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Fish Culture Economics and Extension

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Abstract: Fish culture economics and extension was reviewed to enable fish culturist plan effectively before involved in fish culture and practices. The cost and benefits of fish culture need be known before participation in the business. There is need for cross-link between research and the fishing community. Prior to introduction of any new innovation in fisheries extension and evaluation of such programmers, the agency responsible for such exercise should have full knowledge of the existing farming practice/techniques and the reasons behind them. In assessing or evaluating the impact of any new techniques or programmers, consideration should be given to such factors as natural conditions, local infrastructures, socio cultural setting, farmers' production aims and labor economics. The study reviews the types of feasibility study, a typical feasibility study and report on a fish farm project and detail analysis of culture extension to enable fish culturist plan effectively before involved in fish culture and practices.

Keywords: Cost benefit analysis, extension, feasibility study, fish culture

INTRODUCTION

The cost and benefits of fish culture need be known before participation in the business (FAO, 1966). A thorough cost-benefit analysis, market survey and management technique is necessary for the establishment of the project. In assessing the cost of expenditure consider all possible options and decide on the best option for the venture. A feasibility study demonstrates the viability and successfulness of a project (Awachie, 1968). In fish culture ventures, location feasibility involves studies on the topography, source of water and the physical environment. Biotechnical feasibility involves studies on the biology of the selected species, engineering design and other technical aspects. Economic feasibility deals with the aspects of available capital, projected income, pay back and market surveys (Awachie, 1969).

Fisheries extension is aimed at educating, assisting and organizing the fishers / fish farmers obtain the best yield from their fisheries activities (Mutter, 1972a). Research in Fisheries, are of no use unless the findings can be utilized by the rural people. Research findings may not be useable on their initial release nor do they transform into fisheries practices. In most cases, there's usually a considerable time lag between the development of a new technique and its application, for research findings to contribute to fisheries development (Welcomme, 1974). There is need for cross-link between research and the fishing community (Awachie, 1973). The extension agent therefore, is the logical link for this purpose (Mutter, 1972b). The primary objective of extension is to change or improve the living standard of the people. He is therefore an educator. His responsibility is to become thoroughly acquainted with the people, win their friendship, trust and help them, mobilize their efforts and resources in developing processes. This is achieved by developing in rural people, the qualities of leadership, self-reliance and self-confidence (Eweka, 1973).

In extension, monitoring and evaluation are very important. This will enable you access the level and rate of diffusion of your message. How much the target audience understands and applies your new messages, ideas and invocations. Monitoring provides the extension workers/managers with feedback on the extent extension has progressed, when compared with initial or original plan. Evaluation attempts to explain and measure the level of efficiency of plan execution relative to costs and accrued benefits. A key indicator of the effectiveness of training and visit extension is the adoption rate, which provides immediate feedback about program performance. Multiple data collection method is the current approach to monitoring and evaluation. Emphasis is on rapid, cost-effective method that attracts the complexities of the target audience (Ezenwa, 1974).

Monitoring and evaluation in extension sustains a program, ensures continuity and diffusion, even in the event of any change of an extension officer. It is proper to note that any extension program is for rural development. It is people centered and is based on the

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principle of democratic participations. Prior to introduction of any new innovation in fisheries extension and evaluation of such program, the agency responsible for such exercise should have full knowledge of the existing farming practice/techniques and the reasons behind them. In assessing or evaluating the impact of any new techniques or program me, consideration should be given to such factors as natural conditions, local infrastructures, socio cultural setting, farmers' production aims and labor economics. The organizational structure of any extension agency depends on the scope of its subject matter coverage and the number of scattered clients to be reached. Fish culture development can be promoted through the communication of information to supposedly ignorant farmers in a particular area (Welcomme, 1971). This study reviews the types of feasibility study, a typical feasibility study and report on a fish farm project Fish and detail analysis of culture extension to enable fish culturist plan effectively before involved in fish culture and practices.

FEASIBILITY STUDY

A feasibility study demonstrates the viability and successfulness of a project. Investment in fish farming can be from a single item to an integrated item such as:

- Fish ponds or enclosures
- Hatchery
- Feed plant
- Ice plant
- Cold storage
- Processing plant
- Whole sale and retail markets
- Other supporting services such as research, training, extension, credit facilities and information

Three broad aspects of feasibility study in a fish culture venture include:

- Location or site feasibility
- Bio-technical feasibility
- Economic feasibility

In fish culture ventures, location feasibility involves studies on the topography, source of water and the physical environment. Biotechnical feasibility involves studies on the biology of the selected species, engineering design and other technical aspects. Economic feasibility deals with the aspects of available capital, projected income, pay back and market surveys.

Location feasibility: In fish culture projects, it is absolutely essential to know the land geomorphic characteristics, height and slope. A contour survey can show the full drainage pattern and land levels. A contour map of the area facilitates decision on the various locations in the overall farm design. For instance, the drainage pattern is particularly important in brackish and tidal fresh water areas. The tidal range is also very important; especially when the ponds are designed to receive and remove water by gravity. The soil structure, distribution and composition need to be known. Soil structure and composition varies from place to place. For instance, ponds sited in soil with, large quantities of sand, gravel and peat, suffers from water retention problems. A soil map reveals this and determines the suitability of a site. The soil profile in a proposed mangrove site with peaty deposits of several meters depth faces acidity problems. Water leakage from the dyke becomes common. Therefore, in appraising a feasibility study for fish culture venture, the topographic study, need to be carefully examined. This provides the basis for evaluating the suitability of the proposal for engineering design and mode of construction.

The nature and source of water is also important in location feasibility, because the only habitat of fish is water. Therefore, fish culture venture involves a ready source of water. However, not all water is good for fish culture. The source of water, distance and means of procurement, seasonality, quantity, pH and turbidity, level of dissolved oxygen, pollutants, cost and technology of procurement are important considerable factors in fish culture. The depth and pattern of water flow is very important in cage and enclosure culture. It is also necessary to know the nature and nearness to possible sources of pollutants (Abowei *et al*., 2011). Therefore, it is not enough to identify a source of water. The availability, quality and means of procurement are important because these ultimately contribute to the success or failure of the project.

Biotechnical feasibility: This includes the biology of selected species, engineering design and the mode of pond construction. In considering the biology of selected fish species, the life history of the species must be known. It is important to ensure that the species are locally available; easily adaptable to local environmental conditions and can grow fast (Phelines *et al*., 1973). Other factors considerable for culture fish species are:

- Resistance to disease and parasites from crowded conditions in ponds, cages or enclosures
- Availability of seed; can the species reproduce in captivity naturally? Induced spawning or procurement from the natural environment in sufficient quantities
- The food and feeding habit of the cultured fish; can it accept artificial feed or depends only on its natural food

All these questions are necessary because the revenue projections depend on any or all of these factors. Any wrong fish species selection hinders the success of the project.

The design for a fish culture project depends on many factors including the topography, source of water and type of fish culture practice envisaged. For example, if the chosen site is on a slope and the source of water is a perennial stream, it is adequate to have a design for simple diversion, if the stream is seasonal, the design can include a reservoir for water storage. If the terrain is suitable, a simple canal serves as the diversion. A pump station can serve as an alternative to canal when the construction cost of the canal is much.

Fish dies in stagnant water due to oxygen depletion and diseases. Intensive fish culture with high stocking density demands design for water out flow system through the ponds. However, extensive fish culture practice can be designed for water retention alone. A simple slope on the pond bottom is good for ordinary fishponds. But, definite drainage canals are needed in shrimp culture. The height and thickness of dykes depends on the type of terrain. If the area is susceptible to flooding, construct wider and higher dykes to avoid collapse. Diversions and an outflow system are necessary pond designs in sloppy areas, prone to frequent heavy rainfall.

The type of engineering design adopted determines the cost of the project. Therefore, designs should be simple and easy to operate. Even when the farm demands an intensive operation, complicated designs requiring sophisticated machinery should be discouraged unless they are absolutely necessary. The most cost-effective designs are preferred to costly complicated designs.

A feasibility study for a proposed fish culture project must take into account of the mode of construction and its suitability. This depends on the topography and the scale of operation in the proposed farm. On solid land, machinery can be used for the construction. This depends on the depth of excavation required. Some terrains require little excavation. This can be done manually. Manual operation is also good for swampy terrains because of the high cost of procuring appropriate machinery such as swamp dozers or mounted floating excavators. This however depends on the scale of the proposed project.

Machinery is inevitable for large-scale projects. It is quite ridiculous to construct 1000 ha brackish water fish farm manually and absurd to use machinery for a small project ranging from 0.1 to 0.5 ha fishpond in a swampy terrain. The mode of construction determines the amount of expenditure required for the construction of the farm. Therefore, in appraising a feasibility study for a proposed fish farm, adequate attention should be paid to the proposed means of construction and its suitability.

Economic feasibility: This aspect of feasibility appraisal is also very important. A well located farm with perfect construction and managed by experts, can fail when the economic feasibility is faulty. Feasibility appraisal for fish culture involves a thorough analysis of financial inputs, expected income, market surveys, projections and management structure. Assessments of financial inputs include every source of expenditure. The following are some aspects of the sources of expenditure in fish culture:

- Cost of land
- Cost of survey
- Cost of design
- Cost of construction
- Cost of water
- Cost of power supply
- Cost of labor
- Cost of marketing
- Procurement of fertilizer
- Procurement of seed
- Procurement of feed
- Cost of harvesting
- Cost processing and preservation
- Transportation cost

An appropriate decision must be taken on the best option that would serve the best interest of the enterprise. This is inevitable in the cost assessment for these areas of expenditure. Would it be cheaper to use machinery for construction instead of manual labor? Is it more economical to manufacture feed than depend on manufactured feed? All the alternative methods must be considered before adoption.

Another important aspect of financial inputs to be considered in economic feasibility is the various possible levels of financial inputs and the combination that requires the least cost for optimum production. For instance, if it is decided to manufacture feeds for the project, would it be better to invest in a small feed mill? A bigger feed mill earns more money and therefore more desired.

Expected income: An economic feasibility study makes reasonable projections on the possible income from a fish culture project and estimates of income accounts for all possible factors affecting an income. These include:

- The area under cultivation
- The species cultured
- Time of growth to market size
- Projected value of harvestable fish per unit area of pond
- Market value of fish
- Least purchasable quantity on a daily basis

- Fish supply from other sources
- Seasonal price variation index

Cash flow analysis: An economic feasibility presents a credible cash flow analysis, based on pre-knowledge to the project future trends. It estimates the mode of refunding loan and annual entrepreneur payment. Marighae (1991) proposed a formula for the payback period. The modified formula for the payback period is given as:

$$S = A \frac{(r\,(I + r)n}{(l + r)n - 1}$$

where,
S = Annual payment
A = Loan
r = Interest rate
n = loan period

The pay-back period "T" can be estimated as:

$$T = \frac{C}{E}$$

where,
T = Payback period
C = Initial investment
E = Average annual profit

The cash flow analysis after evaluation of all aspects of the cash-inflow and cash-outflow results in a profit statement that estimates the level and extent of the profit accruing from the project.

Market survey: A market survey study on the existing fish market, the price pattern, the preference and biases. It examines the existing source of fish supply and determines the elasticity or rigidity of the demand for fish and its effect on future expansion. The study identifies possible alternative markets in case the local market becomes glutted. The study can indicate the necessity for advertisement to expand the local market (Mann, 1962).

Management structure: A good venture with a faulty management structure can fail for that reason alone. Clashes are bound in improperly defined duties. This can lead to negligence of duty. Therefore, hire only the minimum number of personnel that can be profitably engaged. A feasibility study should include a thorough job description and evaluation of each staff, the optimum labor force required for specific jobs. The decision on the optimum labor force answers certain basic questions:

Is it cheaper to retain a full time worker to cut the grass on the farm or to hire periodically as the need arises? The study can also include the salary structure of the workers and the financial implications of the project.

Bookkeeping: In fish culture ventures, book keeping involve recording the condition of the project, the inputs and outputs. In a fish farm, the 'condition records' can be in the form of water quality such as pH, dissolved oxygen, turbidity, phosphate, nitrogen etc. The inputs reports are in financial terms. The output follows the same pattern. Inputs are of two categories. These are variable and fixed inputs. Bookkeeping effort takes both into account. Records can be kept as outlined below. It is preferable to have separate records for each pond. The categories of records include:

- Daily records (variable inputs)
- Daily records (labor inputs)
- Record of fixed inputs
- Records of loans
- Inventory of assets and assessment of depreciation
- Records of inputs

A typical feasibility study and report on a fish farm project will explain better.

A TYPICAL FEASIBILITY STUDY AND REPORT ON A FISH FARM PROJECT

Introduction: This study was undertaken by FRENES and sons, having been so commissioned by fish farmers' enterprises on the 20th April 2012. The purpose of the study is to provide statistics on the following to assess the viability of the establishment of a fish farm at Angiama-gbene in Southern I jaw Local Government Area, Bayelsa State, Niger Delta, Nigeria:

- The entire concept of the project
- The most viable dimension of the project including construction and structures
- The production technology
- The cost and revenue estimates and other projects for a year period
- Expansion/development and implication schedule
- Cash flow and financial plan of the project

Executive summary:

- The fish farm project is intended to use the back-swamps along the River Nun in the upper Niger Delta for the purpose of producing fish (catfish and tilapia) for sale. The project would be located at Angiama-gbene and would produce fish and fingerlings.
- The labor required would be available, particularly the unskilled, which are readily available in the project area. Manual construction would be

adopted for the construction of the fishponds because of the economic advantages. There is abundant unskilled manpower in the project environment. The market existing in the area, surrounding the project has not been exploited. The project market is therefore unlimited and all fish produced would be a ready market. The demand for table fish exceeds the supply.

- Required electric power would be supplied by the installation of a 15 KVA generator. The electric supply would be used in pumping water from the borehole.
- The project is financially viable and at the envisaged scope of operation (6 years). A long-term loan of $ 1,500,000 (One million five hundred thousand US Dollars), is to be raised. From the second year, the project would generate sufficient cash to sustain production. The loan would be defrayed in the sixth year of the project.
- The project is socio-economically viable. It would create employment and has a potential to improve the economic environment. It would help to put into use waste back-swamps and the project has no discernible hazardous impact on the environment.
- There would be no difficulty in the introduction of the technology to be adopted for the project. The principal manager of the project is adequately trained personnel with skill in fish farming.
- The projections for the project take care of taxes payable from the second year and even at that the profit would be high.
- The sponsors of the project would provide the cost of land acquisition, topographic and parametric survey and design of the fish farm. This could represent their contribution to the capital.

Project background and concept: Bayelsa state covers a land area of 19,240 sq. land area of 923 773 sq. km. The state is dissected centrally by longitude 6°E and latitude 4°30'N. The population of the state is 1,121,293. Its only border is 185 km of coastline through which it's many rivers: Ramos, Dodo, Pennington, Dig atom, Middleton, Koluama, Fish town, Sangana, Nun River, Brass River, St. Nicholas and Santa Barbara flow into the Atlantic Ocean. The Ramos River, which marks the effective demarcation with Delta State, cuts several Ijo communities into unequal parts between 2 states. It places a few Lorhobo and Asoka communities in Bayelsa state. Rivers state is the northern boundary. Traditional fishing is carried out in the rivers and lakes in the back swamps.

During the flood, the flood plains are connected with adjoining rivers and creeks. These flood plains provide nursery and breeding grounds for a large variety of fish. Many fish species find it difficult to survive due to the low oxygen levels present in such water bodies and try to return to the main river during draw down. Others adapted to these conditions remain in the flood plains as they find shelter in local fishponds. Local fish ponds submerged during the flood season are visibly scattered during the dry season. These ponds are dug during the dry season to a depth of 2 m in the flood plains. Within the ponds, solid hollow wood materials are provided for fish to hibernate. The interiors of these materials are cooler than the surrounding water. During the flood, fish of different species are trapped inside the ponds. Between December and March, the ponds are bailed and fish totally harvested.

The state covers numerous low lands in the Niger Delta. The Niger Delta Basin covers all the land between latitude 4°14′ N and 50°35′ N and longitude 5°26′E and 7°37′E with. It extends along the coast from the rivers basin in the west of Bonny River with a characteristic extensive interconnection of creeks. It is the most important drainage feature of the Niger-Basin River system with 2% of the surface area of Nigeria. The annual rainfall is between 2000 and 3000 mm/year. The dry season lasts for 4 months from November to February with occasional rainfall.

The fresh water reaches of the lower Nun River is one of the most important river systems in the Niger Delta providing nursery and breeding grounds for a large variety of fish species. One significant aspect of the Nun River fishery is its occurrence when the catch from the flood plain swamps are reducing. Fishing in the river is intensified and catch per unit effort is reduced. Due to our efforts towards speedy industrialization and recreational activities, this river is fast degraded. Fishing is carried indiscriminately with various traditional and modern fishing gears. Fish production declines at an alarming rate. Fish protein is provided from iced fish supplied from the state headquarters. Fish becomes scarce and expensive. This trend needs to be checked.

Fish market: The fish farm proposed is expected to supply fish to the neighboring communities and the entire state at affordable prices. Table 1 shows communities that can benefit from the project.

Project location: The project would be located at Agiama-gbene in the River Nun. The town is situated on the bank of the silver creek with vast back swamps suitable for conversation into the farms. Presently, the back swamps are not used for any economically profitable ventures and the main desire to locate the proposed fish farm at Agiama-gbene was based on the fact that the back swamps can be profitable and cheaply used. The cost of the land is considerably low because it is presently not used for any major economic venture.

Table 1: Neighboring communities and estimated households

Communities	Estimated households
Yeneka	1392
Ikolo	1584
Ikibiri	1493
Anyama	1430
Oweikorogha	1534
Angiama	1536
Oporoma	1328
Onyonma	1304
Nengiama	1431
Ekowe	1294
Peremabiri	1392
Total	16,718

Project technical feasibility: The project would be in two separate compartments: Fish production unit and a hatching unit. The fish production section would be concerned with the production of table size fish for consumption. The layout of production would start with 20 production ponds of 0.06, 0.08 and 0.3 ha respectively. In the 1st year of operation, four 0.06 ha, three 0.08 ha of ponds would be constructed and stocked.

The four 0.06 and 0.08 ha ponds would have a stocking density of 12,000 tilapia and catfish fingerlings per culture period. The 0.3 ha ponds would have a stocking density of 52,500 fingerlings per culture period. The 10 initial production ponds would therefore have total fish density of 36,600 tilapia fingerlings and 45,000 catfish fingerlings when fully stocked.

Two other non-indigenous species of fish would also be used as secondary stocks in addition to tilapia and catfish. It is intended to introduce other species such as *Heterotis* sp., *Gymnarchus* sp. and common carp (*Cyprinious carpio*), which are native species as secondary stocks (Abowei and Tawari, 2011). A poly culture system of production using a combination of different species would be adopted. In this way, it is expected that total yield would be increased per unit of production. The bio-technical feasibility of the selected two major species is given as follows:

Tilapia: These cichlids are among the most important fish species of commercial interest in most parts of Africa. In Nigeria generally, as in the south-south zone of the country in particular, at least twelve species of cichlids belonging to five genera occur naturally. They are usually quite numerous in the places they occur and the genus Oreochromis is preferred for aquaculture operations. The five genera represent different ecological bio-types. Tilapias are basically herbivorous.

The mouth brooder Nile Tilapia is indigenous to Africa. It is suitable because of its high yield potential, resistance to overcrowding and disease and ability to survive low oxygen levels in water. They are also known for their ability to feed on a wide variety of waste products and high productivity in captivity. This would reduce the problem of procurement of fingerlings.

Catfish: The catfish belongs to the family Clarinda. This family is divided into two genera: Claries and Heterobranchus. Claries have 8 major species while the latter has 3 species in the south-south zone of Nigeria. The former has a single rayed dorsal fin extending almost to the tail; the latter has a rayed dorsal and adipose fin (Reed, 1969).

The Claries family would be used for the project because they feed on wide variety of food ranging from weeds and planktons to insect larvae, snails crustaceans, worms and shellfish (Sivalingam, 1972). The Claries species can accept a wide variety of agricultural by-products, brewery and flourmill wastes which are available locally (Hayward, 1961). When tilapia and catfish are stocked at the stocking rates described; with proper feeding, tilapia can grow to an average weight of 500 g in a year. Catfish can grow to an average of 1000 g in a year (Ezeri *et al*., 2009).

The hatchery section starts in the second and third years of production. At this time, all the fingerlings required for the production ponds would be supplied from the hatchery. In the hatchery, catfish would be artificially induced to spawn by hormonal treatment using pituitary hormone within the hatching units. Catfish matures after 7-10 months at a weight of 200-500 g (Pillay, 1962). However, spawning would not take place since the final stimulation associated with the rise in water levels and the inundation of marginal areas would not occur.

In the hatchery, four female brood fish each weighing 500 g can produce 10% body weight of eggs. The rate of hatchability is estimated at 50% and the survival rate of fry to fingerling at 30%. This means that the hatchery can produce 20,000 fingerlings from the 4 brood fishes, sufficient to meet the fingerling requirements of the production ponds after the initial cropping.

Project execution plan: When the project is fully implemented, a total of 10 brooder ponds and 18 nursery transition ponds would be constructed: 5 brooder ponds and 10 nursery/transition ponds would initially be constructed. The brooder ponds measure 30×20 m (600 m^2) and the nursery/transition ponds measure 20×15 m (300 m^2). Twenty production ponds would also be constructed and stocked for the production ponds, 8 measure 30×20 m (600 m^2), 5 pounds with dimensions of 40×30 m (1200 m^2) and 5 with dimensions of 50×60 m (3,00 m^2).

Construction and operation cost: The capital cost including fish farm infrastructure development is provided in Table 2.

Table 2: Cost of land and fish farm infrastructure development

Activity	Amount ($)
A. Cost of land and land development ($)	
Land acquisition	25,000.000
Survey of land	12,500.000
Fish farm design	16,000.000
Pond construction	425,000.00
Total	478,000.00
B. Fish farm infrastructure development	
Cost of farm house	153,000.00
Cost of office building	20,000.00
Cost of store building	10,000.00
Fencing of the farm	32,000.00
Fish shade building	13,000.00
Generation of power (15 KVA)	42,600.00
Farm road/dykes	25,000.00
Water pumps (2)	24,000.00
Bore hole	30,000.00
Outboard engine/canoe	35,000.00
Hatching building/laboratory	70,000.00
11 spawning tanks	55,000.00
2 collection tanks	20,000.00
Outdoor tanks	45,000.00
Total	574,100.00
Grand total	1,052,100

Table 3: Cost of farm hatchery equipment

Equipment	Amount ($)
Seine nets (3)	10,200.00
Gill nets 3	11,000.00
Transportation	15,000.00
Shovels and spades (6)	3,500.000
Wheel barrows (3)	5,200.000
Feed formulation machine	15,500.00
Meat grinder (2)	10,000.00
Scoop nets (5)	3,500.000
Beakers (6)	2,000.000
Weighing scale (2)	5,300.000
Trays (5)	500.0000
Motor (4)	1,000.000
Water analysis kit	20,000.00
Thermometer boxes (3)	6,000.000
Harvesting boxes (3)	3,500.000
Syringes and needles	200.0000
Brushes (12)	300.0000
Hand towels (20)	600.0000
Total	113,350.00

Table 4: Wages and salaries of workers

Personnel	Amount per annum ($)
Principal project manager (1)	30,000.00
Production supervisor (1)	18,000.00
Hatchery supervisor (1)	18,000.00
Laborers (3)	36,000.00
Security (3)	36,000.00
Production assistant (3)	43,200.00
Hatchery assistants (3)	43,200.00
Account/sales clerk (2)	28,800.00
Hatchery attendants (2)	24,000.00
	274,800.00

The land required for the project was acquired from the community for a cost of 25,000 naira and the perimeter and topographic survey have been carried out. The design of the farm has also been completed. The constructions of the ponds were estimated at 425 dollars. The construction would be undertaken manually, because, it would be more expensive to transport earth moving equipment from the state capital to site. The method of construction would also provide opportunity for greater participation by the unskilled unemployed labor force in the project area. With close supervision of the construction work, it is expected that the time schedule for the implementation of the project would be easily met.

Table 5: Other variable inputs

Inputs	Amount ($)
Fingerling procurement	290,000.00
Fish feed ingredients	22,500.000
Organic fertilizer (125 bags)	10,000.000
Agricultural lime (100 bags)	7,500.0000
Other chemicals	3,500.0000
Total	340,700.00

A farmhouse would be required in the site to secure the project. It would take the form of apartment and provide areas where farm equipment would be assembled and maintained. In view of the high cost of building materials and transportation of such materials to site, it is estimated that it would cost 153,000 naira. A small office and a store valued at 20,000 and 10,000 $ respectively, would be constructed to enable adequate control of the staff activities on the project site.

All other equipment such as generator, outboard engine/canoe, tanks and other laboratory equipment would be procured from established companies. The total cost of all infrastructure for fish farm, would cost $ 576.

Operational costs: The operational costs for the fish farm include the cost of the day-to-day management of the hatching, the wages and salaries of staff and procurement of other operational inputs (Tables 3, 4 and 5)

The purchases for all the materials listed in Table 3 making up the hatchery equipment will be made from Yenegoa and transported to the project site. The prices are current and obtained through competitive quotations.

Salaries and wages: The estimated total annual expenditure on wages and salaries is estimates at $ 274,800.00.

Variable costs: The total variable costs of the project amount to $ 340,700.00 for procurement of fish fingerlings, feed ingredients, inorganic fertilizer, inorganic fertilizer, agricultural lime and miscellaneous expenses.

Annulisation of cost: All of the capital expenditure would be made in the 1st year of implementation of the project. Already, land acquisition, land surveying and fish designing have been completed. The annulization of the operating expenditures have been undertaken and

Table 6: Project variable cost

	Years					
Salaries and wages	1	2	3	4	5	6
A.						
Project manager	30,000	30,000	33,000	36,000	39,930	43,923
Production supervisor	18,000	18,000	19,800	21,800	23,958	26,353
Hatchery supervisor	18,000	18,000	19,800	21,780	23,958	26,353
Labor	48,000	48,000	52,000	58,080	63,888	70,276
Security men	36,000	36,000	39,600	43,560	47,916	52,707
Production assistant	43,200	43,200	47,520	52,272	57,499	63,250
Hatchery assistants	57,600	57,600	63,360	63,696	76,665	84,400
Hatchery attendants	24,000	24,000	26,400	29,040	31,944	35,140
Sub-total	274,800	274,800	302,250	332,500	365,760	402,340
B.						
Fingerlings	290,700	116,280	-	-	-	-
Feed ingredients	25,500	17,000	31,500	36,000	40,5000	45,000
Organic fertilizer	6,500	7,800	9,100	10,400	11,700	13,000
Inorganic fertilizer	10,000	12,000	14,000	16,000	18,000	20,000
Agricultural lime	7,5000	9,000	10,500	12,000	13,500	15,000
Other chemicals	3,500	4,200	4,900	5,600	6,300	7,000
Sub-total	340,700	176,280	70,000	80,000	90,000	100,000
C. Others operational costs						
Fuel (diesel)	60,000	72,000	79,200	86,400	93,600	100,800
Engine Repairs/maintenance	10,000	20,000	26,000	33,800	43,940	52,728
Hormone	12,000	14,400	16,800	19,200	21,600	24,000
Stationary and printing	6,5000	7,800	9,100	10,400	11,700	13,000
M15. express	11,500	13,800	16,100	18,400	20,700	23,000
Repairs of fish pond	80,000	80,000	80,000	80,000	80,000	80,000
Subtotal	180,000	208,000	227,200	248,200	248,200	293,528
Grand total	795,5000	659,080	511,480	660,700	660,700	745,800

shown in Table 6. It shows that the 1st year of the project, a total expenditure of (795,000; 500 naira) would be made to take care of the operating costs of the project. A total of $ 659, 000.00 would be needed for the operational expenditure of the project. After that, the project would be capable of generating sufficient funds to take care of all the operational expenditures.

Estimated revenue: For the purpose of this feasibility report, the revenue expected is restricted to the operation of the production ponds. It is however necessary to mention that the hatchery ponds would produce the fingerlings required for the production ponds after the 1st year of operation.

The production ponds when fully stocked would have a total fish density of 30,600 tilapia fingerlings and 45,900 catfish fingerlings. This would give a total fish density of about 76,500 fingerlings making provision for mortality at 30, 53 and 550% mature fishes. The tilapia fingerlings would be cultivated to a body weight of 100 g. This means that the total weight of tilapia species would be 15,300 kg, while the catfish species harvested would be 45,900 kg. It is expected that Tilapia sp would be $ 20 per kg while the catfish sp, $ 25.00 per kg. Sales from catfish are estimated ($ 918,000) and ($ 227,000, $ 500). And total estimated revenue for the 1st year of production would therefore, is $ 1,147,500. With a modest estimated annual increase in the prices of fish of 10%, the estimated revenue accruing from the project for the first 6 years would be as shown in Table 7.

Table 7: Estimated revenue accruing for the first 6 years

Year		Income ($)
1		1,147,500.00
2		1,262,250.00
3		1,377,000.00
4		1,491,750.00
5		1,606,500.00
6		1,21,250.007
Manpower and costs	Monthly income ($)	Yearly income ($)
Principal project manager	2,500.00	30,000.00
Production supervisor (1)	1,500.00	18,000.00
Hatchery supervisor (1)	1,500.00	18,000.00
Laborers (3)	3,000.00	36,000.00
Security men (3)	3,000.00	36,000.00
Production assistant (3)	3,000.00	36,000.00
Hatchery attendants (3)	3,000.00	36,000.00
Accounts/sales clark (2)	2,400.00	28,800.00
	Total	253,000.00

The principal project manager would be a graduate in fisheries who has acquired skills to provide technical and specialized leadership needed for the management of the fishponds. He would be personally responsible for the day to day running of the fish farm. The positions of the production and hatchery supervisors would be occupied by men/women who have acquired a minimum of 5 years post qualifications experience in fish farm management. It is also expected that they would be trained in the fish farm. The production and the hatchery assistants would also be required to have worked in a reputable fish farm. They would also be trained practically on the job. The condensed income/expenditure of the farm project is presented in Table 8.

Table 8: Condensed income/expenditure of fish farm project

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales	1,147,500	1,262,250	1,377,000	1,491,750	1,606,750	1,721,250
Costs of sales	1,168,000	-	-	-	-	-
Gross profit	20,500	262,250	1,377,000	1,491,750	1,606,750	1,721,250
Operating cost	796,000	659,000	1,377,000	661,000	727,000	796,000
N.P.B.T.	795,000	603,250	777,000	830,750	879,750	925,250
Tax 45%	-	271,460	349,650	373,850	395,900	416,360
Proposed loan payment		300,000	400,000	450,000	480,000	500,000
			300,000	700,000	1,63,000	1,687,500
			700,000	1,150,000		

Table 9: Loan repayment schedule

Repayment	Year 2	Year 3	Year 4	Year 5	Year 6
	300,000.00	400,000.00	450,000.00	480,000.00	57,000.00
Total					$ 1,687,500

Loan repayment schedule: Table 9 shows the Principal $ 1,500,000 + interest 12½ % = $ 1,687,500.

Importance of the project: The fish farm, when in full operation would have tremendous economic and socio economic well-being of the people in the entire Southern I jaw local government area as well as the entire Bayelsa state. Nigeria. Fish has become a very scarce commodity because of the ecological changes taking place in the Niger Delta Area. This has had serious deficiency in the intake of protein by the people in the area. The prices of fish produced in the farm would be cheap relative to the present supply. This can aid the increased intake of protein by majority of the people.

The project would provide direct employment of 19 persons for this operation. This is a significant contribution to the economic well being of the people. One of the main economic problems in the Niger Delta area and the project area is unemployment. The creation of job opportunities would therefore be a noticeable contribution to the economic and social improvement of the project environment.

The ponds would be constructed in the back swamps of the town. These back swamps are presently not used for any economic purpose and are therefore wasted. The project would make use of the back swamps for the fish production. It is also expected that the successful completion and operation of the project would create awareness in the people, the viability of modern fish farming in the back swamps. More entrepreneurs would be attracted to fish culture practice, creating more economic activities in the area.

The figures used in the feasibility report/study are hypothetical, aimed at explaining how a feasibility plan/report could be written.

Fish culture extension: Extension comes from the Latin word 'Extensio" derived from "EX" and "Tensio". EX means out and 'Tensio means to *Stretch.* Extension therefore is a process whereby the extension worker stretches out his knowledge to the target audience, the fish farmers/fishers. It is a process of:

- Getting useful information to the people
- Assisting the people to acquire the necessary knowledge, skill and approach (attitude to utilize the information/knowledge effectively)
- Enabling the people to use these skills, knowledge or information to improve their quality of life

Fisheries extension is aimed at educating, assisting and organizing the fishers/fish farmers obtain the best yield from their fisheries activities by:

- Proper utilization or application of available resources such as gears, fertilizer and feeds or better methods of processing their products to improve its quality
- Efficiency in marketing through individuals or co-operative marketing
- Shrewd and rational use of natural resources e.g. soil and water
- Wise management of credit. Budgeting and farm record keeping and how to make the most economic use of labor and farm equipment
- The welfare of the farmer and his family, which is a reflection of his production efficiency

From the above, the philosophy of helping farmers to help themselves in identifying and solving their farm and family problems are the focus of extension programs. Extension is therefore:

- An educational process (informal education)
- An attempt or process of bridging the gap between researchers and fish farmers
- A two-way flow of information (Extension worker-farmer)

Research and extension: Research in Fisheries, are of no use unless the findings can be utilized by the rural people. Research findings may not be useable on their initial release nor do they transform into fisheries practices. In most cases, there's usually a considerable time lag between the development of a new technique

and its application, for research findings to contribute to fisheries development. There is need for cross-link between research and the fishing community. The extension agent therefore, is the logical link for this purpose.

The productivity of resources (land, labor and capital) can be increased and production functions can also be increased through systematic research. A wide spectrum of interrelated research is required to develop efficient system of operation and to improve existing ones. The research varies with the species. In fish farming, most fruitful research generally lies in the fields of reproduction, physiology and genetic improvement, fish nutrition and feed formulation, diseases and predator control, culture technology, agricultural engineering, management and economics (Pillay, 1968). Such researches are beyond the ability of small-scale farmers; and must therefore be conducted by, government supported institutions.

Both basic and applied research, are needed. Basic research deals with the development of principles and concepts that lead to technological improvement. Applied research is the application of basic research to existing problems under different conditions. Extension agents should be very careful in introducing research application. This is because the basic conditions at the experimental station (s) may differ from the surrounding areas. Therefore, the results of applied research should be tested in the field before being applied to large-scale commercial operations.

Extension program is therefore a bridge between research and field application. Extension agents should carry research results to the farmers and also bring back problems faced by the farmers to the research stations.

Qualities of extension officer: As an agent of change, a communicator, the extension officer has to have some qualities. These include:

- Original in thought
- Leader, not a boss (persuasive)
- Sound in judgment
- Ability to organize
- Reliable
- Ability to identify and solve problems
- Patience
- Easy and quick adaptability to cultural and social changes
- Initiative and drive
- Knowledgeable (averagely intelligent)
- Tactical in dealing
- Avoid ‘police work’ e.g., tax collection/ bribe/ gratification
- Accessible
- Objective (plain)

Roles of an extension officer: The primary objective of extension is to change or improve the living standard of the people. He is therefore, an educator. His responsibility is to become thoroughly acquainted with the people, win their friendship, trust and help them, mobilize their efforts and resources in developing processes. This is achieved by developing in rural people, the qualities of leadership, self-reliance and self-confidence.

The extension officer is a consultant to the farmer/fisher. He teaches the farmer the acts and techniques of better production. He is a programmer, administrator, planner and executor. He is a leaner. He continuously improves himself in his specialty and beyond. He keeps in touch with current research developments, techniques and information. He is an organizer and supervisor of people, (fishers), events (agro-fisheries shows and exhibition ideas (new culture techniques) and forms co-operatives.

He directs the farmer on how, where and when to get his agro-fisheries needs e.g., fish-feeds, fertilizers and fingerlings. He also advises the farmer how and when to stock his ponds. He is a trainer (formal and informal training). He conducts formal and informal trainings for his clients.

He is a public relation officer for his agency. He liaises between his agency and research institutions and the rural communities. He is an expeditor, facilitator of services. He collects data/information, distributes inputs, answers or solves farmers’ problems and reports to the boss.

The extension officer cannot do his work effectively without provision of basic working tools, security and incentives. In fisheries extension services, some of the basic tools include:

Transport: As an extension officer you are to be on the move disseminating knowledge and information from farmer to farmer and monitoring their individual progress. Therefore transportation is a very essential tool. It could be cheap but efficient and reliable. The type of transportation depends on the location of his target group.

Water analysis and field kits: These include:

- Temperature (thermometer)
- Dissolved oxygen (0_2 m)
- Turbidity (secchi disc)
- pH-Litmus range, pH Paper

Chemicals (control of infection and fish mortality): Where such chemicals cannot be carried along, you should know where and how the farmer can easily get it (Holden and Green, 1960). Ensure that the farmer knows the correct rate/method of application as the contrary may result to disaster to the farmer and loss of credibility on the part of the extension officer, which

may never be regained. For instance, for fungal infection:

- Copper sulphate
- Malachite green
- Potassium permangate

Low pH : lime
High pH : Calcium phosphate or alum phosphate

Audio-visual and aids: These are important tools of extension. They make teaching more simple and effective, as people learn better and faster, when most or their senses are used. Such audio-visual aids include, films, posters, slide projections and real objects.

It is worthy to note that regular training (short courses, seminars, workshops and field trips) are very essential for the extension worker to be current of new techniques, ideas and innovations. Exposure and training outside the area of specialization of the extension officer is necessary. He should be vast and dynamic in knowledge. For example, a fisheries officer should also have a good background/knowledge of crop science, animal (livestock), basic health care, rural sociology, etc.

Monitoring and evaluation: In extension, monitoring and evaluation are very important. This will enable you access the level and rate of diffusion of your message. How much the target audience understands and applies your new messages, ideas and invocations.

Monitoring provides the extension workers/managers with feedback on the extent extension has progressed, when compared with initial or original plan.

Evaluation attempts to explain and measure the level of efficiency of plan execution relative to costs and accrued benefits. A key indicator of the effectiveness of training and visit extension is the adoption rate, which provides immediate feedback about program performance. Multiple data collection method is the current approach to monitoring and evaluation. Emphasis is on rapid, cost-effective method that attracts the complexities of the target audience.

In evaluating fisheries projects, certain questions must be asked:

- Is the project reaching the fish farmer/fishers
- Are the rural farmers benefiting from it
- Is the project increasing fish yield/landings

Other methods of evaluating extension program include:

- Demand for visual survey and detailed survey within a given period
- Number of ponds constructed in a given period (increase in hectare)
- Increase in production rate of table fish by weight within a given period
- Increase in fingerling production by number to stock impounded ponds/waters
- Increase in the formation of fish farmers/fishers co-operative

Monitoring and evaluation in extension sustains a program, ensures continuity and diffusion, even in the event of any change of an extension officer (Mutter, 1973). It is proper to note that any extension program is for rural development. It is people centered and is based on the principle of democratic participations. Therefore, it is a necessity for any extension programmer to have the following characteristics:

- It should be jointly planned by, the rural people and the extension worker(s) Specialist advice may be required
- The package should contain what the farmers are willing to learn/adopt
- The objectives should be clear and the participatory roles of the target farmers in course of implementation should be specific and clear

Prior to introduction of any new innovation in fisheries extension and evaluation of such programmer, the agency responsible for such exercise should have full knowledge of the existing farming practice/techniques and the reasons behind them (White, 1973). In assessing or evaluating the impact of any new techniques or program me, consideration should be given to such factors as natural conditions, local infrastructures, socio cultural setting, farmers' production aims and labor economics.
Evaluation methods include:

- Situation analysis
- Farmers discussion forum
- Innovation design/experimentation
- On-farm-trials
- Researcher controlled trials
- Monitoring farm controlled trials
- Joint evaluation of trail results

Evaluation in extension is a continuous and systematic process of assessing the value of extension programme.
Reasons, for evaluation:

- To measure the level of achievement
- To assess the method used in extension
- Evaluation measures goals and methods
- Helps extension workers to establish the present situation, whether it is in the right direction or not
- To locate strong and/or weak points in our extension program
- Improve our skill

- Aids public accountability
- Improve our level of thinking and maturity
- Determines our priority

Programming in extension: Programming is planning the execution of extension. Let us assume that "something" is quantified to be realized in a certain time x. This is hindered by some problems. Solutions must be provided for the problems. Example, if a fish culturist wants a yield of 6,000 kg/ha of fish in one year and the present yield is 4,000 kg/ha. Then this can be caused by the fact that:

- The fingerlings or fish seed used cannot produce enough (problem 1)
- Not enough care was given to the pond management (problem 2)
- Not enough suitable feed was used (problem 3)

If it is confined in the choice to problem one, the question is: what is the cause for the use of this quality of fingerlings?
The answer to this question could be that either:

- Other fingerlings are not known by the farmers or
- Other fingerlings are known but require a different culture method, which is not used in the area

If the second answer is correct, the solution to the problem is to teach the farmers how to culture the new fingerlings in a suitable way.

Categories of extension personnel: Administration and supervision extension director: The director is to plan, organize, direct and control the activities of the organization. They are responsible for:

- Supervision
- Personnel management
- Salary administration
- Facilities management
- Fiscal management
- Programmer development and co-ordination
- Programmer execution and evaluation

The director is all in all. It is thus evident that he has to delegate powers. Effective communication within the organization is thus important. Good directors must have the following qualities:

- Ability to make and implement decisions
- Must have positive attitude in dealing with every one
- Must have highly developed sense of cooperation
- Ability to inspire in others a sense of responsibility
- Basic understanding of effective extension organization
- Technical skills of management
- Understanding fish culture and the ability to relate to people

Management personnel: These could be graduates with specialization. They supervise the village extension workers and other personnel within their respective areas.

They also give individual guidance, encouragement and job counseling of the village extension worker. The qualities are as the same as the director; only the years of experience may be less.

Village extension worker: They are the most important because they come in direct contact with the client. They see to extension programmed implementation at the village level and distribute inputs, collect data and provide immediate answers to farmers' problems. They have a lot of initiative and interest. The characteristics of the village extension worker can be outlined as follows:

- They have regard and love for their duty and profession. They gladly and boldly identify their profession. They are not ashamed to be called extension workers.
- They are confident in themselves by proving to the world that they are right in their career choice.
- They believe in their extension message and technologies that, adopting them would bring about an improvement to farmers' yield and income.
- They transfer their message with zeal and interest, having convinced them, that the packages are good enough for adoption.
- They master their subject matter as much as possible so as to teach the farmers with confidence.
- Packages are authoritatively disseminated to the farmers having mastered their benefits.
- Their teachings are demonstrative. They prefer the use of teaching aids in their transfer of technologies.
- They are not boastful but respect their contact farmers.
- They maintain a cordial relationship with farmers.
- While delivering their packages, they speak to the farmer(s) rather than roofs and windows.
- They make sure that their listeners are attentive, ensuring that they are serious and are in control.
- They allow the farmers to express themselves well enough by, questioning before making their inputs.
- They do not make vain promises. This puts trust in their packages.
- They have respect for the farmers. They do not take the farmer for granted.

Subject matter specialist: These are specialist in their various fields of study. They teach the village extension

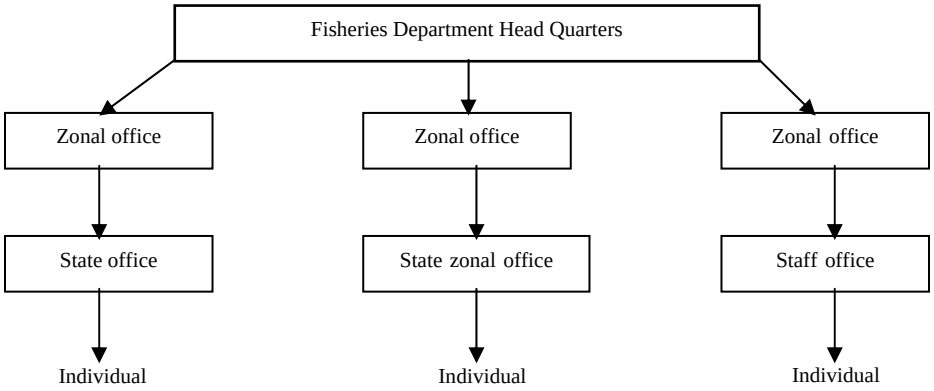

Fig. 1: Organization of fisheries extension service

workers in their forth-nightly training meetings and supervise the village extension workers. The general qualities of the extension worker are as highlighted earlier.

Extension supervision and administration: The organization of fisheries extension service is illustrated in Fig. 1. The organizational structure of any extension agency depends on the scope of its subject matter coverage and the number of scattered clients to be reached. Extension can function at each level of government to maintain contact with the grass root.

Reasons for fish culture extension: Fish culture development can be promoted through the communication of information (i.e., available knowledge plus technology which are beneficial to farmers elsewhere) to supposedly ignorant farmers in a particular area. However it has been observed that:

- Solutions developed at research center do not necessarily have universal validity
- Technical problems alone do not adequately represent the main bottle necks but, are subordinated to political, social or economic problems faced by farm families
- This implies that extension should pay attention to both technical aspects and the relationship between the technical matters and the environment
- Thus there is the need for dialogue between extension workers and the client groups for realistic solutions
- Hence there is a more sophisticated approach to extension

Thus the concept of extension methods takes on a new meaning beyond technology delivery:

- Methods of collecting and utilizing information concerning farmers
- Methods of translating solutions into behavioral objectives for members of specific target groups
- Methods of refining and field testing solutions; and rendering them in the form of messages through recommendations, input packages, etc.
- Methods to disseminate messages, distribute materials, set up organizations (farmers groups) etc
- Methods to disseminate messages, distribute materials, set up organizations (farmers groups) etc
- Methods of collecting information about the effects reached (evaluation)

Extension workers' creed: I believe in people and their hopes, their aspirations and faith, in the right to make their own plans and arrive at their own decision, in their ability and power to enlarge their lives and plan for happiness of those they love.

I believe that education, of which extension worker is an essential part, is basic in stimulating individual initiative, self determination and leadership, that these are the keys to democracy and that people, when given facts they understand, will act not only in their self-interest but also in the interest of society.

I believe that education is a life-long process and the greatest university in the home; that my success as a teacher is proportional to those qualities of mind and spirit that give me welcome entrance to the home of the families I serve.

I believe in intellectual freedom to search for and present the truth without bias and with courteous tolerance towards the views of others.

I believe that the extension service is a link between the people and ever-changing discoveries in the laboratories.

I believe in my work and in the opportunity I have to make my life useful to mankind. Because I believe these things, I am an extension worker.

CONCLUSION

A good feasibility study and report on a fish farm project and detail analysis of culture extension is very necessary to enable fish culturist plan effectively before involved in fish culture and practices.

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