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Performance appraisal of factors contributing to the development of aquaculture

Nisha Elizabeth Joshua* and S.N. Ojha

**Fisheries Economics, Extension and Statistics Division, Central Institute of Fisheries Education, Mumbai 400 061, Maharashtra, India*

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ABSTRACT

Recent declining trends in landings from capture fisheries and increasing population has raised serious concerns about the food and nutritional security of millions of people. Aquaculture is thus seen as a viable alternative to fill the gap in supply of fish. Extension services in aquaculture provide adequate support in furthering the development of the sector. The current study focuses on identification of key factors for the development of aquaculture sector in Kerala, India. A questionnaire based survey was carried out among 550 randomly selected respondents of five selected districts of Kerala, India. The respondents composed of beneficiaries of Agricultural Technology Management Agency (ATMA), staff of the Department of Fisheries (DoF), ATMA Governing Board (GB) members and ATMA Management Committee (MC) members. The major aquaculture development indicators closely associated with extension services were identified. The major indicators included extension contact, information acquisition, information dissemination, ATMA activities and expectations. Similarly sub indicators were identified and were used for the formulation of the performance evaluation matrix. Farmers' score for extension contact (24.54%), farm information acquisition (49.23%) and expectation score (71.39%) indicated enough scope for improvement which implied lack of sufficient contact with resource persons, improper mechanism of obtaining information and high expectation from the extension service providers. Officials' score on extension contact (36%), farm information dissemination score (49%) and expectation (53%) indicated low contact with the farmers, moderate information dissemination and fairly high level of expectation in providing efficient extension services to farmers. Officials' score on farm information acquisition (62.5%) and ATMA activities (57.46%) showed that they need to vigorously conduct extension activities and acquire farm related information from traditional and modern mass media sources. The scores obtained for key performance appraisal indicators reflected scope for improvement in terms of the selected indicators. The findings could be utilised for developing improved policy measures for strengthening aquaculture extension system that could lead to a boom in aquaculture development.

Key words : *Performance indicators, Extension contact, Information acquisition, Information dissemination, Appraisal, Aquaculture.*

Introduction

Capture fisheries and aquaculture play a pivotal role in providing food and economic security, either independently or in combination with both agriculture and livestock rearing in many developing coun-

tries (World Fish Centre, 2011). The vastness of the India's diverse natural resources comprises more than 10 per cent of the global biodiversity in terms of fish and shellfish species (NFDB, 2007). Meanwhile the microclimate of the coastal and inland aquatic ecosystem act as a cradle of diverse aquatic fauna

like major carps, common carps, finfish, shellfish and very much suitable for the aquaculture production (James, 1999).

The contribution of capture fisheries was around 3.5 million metric tonnes in 2021, 1.3 million tonnes (MT) in 2015, while it was only 0.7 MT in 1950 (Tofler, 2023). Though capture fisheries production is also on the rise, the rate of increase has almost reached a plateau. Aquaculture production in India is mounting at an increasing rate compared to that of capture with a production of 12.4 MT in 2022, 5.3 MT in 2015, from a mere production of 0.2 MT in 1950 (FAO, 2014; Market research, 2023). By 2030, India's population is expected to surpass China's and to become the largest country in the world (Worldometer, 2014). The contribution from the marine sector reduced from 58.86 per cent in 1991 to 32.92 per cent in 2015 whereas that of the inland sector increased from 41.14 per cent in 1991 to 65.31 per cent in 2015 (CMFRI, 2012).

In order to compensate the deficit in capture fisheries production, measures should be taken for a substantial increase in the aquaculture production which would ensure the nutritional requirements of the increasing population (Ajayakumar, 2011). Endowed with a fertile coastline of 590 km, Kerala State in the Indian peninsula has the best suitable untapped resources for the expansion of aquaculture with a varying degree of consumer preferences for Indian major carps.

Kerala witnessed 149.1 MT of inland fish production with a growth rate of 6.47 per cent and 530.6 MT of marine fish production with a negative growth rate of 4.07 per cent during 2012-13 (DAHD, 2013). Presently aquaculture bears the distinction of being one of the fastest growing food production sectors in the state (Harikumar and Rajendran, 2007).

Successful development of aquaculture directly depends on the technology development, dissemination of technology, information access, level of information usage and adoption rate. In addition, successful aquaculture development largely depends on services of various state departments, agencies, NGOs and other rural farmer developmental organizations. Equilibrium between the information inputs and information needs into the extension services can have a positive impact in the field level achievements. In India, fisheries extension is a state affair along with fisheries and aquaculture as in the case of farm extension services in agrarian

development.

Wang (2001) found that effective extension services led to increased aquaculture production. In the past, extension efforts for aquaculture development were mainly focused on transfer of technology towards fish farmers. This was only limited to the area where Fish Farmers Development Agency (FFDA) was functioning actively (Dehadrai, 1986). According to Chandrasekara (2002) and De and Sahu (2001) and World Bank (1995) functioning of public extension services cannot be extendable to all the farmers at all times. They also argued to redefine the approaches of public sector extension activities. Additionally, Planning Commission (2011) suggested that fish farmers should be informed on agriculture and livestock production along with various rural activities in order to boost production and to avoid conflicts. State fish farmers seek several sources for gathering information for aquaculture practices. Officials of the Department of Fisheries used various media as a key support in collecting information useful for fish farmers. ATMA is a registered society responsible for technology dissemination at district level (MANAGE, 2007). The major hindrance prevailing with DoF included inadequate manpower and infrastructure, improper research extension linkages and inadequate budgetary allocations (Kumar and Ananthan, 2009). This study is planned with the following objectives to understand the strengths and weaknesses in the existing aquaculture extension system in Kerala.

- To identify the weaknesses in the existing aquaculture extension system
- To identify factors contributing to fisheries development in the area

Methodology

For the study, five districts in Kerala were selected based on the highest number of fish farmers. The districts included were Kollam, Alappuzha, Kottayam, Ernakulam and Thrissur. As much as 45 fish farmers who received ATMA support were randomly selected from each of the five districts, thus, selecting a total of 225 fish farmers from all the five districts. In addition to the above, 16 ATMA Governing Body (GB) members, 16 ATMA Management Committee (MC) members and 33 Department of Fisheries (DoF) staff were also selected from each district, thus, making the total sample size to 550. Sampling for the study is presented in Table 1.

Performance appraisal

The performance appraisal indicators for farmers and officials had been explored under indicators like extension contact (x_1), information acquisition (x_2), information dissemination (x_3), ATMA activities (x_4) and expectations (x_5). Sub indicators selected for x_1 are $y_{11}, y_{21} \dots y_{(s1)1}$. Similarly, sub indicators selected for x_2 are $y_{12}, y_{22} \dots y_{(s2)2}$. A score was assigned to each, within the range 1-10, with scores being not less than 1 and not greater than 10. Then the overall total of the indicator was estimated by totaling the average scores of all the sub indicators. The maximum score for the indicator was calculated by multiplying the maximum score obtained for each indicator, that is, 10 with the number of sub indicators. The total indicator score was obtained by dividing the overall total of the indicator with the maximum score obtained.

Total indicator score for $x_1 = X_1(a) + X_2(a) + \dots + X_5(a) / 10 s_1$, where s_1 is the number of sub indicators within x_1 , $a = [y_{11} + y_{21} + \dots + y_{(s1)1}]$ and $X_1 = 1/s_1$.

Likewise, total indicator score for x_2, x_3, x_4 and x_5 within sub indicators s_2, s_3, s_4 and s_5 respectively were estimated. Total indicator score multiplied by 100 gave a total indicator score in percentage. Finally, a score summary was tabulated, indicating all the indicator scores in percentage. This score when multiplied with the corresponding frequencies gave the weighted score for each indicator. The weighted score was then arranged in descending order in order to rank the performance indicators. Performance appraisal indicators for fisheries development was explored through fish farmers' and officials' perception on different ATMA strategies. Leleua *et al.* (2012) had similarly done taking perception of fishers in the Mediterranean coast as an indicator for finding social acceptance of marine protected areas.

Development of appraisal indicators

Resource person contact index for farmers and DoF staff proficiency index for officials were selected as sub indicators. Appraisal against extension contact for farmers is presented in Table 2. Similarly, an index called 'Resource person contact index' was tabulated based on the farmers' perception of their contact with resource persons like Self Help Group (SHG) members, research station specialists, input suppliers, Panchayath members, Village Extension Workers (VEWs), bankers, Block Development Of-

ficers (BDOs), Marketing agents, KVK professionals, cooperatives and NGO personnel. A questionnaire-based survey was conducted among the farmers to identify their perception on the contact with such resource persons. The ranking for the perception of farmers' contact with resource persons was calculated on a six-point Likert scale, namely, 0- Never, 1- Half yearly, 2- Monthly, 3- Fortnightly, 4- Weekly, 5- More than once per week and 6- As per their need. The mean ranking was calculated for each resource person in every district. This mean ranking depicted the 'resource person contact index' for each resource person. The value of the index ranged in between 0 to 6. The maximum value of 'Resource person contact index' was 6 (because of 6-point Likert scale). The overall index score in a district indicated the index value for all the resource persons in that district. The maximum value of the overall index score was 66 (that is, 11 resource persons multiplied by 6-point Likert scale). The overall index score of a district represented farmers' perception on their extent of contact with all the selected resource persons in that district. The standardisation of the index was necessary for those indicators which were common to both farmers and officials who had different sub indicators. Thus, standardised index was calculated using the following formula:

Standardised index = (Actual score - Minimum score) / (Maximum score - Minimum score).

The DoF staff proficiency with respect to different factors, like, communication proficiency, linkage proficiency, farmer group mobilisation proficiency, farmer-oriented activities proficiency and information dissemination proficiency were measured using the DoF staff proficiency index.

Communication proficiency of the staff as well as linkage proficiency was determined through a number of statements. As the number of statements for checking the proficiency factors were different, both the communication proficiency and linkage proficiency of the staff need to be standardised. Similarly, the proficiency of the DoF staff in mobilising farmer groups and in conducting farmer-oriented activities and information dissemination activities was also governed by a number of statements which was finally standardised.

Garrette ranking were used to assess Farm information dissemination (FID) activity of farmers. Questionnaires were distributed among the farmers for understanding their perception on, the regularity level in disseminating FID and its level of satis-

faction. The farmers were asked to rank their perception on regularity and satisfaction obtained through FID activities. The level of regularity in conducting farm information dissemination activities had been ranked on a 4-point Likert scale, namely; 1- Rarely, 2- Occasionally, 3- As in project proposal and 4- Regularly. The level of satisfaction in dissemination of fisheries related information through the selected items had been ranked on a 4-point Likert scale, namely; 1- Not at all satisfied, 2- Not satisfactory, 3- Satisfactory and 4- Highly satisfactory. After the rankings had been completed, the following formula was used to convert the order merit into percentage.

$$\text{Per cent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

, wherein R_{ij} =

Rank given by the j^{th} farmer for the i^{th} FID activity and N_j = Number of FIDs ranked by the j^{th} farmer. Corresponding Garrette scores for each percentage position was obtained from Garrette ranking table (Vishnuvarthani and Selvaraj, 2012). The total score for each FID activity rank, in all the districts was calculated by multiplying percentage position and Garrette score for each of the FID activity. Finally, the overall score for each district was calculated

through the summation of total score obtained for each FID activity rank in that district. The overall scores thus obtained for each district, were arranged in ascending order in excel spread sheet, in order to identify the most important as well as the least FID activity of ATMA.

Results and Discussion

The category wise key performance indicators for fish farmers and officials (Auckland Council, 2012) are presented in Table 2. Five indicators had been identified for fish farmers and officials. For each indicator, sub indicators showing performance had also been identified for both fish farmers and officials.

Extension contact

The different extension methods used by extension agencies to reach the farmers refer to extension contact (Davidson *et al.*, 2001). Different appraisal indicators against extension contact are presented in Tables 3 and 4. The extent of contact of farmers with different resource persons like SHGs, specialists from research stations, input suppliers, *Panchayath* officials, Village Extension Worker (VEW), Bankers,

Table 1. Sampling frame for the study (No.'s)

Respondent category	Kollam	Alappuzha	Kottayam	Ernakulam	Thrissur
*ATMA GB members	16	16	16	16	16
**ATMA MC members	16	16	16	16	16
**DoF staff	33	33	33	33	33
**Fish farmers	45	45	45	45	45
Total	110	110	110	110	110
Grand total	550				

*There are only 16 GB members in a district in ATMA

*,**Between the districts, there was not much variation among the fish farmer beneficiaries and other respondents. Therefore, a uniform sample size from all the districts was decided.

Table 2. Category wise key performance indicators for farmers and officials

Indicators	Sub indicators showing key performance	
	Fish farmers	Officials (DoF, GB and MC)
Extension contact	Resource person contact index	DoF staff proficiency index
Information acquisition	Mass media exposure, Type of communication facility	Mass media exposure, Type of communication facility
Information dissemination	Regularity and satisfaction through farm information dissemination	Farm information dissemination activity efficiency
ATMA activities	Farmer oriented activities benefitting individual farmers	ATMA activities in aquaculture
Expectations	Perceived changes gained from ATMA	Changes expected

Block Development Officer (BDO), Marketing agents, KVK (*Krishi Vigyan Kendra* or Farm Science Centre) professionals, Cooperatives and NGOs was expressed in terms of an index namely Resource person contact index. The resource person contact index score for SHGs was the highest with 6.04 and the lowest for NGOs with 1.04. Economic impacts of SHGs in life of its members included increase in savings as well as income and access to credit at low interest rate (Rathinam and Akudugu, 2014). A major criticism on NGOs was that its role in reaching the poorest was limited (Rajendran and Raya, 2011). The total 'Extension contact' score for farmers was 0.24.

Table 3. Appraisal against extension contact for farmers

Variable	Resource person contact index
SHGs	6.04
Specialists	5.20
Input suppliers	2.00
<i>Panchayath</i> (local body)	1.57
VEW	1.55
Bankers	1.51
BDO	1.38
Marketing agents	1.10
KVK professionals	1.09
Cooperatives	1.09
NGOs	1.04
Average score obtained = 2.454	
Maximum score = 10	
Total 'Extension contact' score ($2.454 \div 10$) = 0.2454	
Total 'Extension contact' score in percentage (0.2454×100) = 24.54	

Table 4. Appraisal against extension contact for officials

Variable	DoF staff proficiency index
Communication proficiency	2.57
Linkage proficiency	1.24
Farmer group mobilisation proficiency	1.18
Farmer oriented activities proficiency	1.07
Information dissemination proficiency	0.43
Average score obtained = 3.6	
Maximum score = 10	
Total 'Extension contact' score ($3.6 \div 10$) = 0.36	
Total 'Extension contact score in percentage (0.36×100) = 36	

Range and score for each range in parenthesis: 1 - 2.1 (1), 2.2 - 3.3 (3), 3.4 - 4.5 (5), 4.6 - 5.7 (8), 5.8 - 6.9 (10)

Appraisal against extension contact for officials is presented in Table 4. The sub indicator in the case of extension contact for officials was DoF staff proficiency index which was measured in terms of proficiency with respect to communication, linkage, farmer group mobilization, farmer-oriented activities and information dissemination.

Range and score for each range in parenthesis: 0.4 - 1.1 (1), 1.2 - 1.9 (5), 2 - 2.7 (10)

Communication proficiency of DoF staff measured the extent to which they were seeking various fishery related relevant information from various information sources and the frequency of recording such information. If extension officers failed to gather and update relevant information, they could work for the farmers sensibly (Alfred and Odefadehan, 2007).

The linkage proficiency of the DoF staff indicated their level of satisfaction with respect to linkages existing in between allied departments, Research - Extension linkages, Public Private linkages, linkages with farmers organizations and GO-NGO linkages. Linkage with development departments needed to be encouraged as it could provide opportunity for technical upgradation which would ultimately benefit the aquaculture farmers (Kumaran *et al.*, 2012). Farmer group mobilisation proficiency of DoF staff implied their perception on the level of satisfaction with respect to mobilisation of farmer interest groups, women groups, farmers' organizations, commodity organizations and farmer cooperatives, in terms of its capacity building, skill development and availability of funds. Farmer Groups helped in mobilising other farmers and kept them updating with latest production practices (Felsing and Haylor, 1999). The average communication proficiency index in all the districts was 2.57 (which was the highest), while the average proficiency in linkage, farmer group mobilization, farmer-oriented activities and information dissemination were 1.24, 1.18, 1.07 and 0.43 respectively in the area. Information dissemination proficiency was the lowest which implied that the extension agents need to be proficient in disseminating farm related information through distributing leaflets, organising aqua shows and exhibitions for farmers as it can solve many problems.

Information generation and dissemination played a crucial role in development, especially in developing countries (Sani *et al.*, 2014; Oladele, 2011). Information dissemination proficiency was ranked last in the area and such activities had to be carried out

actively in all the districts. As farmer oriented activity proficiency was ranked fourth, DoF staff had to organise more such activities for farmers in the area. Singh and Singh (2014) found that only a few farmers came forward to start up new enterprises and activities like training has resulted in gaining more confidence and skill and hence such activities need to be strengthened. Farmer oriented activities like training, demonstration, exposure visit, farmer scientist interaction, reward and incentive and innovative activities has to be projected more in block action plans each year so as to avail more physical and financial allocation of resources during fund allocation. The total 'Extension contact' score for officials is 0.36.

Information acquisition

Appraisal indicators against information acquisition through sources which were not under the direct control of ATMA are presented in Tables 5 and 6. Ifukor and Omogor (2013) found out that due to the high rate of illiteracy and rural dwelling habit of the farmers, both traditional and modern information acquisition sources should be followed by the extension agents. Hence the present study has included both the information sources. The sub indicators selected for farmers and officials were mass media

exposure and communication facility utility. Mass Media Exposure helped respondents in retrieving more information, helped in developing their confidence thereby finally increasing credibility of technology (Sarma *et al.*, 2011). Exposure of farmers and officials towards media like newspaper, magazine, radio and television (TV) had been explored (Tables 5 and 6) under frequencies like Never, Occasionally, Bimonthly, Weekly and Daily. If communication facilities were adequately available, it could lead to effective development (Orbunde, 2010). The frequency with which different communication facilities like Post Office, Mobile Phone, Internet, Television, Radio and Kisan/ Farmers' Call Centre (KCC) are used by farmers and officials has been presented in Tables 5 and 6.

Appraisal against information acquisition for farmers is presented in Table 5.

Frequency range of CFU and score for each range in parenthesis: 1 - 91 (1), 92 - 183 (5), 184 - 275 (10)

Use of mass media or ICT could reduce the cost of extension to a great extent and they were effective in the first stages of adoption process (Van den Ban and Hawkins, 1996; Van and Ban, 2000). The average score obtained for newspaper was the highest (8.52) as the farmers in the study area were habitual to reading newspaper daily. As they were not ac-

Table 5. Appraisal against information acquisition for farmers

Variable	Variable score	Mass media exposure			
		Newspaper (score)	Magazine (score)	Radio (score)	TV (score)
Never	1	6	158	101	37
Occasionally	3	40	46	68	163
Bimonthly	5	0	5	24	21
Weekly	7	0	8	30	4
Daily	10	179	8	2	0
Average score obtained	8.52	2.04	2.91	2.93	
Communication Facility Utility (CFU)					
Variable				Variable frequency	
Post office				225	
Mobile phone				201	
Internet				65	
Television				198	
Radio				113	
KCC				39	
Average score obtained = 8.22					
Overall total (8.52 + 2.04+ 2.91+ 2.93+8.22) = 24.615					
Maximum score (10 x 5) = 50					
Total 'Information acquisition' score (24.62 ÷ 50) = 0.4923					
Total 'Information acquisition' score in percentage (0.4923 x 100) = 49.23					

quainted to fishery related magazines, the average score obtained for reading magazines was the lowest (2.04). All the farmers in the study area used post office as a communication facility. As the usage of mobile phones and TV were high among the farmers, the variable frequency for mobile phones and TV (201 and 198 respectively) was found to be fairly high. As the usage of KCC by farmers was the lowest, the variable frequency obtained for KCC was the lowest (39). The total 'Information acquisition' score for farmers was 0.49.

Appraisal against information acquisition for officials is presented in Table 6.

Frequency range of CFU and score for each range in parenthesis: 55 - 95 (1), 96 - 136 (5), 137 - 177 (10)

The newspapers obtained the highest (9.25) average score among the mass media. This was due to the educational and professional qualifications, as well as they being habitual readers. Likewise, they were more acquainted to fishery related magazines, the average score obtained for reading magazines is fairly high (6.18). On the contrary, the average score obtained for listening to aquaculture related programmes on radio showed a very low value (4.15). All the officials in the study area used post office and mobile phones as a communication facility. As the usage of radio by officials was the lowest,

the variable frequency obtained for radio was the lowest (27). The total 'Information acquisition' score for officials is 0.63.

Information dissemination

A viable and effective information dissemination system was required for disseminating knowledge relevant to the farming community in order to increase the crop productivity (Reddy, 2004). Appraisal indicators against information dissemination through ATMA are presented in Tables 7 and 8. The selected sub indicators give the regularity and satisfaction of farm information dissemination through aqua show, advertisement, exhibition, leaflet and technology packages shared through internet. There, existed inefficient information dissemination network for small scale farmers in agriculture and hence, FAO (2013) suggested that this could be overcome through programs that supplemented farmers with latest production details. Advertisements should be done locally to promote aquaculture farms (Oladeji, 2011) in festivals and social gatherings for creating awareness as stated by Heong and Hardy (2009). Hence, farmers should be encouraged by DoF staff and ATMA officials to advertise in local newspapers as it could show farmers where and how the farm inputs could be obtained and could

Table 6. Appraisal against information acquisition for officials

Variable	Variable score	Mass media exposure			
		Newspaper	Magazine	Radio	TV
Never	1	0	0	0	0
Occasionally	3	15	24	91	56
Bimonthly	5	0	57	53	59
Weekly	7	6	59	21	50
Daily	10	144	25	0	0
Average score obtained	9.25	6.18	4.15	4.93	
Communication Facility Utility (CFU)					
Variable				Variable frequency	
Post office				165	
Mobile phone				165	
Internet				63	
Television				120	
Radio				27	
Kisan Call Centre				57	

Average score obtained = 6.78
 Overall total (9.25 + 6.18 + 4.15 + 4.92 + 6.78 + 7.89) = 31.294
 Maximum score (10 x 5) = 50
 Total 'Information acquisition' score (31.294 ÷ 60) = 0.6259
 Total 'Information acquisition' score in percentage (0.6259 x 100) = 62.59

timely solve the problem of finding resources. Appraisal against information dissemination for farmers is presented in Table 7.

Aqua shows were organized once every year (rank 1) but dissemination through leaflet and internet was not regular (rank 4 and 5 respectively). Aqua shows earned the highest satisfaction (rank 1) as they perceived it to be regular, and satisfaction through internet, ranked least (rank 6) as farmers did not seem to be internet literate. Since exhibitions were not so regular (rank 3) farmer satisfaction was less (rank 4). Total 'Farm information dissemination' score obtained for farmers is 0.82.

Appraisal against information dissemination for officials is presented in Table 8. Farm information dissemination (FID) activity of officials had been ranked using Garrette ranking similar to that of farmers.

Exhibitions were conducted regularly (rank 1) by officials and satisfaction earned through conducting exhibitions was also found to be the best (rank1). Regularity and satisfaction score in conducting dissemination activities through internet was found to be the least. Total 'Farm information dissemination' score obtained for officials is 0.49.

ATMA activities

Appraisal indicators against ATMA activities are presented in Tables 9 and 10.

Important 11 sub indicators comprising farmer oriented and benefitting activities of the individual farmers were selected. They included training, demonstration, exposure visit, Farmer Interest Groups, farmer scientist interaction, training institutions, farm school, agriclinics, awards and Strategic Research Extension Plan (SREP). Table 9 reveals the frequency of the Farmers participation in different activities organised by the ATMA officials for the farmers.

Frequency range of FOA and score for each range in parenthesis: 1 to 76 (1), 77 to 152 (5), 153 to 228 (10)

All of the farmers participated in trainings organised by ATMA. Only a few farmers were aware of the different awards given to them under ATMA, like, award for the best farmer, awards for the best farmer group etc. Total 'ATMA activities' score for farmers was 0.8.

Appraisal against ATMA activities for officials is presented in Table 10. ATMA officials were found to be engaged in organizing activities for farmers and

Table 7. Appraisal against information dissemination for farmers

Regularity of Farm Information dissemination (FID) Variable	Mean Garrette score
Aqua show	41.56 (rank 1)
Advertisement	41.24 (rank 2)
Exhibition	41.23 (rank 3)
Leaflet	41.05 (rank 4)
Internet	39.73 (rank 5)
Garrette range of FID regularity and its score in parenthesis: 39.6 - 40.2 (1), 40.3 - 40.9 (5), 41 - 41.6 (10)	
Satisfaction through Farm information dissemination Variable	Mean Garrette score
Aqua show	42.19 (rank 1)
Exhibition	41.96 (rank 2)
Leaflet	41.85 (rank 3)
Advertisement	41.77 (rank 4)
Internet	39.61 (rank 5)
Garrette range of FID satisfaction and its score in parenthesis: 39.5 - 40.4 (1), 40.5 - 41.4 (5), 41.5 - 42.4 (10)	
Average regularity score obtained = 8.2	
Average satisfaction score obtained = 8.2	
Overall total (8.2 + 8.2) = 16.4	
Maximum score (10 x 2) = 20	
Total 'Farm information dissemination' score (16.4 ÷ 20) = 0.82	
Total 'Farm information dissemination' score in % (0.82 x 100) = 82	

Table 8. Appraisal against information dissemination for officials

Regularity of Farm Information Dissemination Variable	Mean Garrette score
Exhibition	19.39 (rank 1)
Aqua show	19.38 (rank 2)
Leaflet	20 (rank 3)
*Advertisement	19.37 (rank 4)
**Internet	19.4 (rank 5)
Garrette range of FID regularity and its score in parenthesis: 19.37-19.67 (1), 19.58-19.88 (5), 19.79-20.09 (10)	

Satisfaction through Farm Information Dissemination

Variable	Mean Garrette score
Exhibition	19.38 (rank 1)
Aqua show	19.41 (rank 2)
Leaflet	19.42 (rank 3)
Advertisement	19.4 (rank 4)
Internet	19.39 (rank 5)

Garrette range of FID satisfaction and its score in parenthesis: 19.35 -19.37 (1), 19.38-19.4 (5), 19.41-19.43 (10)

Average regularity score obtained = 2.8

Average satisfaction score obtained = 7

Overall total (2.8 + 7) = 9.8

Maximum score (10 x 2) = 20

Total 'Farm Information Dissemination' score (9.8 ÷ 20) = 0.49

Total 'Farm Information Dissemination' score in % (0.49 x 100) = 49

*Note 1: Advertisement - It could be display board placed by DoF at demonstration ponds, strategy through word of mouth, and advertisement in gathering and social festival

**Note 2: Internet- Sharing of technology packages through IT network

so frequency of organizing such farmer-oriented activities by the officials is presented in Table 10.

Expectations

As expectation/ outcome was a proximate measure of the extension efforts (Gautam, 2000), this had con-

Table 9. Appraisal against ATMA activities for farmers

Variable	Frequency
Training	225
Farmer to farmer technology dissemination at demonstration plot	197
Exposure visit	167
Farmer Interest Groups	154
Farmer Scientist interaction	150
District level training institutions	144
Farm school	94
Agriclinics	85
Awards	6
SREP	5
Average score obtained = 8.0016	
Maximum score (10 x 1) = 10	
Total 'ATMA activities' score (8.0016 ÷ 10) = 0.8002	
Total 'ATMA activities' score in % (0.80016 x 100) = 80.02	

siderable importance. Appraisal indicators against expectations are presented in Tables 11 and 12. The incorporated sub indicators were perceived changes gained by farmers from ATMA through Knowledge on Best Management Practices (KBMP), Skill Development (SD), Knowledge on Improved Farming

Table 10. Appraisal against ATMA activities for officials

Variable selection	Frequency
Training	19
Method Demonstration	22
Exposure visit	21
Technology dissemination at demonstration plot (Result demonstration)	4
Rewards and incentives	12
All	87
Average score obtained = 5.7455	
Maximum score (10 x 1) = 10	
Total 'ATMA activities' score (5.74 ÷ 10) = 0.5746	
Total 'ATMA activities' score in % (0.5746 x 100) = 57.46	

The frequency of conducting demonstration at demonstration plot need to be increased. Total 'ATMA activities' score for officials was 0.57.

Practices (KIMP), Support based on Farming needs (SBF), Increased Income (IINC), Increased Financial Support (IFS) and Marketing Support (MS) as well as changes expected by officials. Appraisal of expectations of the farmers is presented in Table 11.

The highest average score (8.47) was obtained for the knowledge on the best management practices. Average score obtained for marketing support was the least (3.64), which reflected the need for proper marketing facilities for the farmers. Total 'Expectation' score for farmers was 0.71.

Appraisal against expectations for officials is presented in Table 12.

Garrette range for DoF and its score in parenthesis: 18 - 18.7 (1), 18.8 - 19.5 (4), 19.6 - 20.3 (7), 20.4 - 21.1 (10). Garrette range for GB and its score in parenthesis: 81.81 - 81.9 (1), 81.91 - 82 (4), 82.1 - 82.19

(7), 82.2 - 82.29 (10). Garrette range for MC and its score in parenthesis: 81.45 - 81.66 (1), 81.7 - 81.99 (4), 82 - 82.21 (7), 82.31 - 82.52 (10)

Average expectation score obtained for DoF was the highest (5.5), while the average expectation score obtained for GB and MC officials was the same (5.2), probably because there were some common representatives in GB and MC. Total 'Expectation' score for officials is 0.53.

Finally, the total score obtained for five performance appraisal indicators of farmers is presented in Table 13.

A clear inference obtained from the farm information dissemination rank is that strategies of the officials are in the right direction in disseminating farm information to farmers. ATMA activity score ranked second. The expectations score ranked third

Table 11. Appraisal of expectations of the farmers

Perceived changes gained by the farmers from ATMA								
Variable	Variable score	Frequency						
		KBMP	SD	KIMP	SBF	IINC	IFS	MS
Strongly Disagree	1	3	5	7	15	19	32	98
Disagree	4	1	2	8	7	4	13	75
Agree	7	99	122	111	112	144	117	33
Strongly Agree	10	122	96	99	91	58	61	19
Average score obtained	8.47	8.12	8.03	7.72	7.21	6.78	3.64	
Overall total (8.47 + 8.12 + 8.03 + 7.72 + 7.21 + 6.78 + 3.64) = 49.978								
Maximum score (10 x 7) = 70								
Total 'Expectation' score (49.98 ÷ 70) = 0.714								
Total 'Expectation' score in percentage (0.7139 x 100) = 71.398								

Table 12. Appraisal against expectations for officials

Changes expected Variable	Mean Garrette score		
	DoF	GB	MC
Increased income	21	82.24	82.04
Increased financial support	19.94	82.03	82.2
Knowledge on improved farming practices	19.5	82.01	81.49
Skill development	19.99	82.23	81.82
Marketing support	19.9	82.02	81.94
Knowledge on Best Management Practices	19.96	82.18	82.41
Support based on farming needs	19.2	81.99	81.72
Formation of farmer groups	19.97	82.06	82.15
Increased farmer participation	18.6	81.96	81.91
More representation from women farmers	18.1	81.81	81.79
Average score obtained	5.5	5.2	5.2
Overall total (5.5 + 5.2 + 5.2) = 15.9			
Maximum score (10 x 3) = 30			
Total 'Expectation' score (15.9 ÷ 30) = 0.53			
Total 'Expectation' score in percentage (0.53 x 100) = 53			

which concluded that farmers were highly satisfied with benefits they had availed out of DoF and ATMA officials, which signified continuing these beneficiary activities among poor farmers. Only if the farmers became aware of ATMA schemes and support activities, they could avail the benefits. The different methods through which farmers could acquire farm information had to be maximized by means of hand out distribution through farmers' friend *etc.*, to help them to know about improved culture practices, disease diagnostic tactics, marketing strategies, practice innovative ideas or take up diversification of crops. The contact of resource persons with farmers is to be monitored through contact farmers identified, as there was a grievance among some farmers that they were not informed about ATMA support activities like training, demonstration and exposure visit. Such support provided through ATMA was well received among farmers and they were motivated to take up knowledge received through such activities.

So, it is imperative that ATMA officials shall organize more such activities for farmers in coming financial year. For this, ATMA officials need full

support of DoF staff, who shall propose such activities at an increasing rate in action plan so as to channel out financial assistance. The resource persons also need to be informed about the various ATMA support activities. We can use low-cost extension agents like farmer organizations, input suppliers, marketing agents, SMSs, farmer friend, farm school, NGO, post office *etc.*

Finally, the total score obtained for the five performance appraisal indicators of officials is summarized in Table 14. Farm Information acquisition was ranked first while extension contact and farm information dissemination was ranked the lowest. So officials have to reach out to more farmers and shall engage in more information dissemination activities. Henceforth, once field schools and farmer friends are assigned to DoF, contact with these persons may also be recorded as extension contact, as they do not have grass root level officers.

Performance evaluation matrix of farmers and officials is given in Table 15. It could be seen that the farm information dissemination score among farmers was the highest with rank 1, while the same was ranked 4 in the case of officials.

Table 13. Score summary of performance evaluation matrix of farmers

Performance assessment criteria	Score (%)	Frequency	Weighted score	Rank
Farm information dissemination score	82	225	18450	1
ATMA activities score	80.02	225	18005	2
Expectations score	71.39	225	16063	3
Farm information acquisition score	49.23	225	11077	4
Extension contact score	24.54	225	5521.5	5

Table 14. Score summary of performance evaluation matrix of officials

Performance assessment criteria	Score (%)	Frequency	Weighted score	Rank
Farm information acquisition score	62.59	165	10327.35	1
ATMA activities score	57.46	165	9480.9	2
Expectations score	53	325	17225	3
ATMA farm information dissemination score	49	165	8085	4
Extension contact score	36	165	5940	5

Table 15. Score summary of performance evaluation matrix of farmers and officials

Performance assessment criteria	Farmers		Officials	
	Score (%)	Rank	Score (%)	Rank
Farm information dissemination score	82	1	49	4
ATMA activities score	80.02	2	57.46	2
Expectations score	71.39	3	53	3
Farm information acquisition score	49.23	4	62.5	1
Extension contact score	24.54	5	36	5

While farmers were highly satisfied with the farm information dissemination, the officers who provided the same felt the contrary. The result from this study provides different strategic options for the officer to follow. Another interesting finding was that farmers were satisfied with ATMA farm information dissemination activities rather than with the farm information acquisition sources which were not under the direct control of ATMA. As a result, farmers themselves developed different sources for disseminating farm related information which could be observed in the high score. Greater exposure to information sources among the farmers could be a sign that they were taking up interest in farming practices (Muhammad and Garforth, 1999). This was supported by the fact that though farm information acquisition was ranked 4 among farmers, it was ranked first among officials. Thus, it was evident that officials though getting farm related information from various print and mass media sources were not disseminating the information at a level required by farmers. Non ATMA sources (Farm information acquisition sources) cannot have mass media alone as a substitute to complement extension activity. The ATMA activities score was ranked the same for farmers and officials, which indicated, the quality of the extension strategies provided by officials to farmers. Anyhow, it is advisable to increase the number of ATMA activities meant for farmers in a district through projecting such activities in Block Action Plans. The expectation score was ranked third among farmers and officials. This indicated that extension strategies through ATMA were on the whole satisfactory. But the strategies need to be further added up in order to improve the ranking among farmers and officials. The extension contact of farmers was ranked 5 by farmers and officials which was the lowest. Contact of farmers with resource persons has to be encouraged as the inability of farmers to contact with extension agents will affect their perception and awareness on various production technologies. Research areas are created as a result of extension agents' visit to farmers' field/home and feedback can be provided to researchers, thus, contributing to fisheries development.

Conclusion

Aquaculture extension system in India was limited to Fish Farmers Development Agency (FFDA) and Brackish water Farmers Development Agency

(BFDA). Their focus was entirely on the transfer of technology and during the course of time, its role expanded through various established linkages. On the contrary, the contemporary scenario existing in our country demands more proactive action from policy makers and service providers. The requirement of high protein food for the ever-increasing population of the country has exerted severe pressure on demand and availability of food. It is an unequivocal proposition that, the aquaculture development in the country would satisfy the nutritional food security and the development will certainly provide employment to millions. The inertia set by the extension service system in aquaculture development could be marked as ineffective or insufficient in present context. Farmers lack frequent access to information from various sources. DoF and ATMA officials have raised concerns over lack of physical and human resources in order to be effective in information dissemination, moral, technical and skilled support meant for aquaculture practitioners. Several parameters have shown the poor linkages existing between the three categories of respondents (i.e., Fish farmers, DoF staff and ATMA officials) due to financial and technical limitations. Limited dialogues happened between fish farmers and scientific personnel. The performance appraisal done in the study would positively contribute to improving the aquaculture extension services meant for fish farmers. As effective aquaculture extension services could contribute to development of the sector, practicing an improvised version of services by the officials could lead to aquaculture development, thereby ensuring food security.

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