

INVESTMENT PROSPECTS OF FISH FARMING
IN THE JOS-PLATEAU, NIGERIA

by

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ABSTRACT

The investment prospects of fish farming in the Jos-Plateau, strategically located in about the centre of the country are discussed with special reference to its numerous abandoned mine lakes and the tripartite role of government, universities and individuals. In the Jos-Plateau, about 17.0 km² is covered by these disused mine lakes, making up about 20-30% of the area covered. In such enterprise, problems commonly encountered, like population growth and government planning policies, fish demand and supply, manpower, feed and seed availability, preservation, processing and marketing are discussed. In spite of these, prospects still abound with regards to land-use of these numerous disused mine lakes and feed availability based on the principles of using both industrial and farm by-products for fish culture, processing and marketing. These potentials if properly harnessed will help to supplement the protein insufficiency in the diet of the populace. In this regard, proposals on the economics of production and sales, strategies for achieving these development goals, cost-benefit analysis and their implications in further development of fish culture are discussed.

KEY WORDS: INVESTMENT PROSPECTS. MINE LAKES.
FISH FARMING.

INTRODUCTION

In Nigeria and most developing countries in the world, there are problems of insufficient food production and the populace suffer from protein deficiency in diet. Countries like Japan, China, U.S.A. to mention a few have recognized the importance of fish farming as a strategy for increasing production to meet the protein demand of their

populace. There is little or no participation in fish farming from the private sector possibly due to lack of enlightenment on the numerous investment opportunities existing in Nigeria capture and culture fisheries enterprises and their affiliated industries like outboard engines, boats, gears and net manufacturing and processing industries together with import and export business in fisheries. The few government fish farms have not played prominent role in supplementing the fish demand and encouraging the private sector.

Protein intake in Nigeria stands at less than 40%. The per-capita consumption of animal protein was only about 28.6kg/annum, and of these, 10.6kg or 37% was derived from fish (Federal Dept. of Fisheries, Statistics Report, 1980). Importation increased steadily since 1971 from 54,416 metric tonnes (or 11.7% of the total fish production) to over 218,000 metric tonnes (or 28.9% of the total fish production) in the early 1980's. However, by 1983, total import fell to 153,394 metric tonnes due to import restriction following the economic stabilization policy of the Federal Government. This restriction is expected to be an incentive to large scale inland fisheries and other animal production. Okpanefe (1983) put the estimated demand for Nigerian fisheries at about one (1) million tonnes/annum and by the year 2,000, the demand is expected to double. The current demand for fish in Nigeria today is about twice the level of local production from all sources and it is unlikely even in some years to come for Nigeria to resume large scale importation in this period of serious economic predicament and significant drop in foreign exchange earning.

In Nigeria, vast area of land is covered by water which is available in the forms of rivers, lakes or ponds and to a great extent, brackish and sea water at the coastal regions. These water bodies are the main medium through which different animal species can be cultured. The advantage in utilizing these water resources is that both seasonal and perennial culture practices can be undertaken in which water is delivered naturally. The challenge facing Nigeria today is one of solving problems of inadequate food supply and discovery of new protein sources. Different management practices have to be worked out and fish farming must be developed.

In the Jos Plateau, between 20-30% of the land areas is covered by water bodies, particularly the disused mine lakes which number about 1,000. (Patterson & Okechukwu, 1986, Pers. Comm.). Past research work have been directed towards assessing the physico-chemical qualities of the water bodies and their suitability for fish production (Chidobem, 1982; Khan & Ejike, 1984; Wade, 1985; Anadu et al (1986); Wade & Anadu (1986A, B). Similarly, substantive research findings on the suitability of local farm products like cassava,

potato, rice, corn for fish culture have been reported by Ufodike and Matty (1983), Faturoti & Akibote (1986), Otisi & Ufodike (1986), Ufodike (1986).

In the past, decision-making were made with poorly defined channels of control and weak linkages. Infact fisheries has been mostly considered as an after thought. Fish stocking programmes in man-made lakes by government agencies have been with no bench-mark ecological data, no previous biological studies, no stock data and catch statistics. These have been due to poor policy directives and management. After the efforts at fish stocking there is seldom subsequent activity to determine its success or failure, thereby rendering futile any attempt to make a thorough evaluation of the merits of this fisheries management programme.

One of the problems that have often hindered private sector participation in development of inland fisheries include lack of knowledge on the potential of the available resources (Olatunde, 1983). A well planned intensive fish farming has the potential of offering a new and major food source for the populace. The biological and economic problems likely to be encountered, the prospects for such a viable investment and strategies for accomplishing such a task and the tripartite role of government, universities and individuals based on the past experiences of developed nations is reviewed in substantive part of this paper.

INVESTMENT PROBLEMS AND PROSPECTS

PROBLEMS

The need for increased food production has arisen from the problem of population growth and government planning policies which have no up-to-date data which are pre-requisite for national development planning. This has often led to the failure of viable agricultural development programmes. With regards to population growth vis-a-vis fish demand and supply in Nigeria, this seem to be increasing in geometrical progression while food demand (and cost) is in arithmetical progression. If such a planning policy with unreliable data is to continue, demand for fish for the teeming population will not be met.

Man power has also been a constraint to development of fish farming. Until recently few people were trained in the area of fisheries. Lack of qualified manpower makes it difficult for prospective farmers to get required expert advice and assistance; especially on latest practices which would improve performance and increase output. Manpower draws upon multidisciplinary areas of the sciences like Biology, Ecology, Genetics, Biochemistry, Microbiology, Chemistry, Agriculture and Veterinary Science. In addition, biotechnological engineering and managerial skills are required for construction of suitable farms.

With regards to feeds, supplementary feeds ensure healthy and fast growth. Non availability of these is tantamount to poor management of fish farming, and until cheap and nutritionally better feeds are available, this factor will continue to inhibit mass production of these aqua-foods. However, a lot of research work have been done on production of cheap feed for aquaculture in the tropics and developing countries. In the case of seeds availability, for any venture of this nature to succeed, there has to be mass production of fish seeds. This is one problem in Nigeria where little effort is made in induced spawning of fish in captivity. Hatchery technology is not well developed either. Japan, China, U.S.A. to mention a few were able to make a break-through in aquaculture due to successful large scale production of fish fry or seeds. In Nigeria, where hatchery facilities are available, e.g. Panyam fish farm in Plateau State, they are either under utilized or not functioning at all. Any dependence on the slow natural process of reproduction will definitely retard the progress of this enterprise.

For any product to be acceptable, the need for preservation cannot be overemphasized. One major problem affecting preservation is the absence or inadequate cold storage facilities. However, the prospect is brighter with establishment of fishing companies in different parts of the country by private organization which have been able to provide storage facilities like cold rooms. Crude methods of fish processing like sundrying and smoking coupled with poor storage facilities have often resulted in the animal products being exposed to insect pests. These cause spoilage and deterioration. Better processing facilities are now being developed in technology units of Nigeria Institute for Oceanography and Marine Research, N.I.O.M.R., (Tobor 1985, Pers. Com.) and at the Federal Institute of Industrial Research, Oshodi.

The problem of product marketing lies in inefficient transportation network. In the final marketing stage, there is also the problem of middlemen buying at cheap prices from the farmers and selling to final consumers at exorbitant prices. However, with improved net work of roads, there is brighter prospect of transportation and marketing of these products direct to consumers at minimum cost. Some developing nations like Nigeria are beginning to have bitter experiences of effects of pollution. This is in the form of oil, sewage and other forms of pollution originating from industrial and agricultural practices including the use of herbicides, pesticides and other chemicals. Oil pollution like in coastal areas of Nigeria has the threat of getting into swamps and rivers, thereby affecting the lives of organisms (Wade, 1983). Sewage pollution have also been found to affect lives of aquatic organisms (Oladimeji & Wade. 1984) unless well treated before disposal.

Disease outbreak can adversely affect fish production. This problem can be easily overcome if drugs are made available to farmers. The threat of disease outbreak and subsequent cure also extends to the farmer as an occupational hazard, considering the fact that health services has not effectively reached majority of the populace in the rural areas of most developing nations.

PROSPECTS

As the population increases, coupled with increasing demand for protein diet, fish and fish products will continue to play very important role. Apart from its role as food source, fish is an important source of income through the inducement it provides for the establishment of other industries. Some investment prospects of fish farming in the Jos - Plateau are:

DISUSED MINE LAKES

There are numerous abandoned or disused tin mine lakes on the Jos-Plateau. Majority of these lakes date back to 1905 when early mining activities started (Bingel, 1978). The lakes which have considerable volume of water all year round number about 1,000 making up about 20-30% of the area covered (Patterson & Okechukwu 1986, Pers. Com.). Although some of these lakes could be as deep as 20 meters, which in conventional fisheries management practices cannot be regarded as conducive, we envisage that any prospective farmer could use these ponds as reservoirs from which the lake waters could be fed into well constructed fish ponds. This type of practice has been a considerable success with the Rock Water Fish Farm, which is the only indigenous or private fish farm utilising the potentials of these numerous mine lakes. Moreover, with the industrialization programme of the Plateau State government, there are incentives for the private organizations with regards to land acquisition for such enterprises. These mine lakes also provide potentials for development of sports fisheries with respect to tourism and/or recreation (Wade 1986).

Previous research work on the water quality characteristics of disused mine lakes in relation to fish production have shown a considerable promise for a viable investment on fish production (Wade 1985, Anadu *et. al.* 1986, Wade & Anadu 1986a), although some better management practices like fertilization or nutrient enrichment will still be required to enhance production at a more profitable level.

MANPOWER

Although the problem of high skilled manpower in the fisheries industry is glaring, we speculate that considerable efforts being made in our various institutions like the Universities, Fisheries Schools etc. will help provide skilled manpower.

Meanwhile, in the short supply of manpower, consultancy services offered by our Universities in the area of fish husbandry will help the prospective farmer in the establishment and management of the farms.

FEED AVAILABILITY

The prospect for feed availability for fish farming enterprise is bright in view of the wide variety of local food sources which are in abundance. Industrial by-products like the brewery wastes are very rich in nutrients required for fish growth and are cheap. Some of these industrial sources of feeds include the Jos International Brewery Ltd. (J.I.B), N.A.S.C.O. Foods Ltd. For example, the nutrient composition of the spent grains (barley malt chaff) on dry weight basis is as follows: Protein - 22.0% carbohydrate - 48.0%, Fibre - 17.6%, Oil - 7.9%, Ash - 4.5%. Several research findings on cheap feeds for aquaculture in the tropics and developing countries have proved to be promising. Shireman *et. al.* (1978) reported that grass carp (*Ctenopharyngodon idella*) fed natural diet of duck weed (*Lemna minima*) under intensive culture show a high biomass, excellent growth and satisfactory survival rates. Ufodiye and Matty (1983) in studies on growth responses and nutrient digestibility in the mirror carp (*Cyprinus carpio*) fed different levels of cassava and rice reported that fish grew best on the 45.0% rice diet, while carbohydrate digestibility when cassava or rice was added to diet was high and ranged between 86.0% & 97.0%, but was very low (17.0%) when no cassava or rice was added. Similarly, protein digestibility was slightly raised from 76.0% to between 83.5% and 88.0% with the addition of cassava or rice to the diets. These carbohydrates and other food sources are cheaply available in Nigeria.

SEEDS AVAILABILITY

The current overall production of fish seeds or fingerlings is grossly inadequate, although it is hoped that with completion of some hatchery facilities in the Panyam Fish Farm, Plateau State, and other parts of the Federation, production and sales of seeds to private farmers would have enhanced investment opportunities in the fishing industry.

PRESERVATION

With the recent developments in fish technology, processing and preservation equipment have been developed in both the Nigeria Institute for Oceanography and Marine Research (NIOMR), Lagos and the Federal Institute of Industrial Research (FIIR), Oshodi-Lagos (Tobor, 1985, Pers. Comm.). These technological developments will greatly overcome the problems of loss in farm products.

TRANSPORTATION AND MARKETING

Considering the fact that road development in Nigeria have not until recently been given much priority, especially in the rural areas, this has often resulted in deterioration of farm products before getting to the market, thereby causing considerable loss to the farmer. However, we envisage that apart from the fairly good road network here in the Jos Plateau, it is strategically located in about the centre of the country with the result that it is accessible to all parts of the country by air, road and rail. Market for fish will no doubt be very high, as the present supply, especially in developing countries like Nigeria is far less than demand.

MULTIPURPOSE USE OF RESOURCES

The effective conservation of our water bodies could involve utilization of alternative sources of the lake water for other purposes like irrigation. In this respect, we propose fish farming in multiple use of resources, with special reference to fish-cum-animal-cum-crop farming. This proposal is based on the observations and success of dry season irrigation using these pond waters. A prospective fish farmer can go into vegetable-cum-animal farming. In any case, if fish is to be in short supply in any given area, not only could such an area be stocked with different fish species, but livestock and poultry could be reared. The basic principles in the rearing of such other animals and fish is that the latter can feed on the part of food wasted by animal and on their organic faeces sometimes very rich in in-completely digested foodstuff. Apart from the waste of these animals being utilized for fish growth, the animals themselves contribute substantial amount of edible protein. A well planned fish-cum-animal farming has the potential of offering a new and major food source.

The benefits of fish-cum-animal-cum-crop farming with reference to food availability is presented in a schematic form (Fig. 1). Combination with other types of farming makes for greater overall efficiency, as by-products from some of the activities are used. An ideal situation is to combine fish with vegetable garden, perhaps under irrigation and some form of intensive livestock raising like pigs and poultry. Waste from the vegetable garden could be used for fish, as well as manure. Small, undersized fish and fish offal can be fed to the animals, while excess mud from the pond bottom can be used for fertilizing the garden. It often happens that much of the fertility in a pond becomes locked in the soil and does not affect fish growth, and is wasted unless used elsewhere.

DEVELOPMENT STRATEGIES

Numerous development strategies for fish farming can be adopted. These include integrated development policy and planning and availability of credit facilities (Wade 1985b). In this discussion, emphasis will be made on the tripartite role of government, Universities and individuals in achieving this goal.

INTEGRATED DEVELOPMENT

In integrated development, fish farming can gain consolidating efforts of small scale fisheries into one whole. In this case, a simultaneous attack must be made on the various aspects of vicious cycle of poverty, productivity in the mixed farming and marketing as well as welfare problems. The aims of any integrated development strategy include:

- a) helping to preserve and strengthen fish farming industry;
- b) increasing alternative employment opportunity for the populace.
- c) constructing a self sustaining system of private and co-operative fishing activities, which with government aid would continue to promote economic development in a socially and economically balanced fashion.

Most small scale private farmers are typically rural dwellers which need to be incorporated in integrated rural development which can be initiated by external integrations like the fishermen co-operative society or by government through extension workers. Benefits of this integration, as also proposed by Garhardsen (1977) include:

- a) co-ordination of successive production process with regards to processing and marketing;
- b) risk reduction and income stabilization;
- c) better opportunities for changing production methods;
- d) better opportunities for securing markets for final products.

Some strategies for ensuring integrated development through the role of government and universities include:

- a) integrating fish-cum-animal-cum-crop farming, strengthening co-operation and co-ordinate at village level various fisheries activities with agriculture;

- b) the government providing incentives to the prospective farmer through the co-ordination of the various stages of fisheries activities with general infrastructural arrangements like access roads, transport, electricity, portable water, good housing and special fish servicing activities like gears, seeds, feeds (Olatunde, 1983). To attract prospective farmers, the government could establish "model projects" as a demonstration of improvement and economic opportunities before them. Welfare schemes should be worked out as a "package programme" for fishery development for the rural dwellers;
- c) both state and federal governments should contribute adequately in providing research grants to universities through a co-operative fisheries research unit which should be an embodiment of personnel from universities, Federal and State fisheries department. There should also be acknowledgement of specific research information need by aquaculturalists or fish farmers and agents at grassroot levels, identifying and transmitting such information through the extension systems to researchers. There should also be mobilization and training of private fish farmer by government and fish training institutions;
- d) Nigerian Universities involved in fisheries researches and training are expected to show excellent results of research in the areas of nutrition and feeds development, reproductive physiology, genetics and selective breeding, infectious diseases - identification, prevention and control, toxicology, intensive culture systems and transportation, processing and preservation of products.

Otisi (1986) proposed that universities should acquire some hectares of land, about 10-15ha, to establish fish farms and research centres where results are put to commercial use for pilot testing before being disseminated to the public. The future roles of both governments and universities should overlap, as there cannot be proper divorce between each other in the management of our aquatic resources.

POLICY AND PLANNING

These are multidisciplinary efforts directed towards the attainment of resource quantified output. Policy embraces stages of development, communication, implementation and

evaluation, while planning is mainly preparing a scheme of action which in fisheries management is a process done prior to implementation, and devoted clearly to identifying and determining the best alternative course of necessary action required to achieve determined goals and objectives. The process of planning and policy analysis are dynamic, demanding constant reviews of laws, rules, regulations and guidelines and use all available knowledge and skill to assess and re-assess alternative ways of achieving identified goals and objectives. Policy makers and planners in both government and private agencies can adapt a strategy of optimum utilization of natural resources through intuitive judgement and decision making. This calls for broader application of expertise of a multitude of disciplines in a rigorous frame work of planning, policy formulation and analysis in respect to investment opportunities in fish farming.

CREDIT FACILITIES

Credit facilities as a strategy in developing fish farming enterprise in Nigeria could play a key role in achieving growth targets (Hamlisch, 1976). It is imperative to set up specialised credit schemes for reducing financial burdens, for a major development project like this. Fish farmers may require funds either for improvements in their installations and facilities to prevent deterioration and raise operation efficiency. Experience has shown that small scale operators are mainly in the low income group and experience difficulties in raising credit funds on a continuing basis due to inability to provide collaterals, pay prevailing commercial interest rates (Hamlisch 1976). Most credit facilities granted to small scale farmers are short term which do not take cognisance of other commitments. This results in diversion of such loans to meet family financial commitments like expenses for housing, school fees and hospital bills.

A comprehensive credit scheme must ensure that more important personal needs of the producer and his family are not ignored, and every effort should be made to make the prospective farmer realise that loan application for purchase of improved production tools, like better seeds, feeds etc., rather than expenditures on non-essential consumption goods will, in the long run, enable them obtain disproportionately greater satisfaction.

Some strategies for successful credit facilities are:

- a) proper project feasibility study by professionals to know the magnitude of the borrowers' credit needs;

- b) government taking a lead in providing necessary finance at initial stage for pilot projects until the farms become productive. This is to attract farmers and to enable banking institutions make funds available at a later stage when the project becomes operational;
- c) making available credits for input acquisition through revolving fund arrangements, with the original financial allocation coming from government budgetary sources;
- d) administrators of such loan schemes should make every effort to eliminate bureaucratic bottle necks not absolutely essential and, in general, speed up loan processing.

Since funding is a limiting factor, emphasis should be placed on creating, expanding or strengthening credit schemes. This depends largely on combined actions of the governments, financial institutions, private organisations, researchers and farmers in determining the utilization of this potential to meet the challenges of our time.

ECONOMIC CONSIDERATIONS

Economics of Production

There is no doubt that under planned management of resources, economics of production with regards to cost will be minimal. This type of mixed farming is flourishing in Asia and Far East especially in China, Japan (Maar et al. 1974). It provides an estimated 10% of the world's water derived protein with a harvest of 5-6 million metric tonnes/yr valued at about US \$2.5 billion (Bell, 1980). As elaborate facilities are not necessarily required in this type of mixed farming, construction cost is usually low. Maximum use is made of the bye-products and nothing goes to waste. Under this system, a kilogram of fish could be produced more cheaply than a kilogram of red meat. In other words, fish tend to be better converters than land based animals. The harvest is usually high at low economic inputs. In relation to sales and thus income expected from these products, there is no doubt that there will always be a ready market, considering the important roles which fish and animal products will continue to play in decades to come.

COST-BENEFIT ANALYSIS

The cost-benefit analysis can be viewed from two perspectives; individual production and integrated farming. In both cases, the economic evaluation considered as cost which the prospective farmer will have to embrace are pond construction, water system equipment and management, irrigation, feeds, seeds harvesting, marketing and labour, as shown in Table 1.

This financial analysis is based on intensive culture in which formulated rations are fed to achieve faster growth at shorter time interval. A summary of the financial analysis shows that one (1) hectare pond construction including channels will cost an average sum of ₦6,500.00. The cost of water reservoir and/or dam construction does not arise since acquired mine ponds with large volume of water will be utilised. Total input for one hectare pond would be about ₦16,980.00; while output would be about ₦30,605.00. Financial gain or benefit to be derived in the first year will be about ₦13,625.00. Special fish servicing activities like ponds, fishing gears etc. will only be borne by the prospective investor in the first year. The input of these costs in subsequent years are added to the benefits of the investor. Other benefits of such investment include fishery and recreation (Wade 1986), better nutrition and irrigation.

With regards to the cost based on individual production (i.e where there is no integration of fish-cum-animal-cum crop farming) especially on a smaller scale, it is likely to be high with no financial returns (Ref. Table 2.5). Thus utilization of resources in terms of feeds on the farm is seldom complete, resulting in wastage and consequently low interest returns. In such a situation where the cost-benefit ratio and interest rates are not viable, such an investment will appear to be uneconomic. Bardach & Ryther (1967) gave annual return on milk fish culture alone as 10-20%, while an integrated fish-cum-pig farming yielded about 30% returns in Malaya.

Managerial methods for individual production depends on production targets, socio-economic situations and environmental conditions. In this type of production, cost is likely to be high as a result of feeds purchase compared with natural food from a polyculture system. The cost of individual production implies employing high quality feed, chemical fertilizers and other capital to stimulate production of natural foods. In spite of cost accruing, one benefit from this is increased fish density with parallel increase of much resource competition.

Cost-benefit analysis of integrated fish-cum-animal-cum-crop farming is much more rewarding in terms of investment and management (Ref. Table 2). There is the potential of increased production resulting from better food utilization. This mixed farming could be a very lucrative business where professional and managerial skills are available. At the managerial level, feed availability will not be at a high cost vis-a-vis individual production in view of the prospects of feed availability earlier discussed.

Extra income or benefits (Table 2) to be derived from overall yields will cover other expenses, making such an enterprise worthwhile.

Certain constraints to this type of investment may be market limitation and seeds supply. The former may be imposed by marketing potential in terms of demand and by the handling capacity of the farm in terms of supply. It is therefore imperative that the farmer analyses the economic results of the previous culture and plans accordingly for the future. Infact, economic considerations should be a major factor in influencing production especially where the main thrust of development is introducing integrated fish-cum-animal-cum-crop farming rather than developing specific schemes likely to be capital intensive. We propose that in a situation with favourable natural environment like the Jos-Plateau, the initial requirements is for organizations or some agencies (government, parastatals, private) to first convince farmers of benefits of such investment, secondly, organize the supply of inputs like fish seeds and thirdly, assist with marketing. Once the commercial feasibility of a technology has been demonstrated, the other requirement is for an extension service.

This integrated farming has become a profitably modern aquacultural production system in many countries. The prospect here is bright, especially when modern methods based on sound scientific, ecological, technological and economic principles are applied. This innovation, as Garhardsen (1977) points out, on a large scale for profit in terms of better commercial and social returns on investment of money, time and human effort will be realized only by the informed and venturesome.

CONCLUSIONS

Fish farming enterprise has a very bright prospect in Nigeria, considering the need to explore and utilize the abundant inland water resources to supplement the grossly inadequate protein requirements. Such an enterprise cannot be easily achieved without tackling some attendant problems like fish supply vis-a-vis population growth, effect of income growth amongst the populace vis-a-vis fish demand and lukeworm attitude of most government policies towards effective fisheries development. Other problems are man power shortage, which draws upon multidisciplinary areas of the sciences and social sciences, threat posed by pollution, seeds availability, preservation, processing and marketing of cultured species.

Prospects however abound for this enterprise in view of the role fish play in world protein supply. The bright future abound in respect of inland water resources, feed availability from both animal and other plant sources. The economics of production and sales for this type of enterprise has shown quite encouraging results considering the

low cost of capital investment and profitable revenue that accrue based on experiences from other countries.

It is proposed that strategies for development of this enterprise include provision of credit facilities, integrated rural development as an important step to attacking the aspects of vicious cycle of poverty, productivity, marketing and welfare problems. Proper policy and planning in both government and private agencies can adopt a strategy of optimum utilization of natural resources through intuitive judgement in decision making. Based on the cost-benefit analysis, and with good management, such culture system is profitable. Implications for future trend for management, combined culture system and aid are important factors which if taken into account can result in a very successful venture.

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TABLE 1 - COST - BENEFIT ANALYSIS ON USE OF ONE MINE POND**

ONE HECTARE POND**	INPUT (₦)	OUTPUT	BENEFIT
1 <u>POND CONSTRUCTION</u>	6,500.00		
2 <u>FISH SEEDS</u>			
a/. <u>Carp.</u>			
1,666 fingerlings @ 30k each	500.00		
b/. <u>Tilapia</u>			
2,000 fingerlings @ 10k each	200.00		
c/. <u>Catfish</u>			
2,375 fingerlings @ 40k each	950.00		
3 <u>FISHING GEARS</u>	1,300.00		
4 <u>FISH SEEDS</u>			
a/. Brewery wastes - one tipper load per month @ ₦30.00/trip	360.00		
b/. Rice bran @ ₦50/50kg bag	2,600.00		
c/. Maize @ ₦60/50kg bag	720.00		
d/. Groundnut - ₦50/50kg bag	600.00		
5 <u>FERTILISER/MANURE</u>	100.00		
6 <u>LABOUR</u>			
a/. Management/maintenance	2,500.00		
b/. Liming/fertilizing/stocking	50.00		
c/. Cropping	100.00		
d/. Transportation and/or marketing	500.00		
7 <u>PRODUCTION/SALES</u>	-		
		a/. <u>Carp:</u>	
		1,600kg @ ₦6/kg	= ₦9,600.00
		b/. <u>Tilapia:</u>	
		1,600 kg @ ₦3/kg	= ₦4,800.00
		c/. <u>Clarias:</u>	
		2,315kg @ ₦7/kg	= ₦16,205.00
<u>TOTAL</u>	16,980.00	₦30,605.00	₦13,625.00

** Costing based on intensive culture over a period of one year.

TABLE 2 - COST-BENEFIT ANALYSIS ON INTEGRATED FARM
AT PANKSHIN - PLATEAU*

AGRICULTURAL PRODUCTS	INPUT (₦)	OUTPUT (₦)	BENEFIT (₦)
1 POULTRY	16,375.00	81,600.00+	65,225.00
200 No. spent layers @ ₦10.00 each	-	2,000.00	-
2 CATTLE	14,465.00	24,000.00	-
3 GOATS	2,600.00	-	-
4 FISH**	30,980.00	95,000.00	64,020.00
5 VEGETABLE	800.00	841.00	41.60
TOTAL	65,220.00	203,441.60	138,821.00

* The farm is not yet on intensive production

** Construction cost of dam, pond, feeds and fingerlings inclusive

+ Income obtained from sales of eggs only per year

++ Estimated income per year at an average sale of ₦5.00/kg.

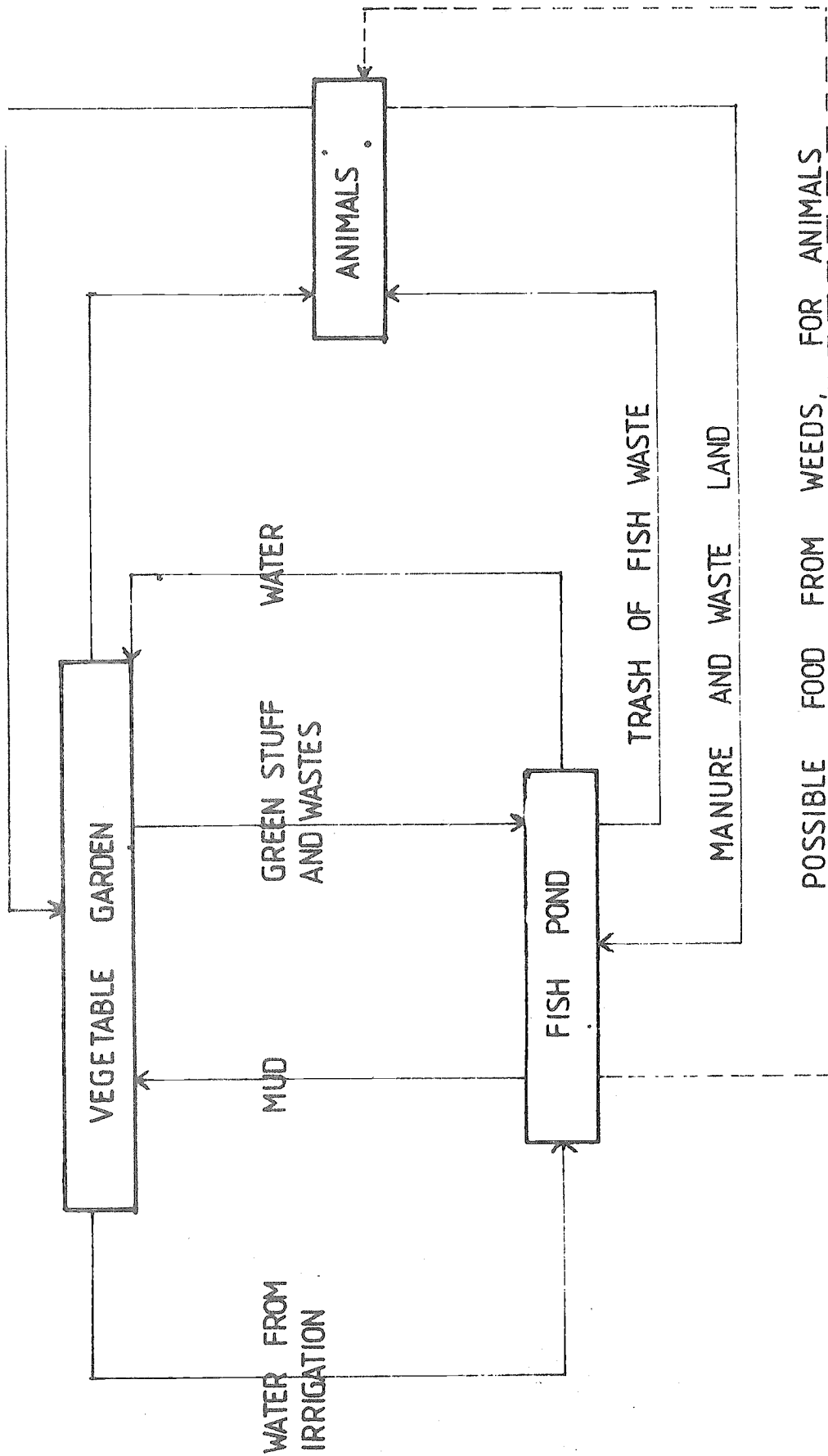


FIG. 1: COMBINED FISH, CROP AND LIVESTOCK FARMING SHOWING INTER-RELATIONSHIP
 (SOURCE: MODIFIED FROM MAAR et al 1974).