

At the national level:

- Producers, distributors and processors should be able to increase self protection through financial mechanisms. This is particularly relevant for aquaculture (e.g. cluster insurance) but financial services could also be used to promote emergency funds more widely through the sector.
- Investment in the sector, especially in infrastructure, will need to consider climate change which will require developing better information on the costs and benefits of protection.
- Transfer or spread of sector-related risk – from individuals and communities to the state through contingency plans – will be based on specific fiscal provisions but also may be tied to innovations in resource manage-

ment through which the insured accept responsibilities in exchange for protection.

- Financial instruments that can promote risk reduction and prevention practices include initiatives such as relocation allowances from low lying areas and disincentives for misuse of water in aquaculture.
- Existing and new initiatives for improving equity and economic access, such as microcredit, should be linked to climate change adaptation responses such as livelihood diversification.
- Mitigation options can include fiscal incentives for reducing the sector's carbon footprint, developing more efficient processes and sector agreements, and providing payment for environmental services, particularly offering additional livelihood options to poorer communities.

At the international level:

- Funding agencies can “climate proof” their approaches and, at the same time, take advantage of new opportunities in the fisheries and aquaculture sector by jointly promoting food security, reducing negative impacts of climate variability and change, and improving resource management.
- Donors should be made more aware of the importance of the fisheries and aquaculture sector in terms of food security and its sensitivity to climate change, and of effective ways in which the sector could become part of cross-sectoral investment strategies.
- Private sector investors should be encouraged to incorporate “climate proof” approaches into international sourcing, trade and market development, and into broader corporate responsibility areas, including delivery of local benefits and inclusion of smaller scale producers.

New initiatives in fisheries extension

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Improved communication and information access is directly related to social and economic development. However, the rural population still have difficulty in accessing crucial information in forms they can understand in order to make timely decisions. There is a concern that the gap between the information rich and information poor is getting wider. New information and communication technologies are generating possibilities to solve problems of rural poverty, inequality and giving an opportunity to bridge the gap between information-rich and information-poor and to support sustainable development in rural and agricultural communities. However remote rural communities still lack basic communication infrastructure. The challenge is not only to improve the accessibility of communication technology to the rural population but also to improve the relevance of information to local

development. The article focuses on innovations in technology dissemination with particular focus on aquaculture.

Public sector initiatives

Single window delivery system

In an information age, the role of appropriate information package and its dissemination is of crucial significance. It is not enough to generate information but it is also essential to ensure that the required information is delivered to the end-users at the earliest and with the least dissemination loss. The establishment of agricultural technology information centers (ATIC) can forge a better interaction between researcher and technology users. This serves as a single window system with an objective to help the farmers and other stakeholders both to provide solution

to their location-specific problems and to make available all the technological information along with technology inputs and products for testing and use by them. Such information is useful for:

- Farmers;
- Farmer-entrepreneurs;
- Extension workers and development agencies;
- NGOs; and
- Private sector organisations.

ATICs facilitate direct access to the farmers to the institutional resources that are available in terms of technology, advice and products, thereby reducing technology dissemination losses. Under the National Agricultural Technology Project (NATP) the Indian Council

for Agricultural Research (ICAR) has established 44 ATICs in State Agricultural Universities and in ICAR Institutes. Three such ATICs are operating in specialised fisheries research institutes viz., the Central Institute of Freshwater Aquaculture, Bhubaneswar, Orissa ; the Central Marine Fisheries Research Institute, Cochin, Kerala and the Central Institute of Fisheries Technology, Cochin, Kerala.

Kisan call centre

The Department of Agriculture & Cooperation (DAC), Ministry of Agriculture, Govt. of India launched Kisan Call Centers across the country to deliver extension services to the farming community. A Kisan Call Center consists of a complex of telecommunication infrastructure, computer support and human resources organized to respond to queries raised by farmers in their local language. Subject Matter Specialists (SMSs) using telephone and computers, interact with farmers directly to understand the problem and answer the queries at the call centre. Formally launched on 21 Jan 2004 by the Prime Minister of India, the call centres are getting more than 2,000 calls per day. There are call centers for every state which are expected to handle traffic from any part of the country.

Helpline

Leveraging on the IT revolution in India and the increasing penetration of telephones in villages, many State Agricultural Universities and ICAR institutes have started helpline services. The helplines address queries related to farming during fixed days of the week at specified hours. The helpline number is advertised through mass media viz., radio and press. The Central Institute of Freshwater Aquaculture has initiated this service on every Tuesday and Friday during 3.30-5.00 p.m. and the no. is 0674-2111849.

Farm school on the air

Radio has been used extensively as an educational medium in developing countries. Radio has supported educational programmes in a wide range of subject areas in many different countries. The latest technologies are taught to farmers by offering series of lessons broadcast over a period of time (three months usually). Each broadcast ends with few questions to encourage participation and the audience are asked to send

in replies within a weeks time. From among the right entries a draw is conducted and the selected ones are awarded. All India Radio, Cuttack recently broadcasted 11 lessons related to aquaculture.

Private sector initiatives

The corner stone of India's blue revolution is availability of quality fish seed and improved management practices for increased productivity, sustainability and stability. This has triggered the search by the farmers for availability of quality fish seed, fish feed and other inputs, easy accessibility to diagnostic services for soil and water, fish health management, availability of appropriate information packages through printed, audio, video and electronic media. It has also prompted multiple players to offer consultancy services in aquaculture.

Private commercial organisations

Shrinking public investment, growing willingness of farmers to pay for services, shifting priorities of aquaculture production towards high value products - prawn, crab, ornamental fishes, value added products etc. have led to the emergence of privatized extension services. Besides partial recovery of cost, privatization renders the extension system more accountable to information seekers. Many private players are engaged in quality seed production, intensive and super intensive culture, processing, value addition, ornamental fish breeding and culture etc. Firms engaged in fisheries namely Hindustan Lever, Lipton, Water base, CPAqua, Avanti, Higashimaru etc have their own well knit network of R&D, extension and marketing. They have a cadre of technicians to offer consultancy to farmers who buy products from them. IFFCO and KRIBHCO have prominently entered the extension arena by passing on full crop production messages through field demonstration and training programmes (Mathur, 2004).

Aqua service centres

Unemployed educated youths have started operating aqua service centres in the line of agri-clinics. These centres are offering services like soil and water testing, feed analysis, seed quality testing (PCR test), disease diagnosis and market intelligence. These centres are in the business of selling inputs such as feed, fertilizer, pesticides, other

therapeutics etc. In Andhra Pradesh several such service centres can be found in Kolleru lake area of West Godavari district, although they may be known by different names such as farmer facility centres, aqua service centres etc. Farmers need to pay for availing the services of these centres.

One stop aqua shop

One of the major recommendations of DFID funded project "Investigating improved policy on aquaculture service provision to poor people" was to establish one stop aqua shop (OAS). It is intended that OAS would provide better access to farmers regarding appropriate aquaculture technology as well as information on government schemes and rural banking and micro finance. It was also envisaged that OAS would sell fish seed and other inputs. In Purulia one OAS (Matsya Seva Kendra) started by Kuddus Ansari last year. The shop is a single outlet for all inputs that a fish farmer may require in the cultivation of fish. The inputs include fish seed, fish feed, fertilizer, chemicals etc. (The Telegraph, Kolkata, June 8, 2004). Besides, the OAS is helping farmers in providing information on fish farming through posters and though information brochures supplied by state departments and research institutes. This is becoming quite popular. One OAS has also been established in Ranchi, Jharkhand and four more are coming up at Balangir and Nuapada of Orissa (Tripathi et al 2004).

Initiatives in ICT applications

Information and communication technology (ICT) is defined as capturing, processing, storing, and communicating information electronically within a digital medium. It enables an effective and cost-effective flow of information products, people and capital across national and regional boundaries. The lack of communication facilities in communities therefore, inhibits the social, political and economic empowerment of the majority of the population. The Secretary-General of the United Nations states: "The new information and communications technologies are among the driving forces of globalization. They are bringing people together and bringing decision makers unprecedented new tools for development. At the same time, however, the gap between information 'haves' and

Table 1. Necessary paradigm shifts in extension (Vijayraghavan, 2004).

Components	Traditional extension	Extension for 21 st century
1. Goal	Transfer of technology	Enhancing the over all capacity of farmers
2. Need assessment and programme planning	Top-down approach, and rigid	Bottom up approach involving farmers and flexible
3. Source of technology	Mainly government research Institutions	Multiple sources government private and farmers' knowledge system
4. Nature of technology	1. Input intensive, crop based and general recommendations 2. Fixed package of information	1. Knowledge intensive, broad based, farming system perspective and location specific 2. provision for choices
5. Dissemination of technology	i. Individual approach with lack of participation of farmers ii. NGOs not involved	a. Group approach with increased participation of farmers and their organization b. Greater involvement of NGOs
6. Clients	Mostly male farmers	Efforts to reach both male and female farmers, rural youth and farm labourers
7. Farmers' activity	Routine application of technology/inputs	Encouraging farmers experimentation and learning
8. Role of extension agents	Information transfer	Facilitation of learning and building overall capacity of farmers
9. Rewards and incentives for extension personnel	Rewards not linked to performance	Rewards linked to performance
10. Financial sustainability	Very low	High

'have-nots' is widening and there is a real danger that the world's poor will be excluded from the emerging knowledge-based global economy".

Indicated below are some of the ICT initiatives in India:

Aqua choupal

Aqua choupal, the unique web based initiative of ITC Ltd. offers the farmers of the state of Andhra Pradesh all the information, products and services they need to enhance productivity, improve farm gate price realization and cut transaction costs. Farmers can access the latest local and global information on weather, scientific farming practices and market prices at village itself through a web portal all in Telegu. Aqua choupals also facilitate the supply of high quality farm inputs as well as purchase of shrimps at their doorstep.

The M.S. Swaminathan Research Foundation developed 'infovillages' to help ensure food security. The project includes local language content and wireless internet access. The initiative started in 1998 in 10 villages in Pondicherry. It also provides relevant information regarding fish density in the ocean to the fishing communities.

e-choupal

A unique web based initiative of ITCs International Business Division in Central India caters to soya growers regarding all information, products and

services required in soya farming. It facilitates supply of high quality farm inputs and purchase of soya at the doorstep of farmers. The project has started 23 telecentres in Hosangabad and has around 600 kiosks in central India.

Rural Knowledge Centre

Rural Knowledge Centre is a part of a nationwide plan and has been set in motion in July 2004 by the Centre in collaboration with the States, NASSCOM, UNDP and a host of NGOs. Its primary aim is to set up multipurpose resource centres at all the six lakh villages of the country by 2007, for which an initial sum of Rs. 100 crores has already been allocated by the Centre. This public - private partnership is expected to help eradicate poverty and improve the lives of poor people through application of information and communication technology (ICT). Each knowledge centre will be run by local self help groups, and will cater to knowledge based livelihoods and create income avenues for rural people, farming communities and disadvantaged people. It is an innovative attempt to explore the in depth interdependence between ICT and human development and demonstrate empirical links between the two using millenium goals as the benchmark. It will lead to rural knowledge revolution and aid in capacity building. Establishment of rural knowledge centres will go a long way in revitalizing traditional knowledge and lessen digital divide.

Cyber extension

Modern communication technologies when applied to conditions in rural areas can help improve communication, increase participation, disseminate information and share knowledge and skills. It is being said that "Cyber Extension" will be the major form of technology dissemination in the near future. The Internet is emerging as a tool with potential to contribute to rural development. Internet access enables rural communities to receive information and assistance from other development organizations; offers opportunities for two-way and horizontal communication and for opening up communication channels for rural communities and development organizations. It can also support bottom-up articulation of development needs and perceptions, and thus help in reducing the isolation of rural communities. It can facilitate dialogue among communities and with government planners, development agencies, researchers, and technical experts; encourage community participation in decision making; coordinating local, regional and national development efforts for increased effectiveness; and help agricultural researchers, technicians, farmers and others in sharing information. Internet can give access to a vast global information resource. One important thing has to be ensured that information availability is demand driven rather than supply driven.

Needed changes

The increasing market orientation of aquaculture in liberalization of trade, the emergence of global markets and competition and increasing concern about food and the environment place the aquaculture sector of developing countries under tremendous pressure. Diversification and intensification are some of the key factors for sustainable aquaculture development and therefore the regular information flow among farming communities, technical and marketing resources and other supplying institutions is a must for steady growth in the farm economy. Small holder farm families who comprise the majority of farming families are facing increased pressure to respond to rapidly changing market demands and to adopt latest of technological innovations.

The agricultural decisions and transactions in the developed world are now manipulated through digital networks. The Internet and mobile telephones in particular, are used by governments to provide services to citizens (e-government) and provide a platform for citizens to interact with fellow citizens as well as experts. Access to information is clearly a key determinant for maintaining a successful farming business (Farrell, 2003).

Public extension systems require a paradigm shift from top-down, blanket dissemination of technological packages, towards providing producers with the knowledge and understanding with which they solve their own location - specific problems.

Conclusion

Fisheries extension has significantly contributed towards enhancement of fisheries production in India. From 50 kg/ha/year in 1950-51 average fish production has increased to 2,200 kg/ha/year in 2002-03. The socio-political environment within which extension system operates has also undergone a lot of changes. The information needs of clients have multiplied. Extension today has to assume multiple roles of providing information about technologies, prices and market, policies; organising farmers for exchange of information, facilitating learning from experiences; provide problem solving consultancy in order to serve the farming community (Sulaiman,

2003). Farmers now need quality information about technological options in farming to produce and participate better in markets. They need to know not only market prices but also trends about market prices to plan cultivation.

In order to address successfully the challenges of WTO, greater attention will have to be paid to information-based technologies. Strengthened means of dissemination will be needed to transmit this information to farmers. To make information transfer more effective, greater use will need to be made of modern information technology and communication among researchers, extensionists and farmers. In the era of information technology, where information play a vital and decisive role in strategic decision making, extension personnel will have to acquire latest knowledge as well as skills in use of various electronic devices including computers, multimedia and the internet. The day is not far off when tele/video conferencing will be common means to interact with larger number of farmers to extend extension messages or sharing market information by extension personnel. In coming years, the area of management and communication skills must be the largest segment for competency building among agricultural extension personnel for supporting farming community.

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