

Advances in extension techniques for the development of fisheries sector

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Status and trends in aquaculture and fisheries

In the context of current challenges in food production, nutritional security, social transitions and growing climate uncertainties, fish and aquatic animals play important role to maintain the *status quo*. Global fish production has attained a target of 179 million tonnes in 2018 with an average annual growth of around 6 % in aquaculture and is expected to be increased to the extent of 186 million tonnes by the end of 2030. On the contrary, the trend of Indian fisheries has achieved a big leap in fish production during last seven decades witnessing a quantum leap in production i.e. from 0.75 million tonnes (1950-51) to 14.2 million tonnes (2019-20). Today, it shares about 7.7 % of the total global fish production and has established its dominance in global fisheries scenario as the 3rd largest in total fish production and 2nd in aquaculture production with an average annual growth rate of 14.8%. Out of total global production, around 87 % (156 million tonnes) accounted for human consumption covering more than 3.1 billion people in world (FAO, 2016). Mostly the developing countries account for over 60% of global fish catch, about 50% of global fishery exports in value terms and more than 60% in quantity.

In the livelihood sector, at global level about 59.6 million people are directly employed in fisheries and aquaculture at global level and more than 200 million engaged along the value chain in various upstream and downstream activities from production to distribution (FAO, 2016). In India, it provides livelihood security to more than 25 million (2018-19) of fishers and fish farmers at the primary level and almost twice along the fisheries value chain. Besides, about 84 percent of the globally engaged population in fisheries and aquaculture sector are in Asia, followed by Africa (almost 10 percent), and Latin America and the Caribbean countries (4 percent).

Despite the significant contributions of this sunrise sector, global debates on fisheries issues and policies appear to be dominated by concerns over environmental sustainability, overfishing and overcapacity. In this context, it is alarming to note that the sector has not received adequate attention from the social scientists to understand its various socio-economic dynamics to prove the fisheries sector as a potential driver of local and national economic development.

Problems in small scale fisheries

Small-scale fisheries are normally characterized by low capital input activities, low capital investments, lack of equipment and labor-intensive operations followed by traditional fishers. They also usually operate as semi-subsistence, family-based enterprises, where a share of the production is kept for self-consumption (Garcia *et al.*, 2008). Traditional fishers dominate the marine sector and they are socially deprived, educationally weak with very high occupational rigidity. There is inequity in the distribution of yield and effort in marine fishing in case of traditional fishing communities. They are unorganized with least social security. The

informal social security system in the form of sharing of earnings among the community prevailing in the traditional fishing is hardly seen in the mechanized fishing. There are also huge regional variations in productivity among them.

Technologies are the main drivers of growth. Hence, systematic technological interventions backed by appropriate policy and institutional support are vital for making the aquaculture operations sustainable and economical. Generally, the technologies and trade interventions reinforce each other which can be characterized as skill-based, cost effective, capital intensive, cost-sharing; which can bring a change in the performance of the sector. Hence, there is an urgent need to reform that agriculture allied sectors in holistic, scientific and systematic approach to meet the recent challenges due to climate change and global competitiveness so as to achieve sustainable production and growth under different agro-climatic conditions. Keeping eye upon this, some of the advanced extension techniques have been suggested for an accelerated fishery development with focus on poverty alleviation of poor fishers.

Revamping extension systems for sustainable fisheries

The role of extension in fisheries cannot be ignored. Strong extension system is the key to bring the desired changes to meet the present day challenges related to sustainable fisheries. Basically, the end product of the fisheries extension system is to work with fisheries within an agro-climate and economic environment by providing suitable technologies to enrich knowledge and upgrade skills to improve better handling of natural fish resources and applying the cutting-edge technologies to achieve desired production level. Extension system plays a pivotal role in empowering fishers and other stakeholders to make fish farming more participatory, demand-driven, knowledge intensive and skill supportive for disseminating most appropriate technical, management and marketing skill to improve profitability in fisheries that can overcome the emerging challenges and concern, thus developing a synergistic pathway for enhancing productivity along with quality produce in order to sustain production base and ensure ecological and livelihood security. The extension system needs to disseminate a broad array of information starting from farm to fork in an integrated manner for safe delivery from field to the consumer considering all the aspects of conservation and production technologies, post-harvest management, processing and value addition. Such knowledge based decision should be incorporated in reshaping of extension approaches. In present scenario, the extension system envisages a transformation from technology driven to market driven extension, where fishers would give emphasis on commercialization of fish and fish based products, maintenance of quality, fulfilling consumers' demands, etc., in the program planning process for the effectiveness of any extension programme.

Advanced extension techniques for technology dissemination in fisheries

With the advent of global competitiveness and market liberalization, our prevailing extension system has become defunct, which needs to be strengthened with innovative extension techniques to tackle the interwoven challenges in fisheries viz., enhancing production, climate change, weather aberrations, dwindling resources, quality and safety of products, growing market demand, entrepreneurial opportunities in fisheries, conservation of environment and international trade promotion etc.; so that fishers can adjust their production portfolio keeping eye upon the emerging trends in food consumerism in domestic as well as global markets. In India, in the course of development, many different models for transfer of

technology have been tested and some robust extension approaches have been tested and validated. Furthermore, the frontline extension system of the country has been revisited and sharpened through fishers oriented approaches for technology adaptation and dissemination. As a result, the extension system in India has been designed to move beyond technology and beyond commodity through reciprocal fishers-research-extension linkages for sustainable growth and livelihood security of the farmers. In order to streamline this mechanism, a conceptual framework has to be developed in response to recognizing and considering different livelihood assets viz., *human, social, physical, natural and financial resources*. In general, fish farmers suffer from lack of access to appropriate services like credit, inputs, market, extension, technologies etc. Therefore, participatory technology development and participatory extension approaches emerged as a part of integration of the '*interdependence model*' and the '*innovation systems framework*' that offered more inclusive ways of involving the institution in technology generation, customization and diffusion. Some of the following innovative and advanced extension techniques validated through research systems must be adopted on trial basis to make fisheries more lucrative and sustainable.

a. Asset Based Community Development (ABCD) approach

Conventionally, poor people consider themselves as the impoverished population with certain needs for development that can only be resolved by various supporting agencies. But Asset Based Community Development (ABCD) approach intends for the development of community based on the principle of identifying and mobilizing individual and community 'assets', rather than focusing on problems and needs. It is an extension approach in which a community's micro-assets are linked with its macro environment. It believes that communities can initiate and sustain the process of growth and development themselves by recognizing and harnessing the existing, but often unrecognized assets, and thereby promoting local economic potential to drive its development process (Rans & Green, 2005). The approach is optimistic in nature, because the focus is on '*what is possessed by the community, rather than the problems of the community.*' The focal point in this approach is asset and not the need of the community. Assets of individuals, associations and institutions are identified after an extensive survey and assets are then matched with the need of the people to empower communities to control their futures and create tangible resources such as services, funds and infrastructures etc. (Foot and Hopkins, 2010). In fishery, ABCD approach gives greater emphasis on reducing the use of external inputs and on a high degree of social mobilization in which the assets of the poor (*social, physical, financial as well as human*) can be utilized to bring sustainable livelihoods in fisheries through number of different fishery related activities.

Five Key Assets in ABCD

As per ABCD approach there are 5 categories of asset inventories such as individuals, associations, institutions, physical assets and connections

1. **Individuals:** Every individual has got certain assets, gifts and qualities; such individual is at the center of ABCD approach.
2. **Associations:** Groups of people working with a common interest are critical to community mobilization.
3. **Institutions:** The assets of institutions help the community capture valuable resources and establish a sense of civic responsibility.

4. **Physical Assets:** Physical assets such as land, buildings, space, and funds are other assets that can be used.
5. **Connections:** These are the exchange between people sharing their assets by various methods.

b. Rural Advisory Services (RAS)

Rural Advisory Services (RAS) refer to all the different activities that provide the information and services needed and demanded by farmers and other actors in rural settings, to assist them in improving their livelihoods by developing their technical, organizational and management skills and practices (GFRAS, 2011; FAO, 2010). RAS must be designed to provide the information related to farm, organization, business management etc. recognizing the diversified actors involved in extension and fields advisory works (public, private, civil society); knowing the need of fishers, fish farmers' producer organizations (FFPOs), fishermen cooperatives and rural communities beyond technology related information and explaining them the role of facilitation and brokerage in rural development and value chains. In the case of aquaculture, large-, medium- and small-scale fishers need different types of RAS support. The large aquaculture farms are mostly self-reliant and need only regulatory support, while medium-sized farms need mobilization and facilitation support in addition to regulatory support. Small aquaculture farms need more education and input provision alongside facilitation (Kumaran, 2014). Timely sharing of research recommendations can address the problem of technology information for the fishers. In this direction, innovative extension strategies are being formulated keeping the fishers' needs and capacities in mind to pass on appropriate technologies by combining Internet, telecommunications, video, and print technologies that may bridge the information gap and empower fishers to make better production and marketing decisions (McLaren et al. 2009).

In fishery sector, RAS helps in,

- ❖ Providing management and business development support appropriate to the scale, resources and capacities of each fisherman.
 - ❖ Better understanding markets (prices, products, seasonality, standards, value addition etc.) related to fish and fish products.
 - ❖ Linking fishers to other stakeholders involved in provision of varied support and services.
 - ❖ Creating platforms to facilitate interaction and sharing among the various stakeholders including FFPOs to ensure coordinated support to fishers.
 - ❖ Exploiting information communication technologies (ICTs) to provide fishers with a range of information related to weather, prices, extension programmes and generic information regarding fisheries.
 - ❖ Facilitating the formation of FFPOs and also collaborate with FFPOs to strengthen the demand and supply side of RAS.
 - ❖ Promoting institutional and policy change to enable and support small-scale fishery.
- RAS encourages the formation/ organisation of groups by involving individual fishers, who have little influence over the social, economic and political processes affecting them, but as a group/ organizations and networks they can deal with their specific challenges. This can act as a platform to articulate concerns, exchange knowledge, influence policies and engage in collective action so that their livelihood remains sustainable and profitable. Effective formation of Rural Resource Centres (RRCs), Fishermen Cooperative Society, Fish Farmers' Producers

Organisations (FFPOs) can be instrumental by galvanizing collective action in order to ensure better access to markets and to support innovation by their members in related activities (Sundaram, 2014).

c. Model Village System of Extension (MVSE) approach

MVSE is an integrated and holistic extension approach where *community participation* is prioritized for suitable technological interventions in the fisheries to bring all-round development in fisheries sector in terms of socio-economic upliftment, technological empowerment, self-governance thereby enhancing the futuristic knowledge base and skills through participatory framework. MVSE emphasizes on involvement of all stakeholders in the process to converge their activities with a stake in the food value chain linking producer to consumer. Nevertheless, MVSE is an action research taken up in fishers' farm based on the principle of leveraging the activities, investments and resources from outside agencies/externally aided projects resulting higher productivity, ensuring food security and sustainable improvement in overall quality of life by promoting leadership, self-dependency of the community in food chain. Economically viable, ecologically compatible and socially acceptable suitable technologies are successfully intervened in a cluster approach through participatory mode by integrating the multi-disciplinary research. The cluster of villages is adopted as model village, the success of which is later replicated to other villages. The village is developed as a commodity village branding for a particular commodity in the market.

MVSE approach works on the following principles:

- Promotes self-governance among the fishers
- Skill improvement and leadership development among the fishing community.
- Establishing linkage through pluralistic convergence of multiple stakeholders associated in the sector.
- Encouraging the market opportunities through commodity based village development (CBVD).

d. Farmers Field School (FFS) approach

The FFS extension approach is an alternative to the top down extension approach which was evolved as a method to solve complex field level issues in fisheries sectors. FFS aims to build fishers' capacity to analyze their production systems, identify problems, test possible solutions, and eventually encourage the participant member to adopt the practices most suitable to their farming systems (FAO, 2003 c). This is a learning-by-doing approach which emphasizes group observation, discussion, dissection, modification, and promotes field-based experimentation, analysis for collective decision making followed by actions. The FFS approach is an innovative, participatory and interactive learning approach that emphasizes problem solving and discovery based learning. FFS also provides an opportunity to fishers to practice and evaluate sustainable resource use technologies, and adoption of new technologies by comparing with their conventional technologies developed in congruent with their own tradition, culture and resource use pattern. The goal of FFS approach is such that, after observing and comparing the results of field level experiments, fishers will eventually "own" and adopt improved practices by themselves sidelining the conventional ones without any external compulsion. Field day is being organized at the end of the season to give visibility to the entire activities to convince the non-adopters. Exchange visits with other FFS is also encouraged to learn by association and comparison A group of 20-25 fishers can form a Farm

School under the guidance of a FFS facilitator. Extension workers, NGO workers, fishermen co-op members or previously trained fishers can become Farmer Field School (FFS) facilitators. The facilitators are trained by master trainers, who have expertise in the particular subject matter. FFS is a time bound activity usually covering one production cycle or a year.

It is also significant to note that irrespective of the merits of the technology, the acceptance to technologies is influenced by the extension methods. Farmer Field School (FFS) model has been accepted as a good extension technique because of its exclusively participatory nature. FFS was also found to be effective in avoiding barriers like socio- economic constraints, infrastructure problem and incompatibility of technology for the adoption of sustainable fishery practices. The basic component of FFS is setting up of a Participatory Comparative Experiment (PCE), commonly referred to as Participatory Technology Development (PTD), whereby the fishers put the FFS concept into practice under close monitoring and supervision by the FFS members. A PCE can be developed in the field of agriculture, livestock, fishery, forestry, agro-forestry, livelihood system and others.

Principles of Farmer Field School(FFS)are as follows: -

- Field is the learning place.
- Emphasizes hands on and discovery based learning.
- Farmers become experts.
- Integrated and learner defined curriculum.
- Doing is better than learning/ seeing.
- Experiences are the start of all learning.
- Link to actual field situations and should be relevant to local needs and problems.
- Participatory monitoring and evaluation.
- Fishermen are decision makers.

e. Market Led Extension (MLE) approach

In order to make farming more enterprising, extension professionals need to be proactive beyond the regular objective of maximizing the productivity of the fishers by transferring improved technologies rather fishers should be sensitized on various aspects of farming like culture, harvest, quality, processing and value addition, consumer's preference and market intelligence. This will help the fishing community to realize high returns for the produce, minimize the production costs, and improve the product value and marketability that may lead to realize the concept of doubling farmers' income (DFI). With the globalization of agriculture, emphasis on productivity and profitability to the farm enterprises has been increased and, therefore the demand- driven agriculture (and allied sectors) has led to the paradigm shift from production-led extension to market- led extension. There are many challenges in the agricultural marketing system, which can be resolved through the efforts of market- led extension models.

In this approach, fishers are viewed as 'Fish-entrepreneurs' who expects high returns 'Rupee to Rupee' from his produce by adopting a diverse basket of package of practices suitable to local situations/ farming systems with optimum cost benefit ratio (C:B ratio) ensuring maximum share of profit by exploring the market demand. Goal of market led extension is to facilitate fishers to get better price. Market led extension focuses on harnessing

the ICT tools to access market intelligence including likely price trends, demand position, current prices, market practices, communication network, etc. besides production technologies.

For farmers, as the extension system is more credible source of farm technologies, the extension personnel ought to be knowledge- and skill-oriented in relation to production and marketing of agro-enterprises. Thus, revamping the extension system will have a catalytic role for ushering in farmer-led and market-led extension; which can subsequently alleviate poverty and ensure livelihood security. In the light of this, the challenge remains to motivate the extension personnel to learn the new knowledge and skills of marketing before assigning them marketing extension jobs to establish their credibility and facilitate significant profits for the fishing community. SWOT analysis of the market, Organization of Farmers' Interest Groups (FIGs), capacity development, establishing linkage and synergy, harnessing ICTs, digital marketing etc are the competencies required by the extension personnel in order to effectively implement market led extension.

f. Digital Extension approach

Extension reforms brought a transformation in fishery extension system through introduction of Information and Communication Technologies (ICTs). The ICT-enabled extension system referred to as Digital Extension has the potential for enabling the empowerment of fishing communities by improving their access to information and sharing knowledge with innovative e-agriculture initiatives (Saravanan, 2010a).

With the phenomenal growth in information and communication technology, use of ICT application in agriculture and allied sectors will bring remarkable change in the attitude and knowledge level of user. Basic requirement is to provide most appropriate information in such a capsule that can be easily understood and used by them. This approach will strengthen the extension system for better dissemination of technology. Hence, along with ICT-based advisory services, input supply and technology testing need to be integrated for greater impact and content aggregation from different sources require to be sorted in granular format and customized in local language for rapid adoption of technologies (Balaji et al., 2007&Glendenning and Ficarelli, 2011).

The effectiveness of this innovative extension approach depends on capacity building, people's participation along with government initiative to provide strong infrastructure to be worked with the cutting edge technologies. The farmer friendly technology dissemination process needs to be handled with careful planning by the incorporation of information communication technology. The use of ICT application can enhance opportunities to touch the remote farmers to live in close proximity of the scientific input. The computer based web portals namely aAQUA, KISSAN Kerala, TNAU AGRITECH Portal, AGRISNET, DACNET, e-Krishi, ASHA, India Development Gateway (InDG) portal, Rice Knowledge Management Portal (RKMP), Agropedia, KIRAN, AGMARKNET, ITC-e-Choupal, Indiancommodities.com, Mahindra Kisan Mitra, IFFCO Agri-Portal, Agrowatch Portal, iKissan, etc. along with some mobile based Apps like mKRISHI® Fisheries, riceXpert, Pusa Krishi, Krishikosh, m4agriNEI, CIFTFISHPRO, CIFT Lab Test, CIFTraining etc. launched in India are some of the successful digital intervention for technology dissemination.

The use of internet, mobile and video- conferencing assists the IT enabled farmers to utilize the facilities for their favors for which the most suitable permanent infrastructure is the

basic requirement. Strong linkages need to be established between direct ICT interventions and it should be part of the national level program on holistic agricultural development.

g. Disruptive Extension:

Recently, a new extension technique christened as ‘disruptive extension’ comes into limelight which is considered as an innovative extension approach that creates a new paradigm of extension that eventually disrupts an existing approach followed by extension professionals in the field of agriculture and allied sectors with a pre-conceived idea about the field level problems. It is an entrepreneurial oriented sustainable extension system that can be able to transform every link in the food chain, from farm to fork, pond to plate and deck to door. It is a combination of different innovative extension techniques like ABCD, CRE (cost-recovery extension), MVSE, CBVD etc. blended with suitable conventional approaches, the fulcrum of which lies between resource exploitation on one side and resource conservation on another side that influence the livelihood security and technology sustainability for small scale farm holders. It deals with the following principles:

- Importance of good governance in agriculture (and allied fields) that considers the resource rights of the farmers.
- Emphasis on growing interest among the stakeholders by explicit analysis of field level issues for technology adoption.
- Potential to resolve the social conflicts for equal access to community resources through Memorandum of Understanding (MOU).
- Based on cost recovery mechanism.
- Ensure commitment to optimum resource management and maximum economic benefit to improve food security.
- Provision of community based social insurance.
- Maintaining the sustenance of the technology supports through custom hiring approach.
- Focus on pluralistic convergence of different partners to build a network of linkage with various entities around the farm households.
- Encouraging the farmers-scientist interaction for technology development, assessment and application through Farmers’ FIRST approach.

Fisheries embraces diverse actors in its endeavour to support their livelihood system giving an impact in food and nutritional security. At the same time, the contribution of women fishers also cannot be ignored particularly in on-farm operations, harvesting, post-harvest management, processing etc., especially in fishery and animal husbandry sector. Hence, in today’s scenario innovation in extension is the key to address the growing challenges, which need to be validated, integrated and scaled up and further recommended for large scale implementation by the policy makers. The advanced techniques of extension should be based on capacity building, skill development, people’s participation along with government initiative to provide policy support in line with the cutting-edge technologies. Much effort has been initiated in going beyond the farm and the fishers and focus on beyond the technology to a wider innovation system.

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