

Human Resources Development for Sustainable Aquaculture in Bangladesh

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Abstract

The ennoblement of human resources has become a prime issue in the philosophy of sustainable aquaculture development in the new millennium. Being the planners, designers, conductors and philosophers of sustainable aquaculture, human beings always demand their further improvement at level best from their current positions to bring supreme success in the sector. As sustainable aquaculture is socio-economic -cum-environmental in concept, its operation and management requires constant interplay of various human knowledge for ensuring its smooth direction and for achieving its goal. So, the arrangement of different types and levels of training and education are the great need for the development of personnel involved in sustainable aquaculture route and also for growing awareness of environmental issues. The modus operandi of training and education has to be changed systematically to answer the calls of the needs of the new millennium. In the developing and developed countries where aquaculture plays a vital role in promoting production of aquatic organisms, alleviating of poverty, ensuring environmental compatibility, replenishing and improving the natural stocks, increasing socio-economic upliftment through integrated development approach, developing and managing the aquatic resources, maintaining gene banks and preserving the diversity of fish stocks, it has been already proved that Human resources development (HRD) is inevitable to bring sustainable aquaculture and plays a great role in the flourishing of the system. Different types and levels of training of personnel required for sustainable aquaculture in the new mil-

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lennium are brought forward in the study. The importance of human resources development (HRD) through specialized training to the personnel is also depicted.

1. Introduction

Human resources are at the focal point of philosophy of all sustainable development. They are the creators, operators and protectors of any sustainable development. As sustainable aquaculture is the united venture of man's attempts and knowledge, various sciences, arts, economics, biotechnology and business filed for the purpose of promoting or improving growth and hence pursuit of production from water, concerned land, animal, plant genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable. So the development of human resources is the great need for enjoying successful sustainable aquaculture in the view of millennium.

Sustainable aquaculture requires scientific, systematic, technical and logical manifestation of unifies and well organized thoughtfulness of well developed manpower for enjoying auspicious starting and for finding the proper way for the proper execution and management and hence a successful ending of it. As a follow up to this, aquaculture is likely to sustain itself based on economic viability alone, but will need to ensure social and environmental sustainability as well (Kutty, 1977).

At present, aquaculture has to advance at the same speed with the increasing need of a growing population and economic upswing in most developing countries. There is a great need to increase production per unit of area to meet the needs of the generation in the new millennium by exploring changes in technologies by the skilled or trained personnel. The aquaculture products should be maintained in hygiene standards with quality and the system must be eco-friendly.

So, the development of human resources is the key issue for sustainable aquaculture in the new millennium. As aquaculture revels itself as a great potential for the alleviation of poverty and represents the waves of the future in human food production and provides excellent opportunities for employment and income generation, so we should set our eyes on the development of the sector by ennobling the involved personnel.

1.1 Human Resources Involvement in sustainable aquaculture development

Human beings which are engaged in starting, operating, managing and achieving the goals or objectives of any development are called Human

Resources Development (HRD). There are different types of human resources available in any development activities. They are the key-components of the sector. Human resources consultants, human resources development specialists and human resources coordinators-help to match employers with qualified jobseekers. Human resources involvement in sustainable aquaculture are available from the following sectors: 1) research organizations, 2) governmental organizations 3) Non- governmental organizations and 4) Farming sectors.

However, human resources who are employed in sustainable aquaculture development are mentioned more specifically in below:

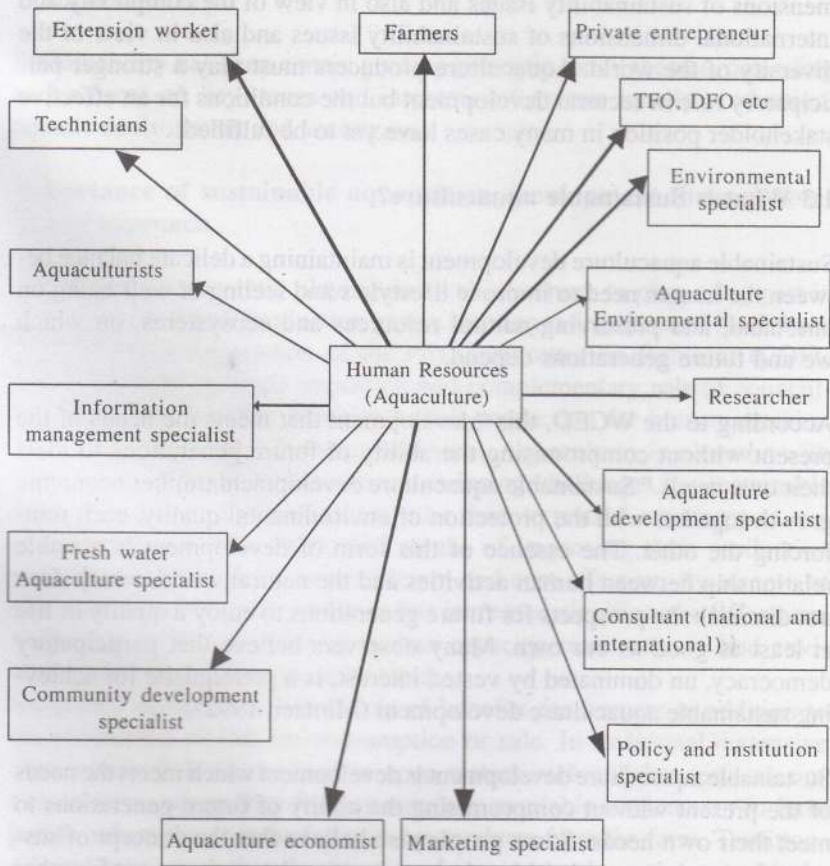


Fig: flowchart for the Human resources in aquaculture development

1.2 Interaction and collaboration among various human resources

There is an increasing trend towards creating partnerships and collaboration between aquaculture production and scientists, government officials and other stakeholders. Producers are recognized as key players of sustainable aquaculture development, being direct users of resources during the production of food. However, more interaction and better communication and coordination between them and natural and social scientists and other stakeholders interested in aquaculture, is required. Producers should have a better stakeholder position through stronger representative associations particularly in view of the complexity and international dimensions of sustainability issues and also in view of the complexity and international dimensions of sustainability issues and also in view of the diversity of the world. Aquaculture producers must play a stronger participatory role in sectoral development but the conditions for an effective stakeholder position in many cases have yet to be fulfilled.

1.3 What is Sustainable aquaculture?

Sustainable aquaculture development is maintaining a delicate balance between the human need to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which we and future generations depend.

According to the WCED, this "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable aquaculture development implies economic growth together with the protection of environmental quality, each reinforcing the other. The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own. Many observers believe that participatory democracy, undominated by vested interest, is a prerequisite for achieving sustainable aquaculture development (Mintzer, 1992).

Sustainable aquaculture development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs. Some people also believe that the concept of sustainable development should include preserving the environment for other species as well as for people. Sustainable aquaculture development re-

spects the limited capacity of an ecosystem to absorb the impact of human activities.

The aquaculture act includes the promotion of ecologically sustainable development of marine inland aquaculture as an objective of the legislation and requires that the Minister to have regard to and seek to further the objectives of the Act, which are:

- To promote ecologically sustainable development of marine and inland aquaculture
- To maximize benefits to the community from the state's aquaculture resources
- Otherwise to ensure the efficient and effective regulation of the aquaculture industry.

Sustainability has been a main guiding principle for all themes, providing major focus on key issues and interaction between aquatic production, aquatic environment and society.

Importance of sustainable aquaculture development through integrated approach

Aquaculture is currently playing and well continues to play, a big part in boosting global fish production and in meeting rising demand for fishery products. A recent session of the FAO committee on Fisheries (COFI) stressed the increasingly important and complementary role of aquaculture and inland capture fisheries in fish production for human nutrition and poverty alleviation in many rural areas. Aquaculture, in common with all other food production practices, is facing challenges for sustainable development. Most aqua-farmers, like their terrestrial counterparts, are continuously pursuing ways and means of improving their production practices, to make them more efficient and cost-effective. Awareness of potential environmental problems has increased significantly. Efforts are under way to further improve human capacity, resources use and environmental management in aquaculture.

Integrated aquaculture has variety of benefits for farmers in addition to the production of fish for consumption or sale. In traditional, extensive aquaculture, fish can be bred in open waters such as lakes, estuaries or coastal bays, where they feed on naturally available nutrients, or in farm ponds, where they can be fed with by-products from the farm. Traditionally in China, more than five species of carp are bred together to make the best use of feeds and ponds.

Specific issues and challenges for attaining the lasting sustainability of aquaculture are:

- Promotion and definition of research and technology development programs for sustainable aquaculture development.
- Human resource development, capacity building and education, in particular, training, technology transfer and the provision of and access to information.
- Promotion of appropriate and efficient use of resources, including water, sites, feed, seed stock and other inputs.
- Comprehensive policies and supportive legal and institutional frameworks based on communication and consultation with the major stakeholders, the producers and
- Development of investment incentives, market studies, product marketing programs and consumer awareness campaigns.

It is recognized that governments, private sector organizations, public interest groups and individual citizens all have a role to play in achieving sustainable development. Aquaculture in the context of sustainable development incorporates the following elements:

- Maintaining or enhancing the quality of life and the environment for present and future generations
- Adopting an ecosystem approach and respecting the interests and values of all resources users and considering those interests and values in decision-making
- Identifying, planning, developing, operating, harvesting, processing and when necessary disposing of aquacultural products in the most efficient, competitive and environmentally responsible manner, using best practices.
- Respecting constitutionally protected aboriginal and treaty rights
- Creating and sharing knowledge to promote innovation, continuous learning and efficiency
- Securing the participation of stakeholders, individuals and communities in decision making to ensure best use of aquatic space, and making decisions

2. Practical application of ecologically sustainable development

Ecologically sustainable development has been clearly defined and accepted as a guiding framework. However, in practice its application is problematical since its principles can be contradictory, weighted inconsistently and interpreted in widely different ways. Consequently, applica-

tion of the principles of ecologically sustainable development requires clearly defined sustainability objectives, indicators and performance measures. During 2000, a series of ecologically sustainable development objectives specifically relevant to fisheries and aquaculture was developed along with a draft conceptual framework for reporting and assessing performance against these objectives. The core objectives established under the conceptual framework prepared by the Standing committee on Fisheries and Aquaculture and Ministerial council on fisheries are:

- Protection of biodiversity and maintenance of essential ecological processes
- Enhancement of individual and community well-being by following a path of economic development that safeguards the welfare of current and future generations
- Providing effective legal, institutional and economic frameworks for ecologically sustainable aquaculture development.

2.1. Contribution to ecological well-being

2.1.1 Impacts within facility : Individual operations should maintain their impacts within the acceptable levels which take into account background levels and specific catchments issues and limits

2.1.2 Impacts within catchments : The total impact of all aquaculture facilities in each catchments should be kept within the agreed limits, given the assimilative capacity of the catchments and a recognized of impacts already occurring.

2.1. 3 Impacts on the general environment : to manage the impacts of aquaculture such that acceptable impacts occur to functional ecological relationships, habitat and processes.

2.2 Contribution to human well-being:

2.2.1 Indigenous community well-being : To satisfy traditional needs, cultural and economic development and sustainability of indigenous communities.

2.2.2 Community and national well-being : To contribute to community, regional and national well-being, lifestyle and cultural needs

2.3. Ability to achieve Governance:

To ensure that ecologically sustainable development principles are underpinned by legal, institutional, economic and policy frameworks capable of

responding and taking appropriate preemptory and remedial actions. To allocate the resource to maximize or optimize community benefits

Sustainable aquaculture will contribute significantly to food availability, household food security, income generation, and trade and improved living standards in many developing countries in Asia. In poor and rural communities, aquaculture can be an integral component of development contributing to sustainable livelihoods and enhancing social well-being. Aquaculture is forecast to dominate, if not surpass, the importance of marine capture fisheries in providing high-quality animal protein to lower income groups, employment and export earnings. Growth in aquaculture was not sustained because of several problems, notably environmental degradation: low growth and productivity due to poor fish farmers, and post production facilities and marketing infrastructure, conflict in water use in open water areas among fishing, fish farmers, and other users and lastly, lack of social preparation for community participation and inefficient extension service. The financial crisis further aggravated the accessibility of credit and effectively increased the prices of imported inputs such as feeds and chemicals.

3. Potentials of women in aquaculture development

In most rural communities, there are essential differences between the economic, social and political roles of men and women. This also holds true for fishing communities. While the nature as well as the dimension of these responsibilities may differ from country to country and from community to community, a number of basic features can be identified. Fisheries activities are commonly perceived as men's work. This is also a common phenomenon. However, while there exist difficulties of different magnitude for women to be fully involved in fisheries. Involvement of women in all development initiatives including agriculture is seen as a priority in the national development paradigm. Traditionally, women have played a major role in agriculture; research studies show that besides their regular household work, 43% women are involved in activities, related to agriculture and almost 15% undertake agriculture as their second occupation.

3.1 Pond fishing

In rural Bangladesh, most women spend a major portion of their time doing household work. The type of work a woman has to do make it

necessary for her to be close to a pond where she has to wash, bathe, collect drinking water and perform other household tasks. There exists therefore, a natural condition for women to explore the possibilities for fish cultivation. These ponds are also used for vegetable cultivation, ensuring the supply of much needed nutrition for the family. By undertaking pond fisheries activities, women can:

- Contribution to the family income considerably
- Ensure constant supply of much need family nutrition
- Generate an opportunity for self employment
- Uplift their overall socioeconomic condition
- Become more skilled

3.2 Seasonal fishing

Lands adjacent to the homestead remains water logged for three to six months in a year. These lands are situated close to the rural households. Normally, these lands/ ditches remain unutilized. By using a proper method or treatment and cleaning, these fallow lands can be prepared for fish cultivation. Seasonal ponds can be economically profitable, as the land becomes fertile with the homestead organic waste and often their inundation of floodwater. With nominal investment and labor by the family members, these water bodies could be used for fish cultivation. Various types of fish like *Puntius sarana*. *Oreochormis nilotica* can be cultivated in these types of water bodies. The investment is affordable and the work does not require much labor. Women therefore can conveniently embark in such ventures.

3.3 Mini Ponds

These types of ponds provide the ideal conditions for fish cultivation for fish cultivation. Ensuring water availability throughout the year would guarantee fish cultivation for the entire year. Women can undertake fish culture in these pond sin the same manner they would cultivate vegetables in and around the plinth of their daily diet and also to meet extra family expenses. Fish culture in the mini ponds does not require extensive technology. This kind of activity in expensive and can be easily managed.

3.4 Shrimp Aquaculture

In coastal area of Bangladesh where shrimp farming is a dominant occupation, women are already actively engaged in many ways. It was found

that almost 85% of the women are engaged in fry collecting as it does not interfere with their day to day household work, and helps supplement the household income. The principal source of fry collecting is from rivers and women's access to rivers is unhindered. Moreover, the work is not time bound and therefore women can do it at their convenience. Women are also actively engaged in various kind of work in shrimp farm. In these farms, they do dyke construction and maintenance, liming, harvesting and other farm-related activities. Typical of shrimp aquaculture, women also work in the depots/ factories and in places where the trading takes place. They play an important role at the export level in fish grading, de-heading and packaging. It must however be recognized that these services of women are in great demand because of the fact that they are paid much less than men for the same types of work.

3.5 Crab culture

This is another kind of work that women can do close to their homestead. Traditionally, it is often difficult for women to go away from their homestead to work. It was found in a number of studies that the social and familiar life of women who got out for earth cutting work is affected because her absence from home for a long period of time is not socially accepted. If opportunities are created and made available, women can undertake crab culture in the ponds adjacent to their homestead, much like pond fisheries.

3.6 Fish Processing

Women can undertake projects for fish drying using indigenous and available species. The dried fish can be marketed during the lean season to earn good returns on their investment. Besides, they can also buy fish from the trawler and deep-sea fishing boats directly.

3.7 Fishing gears

This is traditionally an area of work done by rural women. They have the required expertise and are aware of the technology best suited to make different kinds of gear.

3.8 Fish feed preparation

In Bangladesh, many women are involved in making prawn / fish feed at

home for their own use. It has also become an important income-generating activity as they can sell the feed to other farmers in the area. This is another example of the kind of work that women can do conveniently at home.

3.9 Socio-economic Aspects

- Participation of women in fish farming activities has increased considerably. At present 43% of the total beneficiaries engaged in pond aquaculture are women and in fact, they do almost all the activities that used to be done by men. The women's groups are practicing test netting, fish harvesting and marketing on their own without any help from others.
- The living standards have improved and the beneficiaries are now sending their children to schools as they can meet the education expenses of their children.
- The program has created a strong feeling among the poor beneficiaries regarding their social and economic status, resulting in strong organizational integrity within the groups. The women's groups in particular, have demonstrated a strong bond unity as well as commitment towards their quest for self-development
- With increased economic power and respect, the group members are now well accepted in society. They are called upon for local arbitration and their views are greatly valued.

4. Human Resources Development (HRD) and Sustainable Aquaculture

Human Resources Development (HRD) refers to further educating and training the personnel from their present status related in aquaculture enterprise and to enhance the awareness of environmental aspects. It is to improve the quality of human resources for doing in perfection with knowing to achieve success or objectivity of any venture like aquaculture. It is the production of valuable human resources through proper policy, guidance and sincerity. The system is to develop fish farming skills efficiency and standard of living by technological development. It educates the personnel on the technical know how and experiences as well as to target personnel to do the right attitudes to do thing by themselves.

Human Resources Development is an integrated sense encompasses education and training, health care, nutrition, population policies and employment (Muqtada and Hildman, 1993)

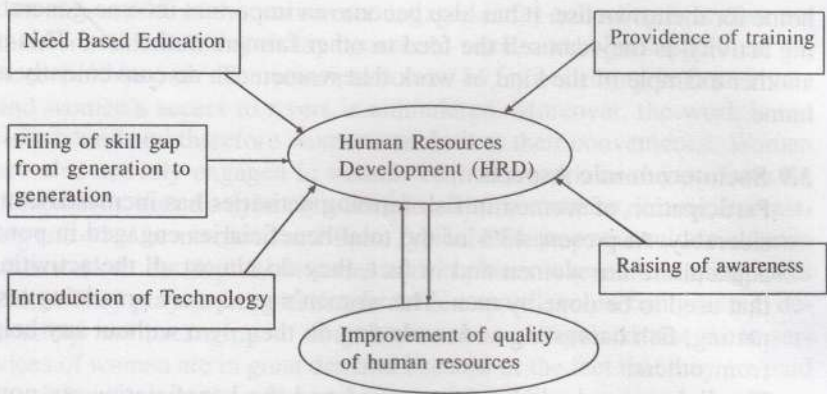


Fig. 2: Human Resources Development

As sustainable aquaculture in the new millennium sustains a great message that ensures economic and environmental consistency, it is very complex in operation and management. So the developed human resources are useful for ensuring ecologically sound development by formulating magnificent management strategy to minimize adverse effects and to enhance positive effects. Skilled manpower with broad based knowledge and hand on practical experiences in the aquafarming practices to perhaps the most important consideration for ensuring the success of an aquafarm. Successful sustainable aquaculture involves skillful management of the stock and the environment. This calls for the sound knowledge in all ecological engineering and economic aspects. These can be done only by skilled or developed manpower. Experienced and skilled farm operators are instrumental to maintain conditions favorable to the optimum growth and high survival of the cultured species and hence to ensure regular and consistent optimum production to fulfill contractual obligation in supply. As sustainable aquaculture also considers the environmentally sound development, so the personal require an application of special means and methods to manage or save the ecology. Now most nations consider Human resources development (HRD) as a priority area for development of the aquaculture sector.

A recent survey of network of Aquaculture Centers in Asia Pacific (NACA)/ Food and Agricultural Organization of the United Nations (FAO) in Asia revealed that 93% of the countries considered Human resources development (HRD) as a major problem facing aquaculture, and 71% of the na-

tions noted that a lack of skilled personnel was a major impediment to further development (NACA/FAO, 1996). A recent review on aquaculture development in Africa identified eight strategies as pivotal to the development of the sector, and not surprisingly five of these involved Human Resources development (HRD), particularly in relation to small scale farmers and extension workers (Machana and Moehi, 2002). On the issue of HRD, it is also important to recognize the specific needs of nations and regions. Past experiences in the aquaculture sector and elsewhere has shown that mere transfer of technologies is not always effective and can even be counter productive.

Although aquaculture offers tremendous socio-economic benefits, it has emerged at a time marked by heightened public awareness of the potential impacts of industrial activity and increased public scrutiny of industry and government actions to mitigate such impacts. While people are interested in realizing the full potential of aquaculture, they are also concerned about issues such as escapes of farmed salmon, food safety, therapeutic use, habitat interactions, water quality, organic loading, navigation safety, aquatic animal health, and esthetics. So the skilled manpower is greatly needed to ensure all the above mentioned issues.

All development activity should be economically, socially and environmentally well-compact or consistence or acceptable in term of profit or benefit. There are some central philosophies of the sustainable aquaculture in Bangladesh: "Where there is sustainable aquaculture development, there is optimum output by minimum input: there is no environmental degradation and there is upliftment of socio-economy". The development of the aquaculture sector can be achieved through adopting some important measures which can be ordered as follows:

- a) Technological development
- b) Minimum environmental degradation
- c) Efficient use of primary resources
- d) Great effort towards meeting human development

Technological development proceed hard in hard with changes in the knowledge gained from day to day experience , skills and outlook of culturist, extension workers , researchers , developers etc; in essence, through all key stakeholders . Role of Human resources development on fisheries and aquaculture sector in the globalize world are expressed by following figure.

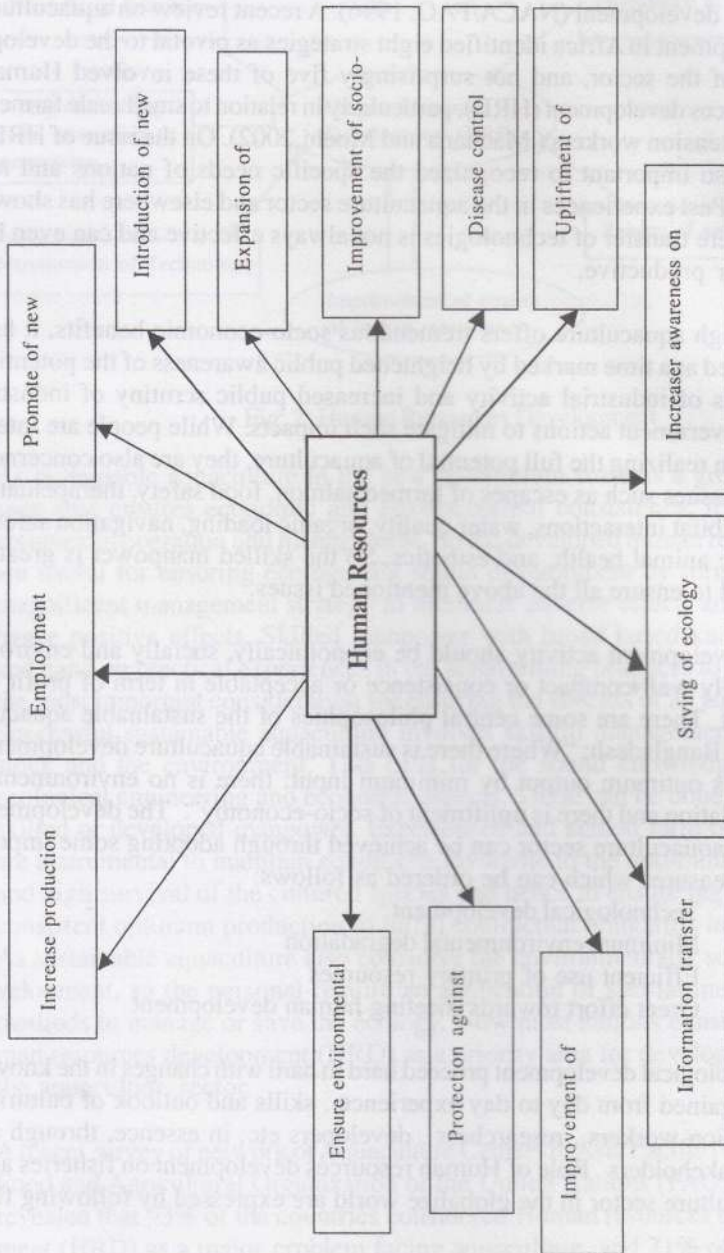


Fig 3: Role of Human Resources Development

5. Providence of training to personnel for their development in the new millennium

Sustainable aquaculture demands a good understanding of the physical, chemical and biological processes necessary for successful production. Being an interdisciplinary science, aquaculture calls for a blend of expertise from many disciplines. So different types of training are greatly needed for personnel for going to the venture on par excellence. Based on estimates of manpower requirements it should be possible to determine whether permanent training programs are justified or whether ad hoc training programs will be adequate. In the majority of cases, technicians will have to train within the country, with adequate emphasis on the culture system and techniques that are proposed to be adopted.

One other important factor that needs to be taken into consideration in HRD is the diverse nature of the aquaculture sector. Currently it is estimated that 150 species are cultured, ranging from invertebrates to reptiles (FAO, 1999) including marine, brackish, and freshwater, temperate and tropical species. Culture practices range from extensive to semi-intensive systems and involve the use of ponds, raceways, pens and cages etc in open, flow-through and closed systems.

Aquaculture is practiced in widely diversified ecological and socio-economic conditions and the handling of the post-harvest products also varies considerably. This diversity exacerbates the complexity of providing skill development and knowledge transfer at all levels of enterprise needed. If aquaculture is to develop in a sustainable manner in the new millennium there needs to be an increase in research capabilities at the center of emergent aquaculture. So, continuous dependence on training and expertise from temperate and developed regions should be re-evaluated and resources enhanced for within-region training where enterprise is based on local aquaculture systems.

So, the following points should be considered:

- Training, extension, education, transfer of appropriate technology
- Awareness raising among aquaculturists and general public
- Improved provision of and access to information
- Special requirements of developing countries and continued need for

technical and financial assistance

- Formulation of a sub-program on aquaculture development within the inter-regional program in support of the implementation of the code of conduct
- Continued regional cooperation, particularly through strengthen cooperation among regional organizations
- Growing need for technical review and agreement on international standards will require appropriate international forum, for discussion and consensus building.

6. Importance of Technical Assistance

Technical Assistance will help to contribute to the poverty reduction and food security goal of the government and protect the environment in inland and coastal water areas. The Technical Assistance (TA) will help the government prepare an investment project for the sustainable development and management of aquaculture though

- Increased fish production and products
- Improved employment, income and nutrition of poor fish farmers and coastal communities
- Adaptation of environmental sustainable technologies

The TA will assess the status of aquaculture development in the country , identify major problems, opportunities and strategies to achieve sustainable growth and reduce poverty . The TA will use the participatory and consultative approach as a basic strategy and techniques such as surveys, questionnaires and focus group discussions to collect baseline data and develop protocols for monitoring and evaluation. A participatory livelihood assessment will be carried out to determine the activities of men, women and the poor to enable participation and ensure more focused targeting of benefits. The TA will formulate and investment project, which is envisaged to have the following components:

- Empowerment of fisher folk communities
- Rehabilitation and improvement of management systems for traditionally cultured freshwater species such as carp, tilapia and cat fish; and development of technologies for other high value species such as eels and turtles.
- Rehabilitation and improvement of management systems for traditionally

- Cultured brackish water and marine species-groupers, sea bass, prawns, milkfish, aquarium fish, seaweeds and shell fish – and development of technologies for new species such as seas horses, wrasses, etc; and
- Institutional strengthening and development support services.

7. Human Resources Training and Development

Training for personnel involved in the care and use of animals for scientific purposes including researchers, teachers and technical support staff.

7.1 Training of aquaculturists

The aquaculturists would need to have a fairly high educational background generally up to the university or equivalent level. He should be given specialized theoretical and practical training in all the basic disciplines involved in aquaculture work at the post graduate level. The high level training is necessary as he as to guide and participate in all technical aspects of an aquaculture program.

7.2 Training of technicians

The technician, who is equivalent of a foreman in a factory, should received specialized training with greater stress on practical work. Much greater restriction of the scope of training and specialization in particular culture system or techniques of culture, e.g. fish, shrimp and oyster culture and hatchery operation, feed preparation, pond management etc will be possible and indeed desirable.

7.3 Training of extension workers

Its objectives, characteristics, philosophy and principles; its role in transfer of technology to farmers; extension as a part of integrated rural development programs.

Objectives of aquaculture extension as part of the general program of socio-economic uplift of farmers. Promotion of aquaculture as an industry and attainment of improved production through:

- Transfer of technology – site survey, design of installations, farm

construction, culture techniques, pond maintenance, disease diagnosis, quality control, etc.

- Linkages with support services: ensuring supply of quality seed, fertilizers, chemicals and drugs, fabrication and supply of farm requirements like monks, cages, rafts, clutches, etc.
- Linkages with credit facilities: arranging credit and ensuring its proper utilization; short term and long term loans; financing agencies
- Organization of marketing and distribution systems and cooperatives trading facilities; product development, consumer education and demonstration marketing
- Training of farmers in aquaculture techniques

c.1. Extension methods

Some extension methods applied for the better aquaculture practices through:

- Results of demonstrations, demonstration farming etc.
- Communication of useful research results through bulletins, pamphlets, handouts, newspaper articles etc
- Radio and television talks

c.2. Extension tools

Transport, water analysis and field study kits, some common chemicals for control of infections and mortality of fish, film strips, slides, posters, projection, equipment, demonstration farms etc.

d. Role of cooperatives in extension programme

d.1. Organization, execution and evaluation of extension programmes

Nature and importance of extension programmes building; socio-economic survey to decide on the most suitable type of extension programme; formulation of objectives; procedure for developing sound extension programmes; roles and responsibilities of different categories of extension workers, rural leaders, government institution, etc.; formulation and execution of work plan; evaluation in extension – purpose; types; internal evaluation techniques; analysis and interpretation.

d.2. Extension supervision and administration

Function of extension workers at various levels, qualities required of good extension supervisor; inter-relations of extension supervisors with other extension and research personnel; administrative organization of extension service ; principles of effective budgeting ; promotion of adult education in rural areas as an essential adjunct to aquaculture extension

d.3 Extension training

Training of technicians and farmers, short and long –term courses, specialized training of technicians to suit local needs, organization of periodic refresher training courses of extension personnel. Handling and operation of extension tools, preparation of extension aids (like lantern slides, posters, film strips, etc.) , visits to private aquaculture farms for rendering technical assistance , participation in organized field days.

The role of extension worker is to constantly enrich themselves with such new technical information, test it's and spread to the fisherman. An extension worker usually performs various roles as a n adviser, a teacher, an organism, a co-worker, a liaison officer, a friend and a sympathizer in the group he works with. Extension worker bring to fisherman useful information that can help how to increase his yield and profitability. He will bed additional training in extension techniques, such as method and result demonstration, farm visits, farmers training, use of audio-visual aids etc.

e) Training for other personnel

The farmer may benefit by short-term courses in specific techniques, especially when improvement or innovation have to be introduced. Scientific personnel for basic and applied research as well as specialist service such as diagnosis and treatment of disease should processes university level education with specialization in selected filed.

Well equipped research institution can provide appropriate training facilities for scientific personnel. On the job training of the candidate wit the basic qualification may generally be the most practical way of training such personnel. One common factor operating at all levels of human re-

sources development (HRD) is the sharing and effective dissemination of information. He has to be trained to be excellent techniques whose technical knowledge and ability will be recognized and appreciated by the farmers and at the same time have the ability of winning their friendship and confidence.

Role of educational institutions, GOs, NGOs, donor agencies and other private sector

Actually, prior to do any culture, research, experiment or massive work, financial and technical supports are obvious. So, in order to provide those basic needs of this sector the various institutions can play a vital role. These should have some rules and regulation as well. Developed human resources should be properly utilized by the above mentioned organizations. The whole development of any sector depends upon its grassroots level. If all the advanced steps are gathered as a holistic approach the real advancement may occur. The financial as well as every technical support should be sufficiently provided by those institutions. Micro-credit loan in the form of co-operative society is so much effective in the folk-society. Beside this, to enrich the national economy government should think more about these sectors. That's why a well managed, developed and need based plan must be done to involve these institutions in aquaculture sector. Only proper co-operations among them can ensure the whole development of this sector. Generally the GOs, NGOs and donor agencies are involved in aquaculture development in Bangladesh which is a good sign, but it should be enriched. At present in Bangladesh many banks and government research centers are helping by some opportunities. Many NGOs and donor agencies (Danida, DFID, FAO, ADB, UNDP) are involved in the development of aquaculture. These institutions are providing various extension services in the coastal areas of Bangladesh for the development of sustainable aquaculture.

New approaches for Human resources Development for Sustainable Aquaculture

Aquaculture Extension services have gained much importance with the increasing reliance's of aquaculture. Existing culture techniques or technology developed in one locality may need modification and refinement to adapt to the local conditions of different geo-political environment. Train-

ing of extension workers has to be modified to incorporate and reinforce information delivery methods and mechanisms as well as practical farming techniques. There is also a need for greater interaction between extension trainers and farmers during training. Furthermore, the route of the extension training should be exceeding the traditional models of the past. New models and players in extension are needed media, farmers association, development non-governmental organizations (NGOs), private sector suppliers and other will likely come into more prominence, broadening training experiences.

The new approaches are

- Increasing co-operation among extension training providers including Govt., NGOs and the private sector
- Participation of farmers in extension project planning , development and orientation of precise farming technologies
- To make further bridge for the moving of research findings to extension workers and then to farmers
- Increment of researcher in term of quality and quantity
- Growing of awareness / consciousness of all personnel for the saving of ecology being eco-friend in doing the aquaculture venture.
- Development of research capabilities and gear the research to meet the ever increasing need and challenges imposed on the sector
- Providence and further incentives to the researchers, farmers and other personnel for their further improvement
- The great role should be played by donor agencies by their fund dedication to Human Resources Development (HRD)
- More application and extension services to the farmers
- More training to the farmers
- Conduct training courses in culture techniques and general biology of aquaculture species
- Provide extension support to private aquaculturists and government fisheries and aquaculture staff to develop commercial and subsistence aquaculture crops within the region
- Help develop and support hatcheries and grow out farms for giant clams, sponges and other species as requested by local authorities
- Assist in reef reseeding programs and surveys for giant clams, sponges and other species as requested by local authorities
- Develop extension fact sheet, manuals and videos to educate existing

and potential aquaculture producers in the region

- Conduct or organize general aquaculture information sessions and workshops on established and potential aquaculture species
- Provides aquaculture information in the form of papers, manuals and videos for producers, government representatives and interested parties throughout the region upon request
- Integrate the principals of sustainable aquaculture development by policy makers into country policies and programs and reverse the loss of environmental resources

Conclusions

Human Resources Development (HRD) can be of definite help in achieving optimum objectivity, efficiency and reliability of sustainable aquaculture on a long term basis in the new millennium for Bangladesh. It may minimize the uncertainty, confusion and practical hazards and ensure the economic viability and helps aquaculture to go an par excellence. So, development of human resources through training, education and awareness growing in the summons of the sustainability aquaculture in the new millennium.

References

Commonwealth Secretariat (1993). *Foundation for the future-Human Resources Development (Report of the commonwealth Working group on Human Resource Development Strategies)* London.

Cascio W, F. 1997. International Human Resources Management issues for 1990s Asia pacific journal of Human resources, Vol. 30. No.4. 27 Januray, pp 1-17

De Silva, S.S. 2001. A global Perspective of aquaculture in the new millennium. *Aquaculture Asia*, Vol. 23. No 2. pp 20-30

David E. Guest, 2000. Human Resources Management: its implications for industrial relations and trade unions” In *New perspectives on Human resources Management*, op. cit. 41-43

Economic Development Board, 1994. *Singapore manpower and capacity development of Singapore*.

FAO, 1999. *FAO Aquaculture Statistics. 1997-1998*. FAO Fisheries Cir-

cular. No 815. Rev.11. FAO. Rome, Italy. 203p

Kutty, M.N. What ails aquaculture? *Aquaculture Asia*, 2:8-11

Machnena and Moehl, 2001. Sub-Sahara African Aquaculture: Regional Summary. Vol 20. No 12, pp 12-16

Muqtada , M and Hildeman, A (ed.) , 1993. Labour Market and Human Resources Planning in Asia: perspectives and Evidence UNDP and ILO Asian Regional Term for Employment Promotion (ARTEP)

NACA/FAO, 1996. Report of the survey and workshop on aquaculture development Research Priorities and Capabilities in Asia, Bangkok, Thailand.

Sorgeloos, P. 2001. Technologies for Sustainable Aquaculture Development . Vol 14, No 2, pp 29-40

UNDP, 1996. Human Development Report, 1996. Oxford University Press, New York