RAP Publication 1999/23

Trickle Down System (TDS) of Aquaculture Extension for Rural Development

REGIONAL OFFICE FOR ASIA AND THE PACIFIC
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Bangkok, Thailand

RAP Publication 1999/23

Trickle Down System (TDS) of Aquaculture Extension for Rural Development

Dilip Kumar

REGIONAL OFFICE FOR ASIA AND THE PACIFIC
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Bangkok, Thailand

P R E F A C E

Since the technologies for artificial breeding and large-scale production of fish seed, especially for freshwater Asian carps, were discovered some 3 – 4 decades ago in China and India, progress in fish culture has been dramatic. Development of polyculture and integrated culture systems in China and composite carp culture in Indian sub-continent made carp culture a highly profitable venture. Other countries in the region such as Thailand, Indonesia, Philippines, Nepal, Vietnam, etc. have followed suits and have achieved very successful results in culturing many indigenous and exotic species. Rapid expansion of small-scale, semi-intensive polyculture/integrated culture of carps were made possible by successful public sector interventions through the production and supply of fish seed and other basic inputs needed by the producers and the transfer of appropriate culture technologies through effective extension services.

Looking back at the evolution of freshwater carp culture in Asia, one cannot fail to acknowledge the tremendous contributions made by the dedicated extension services in the countries where aquaculture has established itself as a viable and important economic activity, making substantial contribution to household food security, employment and income. Like agriculture, each aquacultural country in the region has developed its own aquaculture extension services delivery system with its own methods and approaches. In this publication, an extension method called Trickle-Down-System (TDS) of extension, which was applied through FAO field projects in Bangladesh and Vietnam with great success has been reviewed. In the project areas in both countries, unit production (kg/ha/yr) had increased by over 200%. This dramatic increase in production was attributed to the effective extension services provided by the projects through the implementation of the Trickle-Down-System of aquaculture extension. The amount of increase in production has been called “Extension-Gap” which the author believes can be bridged through the implementation of appropriate extension services in many countries.

List of Acronyms

ADAB	:	Association of Development Agencies in Bangladesh
ADF	:	Assistant Director of Fisheries
AFO	:	Assistant Fisheries Officer
CEU	:	Central Extension Unit
CPR	:	Common Property Resources
DDF	:	Deputy Director of Fisheries
DFO	:	District Fisheries Officer
DG	:	Director General
DOF	:	Department of Fisheries
FA	:	Field Assistant
FAO	:	Food and Agriculture Organization of the United Nations
FC	:	Field Counterpart
FF	:	Fellow Farmers
IRDP	:	Integrated Rural Development Programme
HQs	:	Head Quarters
LIFDCs	:	Low Income Food Deficit Countries
NACA	:	Network of Aquaulture Centres in Asia-Pacific
NGO	:	Non-Government Organization
PRA	:	Participatory Rural Appraisal
PTC	:	Post-training clarity
PTE	:	Post-training evaluation
RDF	:	Result Demonstration Farmers
RRA	:	Rapid Rural Appraisal
TCP	:	Technical Cooperation Programme
TDS	:	Trickle Down System of Aquaculture Extension
TFO	:	Thana Fisheries Officer
UNDP	:	United Nations Development Programme

PREPARATION OF THIS DOCUMENT

This document, prepared under an author's contract, by Dr. Dilip Kumar, describes aquaculture extension services delivery method called the Trickle Down System (TDS) of extension which was applied in FAO field projects in Bangladesh and Vietnam with great success. The opinion expressed in this publicaiton are those of the author's alone and do not imply the expression of any opinion whatsoever on the part of FAO.

CONTENTS

1. INTRODUCTION

In Asia, emphasis on aquaculture during the past two decades has resulted in increased fish production and has stimulated rural development. The 1987, aquaculture production of 10.9 million tons, representing 21% of total fishery production in the Asia-Pacific region, was almost a three fold increase over that of 1976 which was only 3.7 million tonnes representing about 12% of total fishery production. Output from aquaculture continued to increase at a faster rate compared with other food production sectors. Between 1986-1996 global aquaculture in terms of quantity and value increased at the rate of 10% per year and in 1996 it reached 34.12 million tonnes and US$ 46.6 billion, respectively. Asia continues to dominate world aquaculture production and in 1996 Asia accounted for 91% and 83.5% of production and value, respectively. In the next millennium the demand for finfish and other aquatic edible organisms is likely to increase multifold due to rising trend in population and living standards. In view of the declining capture fisheries production, it is expected that much of this demand is likely to be met from aquaculture. The major challenges ahead for aquaculture therefore are to make sustainable increase in production and promote aquaculture as a long term farming activity to support equitable rural development.

Asian aquaculture is predominantly a rural food farming activity where major production is contributed by small holders in rural communities through farming of low valued species of aquatic organisms in family ponds and common property resources like community ponds, seasonal and perennial tanks and other water bodies. Majority of these producers are relatively resource poor, less educated and invisible to fisheries research and support services. Further, due to large number of relatively small holdings, remote location, seasonal and scattered nature of their production bases, their contribution is considered to be grossly underestimated (Mekong Committee, 1992). The number of ponds in Bangladesh has been estimated in 1889/1990 to be over 1.48 million. The figure still stands valid even after a decade of significant expansion in this area. Most of the concerned development agencies feel that the number might have crossed over 2 million mark by now.

To achieve sustainable development, aquaculture need to address widespread rural poverty and inequity in developing countries. According to Dr. Swaminathan any development may not be sustainable if it is not equitable (Swaminathan,1994). Future development of aquaculture is expected through increase in area and intensifying production in existing aquaculture areas. Majority of the small and medium scale Asian farmers are primarily engaged in agriculture and aquaculture is the secondary or subsidiary farming activity. There is growing feeling among them that there is limited scope for their development exclusively through agriculture. Main reason being the marginalization of profit from crop farming due to increasing cost of inputs, erratic power supply, supply of sub-standard seed, fertilizers and

pesticides. Aquaculture, on the other hand, even at the subsistence level, assures substantial cash income from the sale of domestic surplus. Further, due to large number of native species of different feeding and living habits, aquaculture has great potential for its expansion in areas like saline soils, swamps, flood plains etc., which are not suitable for agriculture. Farmers, although still keen to ensure food security for their families, are looking increasingly towards cash crops, trade and complementary activities to supplement their income and improve their living standards. Aquaculture is also viewed as one of the alternative farming activity and as such the role of aquaculture will be of importance in planning for sustainable rural development, especially in countries where aquaculture is already established as a recognized economic activity. In this context, the need for an effective Extension Services cannot be overemphasized.

2. AQUACULTURE PRACTICES AND THEIR RELEVANCE TO RURAL DEVELOPMENT

Like agriculture, aquaculture has also various dimensions and scales of operation. Rural aquaculture is basically a rural food farming activity which is highly compatible with other food farming components of the family level farming system. On the other hand, highly commercialized, high inputs based intensive culture of high valued finfish and shell fish is another dimension of aquaculture. Besides, there are also several intermediate levels and scales of operations.

Recent developments in the field of aquaculture, especially culture of high valued species like shrimp has brought aquaculture under the focus of attention of the people in general and the entrepreneurs and exporters in particular. The development of shrimp culture during the past 10-15 years have attracted non-farming communities and created mass awareness among the people about the potential of aquaculture for earning livelihood and for generating cash surplus. Our immediate concern, however, is to promote the type of aquaculture that is widely accepted as a potential tool for ensuring food security and generation of gainful employment opportunities in the rural areas. As indicated before world aquaculture production is dominated by small scale farmers through farming of low valued species.

Depending upon the level of intensification and extent of inputs used aquaculture practices are broadly categorized here under (Table 1).

Extensive culture systems depends largely on single input, the seed. No other extraneous material inputs are used and consequently such systems heavily depend upon the natural feed produced in the system or brought in by water in-flow. Extensive rice fish culture, culture based fisheries in ox-bow lakes and small seasonal reservoirs, shrimp/fish culture in rice fields of Kerala and bheries (large impounded shallow water areas with facilities for drawing tidal water) of West Bengal, India and fish culture in seasonal tanks of Sri Lanka are common examples of such systems.

Semi-intensive culture systems, on the other hand, also depend largely on natural food produced *in-situ.* However, the production of natural food is enhanced by application of organic or inorganic manure or combination of both. At this level, the practices are known as low-cost semi-intensive system. Further intensification in these systems are attained by increasing the stocking density and application of commercially available or farm made feed or locally available agricultural byproducts like bran of rice, wheat, maize etc., and various types of vegetable de-oiled cakes as supplementary feed. In semi-intensive feed and manure based freshwater carp culture, feed alone amounts to 60-70% of the total production cost. As a result, feed based culture of low valued fish species have limited acceptance among the resource

poor farming communities. Low cost semi-intensive systems are followed extensively in small undrainable family ponds and relatively larger community ponds, pens erected in lakes etc. These are closely integrated component of the family farming system being practised by the majority of Asian rural communities. The integration becomes more visible when livestock housings are brought closer to the aquaculture facilities or the livestock animals are housed over or near the pond. The water is not only used for aquaculture but also for irrigation of crops, husbandry of livestock and other domestic purposes. Again, the wastes and by-products from crop/horticulture and excreta from livestock farming activities are efficiently recycled in the aquatic ecosystem in the form of high valued protein rich food. It happens in any way, whether the farming components are closely sited or kept apart (e.g. Integrated fish farming system in China).

Seasonal tanks are perhaps one of the potential resources for promoting rural development in Sri Lanka as the undrainable homestead ponds of Bangladesh, India, Vietnam and many other Low Income Food Deficit Countries (LIFDCs) of Asia. Due to its seasonal nature, most of the desired pre-stocking management measures are automatically completed. The area is dried and the bottom is exposed to the sun light which helps in disinfecting the tank. Subsequently, the area get automatically manured by the grazing cattle population that helps in the production of natural fish food in the tanks once they are filled with water. The only and the most critical input required is the desired size and species of fingerlings. The success of fish culture in these seasonal tanks will depend exclusively on the timely availability of quality fingerlings(Kumar and Pushpakumar, 1998).

Intensive culture systems are high inputs–high output based systems which require infrastructure facilities, large investment and adequate managerial skill. Such systems depend largely on complete and commercially available feed, oxygenation of the system, exchange or circulation of water etc. These culture systems are followed by corporate sector or commercial scale farmers and entrepreneurs. Such systems indirectly benefit the rural communities by creating limited job opportunities at farm level and through development of ancillary industries.

Culture of fish in cages is a technically feasible proposition but due to heavy dependence on feed, success of an operation depends largely on the cost of feed used and the market price of the produce. Seed, feed, organic and inorganic manures, lime, piscicide and certain common fish therapeutics are the usual material inputs which are required for aquaculture. The list of requirements becomes shorter when relatively low cost aquaculture is attempted. Feed is considered as the most expensive input required for semi-intensive and intensive type of aquaculture systems.

It has been repeatedly demonstrated that even at the subsistence level, aquaculture brings sizable cash income to the family besides providing fresh fish for domestic consumption. Experience gained from pilot scale interventions in several countries in Asia clearly indicate that resource poor farmers usually opt for low cost

or organic manure based low-input aquaculture systems. Subsequently, by gaining confidence and experience, they gradually switch over to organic manure, inorganic fertilizer and feed based semi-intensive culture systems. Availability of a large number of economically viable culture technologies with various levels of inputs and intensification, aquaculture provides opportunities for landless, resource poor as well as well off rural communities to embark upon aquaculture for food production and income generation.

In view of the actual and potential contribution of extensive and semi-intensive aquaculture systems in providing increased availability of cheap animal protein to the traditionally rice and fish eating rural population of Asia, and supplementing family income through sale of domestic surplus, some of the countries in the region such as India, Bangladesh, Vietnam, Laos, China, *etc*. have accepted aquaculture as one of the components of their Integrated Rural Development Programme (IRDP). As a component of the family farming system, it helps in product diversification and spreading risk.

Table 1. Aquaculture systems based on levels of intensification and inputs use

Intensification levels	Major inputs	Some common examples
Extensive culture systems	Seed from adjoining natural source or hatchery produced or from both	• Shrimp culture in paddy fields of Kerala • Shrimp culture in "bheries" of West Bengal • Shrimp culture in "ghers" of Bangladesh • Fish culture/culture based capture fisheries in ox-bow lakes in Bangladesh • Fish culture in seasonal and perennial tanks of Sri Lanka
Semi-intensive culture systems • Low-input based systems	Seed manure Lime Piscicide (once in several years for perennial ponds and only when drying is not possible)	• Carp polyculture in undrainable community and small family ponds • Family level integrated fish culture in homestead ponds(VAC system of Vietnam) • Integrated fish culture in larger ponds • Tilapia culture in family ponds • Puntius culture • Oyster culture
• High-input based systems	Seed Organic and inorganic manures Feed (mostly farm made / compounded) Lime Fuel or electricity for dewatering perennial ponds or piscicide when drying is not possible Common therapeutants	• Composite carp culture in India • Fish culture in family ponds • Catfish culture in family ponds • Tilapia culture • Shrimp culture in community pond complex • Carp / prawn polyculture • Seabass culture
Intensive culture systems	Seed Feed (mostly pelleted and commercially available) Lime / dolomite Piscicide Energy (electricity / gasoline) Water(exchange / recirculation) Oxygen (aeration) Therapeutant High level of management	• Shrimp aquaculture • Freshwater prawn culture • Eel culture • Culture of salmon and trout and other high valued species • Culture in raceways • Culture in high-tech indoor facilities

3. AQUACULTURE EXTENSION

3.1 Objectives

The prime objective of aquaculture/fisheries extension is to persuade and help aquafarmers and fishing communities to improve their socioeconomic condition and quality of life by making improvement in their farming practices resulting in increased fish production and income. Once the primary objective at household and community levels is achieved, the overall national development objective of increasing national fish production, is also attained. There has been a general trend for targeting substantial increase in fish production in the successive national development plans of the countries in the region. Though in most instances, the targets appear to have been set for the government, by the government (Fisheries Department), in reality, the targets are fixed for the primary producers of the sector – farmers and fishermen communities. It is the primary producers of the fisheries sector who actually accomplish the target. However, this top down approach deserves revision and warrants active participation of primary producers in the process. It is highly desirable that the primary producers are well informed and involved in the planning process from the very beginning and supported by the Government to enhance their production to achieve the planned national targets. Further, it is also equally important that while providing extension services support to these primary producers for developing their farming practices, utmost care be taken that recommendations suggested are in line with the need, means and ability of individuals and the communities and at the same time these are economically viable and socially acceptable. Only appropriate programme can generate mass participation to achieve national objectives

Further increase in aquaculture production is possible by intensification of aquaculture practices in existing areas and bringing additional areas into its fold especially those which are not used or considered to be unsuitable for agriculture. Aquaculture is still an emerging farming practice. Compared to agriculture and animal husbandry, relatively few small-scale farming households practise aquaculture even in Asia (Edwards and Demaine, 1997). Again major increase in production is likely to come from new entrants as there are enough scope and opportunities in aquaculture to attract the rural farming and resource poor communities. The targeted expansion of aquaculture production will depend upon many factors, including the development of necessary infrastructure and marketing facilities, easy availability of required inputs and perhaps the most important of all these factors is the need for a system of information transfer from the research and development centres to the farming households. However, it requires much more than simple transfer of information and hence the role of extension service is very important. The major task for extension thus becomes to collect the desired information, inform and convince

the people about the value of new and better technology packages, make further refinement to suit them and motivate them to adopt it and draw benefit from it.

3.2 Scope

The fundamental objective of extension is the development of the people where the meaning of development is not restricted to physical and economic aspects. The idea is to help the people to help themselves. Discussing wide range of matters with the people and help them to get a clearer insight into their problems and developing capacity to make them decide how to overcome their problems is the central role of extension. Hence, it is a process which continues over a period of time and not a single and one time activity. It involves changes in the behavior of the clientele, presumably resulting in further improvement in their farming practices, production and income, living condition, social status and confidence. However, fundamental to behavioral changes is to bring change in their attitude and by doing so, extension attempts to make advance from the static situation which usually prevails in traditional rural societies of Asia. Educating and training rural communities to develop/improve their aquaculture skills and capabilities so as to increase their farming efficiency is the core function of aquaculture extension services system. Besides, the service also assists the farmers by providing necessary information on product development, value addition, food safety issues, credit availability, marketing etc. As and where applicable the extension system helps the local communities to organize themselves into formal or informal production/marketing groups and in participatory management of Common Property Resources (CPR). In some countries the system has set example of providing guidance and assistance to the resource poor communities in accessing public/common property resources and their sustainable utilization. Extension services system is also assisting in developing certain guidelines and their implementation for sustainable utilization and management of aquaculture/ fisheries resources.

3.3 Role in Rural Development

About 70 to 80% of the Asian population live in villages and majority of them are poor. They live mainly on agriculture and agriculture related activities such as livestock rearing, aquaculture and fisheries, forestry, etc. In general these rural dwellers are resource poor and a sizable population is landless. Their average farm holding size in most of the countries is less than a hectare. Due to the growing family size, pressure is gradually increasing to ensure family food security. Compared to coastal areas and fertile plains, poverty is relatively more pronounced in upland areas of most of the countries in the region. The main source of livelihood among the upland rural communities is rain-fed agriculture. They employ a wide range of production systems in agriculture, agro-forestry, forestry and livestock rearing. The dryland shifting cultivation is more prevalent among most of the upland communities of the region, the sustainability of which is becoming increasingly doubtful.

Rural farming communities in general, in addition to ensuring family food security, are looking increasingly towards cash crops, trade and other complementary activities to generate extra income to improve the quality of their life.

Small-scale rural aquaculture which contributes over 70% to the total aquaculture production, is a potential resource for improving household food security and supplementing family income of the rural poor. Even at a subsistence level, aquaculture provides the much needed animal protein food and substantial cash income from the sale of the surplus crop. Aquaculture in homestead family ponds is also developing as a gender-sensitive family farming practice. A less strenuous and shorter daily labour requirement, close proximity to the homestead, good return on investment and a source of high quality food for the family, makes working in aquaculture acceptable to the women members of farm families. Year-round cropping opportunity and quick return, makes aquaculture a highly acceptable food production system even for the upland communities. As indicated in Table 1 aquaculture offers wide range of culture technologies which could easily be incorporated into the family farming systems to diversify the family food production, spread risk and make more productive use of by-products generated from other farming activities. Low input based systems exclusively depend upon on-farm resources and therefore except for the seed no purchased or extraneous input is required. Fish is a highly nutritious and preferred food item. In most of the Asian countries rice and fish form the daily diet of the people. Because of these qualities, small-scale aquaculture has been accepted as a powerful production option for reducing rural poverty, alleviate cases of malnutrition among children and mothers, empowering women and raising family living standard. Asian small-scale farmers are convinced that fish culture is a cash crop and has the potential for crop diversification and improved earnings. As a result, the number of small-scale aquaculture farmers in Asia is increasing.

Aquaculture extension services have played a significant role in the development of aquaculture, however, a role of greater dimension is expected in the coming years. Most of these new entrants are expected from rural resource poor communities though this group have extremely limited access to information and other support services. At the grass roots level, extension is the most important part of the Aquaculture Support Services as it cut across all other services. Efficient extension services are required to support the existing farmers and the new entrants for effectively promoting equitable and sustainable development of aquaculture that will contribute to overall rural socio-economic life.

It is quite evident that when the support from extension service is not adequate, the small-scale operator has to depend upon external sources for information. In the case of higher input based culture of high valued species like shrimp, it has been experienced that in the absence of effective extension services, most information is volunteered by groups associated with manufacturers and dealers of drugs, chemicals, feed, appliances and equipment. Aggressive marketing efforts

by these interest groups often push the farmers towards over-intensification by luring them to short-term profitability at the expense of environmental and social sustainability.

3.4 Clientele

Aquaculture is both a primary source of livelihood and a secondary or supplementary farming activity. At one end there is a huge number of household or small-scale aquaculturists and, at the other end, there are the large or commercial-scale or industrial-scale farmers, corporate groups. The latter group of aquaculturists are highly organized, having access to information and innovations, and enough resources to benefit from improved or new technologies. These groups have also better access to policy-making institutions and are well organized and powerful enough to influence decisions. On the other hand, the small-scale or subsistence level farmers have relatively limited resources and little access to technical innovations. Though the small-scale farmers make up a relatively big number, they are unorganized, with poor level or virtually no education, and have little awareness about environmental implications or regulations. To ensure that the small-scale sector get the benefit, it is desirable that the proven low-cost technologies appropriate for small-scale farmers are extended widely. They are also informed about innovations made in research institutions and helped in drawing benefit from such innovations. In the absence of such support the small -scale farmers will lag behind.

Aquaculture is also practised in common property resources mainly by the resource poor groups. In this context, the task of educating the local communities in the management of resources also becomes an additional responsibility of the extension system. Keeping such functions in view, the extension workers need to be trained in aspects like participatory techniques, group mobilization, participatory resources management etc.

4. TRICKLE DOWN SYSTEM (TDS) OF AQUACULTURE EXTENSION

The Genesis and Concept

Experience gained from better organized and established extension services in the food farming sector clearly indicate that in addition to a dedicated and efficient extension services network, appropriate extension approach is also needed to provide definite direction to the programme operation and to amplify its impacts. Depending upon the existing socio-economic and cultural setting, knowledge, skill, experience and education levels, the needs and requirements of the client groups, their location, transportation facilities and in the background of overall national aquaculture development programme, several approaches and strategies could be designed.

Appropriate approaches are usually designed while keeping two main objectives in mind. The first being to get closer to the client groups and get familiar with their wants and needs, tradition and culture, resources and constraints and potential for development, existing knowledge and skill, farming practices being followed, marketing and pricing of the products etc. Once a close relationship is established and these information are available, the next objective is to draw their interest and active participation in solving their problems, plan common action for improving their existing aquaculture practices and attract new entrants. Approaches are drawn to ensure achieving the extension objectives at a faster rate with economy of time and resources.

The TDS approach of aquaculture extension is a participatory farmer to farmers extension approach which involves an initial bottom-up participatory planning of extension programme and thereafter a lateral spread of knowledge and skills of improved culture technology. TDS ensures an active flow of information from the Result Demonstration Farmers (RDFs) to the Fellow Fish Farmers (FFs) by involving both categories of participating farmers in the extension programme.

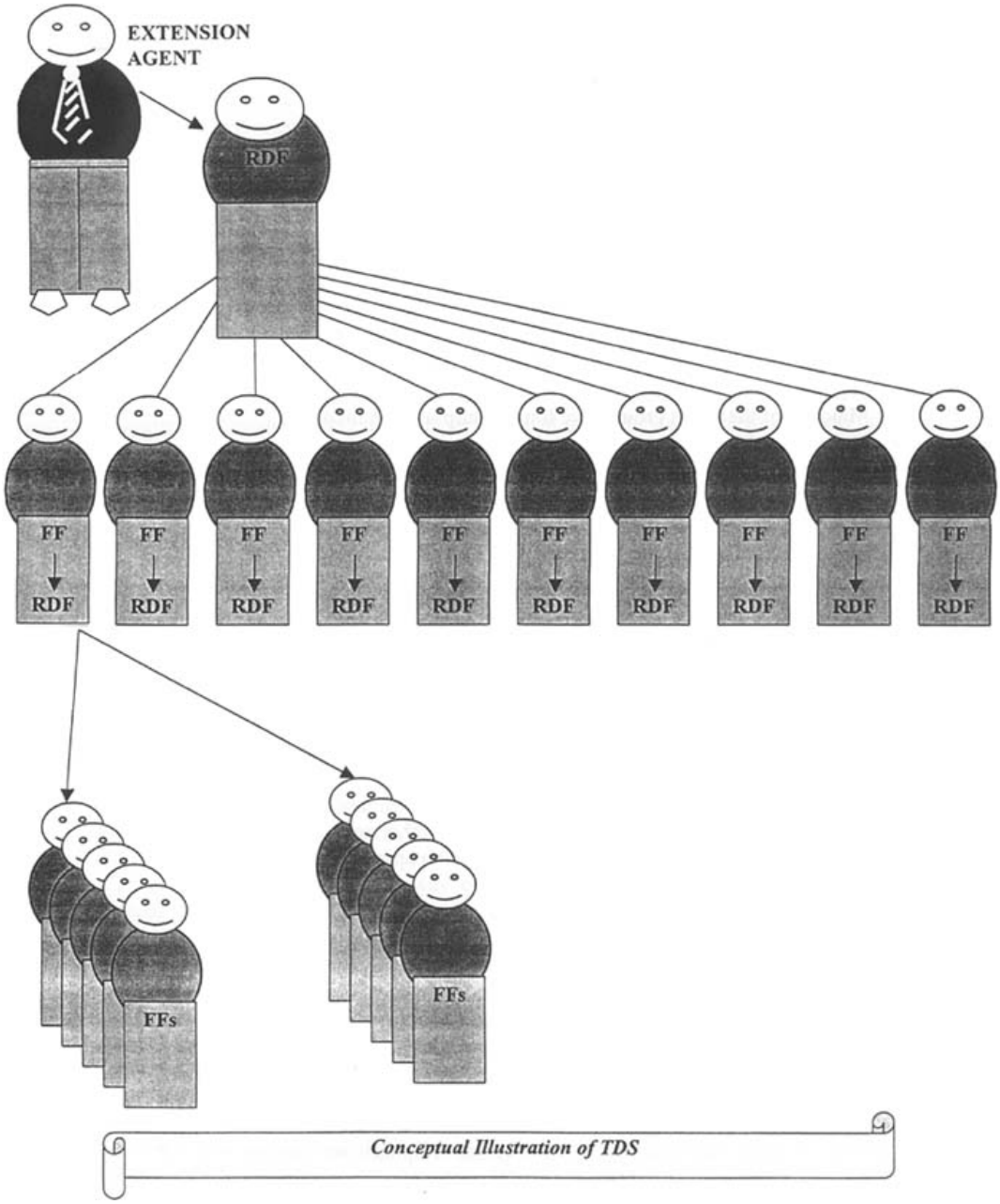
The TDS approach of aquaculture was developed and successfully demonstrated in Bangladesh, though on a limited scale, by the FAO / UNDP project "Institutional Strengthening in the Fisheries Sector" (BGD/87/045) during 1990-1993 (Karim, 1997). The project also recommended the strengthening and institutionalizing of the aquaculture extension services under the Department of Fisheries (DOF), Government of Bangladesh. Convinced by the viability and sustainability of the TDS approach, the Government of Bangladesh submitted a formal request to the FAO for assistance under Technical Cooperation Programme (TCP) with the main objective of demonstrating the TDS system on a pilot scale. As requested, the FAO assistance was made available in the form of a FAO TCP project "Strengthening Pond Fish Culture Extension". The project successfully demonstrated

the application of TDS of aquaculture extension on a pilot scale in 52 out of 64 districts of the country during 1994-96. The pilot scale operation also helped in further fine tuning of the approach.

As an initial step, an aquaculturists group was organized at the village level and by employing the Rapid Rural Appraisal (RRA) technique, a broad based participatory assessment was made about the size and type of aquaculture resources, local availability of essential inputs, status of farming practices, local farming skill, ability to mobilize the extraneous inputs, constraints, etc. In the background of such information and with due considerations to the existing socio-economic environment, needs and problems of the local communities, appropriate alternative technology packages were suggested. Once the interest was visible, Result Demonstration Farmers (RDFs) were selected with the consent of the group to take up the appropriate culture technology for trial. Adequate extension support was extended to the RDFs through repeated short time instructional training and periodical home/pond visits to conduct the demonstration of the selected aquaculture technologies in their ponds. Once the crop attained the presentable stage they were encouraged and assisted to organize practical training for their Fellow Farmers (FFs) by demonstrating the various steps of culture technology and displaying the crop. The role of the RDFs was constantly highlighted and appreciated and that helped in raising his/her status in the community and therefore acted as a valuable incentive for them. RDFs were thus groomed as voluntary extension workers who worked on behalf of the Department of Fisheries. This inspired the RDFs to take more interest in propagating the aquaculture technology in the surroundings. In the subsequent cropping cycles some of the FFs came forward to take up similar demonstration function and thereby graduated to become RDFs and in turn involve other farmers as FFs. This chain of events went on in the farming community.

The approach had helped in developing an “extension” culture among the senior as well as field staff of the DOF and institutionalizing the aquaculture extension services system under the DOF. It seems relevant to mention that unlike in the agriculture sector where primary activity is extension, the fisheries sector has multi-faceted responsibilities ranging from management of fisheries/aquaculture resources under the state/public ownership such as rivers, lakes, reservoirs, flood plains etc., to provision of extension services to fish farmers and fishers communities. Additionally, most of such resources are remotely located, as a result accessibility by public transport system is extremely difficult.

Encouraged by the good results, the Government of Bangladesh launched a nation wide project on aquaculture extension based on TDS approach through its own funding in 1996.



Conceptual Illustration of TDS

5. PLANNING, DESIGN AND OPERATION OF TDS

5.1 Key Considerations

The following aspects of the aquaculture sub-sector of Bangladesh were given due considerations before planning and designing the TDS aquaculture extension approach**.**

- Vast, varied and scattered aquaculture / fisheries resources.
- Vast population of heterogeneous client group.
- Compared to agriculture, aquaculture is practiced by relatively small number of farmers offering greater scope for other farmers to take up aquaculture.
- Aquaculture is a non-traditional farming practice.
- Majority of the client group have limited surplus cash income.
- Understaffed Department of Fisheries.
- Field based technical personnel have multifaceted job to perform like technical management of aquaculture/fisheries resources, collection of revenue, enforcement of fisheries laws and regulations, recovery of loans etc. As a result, at times, they play contradictory roles.
- Unlike agriculture sector, extension is still in infancy stage of development in aquaculture/fisheries sector.
- Field personnel, inadequately trained, are not oriented towards their role as extension agent and have limited hands on attachment experience in the field of aquaculture extension.
- Very limited facilities for mobility of the extension/field personnel.
- Sizable population of the clientele with traditional outlook.

In view of these multifaceted problems and limitations of adequately trained and experienced field / extension personnel and other resources, area / community focussed and result oriented participatory extension approach is a necessity.

5.2 Functional Design and Key Players of the System

Compared to agriculture, extension is a recently introduced activity in the fisheries/aquaculture sector. The Fisheries Department is primarily involved in management of fisheries resources with major emphasis on fisheries administration and certain level of direct involvement in production and commercial activities through its fish seed production farms. Extension is still an emerging area and hence most of the field staff are inadequately oriented towards their role as extension agent. In view of these constraints, TDS gave greater emphasis on training to develop the extension capacity of the field staff of DOF working at Thana (the organizational unit

working at the field level), District and Division levels, as well as the farming communities.

Bottom up planning activities were initiated at the Community/FFs-RDFs interface level and moved successively upward towards the RDFs- Extension Agent interface, Extension Workers- Extension Officers interface and also at the Extension Units - Central Extension Units (CEU) interface levels

Following were the four major functional aspects of the system

- **Grass roots level initial planning**
- **Training**
- **Demonstration and**
- **Periodical home / pond visits**

Result Demonstration Farmers (RDFs) and Fellow Farmers (FFs) from the farming communities and the team of technical personnel attached to the local unit of the Department of Fisheries (DOF) were the key players of the aquaculture extension programme based on TDS approach. Valuable contributions were also made by community opinion leaders, senior fisheries officers posted at District, Division and HQs and the NGOs active in the area.

5.3 Operation of TDS

5.3.1 Planning and selection of RDFs

As already stated, the main objective of extension is to help the farmers identify and know the potential of their resources and to suggest to them how to develop and utilize those resources. It implies more listening from the people and learning from them, knowing them and their resources rather than imposing one's own views and ideas. The aim should be at increasing self reliance of the people and the community and infusing a sense of participation in the decision making process. This approach stimulates two way communication, gauge across grass roots level needs and priorities and reach agreement for action at individual and community levels. There are two commonly employed methods for participatory resources assessment and constraints identification. Participatory Rural Appraisal (PRA) is promoted by social welfare sectors emphasizing more on getting closer to the people and more with the conviction that participation is the most essential element. PRA Approach enables multi-sectoral extension teams to assist the community to gather data and other information, enlist their expressed needs and priorities and draw up a comprehensive plan of action for the overall development of the village community. A high degree of peoples participation is applied. However, a lot of time and efforts are required for such exercises. Rapid Rural Appraisal (RRA), on the other hand, is a more cost effective approach in terms of time and resource and more appropriate when the programme is focussed on aquaculture development. The type and quantity

of information to be collected are restricted to aquaculture/enhanced fisheries and other closely interlinked aspects. However, the degree of participation through RRA is lower than PRA.

Villagers participating in RRA.

To start with, the Thana (Administrative unit at the operational level) team identified few villages having greater potential for aquaculture development. As soon as the villages were identified, the extension agent made a few visits to the village and got familiar with some of the local opinion leaders and practising aquaculturists. During the visit the agent got an overview of the resources and also gave them some idea about the potential for development through improved aquaculture practices. Once interest was expressed, the possibility and conditions for a village level training programme was revealed. Conditions implied token support and initiative from the community, like deciding the time, venue and date of the training, inviting the participants, arrangements for siting, etc. To ensure the participation of genuinely interested farmers and their family members, it was made clear that there was no provision for training allowance or any other assistance and the training was being organized at the request of the villagers. The stress was given to make the community feel that the programme was being organized on their request and for their benefit. It was ensured that there was opportunity for the entire family to participate.

The venue of the meeting was also important. It was also kept in mind that villagers were not used to captive class room environment and hence the planning workshop/training should be organized in open environment under a tree or any other open public place. During the initial course of this participatory activity the participants were encouraged to explain the details about their resources, existing

culture practice, inputs used, source and availability of inputs, yield, consumption and disposal pattern, problems encountered, common constraints etc.

Meeting of villagers in open environment.

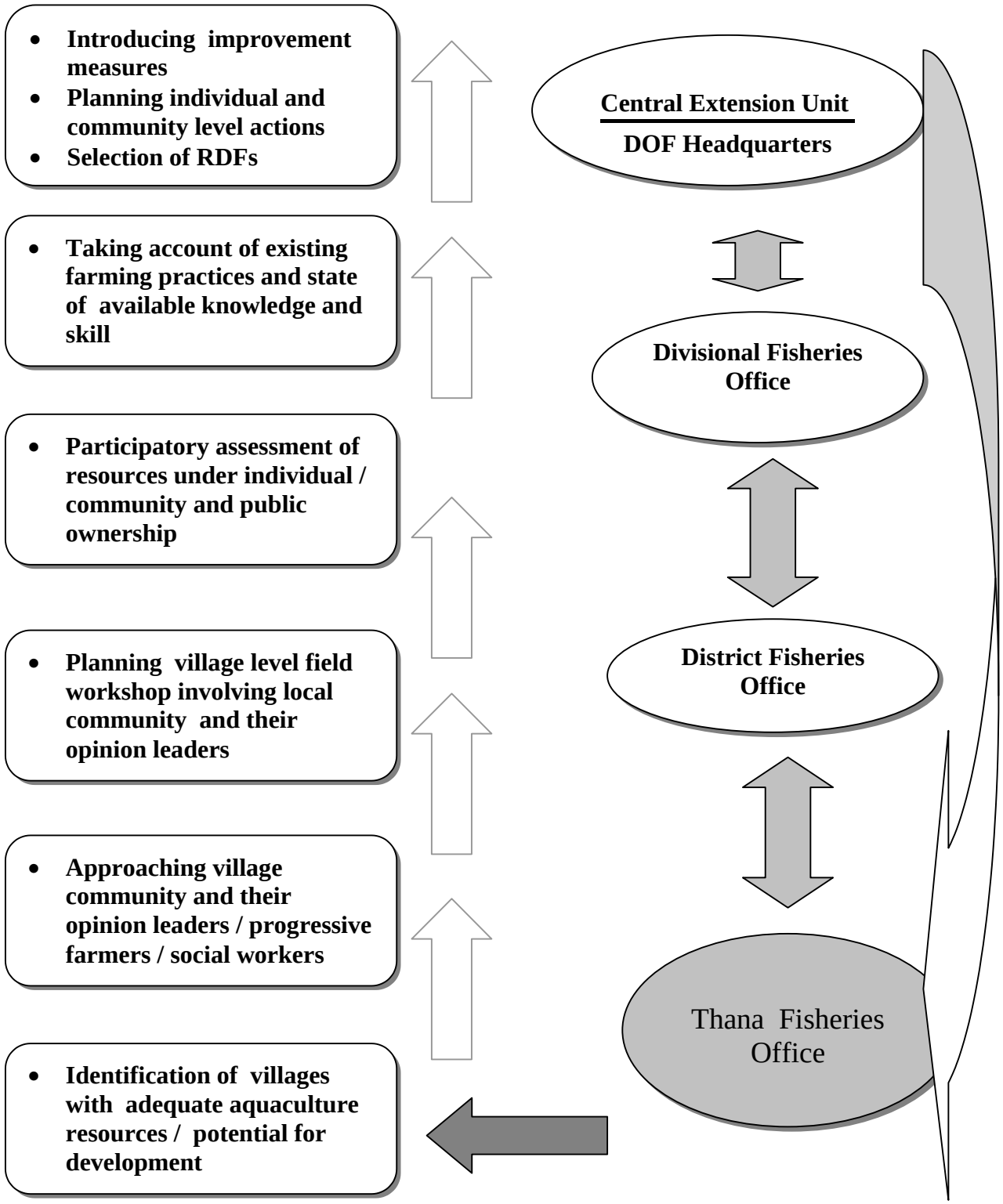
This exercise helped in participatory review of the resources, up to what extent these resources were utilized, problems and potential for development, and common and individual actions required for harnessing the opportunities for development. Once the interest was expressed, appropriate technology package was introduced emphasizing its simplicity, operational ease, low input cost, production and profit potential, etc. To make the communication effective, suitable audio visual aids and tools were used. Soon after getting clear insight into the local situation, the group was assisted in drawing a careful plan for the improvement of the existing culture practices. Alternatives were suggested and agreed upon. Finally assistance was promised to support the demonstration of the selected technology through further training and periodical visits. From the group, one or two innovative farmers who volunteered to conduct the demonstration, were tipped off to act as Result Demonstration Farmers (RDFs). However, the selection was made in consultation with the local communities. Selected farmers were designated as RDFs while other interested farmers were designated as Fellow Farmers (FFs). FFs were advised to participate by watching or observing the operation and wait till results were visible. At the end, the concept of the programme was explained clearly indicating no chance of getting any input assistance or credit support.

Selection of RDF.

Such an approach generated interest and competition among the interested fish farmers and instead of being selected by the extension officer, the farmers themselves offered to volunteer to act as RDFs. The role of extension officer/agent is very crucial in generating such interest and enthusiasm.

It was a general observation that some of the farmers were better educated, had more resources and more enthusiastic about adopting most modern farming practices. It had been noticed that a progressive agricultural farmer or a good livestock farmer equally performed better if he/she had started aquaculture.

Based on the village level exercise, a Thana level extension plan was drawn by the Thana fisheries unit and forwarded to the District Unit. This should also be noted that Thana level initiatives were taken up in line with the broader national aquaculture development framework. The district level plans were compiled and forwarded to the Divisional unit from where it was sent to the Extension Unit of the DOF. Necessary modifications and adjustments were made in the programme as per the national development priority and availability of resources.



Steps in Programme Planning exercise.

Criteria for selecting Result Demonstrator

Success of TDS depends largely on the success of the demonstration which further depends on the right type of RDF. Though RDFs are selected by the participating community, due considerations should be given to the following criteria.

- Preferably RDFs should be the sole owner of the pond and able to devote considerable time for pond fish farming activities. If pond is taken on lease it should be at least available for the next 2-3 years. Absentee pond owners should not be selected as RDF.
- RDFs should be selected from the cross section of the community so that they represent various socio-economic groups which comprise the village society.
- Framing should be their primary profession and preferably with some experience in aquaculture.
- They should preferably be literate so that they can read and write.
- They should be people of reputation in their own communities and preferably should be those from whom other farmers would seek advice.
- They should be receptive to new ideas and practices and willing to try them out and spread the acquired knowledge to other fish farmers in the locality.
- They should be willing to meet and assist the extension agent during their visits. All problems associated with adaptations of new methods/technologies and the results of the technology adopted should be discussed during the meeting.
- To ensure wider dispersal, RDF ponds should not be next to each other. The pond should be so located that they offer good demonstration effect to the large number of neighbouring farmers.
- Preference be given to women to demonstrate the application of improved technology in homestead ponds.
- Preference should also be given to religious heads and/or school teachers if resources are available and if they are interested in fish culture.
- The culture facility / pond is not risk prone (flooding, poaching etc.)
- The leader of the group assigned to take responsibility of managing community/ village pond or government water body may be a potential RDF. In such a case, though the group leader acts as a focal point, in reality, the entire group becomes the Result Demonstrator.

Role of Result Demonstrator Farmer

RDFs generally represent their community. The role of RDF, therefore should be well defined and should be known to him/ her.

- Select FFs from their own community or adjoining villages.
- Keep regular contact with FFs, other members of the community and the extension agent and discuss all matters related to their farming operation.

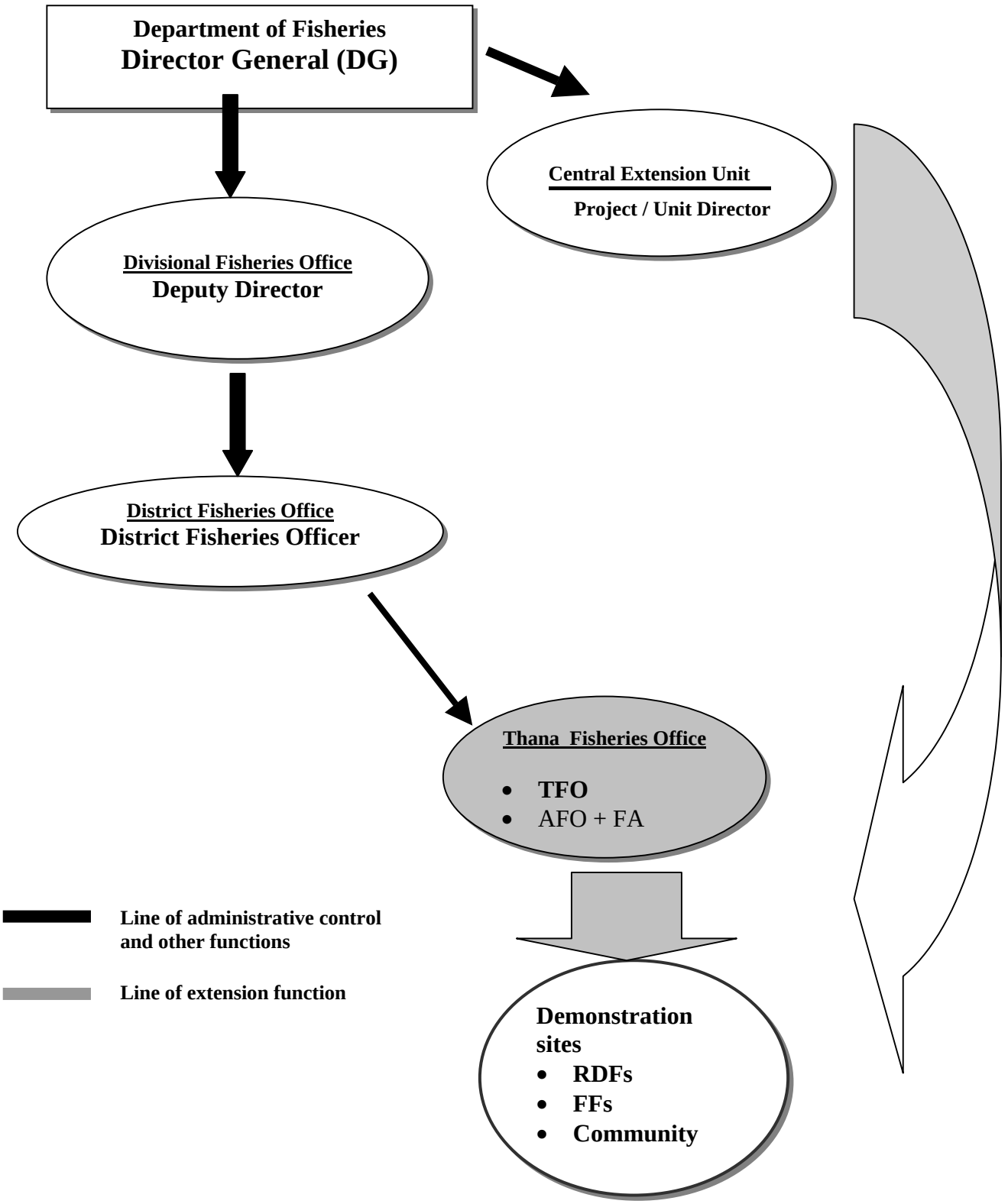
- Take lead role in conducting *in situ* training programme or demonstration for their FFs.
- Try out new ideas and practices in their own pond/facility recommended by the extension agents (TFOs/AFOs/FA)
- Assist and motivate FFs and other farmers in adopting new ideas and practices in their own facilities.
- Take frequent visit to his/her FF's ponds/facilities.
- Follow all the recommended technologies from the beginning to the end of the farming package and keep records of inputs used and results obtained.
- List problems that need special attention of the extension agent and bring these to their notice.
- Assume active leadership role and initiates cooperative group action.
- Work as voluntary extension agent on behalf of the Department of Fisheries.

Changing the Result Demonstrator Farmer

Although result demonstration is one of the most effective method of extension, it is equally risky. If it fails to exhibit the expected results it will lead to disastrous consequences. The people will lose faith and the extension agent will loose face. Approaching the community will become doubly difficult in future. This implies that RDFs are critically important human factor in TDS. Inspite of careful selection, there may be some RDFs who may not show active interest or may not be keen to discharge their responsibility as RDFs. Under such circumstance, they are no longer effective RDFs and should be replaced carefully and tactfully. On the other hand, however, the demonstration may go wrong due to factors beyond RDF's control. In such events, the RDF deserves more support and encouragement.

5.3.2 Organization

Typically, the organizational structure of extension services system should be as flat as possible. Usually, there is no separate network of extension personnel at the field level. To make the extension programme more effective, a direct line of communication was established between the Central Extension Unit (CEU) at the headquarters of the DOF and the Field /Thana Units. A close support, monitoring and evaluation system was also introduced from the CEU. Thana units were advised to send their periodical progress reports to the CEU with copies to their respective DFOs for information and also for necessary action if required. The progress of the programme, however, was also discussed at the district, divisional and national levels during its monthly meetings and the recommendations / observations were forwarded to the CEU. As and when required the field /Thana units were supported by their respective Division / District units. Supervision of the field activities on regular basis was considered to be the critical factor for the success of the programme. It was ensured that somebody from the CEU visits the field sites at least once in 2-3 months. Frequent visit by CEU and district / division levels units was very useful to encourage the field workers, RDFs and the participating farmers.



Organizational structure of the Aquaculture Extension Services System

5.3.3 Training

Training was one of the core activity/component of the system. Although separate training was organized for extension personnel, RDFs and linked FFs, the operating system itself provides a continuous learning environment for all the participating functionaries.

Extension personnel

Initially, short duration Extension Orientation programme was organized for the extension officers/agent and staff of the Department of Fisheries to make them understand the programme and its objectives, the system design and its operation to enable them to proceed to select the RDFs and their pond. Record keeping and reporting schedules such as, RDFs record keeping book, schedule for progress reporting and reporting format etc., were properly explained. Orientation programme was followed by a week long comprehensive extension training in aquaculture for all the involved officers/agents. This also included practical exercise on field activities to be undertaken by them. Efforts were made to bring clarity in their understanding about the package of practices of the selected production technologies and the mechanism for its transfer. Concept of aquaculture extension, appropriate extension approaches, participatory and communication techniques, appropriate extension teaching methods and tools, extension programme planning etc., formed part of the comprehensive training. Discussions were organized after field exercise to review the programme, identify the points where they had gone wrong and where scope for improvement still existed to create greater impact. Depending upon the levels of their education and position, separate training courses were organised for all field level extension officers / agents, e.g. Thana Fisheries Officer (TFO), Assistant Fisheries Officer (AFO) and Field Assistant (FA).

The main objectives of the training were to:

- bring clarity to the understanding of the participants about the rural undrainable pond ecosystem, aquacultural resources and its various functional aspects, especially with regard to the huge size of rural resource base and its potential for rural development.
- adequately expose the participants to the basic principles and packages of appropriate low cost semi-intensive fish culture technologies for rural undrainable ponds and other commonly available aquaculture resources;
- introduce the concept, objectives and scope of aquaculture extension and the application of TDS of aquaculture extension approach;
- develop communication and motivational skill;
- expose to participatory techniques and methods to facilitate group formation and
- improve their technical, extension and management skills and making them more confident and committed aquaculture extension professionals.

Training session of extension personnel - discussion and field exercise.

Operational training workshop for senior officers

Training for senior officers like District Fisheries Officer (DFO), Assistant Director (ADF) and Deputy Director (DD) were organized through divisional level operational workshops. The main objective of the operational workshop was to conduct participatory review of the progress of project implementation, operational design including reporting system, field constraints related to technology and technology transfer and measures to be taken for further improvement and refinement of the extension approach and strengthen the aquaculture extension services system. Such operational workshops of two days duration were organized once in every six months. Besides reviewing the on-going activities, certain need based topics like salient features of the TDS approach, extension programme planning, monitoring and evaluation, leadership development, human resources management, recent advancements in aquaculture technologies etc., were thoroughly covered. Major constraints and their redressal, and ways and means for making further improvements in the design and implementation procedures were also formed important topic for this training workshop.

Operational training workshop for senior officers.

Training of Result Demonstration Farmers (RDFs)

As described earlier, RDFs were selected through organizing RRA at the village level. RRA was followed by a short training. Selected RDFs were advised to prepare

their ponds and in the meantime one day long short training was organized for them which was repeated two to three times during the course of the crop cycle.

Training was conducted at or near the pond of one of the RDF. During the initial phase of the project, these training courses were conducted either at Field Unit/Thana Office or at DOF farms. The training module was designed to develop self confidence, self respect, leadership quality, managerial capability and aquaculture skill among RDFs. To make the training more participatory, an informal approach was followed. During the course of the training, RDFs were encouraged to raise and discuss their problems and clear their doubts. Adequate attention was also given to make them understand the need for maintaining the records of income, expenditures, inputs, yield, hazards encountered, and other details. A simple record keeping book was specially designed and introduced for this purpose. During the course of the training they were also reminded about their social and moral responsibility to help and train 5-10 neighboring fish farmers (FFs) who were going to be selected at their recommendation. Whenever possible relevant examples were cited from local sayings/religious guidelines. Appropriate teaching methods and tools were developed and employed for making the communication more effective. After 3-4 months of field operation, similar one day long training was again organised for 10-15 RDFs near one of the demonstration pond site. The second training refreshed them once again, helped the extension agent to review the progress and problems of the RDFs and take appropriate follow-up actions. At this stage they were encouraged to discuss their on-farm problems and solutions were advised. They were also trained on how to organize and conduct method demonstrations and training for their FFs. These practical training also helped the extension personnel in developing their teaching, training, extension and organizational capabilities.

Pond site training of RDFs.

For making the training effective, instructional manuals were prepared on appropriate package of practices. These manuals contained more illustrations than text and were released after several revisions based on field testing exercise. Appropriate training tools were used during the course of the training to making the communication more effective. They were also reminded about their role as RDFs and how to lead and help their FFs and their community as a whole through the development of aquaculture. After the training the RDFs were supported by regular pond/home visits.

Training for Fellow Farmers (FFs)

During the course of demonstration of semi-intensive fish culture in rural undrainable ponds, some of the fish usually attained marketable size only after 3-4 months of rearing. At this point, RDFs were encouraged and supported to organize a short duration field training of 4 to 6 hrs. They were also encouraged to organize method demonstrations of selected steps like daily manuring, removal of algal scum, application of supplementary feed, growth assessment, health check, application of simple prophylactic treatment, etc., at their pond site for their FFs. For convenience and economy of time, 2-3 RDFs and their linked 20-30 FFs were grouped together for the training. Again for making the programme interesting and more effective, especially designed and developed extension materials and tools were used. Several "do it yourself'' sessions were organized to provide adequate opportunities for the FFs to participate and practise certain steps and make the training practical, participatory and enjoyable. Simple and pictorial instructional manual on fish culture was developed and distributed among the participants through their respective RDFs. Fish culture game card developed by the FAO /TCP/BGD/4451 project where the various steps of fish culture practice were displayed separately on each card, was introduced during the last part of the training session. Farmers were divided into groups and were asked to arrange the reshuffled pack of cards in proper sequence. As per their performance the groups scored points. The game generated active discussion and competition among the farmers groups and added clarity to their understanding of the technology package. This became a very useful and effective training tool especially when the target group was uneducated or had low education level. Such short demonstration cum training programmes were usually repeated once in every 3-4 months. At the time of harvest, the crop as well as the production economics were properly displayed and explained to all FFs and other neighboring farmers by their respective RDFs. This helped FFs to get acquainted with the production and profit potential of the endeavor and also gave them strength and confidence to follow similar practice and act as RDF in the subsequent cycle. Meanwhile, the RDF became doubly confident, recalled his/her weaknesses and pledged to perform much better in the next production cycle. Such RDFs required relatively minimal or occasional support by their extension agent. On the other hand, they became more confident and skilled in their operation and extended more efficiently their services to their RDFs (converted FFs) and graduated to become SENIOR RDFs.

RDF taking lead role in conducting training for FFs.

Besides conducting separate training programme for various functionaries, operational workshop was also organized at Divisional level to bring extension personnel/senior officers as well as selected RDFs on one platform for collective reviewing of the ongoing programme, identifying bottlenecks and discussing ways and means for removing such constraints and assisting them to find solutions, discussing emerging issues and new directions to make the programme more efficient and effective.

5.3.4 Demonstration

Result and Method demonstrations were the integral part of TDS approach. This method was particularly very effective as majority of the client groups were resource poor and illiterate or semi-literate, and as such they had the tendency of avoiding taking risk. Demonstrations offered them opportunity to observe the difference between the improved and the traditional culture practices. It created greater impact when they were able to see that someone from their own community had been successful in following the recommended package of practices and benefited. These result demonstrations also created a sustainable teaching method based on “seeing is believing” and also developed the confidence of the extension agents.

Demonstration sites were also used for conducting *in situ* training for the farmers through display of the crop and demonstration of various steps of the package of practices that were followed by the RDFs. Learning through this method was concrete as it was essentially a doing method and allowed for repetition and practical exercises. The success of the demonstration was ensured because of its simplicity and presentation of concrete results. However, it was also considered to be a risky method mainly because the lateral spread of the improved technology package depends largely on the performance of the RDFs. If results are not up to the expectations of FFs, they tend to loose interest and withdraw. Result of the demonstration, however, depends upon several factors but the most important are the appropriateness of the technology package being introduced, quality of extension

RDF demonstrating results.

services and interest and seriousness of the RDFs. In this context it is important to mention that selection of RDFs is critically important. It was also noted that liberal input assistance often lured such farmers who were more interested in immediate gain than long term benefit from the improved farming practice. It is also experienced that more the farmers invest from their own resources, more serious they remain in following the recommendations.

Method demonstration is a type of demonstration through which RDF/extension worker demonstrates a particular step of a fish culture technology package or certain **impact creating points**. For example, fish farmers may be shown how to pack seed and transport, how to treat the seed and stock them in the pond, how

to prepare and apply manure and feed, how to tackle problems like dissolved oxygen depletion or disease outbreak, etc. Ideally, each participant should be given an opportunity to practice the new skill during the method demonstration session. However, limitation of time and facilities may not permit to do so especially when a large number of fish farmers are participating.

RDF taking lead role in method demonstration.

During the process of demonstration, the agent's role should be supervisory and supportive and not to undertake the work by himself/herself. The RDFs should be encouraged to explain the results in terms of production and its economic viability to the FFs and other members of the community to create interest and attention.

5.3.5 Visit

Periodic home and pond visits were followed as face to face contact method. Though this method was time consuming, it was found to be extremely effective in ensuring the success of the result demonstration. The extension agents met with the RDFs and their family members at their home or pond site and discussed issues of their interest and gave them both information and advice. While building up mutual confidence and understanding between the extension worker and the farm family, this method also enabled the extension worker to know the actual status and progress of the demonstration, technical and personal problems of the RDFs and the prevailing

socio-economic and cultural environment in the community. Above all, it helped in establishing a strong bond between the extension worker, RDFs, FFs and the rest of the farming community that provided the base for launching group teaching programme in future. Home and pond visits were widely used and had been found to be highly effective while dealing with the client groups who were illiterate/semi literate and operated small to medium size farm holdings. Meeting took place in an informal and relaxed atmosphere and the client was able to benefit from agent's individual attention. The method, though expensive in terms of time spent and the number of clients served, was a highly recommended technique as the benefits were numerous. Though it started with individual contact but gradually the impact was felt on a wider community level. Subsequently, the role was taken over by the RDFs who started serving their FFs in the following cropping cycle. After conducting the successful demonstration, the RDFs required very little assistance but more encouragement to assume the role of a voluntary extension agent. To be more effective and economical, extension agents were advised to be clear about the purpose of such visits and to plan the schedule carefully.

Extension agent visiting home of RDF.

Details of activities during visit were recorded in the diary especially designed for this purpose. Follow up actions and advice were also recorded by the agent in the record keeping book provided to the demonstration farmers.

During the course of such routine visits to ponds/cage culture sites, sampling was carried out to check the state of health, growth, water colour, level of plankton in

the pond, manuring, feeding, etc. The details of the work to be completed by the RDFs before the next visit were explained. At this point, the recommendations were explained properly and repeatedly to the RDFs and their family members.

Follow-up

The extension agent maintained a tour diary wherein an individual report section was provided for each individual RDF and after each visit, the date, the purpose, conclusions and recommendations of the visit were recorded. In case any promise was made by the agent, arrangements were made for the follow-up action. Also recorded were the follow-up actions to be taken both by RDF and the extension agent.

5.3.6 Monitoring and evaluation of field activities

Follow up was a must for the proper implementation of fish culture extension programme. It was therefore, important that the supervisory staff had a clear idea of their roles and responsibilities. Regular monitoring, evaluation and support functions were important for the success of TDS based extension programme. Both field level extension personnel and the senior supervisory officers had to play equally important role in this important activity. Supervision of extension activities were not based only on checking the progress reports. Senior officers were advised to spend considerable time visiting the demonstration sites and giving advice and guidance to the extension personnel with a view to helping them to do a better job and also to encourage the RDFs. The purpose of supervision was not merely to check the activities of the staff as required but also to find out the end results of extension work *i.e*. the extent to which the farmers were benefiting from extension service. The following points were given due considerations for conducting monitoring and evaluation work.

- The main tasks of all the supervisors was to support the work of extension agent.
- Supervision was more “field” than “office” oriented. Contact with RDFs and FFs were equally important.
- Record keeping book kept with the RDFs and tour diary of the field unit were useful reference for this purpose.
- Monitoring and evaluation programme had to be well scheduled and conducted on regular basis.

Senior or supervisory personnel spent considerable time in observing and guiding the work of the extension staff, motivating his/her morale, talking to RDFs FFs, identifying the constraints, checking the results of extension in terms of adoption of improved practices and their impact on production, family income and welfare, lateral spread of the technology, etc. The performance and role of the RDFs were

highly praised in the presence of their FFs and the community, making them more effective as voluntary extension worker.

Periodic inspection by Senior Officers.

In order to make the monitoring and evaluation process more precise and effective and to provide appropriate guidance for future course of actions, provision was made for reporting using uniform reporting format. During the course of the implementation of extension programme following TDS approach, a systematic and organized system was developed for the effective management, monitoring and periodic evaluation of field activities and related impact.

The following formats were used for the collection of various information from the field.

- Base line survey data sheet
- Quarterly reporting form
- RDF-Record keeping / recommendations book
- Field diary for the extension unit staff
- Activities monitoring sheet for various levels of functionaries

Quarterly reporting system was found to be more practical, though the progress of demonstration, training and visits and other related activities were part of

the monthly meeting agenda at field unit/Thana, District , Division and Head Quarters level.

The best channel of reporting was found to be forwarding the report directly to the Central Extension Unit (CEU) with copies to authorities in the proper channel. Reporting mechanism provided quarterly flow of information on production and cost functions, progress of demonstration by individual RDF, training, visits, problems encountered and other extension activities undertaken. The Quarterly Reporting Format is provided as Annex-1. A computer database was also developed for the compilation and analysis of field data.

5.3.7 Appropriate technology packages

Overview of the existing farming practices, availability of aquaculture resources, local preference and acceptability of the products, local and nearby market demand and prevailing prices, extent of the availability and cost of the inputs to be used for aquaculture, technical and managerial capacity of the target groups, their interest level etc., were important criteria for the selection of appropriate technology package(s). The selection of the appropriate technology package to be introduced was a critical step as the TDS approach depended heavily on result demonstration. The impact was widely felt when the farmers were able to demonstrate and display the results in terms of size of the fish, overall production, profitability, no risk and ease of operation. The success of any extension programme and adopted approach is highly influenced by the appropriateness of the package of practices introduced. The approach and the technology selected for transfer complemented each other.

Taking into consideration the existing culture practices, technical capacity of the resource poor farming community, undrainable and multipurpose nature of the household ponds, the low-cost semi-intensive fish culture technology and fish seed rearing were selected for the programme in Bangladesh. During the implementation of the programme, however, certain modifications were made in the technology packages to make further improvement which were more suited to local conditions. The practice of multiple harvesting and stocking was introduced to increase fish yield as well as improve cash flow and better return on investment. However, it also created round the year demand for fish fingerlings. To make the local availability of fingerlings year round, the improved method for rearing of spawn up to fry and fingerling size were also introduced. In view of the growing demand for cattle dung, the practice of green manuring was introduced during the initial pond preparation phase. This reduced the cattle dung requirement during the initial rearing and at the same time improved the yield. The low-cost manured based semi - intensive fish culture technology selected for demonstration was earlier tried on pilot scale in the field during the preceding project. Certain adjustments were made for further refinement and making the technology more suitable to the local conditions. These technology packages were readily accepted, yielding expected results, which in turn helped quick acceptance of the TDS of extension approach.

Low-cost culture technology using family farm resources, feeding fish with home-made feed.

5.3.8 Communication tools

The purpose of using extension teaching aids is to make the communication more effective. However, there is complete dearth of appropriate teaching aids and tools on aquaculture to be used by the rural farming communities and extension personnel in most of the developing countries. Extension delivery system need to be strengthened through making improvements in the quality of materials used and the instructional ability of the staff. Use of extension teaching tools helps in making the communication more effective and meaningful. However, to develop appropriate extension teaching aids it is necessary to consider the level of literacy of the target group and the local situation where these tools are expected to be used. It should be noted that majority of the rural small-scale farmers are either illiterate or semi-literate and very few villages have proper electricity supply. Again these group of people are not used to class room type of captive environment. As a result, most of the commonly used aids such as slide and over head projectors become useless for this purpose. Furthermore, due to limitations of transport facility and rural road conditions, it is difficult to carry blackboard, whiteboard, etc. The available manual or guide for the farmers are heavily text and thus are of little use to the illiterate or semi-literate rural farming communities.

Game card

Cost effective and simple teaching aids were developed by the FAO/TCP/BGD/4451 project which were useful for the farmers and the extension personnel. Special mention is made about the flannel board set and fish culture card game. Similar training aids also need to be developed for other appropriate technology packages like fish seed rearing, fish breeding, family level integrated fish farming etc. Based on the principle of "learning while playing", a fish culture card game was developed and used with growing interest. This interesting and inexpensive training tool also helped in conducting post training evaluation (PTE) and bringing post-training clarity (PTC) even among illiterate farmers. The kit consists of a set of 31 coloured pictures depicting various steps of semi-intensive fish culture practice. Cards are reshuffled and each group of farmer is asked to rearrange the cards in sequence as followed in the culture practice. After the cards are arranged in sequence each group is asked to participate in the fault finding exercise.

Farmers playing fish culture game card.

Similar game cards may be developed for other appropriate technology packages. Game cards displaying various events of fish/shrimp culture technologies were very helpful in organizing group exercise for effective learning. Extension agents can make game cards for the technology they intend to transfer, pictures are drawn on card board paper or on ordinary paper and laminated for long life.

Flannel board set

Flannel board set is another simple low cost tool developed by the project which has been widely accepted by the extension personnel as one of the most practical training tool for rural Bangladesh. A piece of 1.5 meter flannel cloth, 41 sketches printed on coloured card board paper, 5-6 sand paper sheets and few ordinary paper clips are the essential components of this training tool set. It is low cost, convenient to carry and easy to use in rural conditions where electricity and dark room facilities are seldom available. It is a display board which works on the principle that one piece of rough textured cloth adhere or sticks to another rough surface. The support is created by rough textured cloth such as flannel or a blanket. Figures, graphs, words, symbols etc., drawn on cardboard and backed by clipped sand paper get readily attached to the board as soon as it is placed on the board. Flannel board is well adapted for step by step story buildup. The capacity for building up interesting story and suspense is the main advantage of the flannel board presentation. Sets of pictures/sketches can be prepared on appropriate subject/area such as fish breeding, rearing of spawn to fry and fingerling stages, identification of technical problems related to environment and fish health, and appropriate measures to taken etc. Flannel board is cheap, can be made locally in a variety of sizes and can be rolled up and tied to a bicycle for convenience of transportation. The flannel cloth can be overlaid on wooden planks or hanged against wall or door and used for sequential presentation by fixing sand paper backed illustrations one after another .

Flannel board set on fish culture was found an effective and convenient training tool.

Application of folk media

Folk songs are extremely popular and closely integrated with rural life and culture in most of the developing countries including Bangladesh. There is rich cultural heritage and as such the people have great love for songs and music in Bangladesh. Some of the folk songs are very popular among the rural people. Based on the tune of most popular folk songs lyrics dealing with cultivation of fish, up keep of pond, maintenance of fish health were recorded. Whenever played in the rural areas, there were quick responses from the villagers. The music always attracted big crowds. Within a short time some of the culture methods were at the tip of the tongue of the local rural communities. These songs were based on the tune of most popular folk songs of Bangladesh and were played during field based demonstration and training programmes. At times these songs were also broadcast by radio. The project produced three video films in SVHS and U-matic systems entitled, "*Rameezer Swapna*"-Dream of Rameez dealing with success story of a RDF*; "Trickle Down System of Aquaculture Extension"* (Bangla and English versions) and "*Fish Culture in Undrainable Rural Ponds"* (Bangla and English versions). The drama was also in line with the folk plays which are popularly played in rural Bangladesh during winter months. These films featured actual field conditions and the actors were participating farmers, their family members and field based extension personnel.

Video and audio programmes based on local folk music and drama are popular among the local communities.

5.3.9 Input assistance

It is worth to note that all the demonstrations were organized by the RDFs exclusively through their own resources. No material or credit input assistance were provided either by the project or by the Government. Reducing the role of material input/credit assistance made it easy for the extension officers to concentrate their efforts on providing technical assistance and training rather than spend their time on credit delivery and credit recovery activities. It was concluded that pond fish culture extension service worked more efficiently and smoothly when the credit component was kept separate from the scope of extension services, especially when the manpower was limited. A prospective farmer, if needed credit to start fish culture, could be helped in getting credit assistance from local financial institutions. Alternatively, informal credit, may be of high interest rate, is always available in the local community. The culture technology selected for transfer need to be of low-cost, so that most of the inputs are available as by-products of other farming activities. In rural Bangladesh, even the fish seed for stocking ponds can be bought on credit from the seed producers/suppliers, and the money is paid after the first harvest. Opportunity to partially harvest the crop within three to four months of rearing, ensure quick return of the investment made by the farmer. A fish farmer like any other professional should start small, grow and gradually intensify their activities gaining experience.

5.3.10 Extension research linkage

The TDS approach had made provision for divisional / provincial level workshops after completion of one cropping cycle. This workshop provided a common platform for the extension agents, senior fisheries officers, selected RDFs and the scientists from the nearby research station to meet and discuss the various emerging issues. The workshop also provided opportunity for the participants to get first hand information about the performance of particular technology packages at the farm level. In such workshops operational and administrative problems were also discussed. Frank discussions and exchange of ideas helped scientists to get an insight into field problems and plan for cost-effective field research. The scientists also got opportunity to brief the group about some of the recent findings and technology developed by the research institutions, and offered ready solutions to some of the emerging technical problems.

5.3.11 Driving force and sustainability

The system aimed at building up problem solving capacity among the farmers and their community and creating an overall friendly environment where farmers, extension agents, fisheries officers and scientists were encouraged to come closer and work together by breaking traditional barriers. To facilitate creating such environment several steps were taken. The most significant was the community meal shared by officers, extension agents, RDFs and FFs during the course of the training.

The meal was simple and prepared at the site by the participating farmers. Enabling and strengthening collective action for implementation of their own activities and problem-solving exercise played increasingly more important role in bringing sustainability.

It was experienced that active involvement of the female members of the family was essential. They were approached during pond/home visits and invited to attend all the training programme. The female members of the family always took the recommendations more readily and followed the instructions more strictly and seriously. It was quite evident from the results of the demonstration. In majority of the cases, results were much better where women member of the family were involved in the result demonstration activities. Impact of the monetary benefit was also more pronounced where women took lead role. Women RDFs spent their earnings more carefully and exclusively for the welfare of their children and family as a whole. This was a good lessons for neighbors.

Appreciation and recognition generated enthusiasm and initiative. The work of successful RDFs were frequently appreciated and as a token of official recognition, medals and other prizes were awarded to them by the authorities. This simple act created tremendous inspiration among the RDFs. They became more dedicated to their duties as extension volunteer and took active interest and pride in helping their FFs. This way they derived pleasure, enjoyed social recognition and respect in their own community. Some of the best performers were also given national level awards. Notice boards were placed near their pond/home indicating that they were the extension volunteers and community level agent representing the DOF. Such acts of appreciation and recognition were found to be the driving force for the success of TDS approach.

Notice board depicting the demonstration centre and RDF as the local aquaculture extension agent.

DG, DOF congratulating the RDF on receiving the National Award.

5.3.12 Role of NGOs

Aquaculture was found to be a priority area for NGOs. Many NGOs were actively working in this area. They were particularly more experienced and efficient in organizing the rural poor and assisting them in food production / employment generating activities by utilizing common property resources like community ponds, ox-bow lakes, seasonal water bodies etc. In view of the limited field level personnel with the DOF, NGOs were encouraged to participate in the programme. Depending upon their interest, NGOs workers were also invited to attend the comprehensive training courses organized for the government field personnel. In view of their growing interest and at their request exclusive training programme for NGOs were also conducted. In fact, association of NGOs in the programme catalyzed the horizontal expansion of aquaculture activities at a much faster rate.

6. RESULTS AND LESSONS LEARNT- CASE STUDIES

6.1 Bangladesh

As stated earlier the TDS approach was designed by the FAO /UNDP Project "Institutional strengthening in the fisheries sector" and subsequently implemented on pilot scale by the FAO project " Strengthening of Rural Pond Fish Culture Extension Services" (TCP / BGD/4451). The activities started in mid 1990 with the objective of providing extension services to 60 fish farmers to raise their average production from 1,000kg/ha/yr to at least 2000kg/ha/yr. The extension services provided mainly include training of the selected farmers in the technology of semi-intensive carp polyculture and providing technical support through visits to farmer's pond. The project did not provide any financial or material support to the farmers. As per the designed TDS approach each of the selected 60 fish farmers functioned as RDF to neighboring 10 FFs. The FFs were invited to participate in the training and demonstrations which were carried out in the ponds of RDFs. Most of the 60 RDFs completed their production cycle and achieved an average production over 3,500 Kg/ ha/yr. Very few farmers used supplementary feed. The main features of the technology included appropriate stocking density and stocking ratio, daily manuring, and multiple harvesting and stocking. On the average approximately 50% of the FFs were promoted to RDFs. In accordance with the decisions of the Tri-Partite Review (TPR), the project expanded the activities under the Extension Component. Accordingly, 473 additional RDFs were brought under the project extension services during the second phase thus bringing the total of RDFs and FFs to 533 and 3,806 respectively. There were 22 women RDFs and 20 women FFs under the extension services provided through this approach. As against 15 ha of demonstration pond area which was the objective of the project a total of over 130 ha and 570 ha were brought under demonstration direct (under RDFs) and indirect (under FFs) operation, respectively, achieving an average production of about 3 ton/ha/yr (FAO,1993).

A socio-economic study carried out revealed that sixteen Phase I fish farmers, who had already harvested their fish, achieved an average production of 5,000Kg/ha/yr. Some of the farmers invested their profits in expanding their fish culture activities; while others used the additional income for repairing or building new living accommodation, children's education and family health care, etc. In addition, all of them consumed more fish than they had before the project.

During this phase of TDS application, 1,262 farmers (RDFs and FFs) were trained on semi-intensive fish culture through pond site *in situ* practical training. 38 TFOs and AFOs who worked as field level extension personnel/Field Counterparts (FCs) were trained in semi-intensive fish culture technology and extension methodology. In addition, 99 Fisheries officers (DFOs/TFOs/AFOs) of the DOF

were trained in extension methodologies related to fish culture and fish seed production, through 4 training courses, one in each Division. At the request of Association of Development Agencies in Bangladesh (ADAB), 45 Fisheries Extension Officers belonging to various NGOs were also trained in fish culture extension.

Subsequently, a pilot scale demonstration of TDS approach was implemented through FAO project "Strengthening Rural Pond Fish Culture Extension" between 1994 and 1996. This project provided opportunity to operate the TDS (Trickle Down System for aquaculture extension) model on a fairly large scale (170 Thanas out of total 460 Thanas of the country) and gave enough scope for field testing and further refinement.

Comprehensive extension training in fish culture were conducted separately for Thana Fishery Officers (TFO), Assistant Fishery Officers (AFO) and Field Assistants (FA). Against the set target of training 100 TFO, 100 AFO and 100 FA, training was imparted to 191 TFO, 148 AFO and 173 FA. Training for management level counterpart officers like Deputy Director (DD), District Fishery Officer (DFO), and Assistant Director (AD), however, was conducted through organizing operational workshop / participatory training at each of the four greater Divisional HQs. Altogether 60 senior GOB counterpart officers (DD, DFO, SAD, AD) were trained against the target of 55.

To give instant start to the field demonstration programme on semi-intensive fish culture , short orientation course followed by field training were also conducted for the counterparts during the very inception phase of the project. A total of 187 GOB Field Counterparts (FCs) participated in the orientation through 6 courses. In addition to this 500 GOB FCs received field training.

Considering the need and request made by the DOF, one day long refresher course was organized at district level for senior officers like DD, DFO, AD, mid level officers like TFO and Fisheries Extension Officer (FEO). Scientific Officer (SO) and junior officers and Staff (AFO and F.A) also participated in this training. A total of 651 senior, mid-level and field-level officers and technical staff (AFO and FA) were trained through 46 refresher courses.

A week long computer training was also conducted for 7 selected HQ officers and staff in the management of demonstration and other extension related information pouring in from the field. They were trained in computer handling, data entry and generation of reports using the two databases developed by the project.

Although training is essentially required for all level of functionaries for overall improvement in their technical, extension and management skill, it is more essential for lower level of extension workers like FA and AFO. During the course of project implementation it was experienced that field level extension support services were provided mainly by these lower level of functionaries. Ironically, very limited

training opportunities were available in the past for these field personnel. Introduction of elements like motivation, leadership development, team building and self-development in the course curricula was found quite helpful in making them more confident and committed fisheries extension personnel.

Training for Farmers

Training was organized for both categories of farmers, the Result Demonstration Fish Farmers (RDFs) who were directly involved in the demonstration programme and the neighboring Fellow Fish Farmers (FFs) who were linked to their respective RDF. *In situ* or pond site practical training for RDFs were conducted in two spells. Altogether 727 and 886 RDFs participated during the first and second spell of the programme respectively against the set target of 500 RDFs .

At the end of the culture operations, when the final results were apparently visible, one day *in- situ* training was organized at result demonstration pond sites for the linked FFs through method demonstrations and crop display. Against the set target of 2,500 FFs, a total of 6,520 FFs were trained in semi-intensive fish culture.

In situ or pond site training of one day duration created much better impact than traditional several days long class room training. However, repeating similar training after few months of culture operation was found essential for solving emerging technical problems, maintaining the sense of participation, interest and adding further momentum to the programme. Giving importance and opportunity to the RDF in conducting training for their FFs through method demonstrations and crop display under the supervision of the extension officers was found to create tremendous impact and drew greater participation from all categories of farmers.

Demonstration and visit

The project was expected to organize 500 demonstrations on semi-intensive fish culture in farmer's ponds selected from 100 Thanas of the country. Considering the urgent need for extension services on the one hand and interest, positive attitude, and strong inclination to work voluntarily on the part of the GOB counterpart officers and staff on the other hand, the demonstration programme coverage was extended to 170 Thanas of the country. The number of demonstration in farmer's (RDFs) ponds also increased to 886 against the set target of 500. Fish farmers were selected as RDF from different strata of the rural society. Most of the ponds were owned by RDFs while considerable number were also taken on lease. Such flexibility in the selection of farmers gave better scope for involving marginal and landless/pondless rural community in the programme.

In accordance with the project document and considering the field reality, regular technical support was provided directly to 886 RDFs through regular pond/home visits by the respective Thana fishery unit and indirectly to over 6,500 FFs through Trickle Down Extension System (TDS) approach.

Special efforts were made to encourage entire family to participate in the demonstration programme. In majority of cases, female members were found to carry out routine daily activities such as daily manuring and feeding, thus giving opportunity to the male members of the family to concentrate on outdoor farming activities.

It is worth noting that all the demonstrations were organized by the RDFs and exclusively through their own resources. No material or credit input assistance was provided either by the project or by the Government. Reducing the role of material input/credit assistance made it easy for the extension officers to concentrate their efforts on providing technical assistance and training. It was concluded that pond fish culture extension service works more efficiently and smoothly when the credit component is kept separate from the scope of extension. The culture technology selected for transfer under the project was low-cost, most of the inputs were by-products of other local farming systems and also gave opportunity to partially harvest the crop within three to four months of rearing, ensuring quick return of the investment made by the farmer. A fish farmer, like any other professional, should start small and gradually intensify his activities as he gains experience.

The semi - intensive fish culture technology selected for demonstration was earlier tried on pilot scale in the field during the preceding project. However, certain adjustments were made for further refinement to make the technology more suitable to the local conditions.

A systematic and organized system was developed for the effective management, monitoring and periodic evaluation of the extension programme ensuring regular and direct technical support to the RDFs. Several formats were developed, field tested and introduced for the collection of various information from the field. Although quarterly reporting system was introduced, the project activities were discussed every month at district, division and HQ levels. To provide operational ease and make the monitoring and evaluation system more efficient, two computer databases were developed by the project. Quarterly reports received from the field were entered and processed using these databases.

Fish production

Final production results received from 701 demonstrations in RDF's ponds indicated that the average production from these ponds had increased to 4.104 ton/ha/yr. from the initial average production level of 1.461 ton/ha/yr. This had also resulted in the average cost of production rise from initial TK 22.483/ha/yr to TK. 44,235/Ha/yr. However, the benefit cost ratio had also increased from 2.1:1 to 3:1. Incidental to demonstration programme of the project, 282,434 kg of fish was produced (FAO, 1996). Although there was significant increase in the average fish production in demonstration ponds, potential appears to be much higher. It was because of the fact that majority of the RDFs were still in trial stage and were

expected to enter into the adoption stage during the next culture cycle. It was also observed that those RDFs, who achieved fish production over 5-6 ton/ha/yr were trying to achieve still higher level of production and profit.

As demonstrated by the project it was quite evident that pond fish production could be increased 3 to 4 times very easily through low cost semi-intensive fish culture technology. Depending upon the input use and level of adoption of technology, some of the RDFs could achieve production to the extent of over 7 tons/ha/yr, indicating that by replacing the traditional culture practice with appropriate low cost semi-intensive fish culture, substantial production increase could be possible. This gap between the existing average production of 1.46 ton/ha/yr and the level achieved by RDFs could be considered as the Extension Gap. By strengthening fish culture extension services, this gap can be reduced resulting in multifold increase in pond production.

Transfer of fish seed rearing technology in rural areas

Consequent to growing popularity of semi-intensive fish culture and large scale open water stocking programme there was increasing demand for seed of native and exotic fish species. At times farmers faced difficulties in collecting the seed of the desired species and size to stock their ponds. It was recommended that 5-10% of the RDFs should be motivated to embark on fish seed production, which was more profitable than producing food fish. This would also ensure ready availability of quality seed in the locality.

International recognition

In recognition of the outstanding performance of the project " Strengthening of Rural Pond Fish Culture Extension Services" (FAO/TCP/BGD/4451) in developing a system of extension services dissemination through TDS approach, the 1996-97 Edouard Saouma Award was given to the Department of Fisheries of the Government of Bangladesh by FAO in November 1997. The concept of the TDS approach was aimed at the development of self reliance and awareness in the mind of fish farmers about aquaculture by repeated training, demonstration and close supervision by the field level extension personnel. This system of extension provided farmers to farmers extension services through small groups. This programme did not provide cash or input assistance to the farmers. It was observed that farmers to farmers extension services in small groups were more effective.

Follow up Project

Inspired by the results obtained by the FAO/UNDP Project BGD/87/045 and convinced by the results obtained through the follow-up project (FAO/TCP/BGD/4451) on large-scale implementation of aquaculture extension programme in rural ponds through Trickle Down System(TDS) of aquaculture extension, the Government of Bangladesh has started a nation wide follow-up project

funded by its own budgetary resources, covering the entire country following the TDS approach. This step is also being viewed as the final step towards institutionalization of fisheries extension under the DOF. All these indicate that the extension approach as well as the technology selected for semi-intensive culture in rural undrainable ponds are fitting well to the local conditions, structural and functional setup of the DOF and the socio-economic and cultural profile of the clientele. The technology as well as the methodology for technology transfer have been found to reinforce each other.

The ongoing follow-up Government of Bangladesh funded project "Thana Level Aquaculture Extension Project" was started in 1996 and covering 400 Thanas of 59 Districts, out of a total of 464 Thanas under 64 Districts in the country. An amount of Taka 71.5 million (US $ 1.58 million) was allocated for this project. This project is expected to enhance annual average production of fish to 3.5 ton/ha in the ponds of Result Demonstrators (RDFs) and 2.5 ton/ha in the ponds of Fellow Farmers (FFs). On the other hand, 79,780 trained farmers will have their part- or full- time jobs as a result of project activities. An average production of 2,833 kg/ha has already been achieved by RDFs and 2,350 kg/ha achieved by the FFs. The project is presently working with 12,000 RDFs and 60,000 FFs. Extension planning is being done through a bottom up approach that starts from village to Thana and to the CEU. All the Thana level field units are given free hands to execute their plan. Necessary resources are also made available to them from the CEU. So far, a total of 72,000 farmers have been trained and benefiting from extension services. The main objective of the project is to institutionalize fish culture extension services in Bangladesh. Recently a mid-term evaluation of the project was conducted jointly by the Ministry of Fisheries and Livestock, Planning Commission and the Implementation and Evaluation Division (IMED). The evaluation mission has reported that the project and its approach is most suitable for rural development and recommended for preparing a long term follow-up programme for submission to the Government for its institutionalization (Nazrul Islam, personal communication).

6.2 Vietnam

The recently concluded UNDP/FAO project, "Freshwater Fish Culture Extension" (VIE/93/001) has established an aquaculture extension system network in 24 Northern provinces including upland provinces of Lai Chau, Son La and Hoa Binh. The project also employed the participatory aquaculture extension approach known as the "Trickle Down System" (TDS) of aquaculture extension. A large number of demonstrations on family pond fish culture were conducted through the Result Demonstration Farmers (RDFs) which helped in the large-scale transfer of economically viable alternative technology packages to FFs and other farmers including ethnic upland minority communities. The project also conducted studies on the socio-economic and environmental impacts of freshwater aquaculture, and concluded that the project had very good socio-economic impacts; and hat the culture

system implemented being low- cost semi-intensive, there was virtually very little or no negative environmental impact.

Through close and regular monitoring and evaluation of the extension programme, the project had successfully developed effective and practical extension techniques and approach based on active participation of the farmers themselves. TDS extension of aquaculture strategy emphasizing farmer to farmers approach with active participation of RDFs was employed with encouraging response from the farming communities. After receiving training and after being selected as RDF they took up demonstration of the selected aquaculture technology packages in their own ponds/culture facilities through mobilization of the required inputs exclusively from their own resources. Subsequently, these farmers were also provided regular extension support through home/pond visits by the extension workers at regular intervals. These RDFs were encouraged to act as local extension agent and that made them feel important. They took pride in assisting their FFs and got pleasure in advising other farmers who came to seek their help. Inspired and impressed by watching the results of demonstration, many of the FFs took up demonstration of similar nature. This programme provided equal participation for extension workers and the farmers. The techniques of individual training through home and pond visits of the RDFs and group contacts through RDFs to FFs training and demonstration were found to be cost effective and efficient. Through this approach there was an active flow of knowledge and information from the extension workers to RDFs and from the RDFs to FFs and the local community. The number of RDFs was increased from 120 in 1995/96 to about 800 in 1996/97 (FAO,1998).

Capacity building at the institution as well as the community levels were given greater emphasis. In addition to initial orientation programme for about 90 Senior Provincial level Chief of DOF (Department of Fisheries)/Department of Agriculture and Rural Development (DOARD), the project also conducted comprehensive training for large number of provincial and field level extensionists. A total of 994 extensionists / fisheries officers and farm managers were trained in aspects of aquaculture technology, technology transfer and human resources management. Out of the total, 352 participants (35.41%) were women. Similarly, 195 field based instructional training of 3 days duration each were organized. A total of 7,503 farmers, RDFs and FFs were trained including 1,268 women farmers.

The project developed 16 instructional bulletins on various aquaculture technology packages and techniques including VAC (family farm level integration) system for farmers. These brochures had been written in simple and instructional form with the help of suitable illustrations. Besides, several low cost training tools were developed for the extension workers and RDFs.

The results from the first spell of demonstrations conducted by the RDFs clearly indicated sharp increase in fish yield from 1.08 t/ha/yr to over 6 t/ha/yr in certain cases, and about 3.5t/ha/yr in average against the project target of 1,200-1,300 kg/ha/yr. There was marked increase in income level from fish farming component

ranging from 75% to about 300%. The terminal tripartite (TPR) review of the project observed that the project was highly successful and that the extension approach followed by the project was one of the most important contributory factor. One woman Result Demonstrator Farmer of the project was awarded the UN Certificate of Merit by the UN Secretary-General, on the occasion of the International Day of Poverty Alleviation, held in New York, on 17 October, 1997.

Experience gained from the project convinced the UNDP and the Government that semi-intensive family scale aquaculture was an important tool for poverty reduction and fighting malnutrition among the growing children and women and also for empowering women. Accordingly, UNDP and the Government of Vietnam have approved a similar project for the development of upland communities of three Northern provinces. The project would be implemented by FAO.

7. REFERENCES

FAO (1996). *Strengthening Rural Pond Fish Culture Extension Services (TCP/BGD / 4451). Project Terminal Report* . 16 p.

FAO (1998).*FAO Fisheries Circular. No. 815, Rev.10.* FAO Rome, 197p.
Mekong Committee. (1992). *Fisheries in the Lower Mekong Basin (Report on Fisheries Sector Review of the Lower Mekong Basin),* Mekong Committee, Bangkok.

FAO (1998). *Freshwater Fish Culture Extension. FAO/UNDP Project VIE/93/001. Project Terminal Report* . 22 p.

Peter Edwards and Harvey Demaine (1997). *Rural Aquaculture:Overview and Framework for country reviews.*FAO RAP Publication 1997/36. Bangkok, Thailand.61p.

Mahmudul Karim (1997). *A Review of Aquaculture Extension Services in Bangladesh.* FAO RAP Publication 1997/35. Bangkok, Thailand. 54p.

M.S. Swaminathan (1994). *Ecotechnology and Rural Development.* MacMillon. India.396p

FAO (1993). Project Terminal Report. *Institutional Strengthening in the Fisheries Sector (BGD/87/045), Bangladesh. Project Findings and Recommendations*. 30p.

George H. Axinn (1998). *Guide on Alternative Extension Approaches. Agriculture Education and Extension Service (ESHE).* Human Resources Institutions and Agrarian Reform Division. FAO .

Annex-1

PERIODICAL REPORTING

Reports should be sent soon after the completion of the quarter to the Chief of CEU

Field Unit	:	Reporting officer	:
District	:	Name	:
Division	:	Designation	:
Date	:	Signature	:

1. Reporting period

Place a tick mark (✓)in the appropriate box .

First Quarter (January -March)		Third Quarter (July - September)	
Second Quarter (April - June)		Fourth Quarter (October- December)	

2. Training activities

2.1 Training for extensionists

S.#	**Topic (s)**	**Participants** ---------- **Men /Women / Total**	**Venue**	**Duration (Days)**	**Trainers**

Critical assessment of the training :

Place a tick mark(✓) in the appropriate box.

Training was very useful : useful : not useful .
Similar training are required in the future : Yes , No .
Other areas where training is critically needed (mention) .....

Measures to be taken for making the training even more effective:

i.....

ii.....

iii.....

2.2 Training for Result Demonstration Farmers (RDFs)

S.#	Topic (s)	Participants ---------- Men /Women / Total	Venue	Duration (Days)	Trainers

Critical assessment of the training :
Place a tick mark(✓) in the appropriate box.

Training was very useful : useful : not useful .
Similar training are required in the future : Yes , No .
Other areas where training is critically needed (mention) .....

Measures to be taken for making the training even more effective:

i.....

ii.....

iii.....

2.3. Training for Fellow Farmers (FFs)

S.#	Topic (s)	Participants ---------- Men /Women / Total	Venue	Duration (Days)	Trainers

Critical assessment and recommendations for next training :

……
……
……

3. Workshop / seminar involving:

Farmers : Extensionists : Scientists Others (mention -.....)

S.#	Topic	Participants ---------- Men /Women / Total	Venue	Duration (Days)	Trainers

4. Demonstration activities

RDF code	Activities this quarter	Money spent this quarter	Money spent till date	Crop harvested this quarter (Kg)	Total harvest (Kg)	Sale income this qarter	Total sale income	Consumed by Family (Kg)	Problems faced

5. General observation on the performance of demonstration by farmers

Aspects	Observation / comments
5.1. On the technology package and its results in terms of production figures	
5.2. On response/ interest of the Result Demonstration Farmers	
5.3. Impact in the locality and among fellow farmers of the locality	
5.4. Problems in general mainly related to the farming technology / field / others.	
5.5. Suggestion for improvement, if any .	

6. Periodicity of home / pond / field visit by extensionists

Place a tick mark (✓) in the appropriate box .

Once in two months ; once in a month ; twice a month ; only once in a quarter ; irregular

7. Periodicity of visit by the demonstration farmers to the Extension Centre/ Demonstration Farms

Place a tick mark (✓) in the appropriate box .

Once in two months ; once in a month ; twice a month ; only once in a quarter ; irregular

Additional information , if any .