slow and could hinder the transfer process. Payment clauses have to do with the terms of payment, exchange rate and other institutional constraints within the recipient fisheries system that might retard the technology transfer process.

7.4 Association between selected variables and the use of Y25Hp Outboard engine in the three states

Results obtained from Table 6.7 revealed that variables like tribe, religion, dependents, wives, children, age and education had no significant association with the use of the Yamah 25Hp Outboard engine in Lagos and Ogun State. This result was evident from the descriptive data which indicated that majority of the fishermen users and non-users of the technology were all from the Yoruba tribe. They were either Muslims or Christians and they all had many children and dependants. The high mean number of children per fisherman tended to be so because most of them were polygamous. Explaining the polygamous nature of the fishermen, Ruttam (1982) attributed it to the fact that most of the people they interacted with at the point of sale were women. Apart from this, the Muslim religion practised by some of the fishermen allows for polygamy. The mean age of the fishermen tended to be at the middle age group when the fishermen were still strong and active so that they could actively involve themselves in the tedious, energy consuming fishing activities, with which the elderly and the very young might not be able to cope hence the low frequency of respondents in the old age and young age categories. Lastly, the urge to leave the village for the city in search of white collar jobs could be very high in the young ones which would eventually make them stay permanently in the cities. Also, the lack of the engine coupled with its current high cost has made fishing very unattractive to the young ones and too laborious for the older ones.

In Ondo State however, there was significant association between the age of the fishermen and the use of the engine. In the descriptive section, it was found that the young ones even below 20 years were into fishing in the state. It was also found that the young ones below 50 years tended to be more in sea fishing which in most cases would not be profitable without the use of the engine. The majority in this group claimed to have inherited the engine from their parents so they could afford to stay back in the fishing village and make their money.

Most of the fishermen in Ogun and Lagos states in the user and non-user category lack basic education. This could be as a result of poor facilities in most of the fishing villages. Most of the villages do not have even a primary school and, attending the secondary school might mean leaving the fishing village entirely for the cities. Thus, after their education in the cities, they seldom come back to the village to start fishing again.

The significant difference that existed between the educational level of users and non-users of the engine in Ondo State could be explained partly by the current scarcity of jobs in the cities. This had made the educated children of the older fishermen return home to take to fishing as a profession.

7.5 Attitudes towards the Y25Hp Outboard engine by users and non-users in the three states

The low attitudinal scores of non-users towards the engine could be explained partly by the socio-cultural/specie constraint factors affecting the non-users of the engine in the inland waters. Most of them have never made enough money to be able to purchase an engine and due to the calm nature of the inland waters as compared to the sea waters, the Y25 Horse power might not be suitable for their type of fishing location. Their scores were low though positive in most cases, but since they have no experience in terms of usage, their reaction could not be as positive as those of the users.

7.6 Determinants of knowledge and utilization of Y25Hp Outboard engine

Findings of Table 6.11 show that only gross income from fishing, and the fishing place of fishermen made significant contributions to the utilization of Y25Hp Outboard engine by the fishermen in the sea location, out of the eight independent variables. In the sea, fishermen either fished the coast or off-coast. In all the states, there were fishermen fishing the coast with the paddle but none could fish off-coast with paddle. This according to them could be due to the intensity of the waves in the off-coast region. The user of the engine would be required to fish the off-coastal but since most of them had very old engines that could not stand the rigours far into off-coastal area, they usually concentrate on coastal fishing.

Supporting this view was Reeves (1976) who claimed that most of the fishermen in the off-coastal areas of the sea in Malaysia had their crafts motorized while 65 percent of those in the coastal areas used the paddle or oars for propulsion. Also, in Sri Lanka, most of the fishermen stick to the coastal location due to absence of engine to enable them go off-coastal (Trung, 1969).

The level of gross income of the individual fishermen affect the utilization of the engine by the sea fishermen. This was supported by the high importance of the economic constraint factor and the income variable. Only the very few with high gross income level could purchase the engine at its current price. This finding was supported by Bamgboye (1980), Etebo (1979), and MIOMR (1983) that only fishermen with high income level adopt most of the fishing innovations. Also, Parker (1982) found a high, positive correlation between the level of income of the fishermen in Canada and their adoption of innovations. A similar trend was observed in Indonesia fisheries by Pasha (1978) who found economic constraint to be of significance in the transfer of gears to the artisanal fishermen. According to him, the fishermen were at the lower end of the continuum both socially and economically. It was very difficult for them to feed their families three times a day. It was however the introduction of subsidy scheme that eventually saved the situation. This was also the view of Engel (1989) and Roling (1989) who advocated for an efficient government support system and favourable structural conditions for an efficient transfer system.

Knowledge

The use of the engine made very significant contribution to the knowledge of the fishermen about the specific instructions for the efficient performance of the engine. Supporting this was the high positive attitude of users towards the engine. With constant use however, they tended to know more about the manipulation of the engine everyday, unlike the non-users. The educational level of the sea fishermen was also significant since those that are educated would be able to read and understand the instruction manual very well. The place of fishing, coupled with fishing experience in the sea, tended to aid their knowledge of the technology. This could be explained that those who fish the sea especially the off-coastal region, used the engine for their fishing trips, which definitely associated them with the technicalities of the engine operation.

7.7 Determinants of the fishing income of the fishermen

a) Traditional fishermen

The type of gear used and labour were the two variables that contributed significantly to the fishing income of the fishermen. These fishermen used various types of gears ranging from the passive gears to the active gears. While the passive gears depend on the movement of the fish for catchment, the active gears depend on the movement of gear for catchment. The number of people employed would however determine the speed, and the number of gears set by the fishermen.

b) Sea-fishermen

The type of gear, use of Y25 Hp, fishing place, labour, fuel, fishing time and canoe number were important determinants of fishing income for this group of fishermen. The selectivity of the gear used would determine the type of fish and the size of fish caught.

7.8 Current costs and returns to fishermen users and Non-users of the technology

Table 6.28 presented the results of findings relating to the current production costs and returns of traditional and mechanized fishermen. The results indicated that the current monthly net revenue of coastal fishermen using the engine was very high. This could be explained partly by the high current cost of the engine and the cost of repairs. The cost of engine accounted for almost 62 percent of the total cost in Lagos State whereas the paddle accounted for a very minimal percentage of the total cost for the traditional fishermen. From the table also, it was found that it could be best, profitwise, to operate the engine in the off-coastal area even though the cost of the engine still accounted for a higher percentage of the cost in this location. This finding also supported the high coefficient attached to the economic constraint factor by the users of the engine in the Discriminant Analysis section.

CHAPTER EIGHT

SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of the preceding chapters and highlights the major findings and conclusion of the study. It also puts forward certain recommendations based on the findings of the study and finally suggests areas for further research.

8.1 The fishery situation and the input supply strategy

The consequences of the fishery sub-sector problems in Nigeria have included fish scarcity, poor nutritional standards and rural-urban migration to mention a few. A general trend of rapid decrease in fish production had made the government to resort to massive fish importation.

One of the ways Government (both Federal and State) had also tried to solve the fishery sub-sector problems was through the technological improvement of the artisanal fishermen's strategy with the major objectives of:-

a) the improvement of catch/yield and thus raising the fisherman's incomes,

b) the change of traditional technology of the artisanal fishermen to modern technology by the use of the Yamaha 25Hp Outboard engine.

c) the change of fishing location i.e., from over exploited lagoon to the open sea. The Yamaha 25Hp Outboard engine was to replace the paddle used in traditional fishing for propulsion.

8.2 The problem and objectives of the study

The Yamaha 25Hp Outboard engine is foreign to the Nigeria fishery. Its transfer, though quite long, is still limited to the material transfer stage. This has reduced transaction with the home industry in Japan to only importation of the engines through the Multinational Company in Nigeria.

Despite the effort directed at improving the low technological base of the artisanal fishermen by the governments through encouragement in the use of Y25Hp Outboard engine, the majority of the fishermen are still clinging to the paddle and the overexploited lagoon. This according to Pellegrine (1980), must have been as a result of the constraints inherent in the transfer process. Against this background, the general objective of the study was to analyse the constraints to the transfer of Yamaha 25Hp Outboard engine in three coastal states of Nigeria. Specifically, the study was aimed at the following:-

1. To describe and ascertain whether significant differences exist in the demographic, personal and occupational characteristics of the fishermen in the three states. These characteristics include: age, educational level, marital status, children, wives, dependents, number and type of canoe, average number of crew, fishing place, craft and gears.
2. To analyse the reasons for the preference of Yamaha 25Hp Outboard engine by users, the number possessed, and alternative users of the engine, mean age before repair and the attitude of users and non-users towards the engine.
3. To study how two groups of users and non-users differ, with respect to some of the characteristics listed in (1) above.
4. To identify the determinants of the following variables- utilization of technology, knowledge of technology, and fishing income of fishermen from selected independent variables.
5. To study, analyse, and categorize the constraints factors at the utilization level of the transfer process.

6. To investigate whether the fishermen in the three states and three different fishing locations differ with respect to the constraints at the utilization level.
7. To ascertain the constraints at the service and multinational company level to the transfer of the engine.
8. To study whether there was a difference between the landings, costs and returns of the traditional and those of users of the engine in the three states.

8.3 Study area, sources of data and data collection procedure

The study was carried out in three coastal states of Nigeria namely Lagos, Ogun and Ondo states. The Yamaha 25Hp has been the most popular Outboard engine supplied to the fishermen in the three states by the state governments. Data for the study were collected from the following sources:

a) Primary sources, specifically through carefully designed interview schedules for obtaining information from the fishermen in their cooperative societies and the extension agents.

b) Interviews with officials of supply unit and the Multinational Company (Almarine) and

c) Secondary sources, specifically from the States' Ministry of Agriculture and Natural Resources Fisheries section and the Agricultural Development Projects, Fisheries Unit to obtain records on Cooperatives and Input supply; and extensive search into available literature in the Nigerian Institute of Oceanography and Marine Research and the University of Ibadan libraries.

A pre-tested interview schedule was used to obtain information about fishermen personal, demographic, occupational, and constraints to the transfer of the Y25Hp Outboard engine. Also, information on constraints were obtained from the extension agents with the aid of an interview-schedule. The biological data were obtained directly from the fishermen at their landing sites.

The actual field survey was carried out spanning a period of six months starting from the first week of January and ending in the last week of July, 1990 with the assistance of trained enumerators. The biological data were collected on a 7 day/month/state rotation for the six months period.

8.4 Sampling procedure

A multi-stage process employing simple random and disproportional stratified sampling was followed in selecting the fishermen respondents for the study. One hundred and twenty respondents were selected from each state comprising 40 respondents from the inland fishermen cooperative societies, 40 from coastal fishermen cooperative societies and 40 from the off-coastal fishermen cooperative societies that were users of the Yamaha 25Hp Outboard engine. Thus a total of 360 fishermen were selected as respondents and were regarded as a representative sample of the population of fishermen in the different fishing locations across the three states.

The fisheries extension agents were purposively selected for the study. Forty-eight officers were interviewed in Lagos State, while 12 and 8 agents were selected from Ondo and Ogun States respectively. Only seven supply officials were purposively sampled in the three states. Lastly, six Almarine officials were purposively interviewed for the study.

8.5 SUMMARY OF MAJOR FINDINGS

Comparison of users and non-users of Y25Hp Outboard engine in respect of some personal, and demographic characteristics of the artisanal fishermen in the three states

Lagos State and Ogun State

The results of chi-test of significant difference indicated that age, wives, children, dependants, religion, tribe and education were not significantly different among the users and non-users of Y25Hp Outboard engine and that the variables were not significantly related to the use of the engine in the states.

Ondo State

Age and education were found to be significantly different between the users and non-users of the Y25Hp Outboard engine. The young and educated ones among the fishermen were in the user category while the elderly and uneducated fishermen were still not using the engine in the state. However, other variables like children, wives, dependants, religion and tribe were not significantly different between the two groups.

8.6 Association between selected characteristics of fishermen, occupational variables and the use of Y25Hp Outboard engine by the coastal and off coastal fishermen in the three states

Lagos State

A significant association existed between active fishing years, number of canoe owned and the use of Y25Hp Outboard engine. The number of people employed in fishing was significantly associated with the use of the engine. Number of fishing trips made per week also had a significant association with the use of the engine. Age of fishermen dependents, tribe, children, religion, wives, number of canoe owned, active fishing gears, and sea distance were not significantly associated with the use of Y25Hp Outboard engine by the sea fishermen in this state.

Ogun State

No significant association was established between the age of fishermen, number of wives, children dependents, tribe,. religion, sea distance, active fishing years, number of canoe owned and the use of Y25Hp Outboard engine by the sea fishermen. The number of trips made by fishermen per week, and the number of people employed in fishing had a significant association with the use of Y25Hp Outboard engine in the state.

Ondo State

Age, education, number of people employed in fishing and number of fishing trips made per week, were found to have significant association with the use of Y25Hp Outboard engine by the sea fishermen. Sea distance, number of canoes owned, number of wives, number of children, dependants and ethnic groups were found to have no significant association with the use of Y25Hp Outboard engine by the sea fishermen in the state.

8.7 Attitude of users and non-users towards the Y25Hp Outboard engine across the three states

The users of Y25Hp Outboard engine across the three states had very positive attitude towards the advantages of the engine; while the non-users attitudinal scores were very low. The disadvantages were reacted to along the same range except that most of the non-users claimed that it was not suitable for the type of fishing in their locality. A chi-square test of significant difference indicated that there was a significant difference between the attitudes of users and non-users towards the Y25Hp Outboard engine.

8.8 Determinants of the utilization of the Y25Hp Outboard engine

The results obtained from the Multiple regression analysis showed that the F-ratio of 4.2122 was significant at 0.01 level. The eight (8) independent variables jointly explained 19 percent of the variation in the Y25Hp Outboard engine utilization scores of sea fishermen. However, only two of the variables, gross income from fishing and the place of fishing, contributed or explained significantly (15.4%) the variation in Y25Hp Outboard engine utilization by the sea fishermen.

8.9 Determinants of the knowledge level of Y25Hp specific instruction by the sea fishermen

The result of Multiple Regression analysis gave an F-ratio of 16.01802 which was significant at 0.01. The six independent variables included in the analysis jointly explained 27.3 percent of the variation in knowledge scores of the sea fishermen. Only four of the variables: Outboard utilization, educational level, place of fishing and fishing experience made significant contribution (25.28 percent.)

8.10 Determinants of the fishing income of the fishermen

a) Traditional fishermen

The type of gear used and labour were the two variables that contributed significantly to the fishing income of the fishermen. These fishermen use various types of gears ranging from the passive gears to the active gears. While the passive gears depend on the movement of the fish for catchment, the active gears depend on the movement of gear for catchment. The number of people employed would however determine the speed, and the number of gears set by the fishermen.

b) Sea-fishermen

The type of gear, use of Y25Hp, fishing place, labour, fuel, fishing time and canoe number were important determinants of fishing income for this group of fishermen. The selectivity of the gear used would determine the type of fish and the size of fish caught.

8.11 Factors of constraints and categories across the three states

a) User category

The result of Discriminant Analysis gave the constraint profile as follows: Economic constraint factor (.91) with such variables like the high cost of Y25Hp Outboard engine, high cost of fuel, lack of money, and high maintenance cost and cost of spare parts as very important constraint variables ranked first in this category. Next was institutional constraint (.90) with high interest rates charged by credit houses, inadequate credit facilities as important variables. Supply constraint (.86) came third in this profile. This was followed by infrastructural constraint (.74) and Y25Hp Outboard engine technical constraint (.60).

b) <u>Non-user category</u>

This group like in the user category had the economic constraint (.93) as the most important limiting factor. This was followed by the institutional constraint (.87), gear constraint (specificity) (.69), socio-cultural constraint (.57), supply constraint (.55), geographical constraint (.55) and specie/value constraint (.53), all had negative effect on the transfer of the Y25Hp Outboard engine to the non-users across the three state.

However, a series of ANOVA (one-way) test of difference of constraint means across the fishing locations in the three states showed the following results:-

<u>Lagos State</u>

There was no significant difference in the means for economic and Y25Hp Outboard engine technical constraint across the three fishing locations in the state, while the other constraints were significantly different.

villages and the use of improper method of information dissemination.

Ondo State

Lack of funds, insufficient transportation to fishing villages, high fishing population lack of facilities in the fishing villages, inadequate supply system, lack of technical training in Y25Hp Outboard engine and no contact with manufacturers were constraints identified at the extension level in the state.

Service level

At this level, the policy of the federal and state governments, high import duties, and the high cost of the Y25Hp Outboard engine were important constraints across the three states.

8.13a Constraints in the multinational company level to the transfer of Y25Hp Outboard engine

Lack of local control, restrictive transfer practices, price, government control, contract agreement clauses, administrative, service and payment clauses were some of the constraints at this level.

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8.14 Costs and Returns of fishermen

The cost of production per traditional fisherman was lower than that of the fisherman operating motorized canoe. This was attributed to the current high cost of the Y25Hp Outboard engine.

However, the current net revenue per fisherman operating the paddled canoe was more than those operating the mechanized crafts in the coastal areas of the three states. It was discovered that the mechanized crafts could be profitably operated in the off-coastal areas of the three states.

Lastly, it was found that the catch data differed significantly for the two seasons except for the off-coastal for Ondo State. Also the mean catch of traditional fishermen and other Y25Hp coastal fishermen of the Y25Hp off-coastal fishermen were found to differ significantly in the three states.

8.15 Implications and recommendations

Based on the findings of this study and the discussions, some implications and measures which aim at improving the effectiveness of the transfer system in general and the utilization of the technology in particular are hereby suggested:

Government

a) The high importance attached to the economic constraint implied that the Federal Government should liberalise the policy on importation of fishing in-puts, especially the Yamaha 25Hp Outboard engine so as to close the gap between the fishermen and the technology. Both the fishermen, extension agents and the Multinational Company blamed the high cost on the current economic policy of the government.

b) The inability of most of the fishermen to purchase the engine is an indication that the current credit and support systems are inadequate. Most banks extend loan facilities to farmers but not to fishermen because of the risky nature of their occupation. There is therefore the need to re-introduce the 50 percent subsidy scheme for the outboard engine in the three states. Also the fishermen should be allowed instalmental payment for the engine. Directives should be given to banks to stop discriminating against the fishing group, especially at the cooperative level.

c) The non-availability of infrastructure and educational facilities in most of the fishing villages implied that fishing is not yet viewed as part of the larger rural economy in Nigeria. A reverse urban-rural migration trend as noticed in Ondo State also implied an increased number of households engaged in fishing. This could mean continued strong pressure on the open-access fishing resources and persistence of poverty (Smith et al., 1980). This transformation and the need to slow down rural-urban migration suggests the need for solutions to the problem of poverty and poor infrastructural facilities in most of the rural fishing villages as a whole. Policies must recognize the totality of the environment of the fishermen and the complementality between fishing and other aspects of the environment, including agriculture and other non-fishing activities. The government at the state level should see to the completion of most abandoned projects and proposed ones in the fishing villages, e.g. the Ogun State proposed channelization project at Igbeki, the suggested mobile aquatic schools for the children of the fishermen. Canals that would shorten the time and reduce the cost of reaching the fishing villages should be considered. Facilities like repair workshops, net lofts, landing jetties, storage facilities should be provided and improved upon at present. Coastal schools should be established for the children of the fishermen in the coastal areas. Adult literacy scheme should be extended to the adult fishermen to enable them learn to keep simple records of costs and returns. Also, medical facilities like dispensaries should be established in the coastal villages. Efforts should be geared towards population control among fishermen through intensive and sustainable family planning campaings.

d) The inability of inland fishermen and some of the sea fishermen to purchase the engine is an indication of the highly exotic nature of the materials used in manufacturing the engine. This has to do with the stage of transfer process. There is need to embark on the design and capacity transfer of the engine which would ensure further adaptability and institutionalization so as to reduce cost. The government should try to incorporate the know-how in the Nigerian system. In most of the coastal fishing villages of Lagos and Ogun States, the Government should introduce coconut oil making technology that could serve as a source of income in the off-season period for fishermen.

e) The presence of the socio-cultural constraint within the non-user's system implied cross-cultural incompatibility. There is therefore the need to study the aspects of culture that are against the transfer and to develop good rapport with the community leaders and associations. On the part of women stationed in the inland waters, lower horsepowers of the Yamaha outboard could be made available to them to operate in the calm waters.

f) The poor contact with the extension agents by most of the fishermen indicated that the fishermen/extension ratio is very high. Apart from this, the extension agents need the necessary facilities to operate so as to be able to meet the fishermen even on-the-job. Speed boats should be provided and gears to demonstrate in the presence of fishermen. There is need to train fisheries extension agents on the technicalities of the Yamaha 25Hp Outboard engine so as to improve their credibility with the fishermen. The State governments should also employ more extension agents into the states fisheries, so as to increase the rate of fisherman's contact with the extension agent.

<u>Almarine</u>

The lack of spare parts of the engine is an indication that there are not enough sales offices within the country. The company should ensure that more sales offices are opened in the country. There is the need to ensure that fishermen buy standard spare parts from the markets through regular advertisement to advise them on the differences between fake and standard spare parts.

The poor performance of the extension agents in the transfer of the engine also suggest that there was no regular contact between the company and the Ministry. The company should organise training programmes for the extension agents and even the fishermen since they constitute the highest percentage on their list of buyers.

The company should also ensure that the engine is assembled here in Nigeria so as to reduce the cost load on the fishermen.

Fishermen

The inability of the fishermen to own the engine is an indication that most of the cooperatives are no longer viable. There have been cases of embezzlement, mistrusts, and poor performances of the cooperative leaders. The fishermen need to work harder so as to make more money and contribute meaningfully to the purse of the cooperatives. Community self-help programmes should be embarked upon as as to reduce the burden on the government. This would ease their burden on some facilities like roads, schools. and others. Fishermen in the coastal areas of Ogun State for instance should also learn to make good use of the coconut tree. The following among others could be made from the coconut tree:

a) Confectioneries: The coconut could be used by the women to produce cakes, candies, bread, biscuits, coconut rice, and other local snacks.

b) Decorations: Brooms, foot mats, table mats, napkin holders, cups, and other beautiful household decorations could be made from the coconut leaves and husks.

c) Wears: School bags, ladies bags, belts, hats, shoes etc are other items that could be made from the coconut tree.

d) Coconut oil: The women could also extract oil from the coconut. This could be sold, used for the preparation of food in the household and the making of creams and soaps.

8.16 CONCLUSION

The following conclusions are made based on the findings on the study:

a) The study found amongst others that the users and non-users of the technology were not different significantly in terms of age, educational level, number of wives, children, dependants, tribe, number of people employed in fishing, and number of canoes owned in Ogun State. While they differed only in the number of people employed in Lagos State, their educational level and age also differed significantly in Ondo State. This gave an indication that the fishing activities were no longer solely in the hands of the old and uneducated fishermen in Ondo State.

b) The number of fishing trips made per week by the sea fishermen and the number of people employed were associated with the use of the Outboard engine. User category reported higher number of trips per week than the non-user category.

c) The user and non-user categories had different attitudes towards the technology.

d) The gross income of fishermen and the place of fishing were best determinants of their utilization scores of the technology.

e) The use of the technology, educational level of the fishermen, place of fishing and fishing experience were four important variables that predicted their knowledge of technology specification scores.

f) The user and non-user categories had the economic constraint as the most important limiting factor in the transfer process. However, in the non-user category, constraint profile, institutional, gear, supply, geographical, and value/specie constraints were others. The user category had also institutional, supply, infrastructural and Y25Hp Outboard technical problem as other constraints. It could be concluded therefore that the Y25Hp Outboard engine transfer was not constraint-free at the utilization level.

g) At the extension, service, and multinational company levels, the Y25Hp transfer process was also not constraint free.

Lastly, with the current high cost of the Y25Hp Outboard engine, artisanal fishermen in the user category could only operate in the off-coastal zone to be able to cover cost. The Y25Hp Outboard engine is the most important cost item for the fishermen in the user categories.

8.17 RECOMMENDATIONS FOR FURTHER RESEARCH

a) A similar study should be carried out in other coastal states of Nigeria so as to be able to compare the intensity of the constraint factors. However the following scales could be used:

1. The attitude scale
2. The constraint scale
3. The knowledge scale.

b) There is need to investigate more into the impact of productivity of fishermen users of the Outboard engine in the coastal states.

c) Study should be carried out to identify the limiting factors on the productivity of women in fishing.

d) Specific cultural values and norms affecting fishery in the coastal states of Nigeria should be identified.

e) Lastly, the socio-economic profiles of the artisanal fishermen in Nigeria should be studied.

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APPENDICES

A

QUESTIONNAIRE

CONFIDENTIAL

Constraints to technology transfer in artisanal fisheries: A case of three coastal states.

All information given for this study shall be strictly confidential and will not be used other than for this research, the benefit of fishermen in the three states.

STATE ________________
____

L G A ________________
____

VILLAGE ________________
____

ENUMERATORS' NAME ________________________________
____

7) Language | Read | Write | Speak

Language	Read	Write	Speak
Yoruba			
English			
Arabic			
Other(s) Specify			

FISHING

Length of time in active fishing .... years.

How much of your total working time do you spend fishing?

none,

some but less than 1/4

1/4 to 1/2

1/2 to 1/4

1/2 to 3/4

How many people do you employ in fishing? ....

How far is the sea from your village ....

Do your wives and children help you in fishing? Yes/No. ....

If you answer is Yes, then in what ways? ....

Tick the correct one

		Wife	Children
1)	Help mend the net		
2)	Propel the canoe		
3)	Clean the net		
4)	Clean the canoe		
5)	Processing and sale		
6)	Others		

How often do they assist? Always, Sometimes, Often at request

(Please tick one).

How many men do you usually go fishing with? ....

How many trips to you make per day? ....

Where do you normally fish at the peak and slack periods of the year?

....

	Code Period		Cope Place	
1)	Peak	1)	Coastal	Fish type(s)
2)	Slack	2)	Deep sea	

What type of fish do you catch Peak/Slack Peak/Slack

....

Fishing income:

1,000 1,000-1.999 2.000-2.999 3.000

	SA	A	U	D	SD
A. Benefits of using the Outboard					
1) The Outboard moves faster than the paddle.					
2) The outboard engine leaves more room for catches.					
3) The outboard engine is relatively cheaper to acquire.					
4) The outboard has a longer life span.					
5) The outboard is easily available than the paddle					
6) More trips are made per day with the outboard engine					
7) With the outboard, the open sea could be reached.					
8) The outboard is very light					
9) The outboard has made it possible to reduce crew.					
10) With outboard, fishes of higher economic values are caught.					

	SA	A	U	D	SD
11) Gears are set faster with the outboards engine.					
12) Catches could be brought faster to landing safe before spoilage					
13) With the outboard engine the canoe does not have to be grounded to be serviced.					
14) With the outboard engine bigger sized canoes are used.					
15) The outboard engine has made it possible to increase the actural fishing day per month.					
16) Reduced hours per day to and from the fishing ground is recorded with the use of the outboard engine.					
17) With the outboard installation, the possibility of the craft fishing is greatly reduced.					
18) With the outboard engine, fishing time lost in repairing the outboard is reduced.					

	SA	A	U	D	SD
Disadvantages of using the outboard					
1) The cost of repairing the outboard engine is too much					
2) The spare parts for the outboard engine are not easily available in the market.					
3) Most of the available spare parts in the market are not original.					
4) The outboard engine is too costly to acquire.					
5) The cost of building the canoe that would be suitable for the outboard is too much.					
6) The cost of fueling the outboard is too high.					
7) The outboard is not suitable for the type of fishing in the locality.					
8) The outboard engine breaks down too often.					
9) The life-span of the outboard engine is too short.					

c) Sports

d) Others (specify)

8) If you use the outboard for other things rather than fishing, please give reason for doing so.

a) ....

b) ....

c) ....

d) ....

9) Why do you prefer the outboard engine to the paddle?

a) ....

b) ....

c) ....

d) ....

10) What gears do you use along with the outboard? Please specify

1)	3)	5)
2)	4)	6)

11) How often does your outboard engine bread down (please specify) ....

12) Where were you fishing before you purchase the outboard engine ....

1. How adequate is your village extension worker in knowledge of your outboard engine problem

1 2 3 4 5

2. How able is your extension worker to communicate outboard ideas

1 2 3 4 5

3. How adequate is your extension worker understanding of the functuring of outboard engine

1 2 3 4 5

4. To which degree do you trust your extension worker in terms of his knowledge of fishing gears, craft, promise; etc

1 2 3 4 5

5. To which degree is your extension worker interested in increased output of the artisanal fishermen

1 2 3 4 5

	SA	A	D	SD
8) The extension agents use improper methods to disseminate information about outboard engine.				
9) The extension agents lack the necessary contact with the manufacturers of the outboard engine.				
10) The supply system is inadequate				
11) The fishermen do not need the outboard so not interested				

EXTENSION METHOD:

Which method does your extension agent use in disseminating the information about the outboard engine? Demonstration, lecture, individual contact (please specify).

Do you like this method? Yes/No

If no, what are your reasons? ....

If yes, what your reasons? ....

CONSTRAINTS

Indicate by rating which of the following hinder the adoption of outboard engine

1	2	3	4	5
Least important				Most important

Socio/Cultural Constraints:

1) It is against the norms and values of the village to own an outboard engine.
2) The village god/goddes is against it.
3) The social functions in the village does not allow one to own an outboard engine.
4) Possession of outboard engine would expose them to the outside world.
5) Your extended family law is against the use of outboard engine.
6) Others (Please specify)

Outboard Engine Constraints:

1) Absence of a power-take-off.
2) Limited propeller selection.
3) Life span of the outboard engine is very short.
4) The fuel consumption is too high.
5) The outboard engine is not reliable.
6) Others (Please specify).

Personal Constraints:

1) You are too old to operate the outboard engine.
2) You do not posses the necessary education

c) The transfer from the Ministry down to the fishermen is partially efficient.

d) The transfer of the engine from the Ministry down to the fishermen is not efficient.

2. Give reason(s) for your choice:

   a)

   b)

   c)

   d)

3. The limitation of the engine transfer to the material level is good for the development of artisanal fisheries in the state.

   Yes/No ....

4. Give reason(s) for your choice

   a)

   b)

   c)

   d)

5. The design and capacity transfer of the engine should be effected. Yes/No.

6. Give reason(s) for your choice

   a)

B.

KNOWLEDGE ABOUT Y25Hp OPERATION

Fuel and Lubricants:

A) Which of the following fuel is recommended for Y25Hp Outboard engine:

1. Unleaded Gasoline containing alcohol. Yes/No.
2. Unleaded Gasoline containing no alcohol. Yes/No.
3. Unleaded Gasoline containing no alcohol with 85 pump octane. Yes/No.
4. Regular leaded gasoline containing no alcohol. Yes/No.
5. Regular leaded gasoline containing alcohol. Yes/No.

B) Which of the following lubricants is recommended for Y25Hp Outboard engine:

1. Use Yamaha CCI oil. Yes/No
2. Use Yamaha BIA certified lubricant. Yes/No.
3. High grade Outboard motor oil. Yes/No.

C) What is the ratio of gasoline oil mixture?

1. 30 : 1 Yes/No
2. 25 : 5 Yes/No
3. 50 : 1 Yes/No
4. 50 : 2 Yes/No

B1.

Reliability of the constraint scale

The reliability of the constraint scale was determined using the test-retest method. This was carried out as follows:

The constraint scale was administered to 60 fishermen from five cooperative societies in Bendel State. The total score for each fisherman was calculated for the 39 selected items on the scale. Another administration of the items on the scale on the same set of 60 fishermen was carried out four weeks after the first administration. The total score, for each fisherman on the second administration was also calculated. The correlation between the scores was then determined by the use of the Pearson r. The calculated value of Pearson r coefficient of 7.23 indicated that the scale was quite reliable.

$E X^2H$ = Sum of the squares of the individual scores in the high user group (20 fishermen)

$E X^2L$ = Sum of the squares of the individual scores in the low non-user group (20 fishermen).

When scores were substituted into the formulae, the 't' value from the t-test was calculated to be 3.89 which was significant at the 0.01 lad. This indicated that the scale was valid since it was able to discriminate between the two group of users and non-users of Y25Hp Outboard engine.

The method of determining reliability was also done as for the knowledge scale. The Pearson r value of 0.11 indicated that the scale was quite valid.

B4

Scores used in the determination of the reliability* and the validity** of the attitudinal scale

Serial No.	Scores for first administration	Scores for second administration
1	150	152
2	145	145
3	150	150
4	165	160
5	170	175
6	140	145
7	148	140
8	172	174
9	156	150
10	149	158
11	145	140
12	152	150
13	145	150
14	150	150
15	150	152
16	162	168
17	152	152
18	154	158
19	135	140
20	140	140
21	142	142
22	146	140
23	136	140
24	130	136
25	140	140
26	137	140
27	138	140
28	160	165
29	136	140
30	140	142
31	138	142
32	140	150
33	134	140
34	130	135
35	140	140
36	136	138
37	152	150
38	136	140
39	139	140
40	142	140
41	124	122
42	134	136
43	119	124
44	121	126
45	108	110
46	110	110
47	98	100
48	100	100
49	92	90
50	90	82
51	97	90
52	90	90
53	92	100
54	90	98
55	65	70
56	82	80
57	72	94
58	100	102
59	90	92
60	86	90
61	93	98
62	100	102
63	82	86
64	86	90
65	70	76
66	82	90
67	70	79
68	60	80
69	92	90
70	80	70
71	73	86
72	92	90
73	110	100
74	80	86
75	70	79
76	100	100
77	102	100
78	100	98
79	90	86
80	80	72

* Pearson r, correlation coefficient was used to find out the level of agreement of scores on the two administrations of the scale in determining its reliability.

**t-test was used to compare the means of the user and non-user groups in determing the scales validity.

B5

Scores used in the determination of the reliability of the knowledge test*

Serial No.	Scores for first administration	Scores for second administration
1	38	39
2	40	41
3	29	30
4	27	30
5	32	32
6	28	28
7	26	28
8	36	36
9	31	32
10	30	30
11	28	28
12	32	36
13	31	32
14	26	26
15	29	29
16	34	36
17	30	34
18	27	27
19	31	32
20	34	34
21	30	30
22	30	30
23	32	32
24	40	40
25	37	36
26	34	34
27	41	42
28	36	36
29	42	42
30	35	35
31	40	41
32	38	40
33	41	40
34	42	42
35	40	40
36	39	39
37	40	42
38	30	32
39	39	39
40	37	36
41	38	40
42	36	37
43	30	30
44	40	40
45	30	30
46	29	32
47	36	38
48	34	36
49	36	42
50	38	40
51	40	40
52	39	40
53	36	39
54	34	34
55	42	43
56	38	40
57	39	36
58	40	38
59	42	45

* Pearson r, correlation coefficient was used to ascertain the lead of agreement of scores on the two administrations of test.

Indicate which of the following constraints retard your activities in outboard engine transfer by marking Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD).

	SA	A	U	D	SD
1. Inadequate training in outboard engine technology and crafts.					
2. Lack of facilities to operate in fishing villages.					
3. Improper organizational communication flow					
4. Insufficient transportation to fishing villages.					
5. Lack of funds.					
6. Fishermen population too high for thė number of extension agents.					
7. Use of improper methods of disseminating information.					
8. No contact with outboard engine manufacturers.					
9. The supply system is inadequate.					
10. The fishermen lack of interest.					

	SA	A	U	D	SD
11. The socio/cultural condition of the villages against the transfer.					
12. Others (Please specify).					

Which method do you use to disseminate information to the fishermen ....

Do you take them of field trials .... Yes/No.

Do you organize training programme for them on the use of outboard engine? Yes/No.

If yes, how frequently? ....

If no, what are your reasons for not doing so.

1.

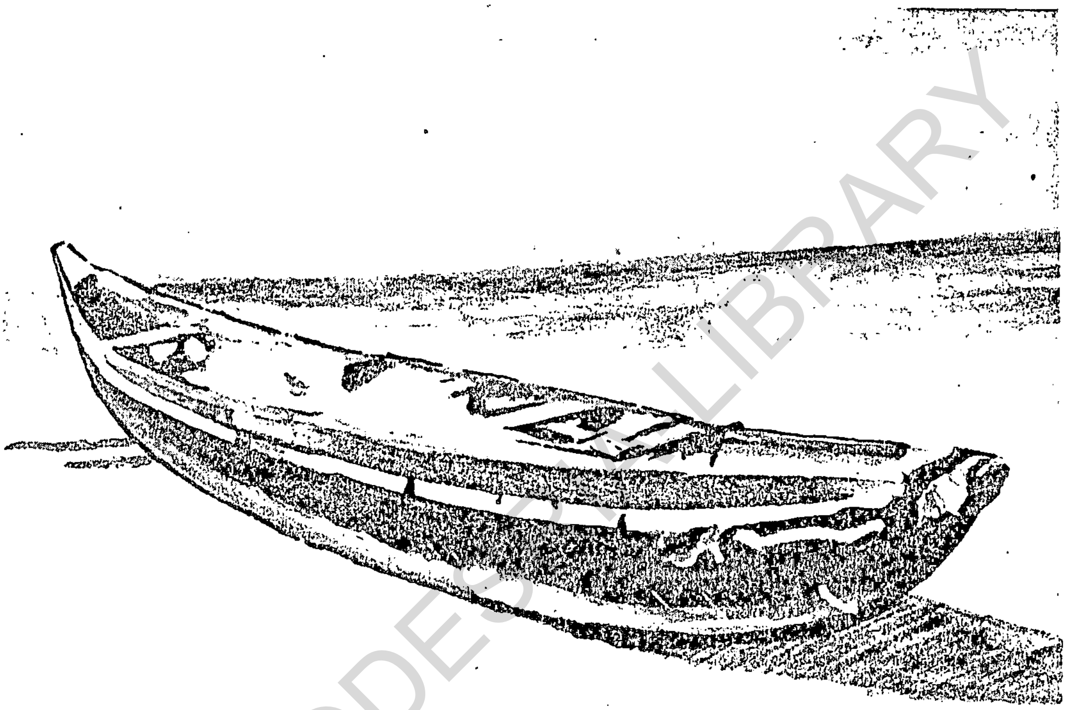
2.

B.

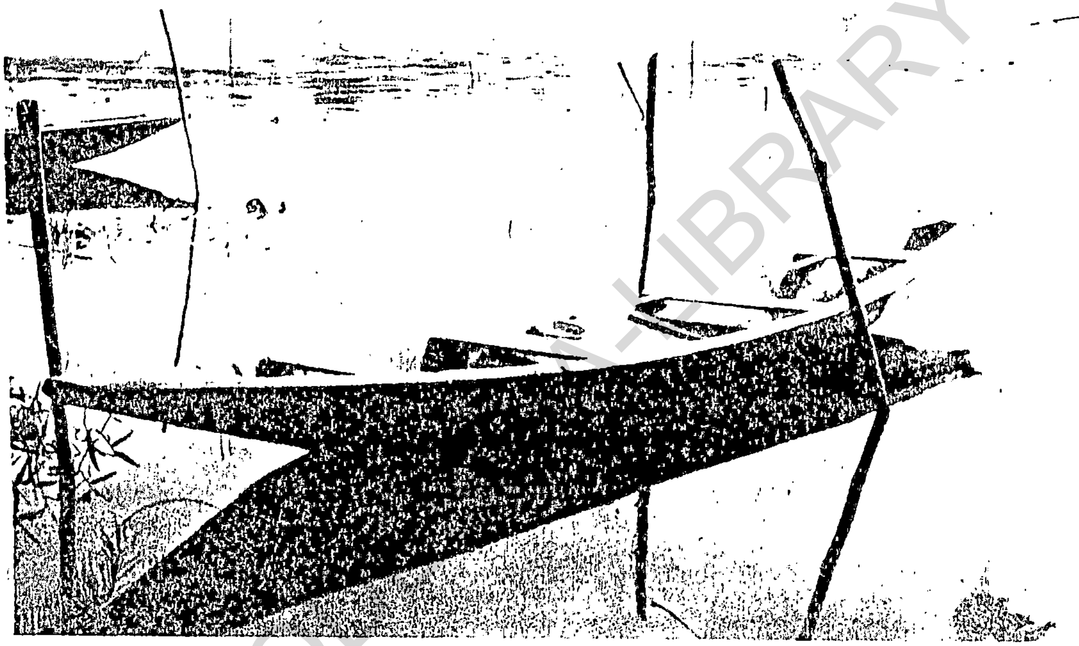
INTERVIEW/DISCUSSION SCHEDULE

A) Almarine Officials

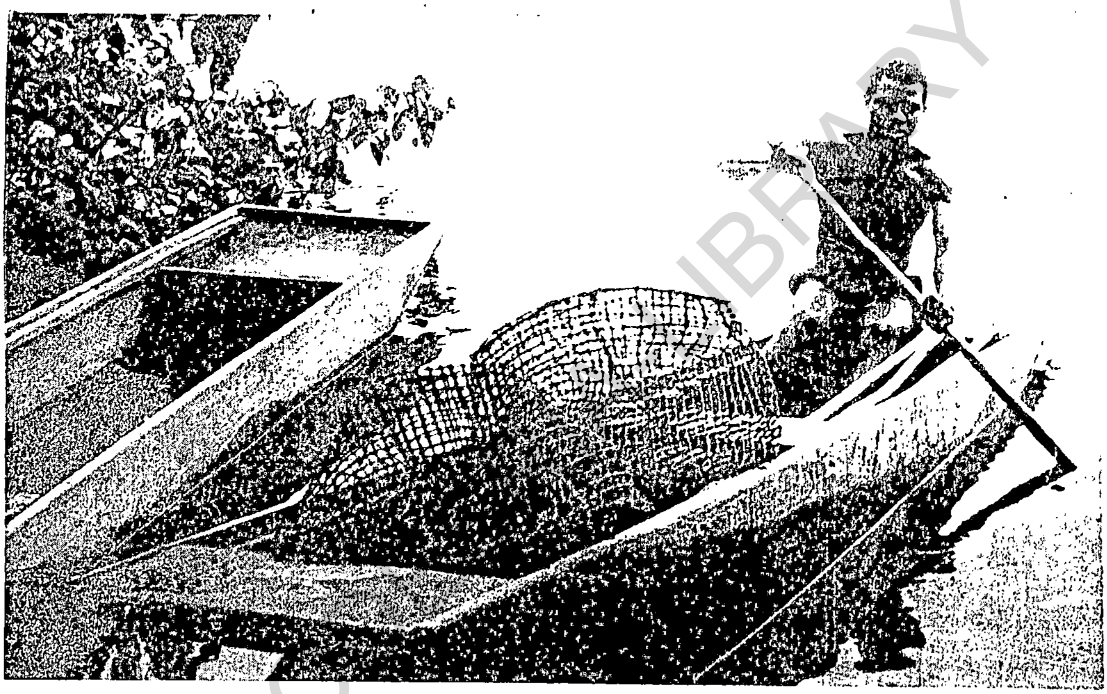
1. What are the constraints associated with the transfer of Y25Hp at the following levels?
    a) State level
    b) National level
    c) International level
2. What are your suggestion(s) for the improvement of the transfer system at the level stated in (1).
3. Any other useful information.



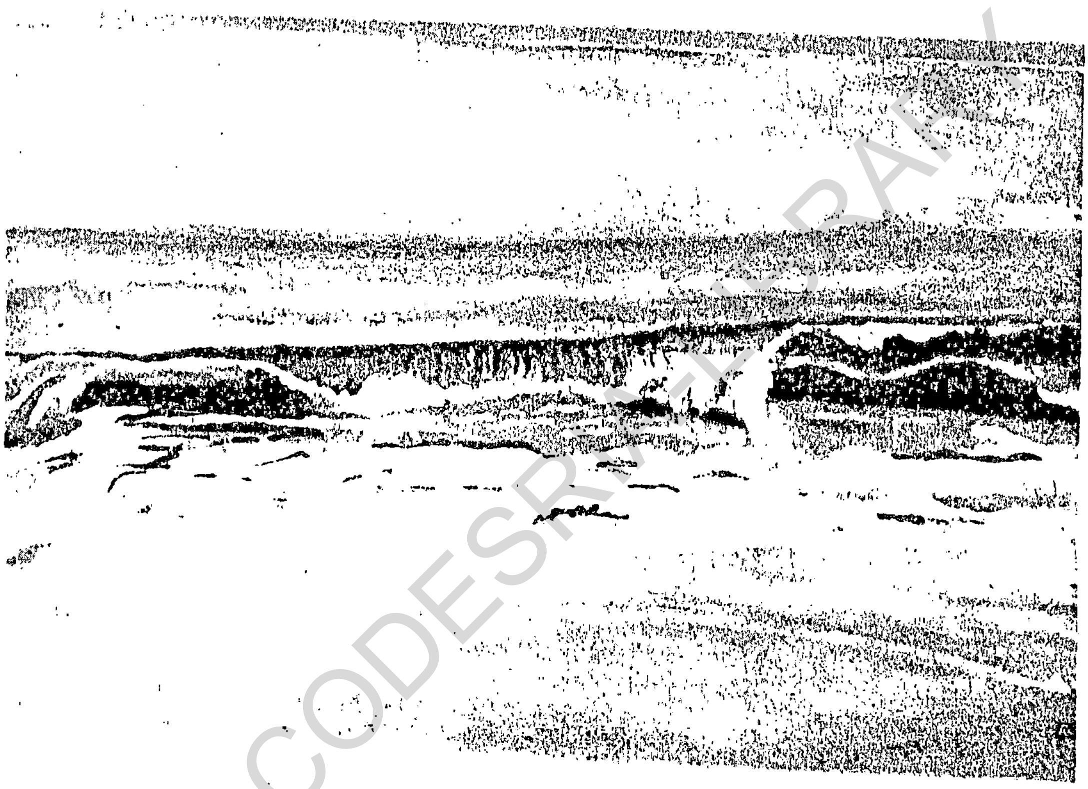
Wooden Canoe used by Sea Fishermen.



Wooden Canoe used by Fishermen in the Lagoon.

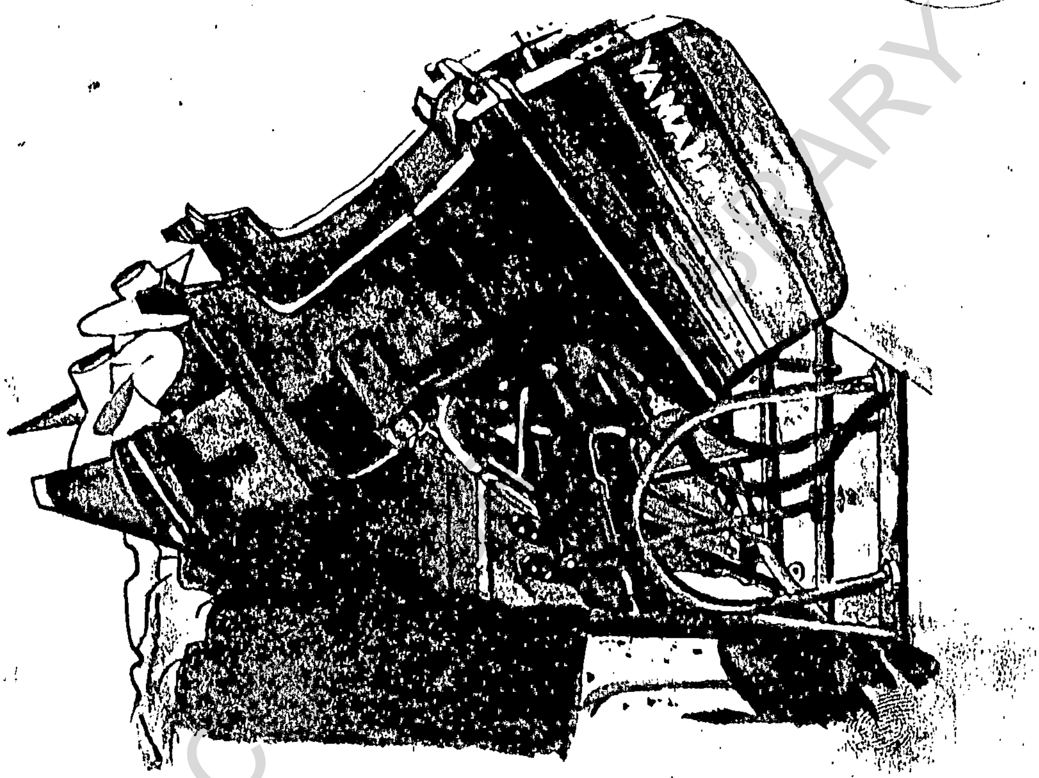


Artisanal Fishermen Paddling the Wooden Canoe.



The Open Sea

The Lagoon



Yamaha 25 Hp Outboard Engine