

# Aquaculture extension among farmers: Policy implications

Nisha Elizabeth Joshua\*, S. N. Ojha<sup>1</sup>, Sheela Immanuel<sup>2</sup> and Shyam S. Salim<sup>3</sup>

<sup>1</sup>*Fisheries Economics Extension and Statistics Division, Central Institute of Fisheries Education, Mumbai 400 061, India*

<sup>2</sup>*Social Science Section, Central Tuber Crops Research Institute, Thiruvananthapuram 695 017, Kerala, India*

<sup>3</sup>*Socio-Economic Evaluation and Technology Transfer Division, Central Marine Fisheries Research Institute, Kochi 682 018, India*

(Received 26 October, 2014; accepted 1 January, 2015)

## ABSTRACT

The study was conducted in five districts which had the highest inland fish farmer population in Kerala. Primary data were collected from 225 aquaculture farmers who availed support through the Agricultural Technology Management Agency (ATMA) and from 165 Department of Fisheries (DoF) staff officials who provided ATMA support to farmers. Contact of farmers with various resource persons was quantified by resource person contact index from the perspective of both farmers and DoF staff, thereafter, to find that there was no significant difference in the index scores, which indicated adequate rapport between farmers and resource persons. Regularity of different farm information dissemination activities conducted by ATMA and satisfaction arising out of it, was assessed among farmers, by means of Garrett method. The different sources through which farmers became aware of ATMA were found out. Policy suggestions were proposed to improve the extension support meant for farmers, which would help in aquaculture development.

*Key words* : ATMA, Resource Person Contact Index, Farm Information Dissemination Activity Efficiency, Aquaculture, Policy Suggestions

## Introduction

Fisheries and aquaculture play sententious role in providing food and income, either singly or combined with agriculture and livestock rearing in many developing countries (World Fish Centre, 2011). The farmer, the nucleus in aquaculture production would be surrounded by resources like inputs, services and markets for its operation. An effective farmer extension agency paved its correct path for farmers to the timely access to such re-

sources to gain quality inputs, equipments, advisory services, institutional credit, exclude middle men and command better prices for their products and mobilise them for better farm management practices (Kumaran *et al.*, 2012). The extension officers should be competent and should have concern for his client, as customer satisfaction was a measure of quality extension services delivered to its clients (Allen, 2004). Effective rendering of extension services could boost aquaculture production (Wang, 2001) and could lead to the economic upliftment of rural

<sup>1,2</sup>Principal Scientist, <sup>3</sup>Senior Scientist

\*Corresponding author's email : nisha.joshua@gmail.com

PhD Research Scholar, Fisheries Economics Extension and Statistics Division, Central Institute of Fisheries Education, Mumbai 400 061, India

poor fish farmers (Omoyeni and Yisa, 2005; Tu and Giang, 2002; Udo *et al.*, 2005). Agricultural Technology Management Agency (ATMA) is a registered society of key stakeholders engaged in technology dissemination at the district level, involved in agricultural and allied activities, for its sustainable development (MANAGE, 2007). Through ATMA, the officials in agriculture and allied departments in association with the Department of Fisheries (DoF) staff started encouraging aquaculture, with new projects and schemes, supporting the fish farmers by means of activities like training, demonstration, exposure visit, rewards and incentives and other innovative activities. In this background, a study was conducted among the ATMA beneficiaries to assess the existing extension support provided to them.

## Materials and Methods

A list of fish farmers who were the beneficiaries of

ATMA supported activities were obtained from the DoF for the year 2010 to 2012 in five districts, which had the highest inland fish farmer population, namely Kollam, Alappuzha, Kottayam, Ernakulam and Thrissur (DoF, 2010). Between these districts, there was not much variation among the fish farmer beneficiaries. Therefore, a uniform sample size of all the districts was decided. A total of 45 fish farmers who had received ATMA support were randomly chosen from each of the five districts, thus, selecting a total of 225 fish farmers from all the five districts. In addition, 33 Department of Fisheries (DoF) staff was also selected from each district, thus, making the total sample size to 390. Primary data were collected through administering schedule among the respondents. Statistical tools available in SPSS 16.0 and MS Excel were used.

Brief description and measurement of variables selected for respondents was presented in Table 1.

**Table 1.** Brief description and measurement of variables

Variables	Description	Measurement (score/codes are indicated in parentheses)	Justification
Resource person contact index	Contact a fish farmer had with development or extension agents for advice	Score: Each extension personnel contacted was scored as 1, i.e., VEWs (1): BDOs (1): Specialists from research stations (1): Input suppliers (1): Marketing agents (1): Bankers (1): KVK professionals (1): NGOs (1): SHGs (1): Cooperatives (1): <i>Panchayath</i> members (1): Further, accessing regularity for each such extension personnel contacted was scored as: Never (0): Half yearly (1): Monthly (2): Weekly (4): More than once per week (5): As per need (6)	The relative importance of extension personnel could not be differentiated and so an equal score of 1 was given for it. Those resource persons who were accessed more regularly was given a higher score
Regularity and satisfaction of farm information dissemination activity	Regularity in information dissemination through different sources and satisfaction arising from conducting such activities	Score. Each information dissemination method score (1), i.e., District level exhibitions (1): Aqua shows (1): Printed leaflets (1): Local advertisements (1): Internet (1). Further level of regularity of each method was scored as, Regularly (3): Rarely (2): Occasionally (1): Don't Know (0). Level of satisfaction for each method was scored as, Highly Satisfactory (4): Satisfactory (3): Unsatisfactory (2): Highly Unsatisfactory (1)	The relative importance of each information dissemination method couldnot be differentiated and so an equal score of 1 was given. Those information dissemination methods which were more regular and which resulted in higher satisfaction level were given higher scores

**Results and Discussion**

Farmers' contact with resource persons was expressed as 'Resource person contact index of farmer' and presented in Table 2.

All fish farmers were aware of resource persons to whom they approached in times of need. The index score for SHGs was the highest with 4.4 (73%) and the lowest for NGOs with 1.4 (24%). The overall index score for 11 resource persons was the highest in Alappuzha with 39.5 (60%) and the least in Ernakulam with 33.2 (50%). As lot of extension work was required for improvement of aquaculture (Khan *et al.*, 1998), resource persons could gain access to resources, in the case of poor farmers who had less capital, assets and institutional support as inspected

by Hoang *et al.* (2006). DoF staff perception on fish farmers' contact with resource persons was expressed as 'Resource person contact index' and presented in Table 3.

The index score for specialists from research stations and institutes was the highest with a score of 4.3 (72%) and the least score was for bankers with a score of 3.3 (64%). The overall index score for 11 resource persons was the highest in Alappuzha district with a score of 44.3 (67%) and least in Thrissur with a score of 40.1 (61%). The index was the highest in Alappuzha, because DoF staff was active in disseminating and promoting aquaculture initiatives among farmers. Moreover, Assistant Director of Fisheries happened to be a professional graduate in Fisheries Science, thus making aquaculture activi-

**Table 2.** Resource person contact index of farmer (n=225)

Resource persons	Kollam (n <sub>1</sub> =45)	Alappuzha (n <sub>2</sub> =45)	Kottayam (n <sub>3</sub> =45)	Ernakulam (n <sub>4</sub> =45)	Thrissur (n <sub>5</sub> =45)	Average (n=225)	Rank
SHGs (out of 6)	4.3 (71.5)	4.5 (75.6)	4.5 (75.6)	4.2 (70.7)	4.4 (73.3)	4.4 (73.3)	1
Specialists (out of 6)	3.5 (58.9)	5.3 (88.5)	5.2 (85.9)	3.2 (53.7)	4.6 (76.3)	4.4 (72.7)	2
Input suppliers (out of 6)	3.5 (58.2)	4.1 (68.5)	4.2 (70.7)	3.7 (62.2)	4.8 (80.7)	4.1 (68.1)	3
<i>Panchayath</i> (out of 6)	3.8 (63)	4.1 (68.9)	3.9 (66.3)	4 (67.4)	3.8 (63.7)	3.9 (65.9)	4
VEW (out of 6)	4.2 (69.2)	4.2 (70)	4 (67)	3.9 (65.9)	2.9 (48.9)	3.9 (64.2)	5
Bankers (out of 6)	4.1 (68.9)	3.7 (61.5)	3.7 (61.5)	3.7 (62.2)	2.9 (49.6)	3.6 (60.7)	6
BDO (out of 6)	2.6 (44.1)	3.7 (61.5)	3.2 (52.6)	2.4 (39.3)	2.9 (47.8)	2.9 (49)	7
Marketing agents (out of 6)	2 (33.3)	2.7 (45.2)	3.2 (53.3)	2 (34.1)	4.4 (72.6)	2.9 (47.7)	8
KVK professionals (out of 6)	2.7 (44.4)	2.9 (48.9)	3.2 (52.9)	2.3 (38.1)	2.8 (47)	2.8 (46.3)	9
Cooperatives (out of 6)	2.1 (34.8)	2.9 (49.6)	2.9 (47.8)	1.8 (29.6)	2.9 (48.5)	2.5 (42.1)	10
NGOs (out of 6)	1.2 (20.7)	1.2 (20.7)	0.98 (16.3)	1.8(30.4)	1.9 (31.5)	1.4 (23.9)	11
Overall index score (out of 66)	34 (51.6)	39.5 (60)	39 (59.1)	33.2 (50.3)	38.4 (58.2)	36.7 (55.6)	12

(The corresponding percentages are indicated in parenthesis)

**Table 3.** Resource person contact index according to DoF staff (n=165)

Resource persons	Kollam (n <sub>1</sub> =33)	Alappuzha (n <sub>2</sub> =33)	Kottayam (n <sub>3</sub> =33)	Ernakulam (n <sub>4</sub> =33)	Thrissur (n <sub>5</sub> =33)	Average (n=165)
Specialists (out of 6)	4.5 (75)	3.9 (65)	4.4 (73.3)	4.8 (80)	4 (66.7)	4.3 (71.7)
VEW (out of 6)	4.7 (78.3)	4 (66.7)	3.9 (65)	4.6 (76.7)	3.9 (65)	4.2 (70)
NGOs (out of 6)	5.6 (93.3)	5 (83.3)	3.3 (55)	4.3 (71.7)	3 (50)	4.1(68.3)
BDO (out of 6)	4 (66.7)	3.5 (58.3)	4.3 (71.7)	4.4 (73.3)	3.8 (63.3)	4 (66.7)
SHGs (out of 6)	3.7 (61.7)	4.5 (75)	3.8 (63.3)	3.7 (61.7)	4.2 (70)	3.9 (65)
Marketing agents (out of 6)	3.4 (56.7)	4.5 (75)	3.7 (61.7)	3.8 (63.3)	3.8 (63.3)	3.8 (63.3)
Input suppliers (out of 6)	3.5 (58.3)	3.7 (61.7)	3.8 (63.3)	4.1 (68.3)	3.4 (56.7)	3.7 (61.7)
KVK professionals (out of 6)	4.1 (68.3)	3.8 (63.3)	3.7 (61.7)	3.5 (58.3)	3.5 (58.3)	3.6 (60)
Cooperatives (out of 6)	3.2 (53.3)	4.1 (68.3)	3.9 (65)	3.4(56.7)	3.5 (58.3)	3.5 (58.3)
<i>Panchayath</i> (out of 6)	3.2 (53.3)	3.4 (56.7)	3.6 (60)	3.1(51.7)	3.8 (63.3)	3.4 (56.7)
Bankers (out of 6)	3 (50)	3.2 (53.3)	3.7 (61.7)	3.5 (58.3)	3.1 (51.7)	3.3 (55)
Overall index score (out of 66)	42.9 (65)	44.3 (67.1)	42.6 (64.5)	43.8 (66.4)	40.1 (60.8)	42.6 (64.5)

(The corresponding percentages are indicated in parenthesis)

ties to be mainstreamed in front of ATMA officials. The index was the least in Thrissur, because this district favoured agricultural activities compared to aquaculture. The index for marketing agents and input suppliers was 3.8 and 3.7 respectively. Kendall's tau correlations for resource person contact index of farmers as perceived by farmers and DoF staff is presented in Table 4.

**Table 4.** Kendall's tau correlations for resource person contact index of farmers

Test Statistics	
Kendall's W <sup>a</sup>	.028
Chi-Square	.333
Asymp. Sig. (2- tailed)	.564

a. Kendall's Coefficient of Concordance

As the p value was found to be more than 0.05 through Kendall's coefficient of concordance, there was no significant difference in the index scores as observed by farmers and DoF staff. This indicated that there existed adequate rapport between those farmers and resource persons. Regularity of Farm information dissemination through aqua show, advertisement, exhibition, leaflet, and sharing of technology package through the Internet was assessed through Garrette ranking and presented in Table 5.

Aqua shows was organised once in every year (rank 1) but dissemination through leaflet and IT was not regular (rank 5 and 6 respectively). Fre-

quency of conducting aqua shows could be increased as it could bring together farmers from various places and they could be motivated through distributing prizes for finest harvest, best value added products and best novelty in farming operations, as referred by Anderson (2003). 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). Exhibitions should be arranged to disseminate scientific information (Sandhu and Dhillon, 2005) and to distribute inputs like seed kits in association with universities, scientists, public and private agencies and NGOs as opined by Shanmugasundaram (2004). More leaflets should be produced by DoF as Heong *et al.* (1998) observed that the most commonly cited source farmers heard from was a leaflet, as it could provide information on innovation and its consequences. Subsidies should be availed for the growth of community owned internet centers as Cecchini and Scott (2003) found out that very few farmers in India owned computer with internet access. Information access through the internet could lead to women empowerment as found in developing countries by Haffkin and Taggart (2001). Satisfaction of Farm information dissemination through the Aqua show, Leaflet, Advertisement, Exhibition and Internet were assessed through Garrette ranking in Table 6.

Aqua shows earned the highest satisfaction (rank 1) as they perceived it to be regular, and satisfaction

**Table 5.** Mean Garrette score for assessing regularity of 'Farm information dissemination activity'.

Activity	Kollam (n <sub>1</sub> =45)	Alappuzha (n <sub>2</sub> =45)	Kottayam (n <sub>3</sub> =45)	Ernakulam (n <sub>4</sub> =45)	Thrissur (n <sub>5</sub> =45)	Total (n=225)	Rank
Aqua show	210.19	207.96	205.56	207.78	207.59	41.56	1
Advertisement	205.00	207.41	207.04	204.44	207.22	41.24	2
Exhibition	206.29	207.78	204.63	207.22	205.00	41.23	3
Leaflet	208.33	206.85	206.48	201.11	203.52	41.05	4
Internet	196.67	202.59	199.26	199.44	195.19	39.73	5

**Table 6.** Mean Garrette score for assessing the satisfaction of 'Farm information dissemination activity'

Activity	Kollam (n <sub>1</sub> =45)	Alappuzha (n <sub>2</sub> =45)	Kottayam (n <sub>3</sub> =45)	Ernakulam (n <sub>4</sub> =45)	Thrissur (n <sub>5</sub> =45)	Total (n=225)	Rank
Aqua show	210.93	211.67	208.33	212.22	211.67	42.19	1
Leaflet	210.19	208.33	209.63	209.26	208.89	41.85	2
Advertisement	211.67	209.44	213.52	203.15	206.48	41.77	3
Exhibition	208.33	212.22	209.26	210	209.26	41.96	4
Internet	200	198.7	197.96	198.89	194.63	39.61	5

through the 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). Mean regularity and mean satisfaction through aqua show ranked first and hence farm information dissemination activity efficiency through aqua shows was the best according to farmers. Mean regularity and mean satisfaction obtained through sharing of technology packages through internet, ranked last (rank 6) and hence efficiency through the internet was the least. Through displays and judging in aqua show, a sort of competition could be aroused among the participating farmers, which would motivate them to strive for better farming operations, leading to best produce and income.

It is important that farmers should be timely, informed about the various farmer oriented activities conducted by ATMA and hence, the different sources through which farmers would become aware of ATMA scheme and programmes were found out through percentage analysis. Various sources like extension agent, neighbour, friend, social worker, coordinator and other farmers through which farmers came to know about ATMA support was presented in Fig. 1.

The majority (36.9%) depended on extension agents for knowing on ATMA support while only 11 per cent of other farmers intimated them on ATMA support activities that could be availed. The reach of aquaculture extension agents among farmers was questionable as an extension agent to fish farmer ratio was less. Around 36 per cent of fish farmers

tried to contact extension agents, for information access, who were not easily available. As access to information was positively related to adoption behavior of farmers as opined by Yirga (2007), farmers should gain access to information from neighbours, friends, social workers, BTMs and coordinators (Korsching and Hoban, 1990). Once they hear about key information they could approach DoF/ATMA official to get more information.

**Policy suggestions**

1. As women were found to be proactive, active ones should be motivated to form SHGs for mussel culture, ornamental fish culture, net mending and repairing, value addition like pickling, ready to eat dishes like cutlets, fish fingers and fish balls which would supplement household income and improve competency.
2. SHGs could utilise NABARD SHG bank linkage programme initiated by Government to avail microcredit assistance for starting small scale homestead activities which required comparatively less seed money.
3. As farmer funds were transferable only to farmer groups in ATMA, it was advisable to form women SHGs to meet expenses in running the venture.
4. Technologies developed by scientists should be in accordance with the farmer’s locale, needs, minimising leverage, increasing production and income. The farmers’ needs and problems could be identified by familiarising with a Strategic Research Extension Plan (SREP) and Block Ac-

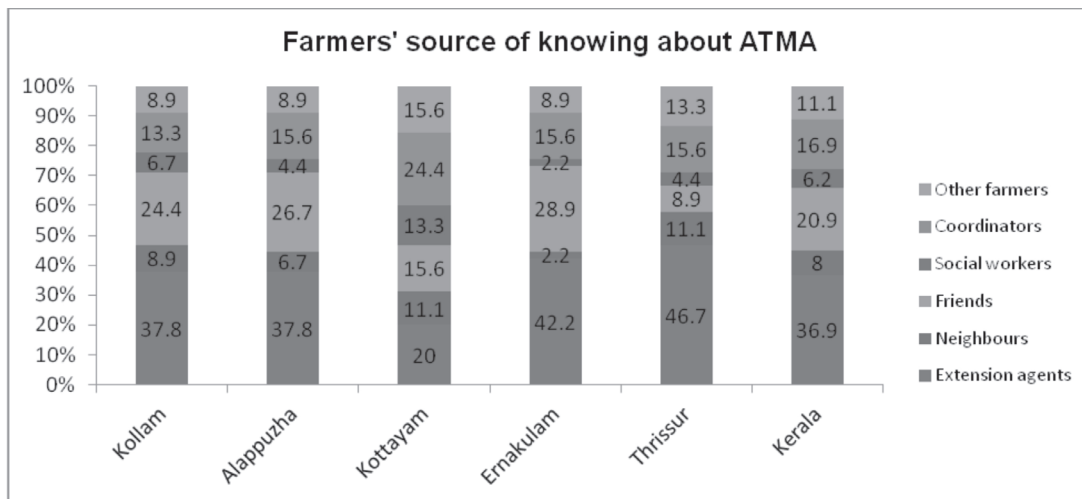


Fig. 1. Farmers’ source of knowing about ATMA (n=225)



- tion Plan (BAP).
5. The performance feedback of technologies extended to farmers should be sought through extension agents for any improvement.
  6. ATMA in coordination with state DoF should organise melas where farmers, input suppliers, specialists and marketing agents would be brought together so that they could establish contact with needful resource persons.
  7. Farmers should be aware of several beneficiary programmes operated at *Panchayath* level only after establishing contact and rapport with the *Panchayath* members. Under *Panchayath Raj* system, Gram *Panchayath* enjoyed more administrative authority and so farmer needs and problems could be brought to the attention of the District Panchayath representative who was Governing Board member in ATMA.
  8. Village Extension workers should identify needy farmers so as to supply necessary inputs in the form of seed, feed, capital *etc.* to eradicate poverty and food insecurity.
  9. Loan amount and repayment term specified by development banks should take into account the risk bearable by fish farmers as aquaculture practices were highly subjected to risk, like, disease outbreak, mass mortality of cultivated species *etc.* Only when the banks tended to be farmer friendly, with respect to ease of access in procuring bank loans, affordable interest rates, flexibility in repayment *etc.*, farmers would approach banks for their farm credit needs. As most of the small farmers needed small, short term loans, microcredit programme should be encouraged by respective officials.
  10. Proper linkage should be established between BDOs and agriculture and allied departments to ensure support to farmers through advisory services, training and financial support.
  11. KVK should concentrate more on fish farmers for giving training on food fish and ornamental fish culture and integrated fish culture, Best Management Practices *etc.* On farm testing of aquaculture species should be encouraged as testing and validation of culture practices could motivate fish farmer to adopt recommended practices.
  12. Well educated farmers could be motivated to join cooperatives that would help in procuring raw materials and protect from exploitation of market intermediaries. Such educated farmers, if active members of cooperatives, after making a profit could act as trend setters to less educated poor farmers who did not have membership in cooperative societies.
  13. NGOs should mobilise farmers in forming Fish Farmer groups, Women's groups, Commodity groups and women/men SHGs, because in ATMA, the funds sanctioned to Deputy Director of Fisheries could be released only through Farmer Groups. As most of the fish farmers were less educated and were less aware of beneficiary schemes, NGOs should help farmers in channelling funds to them through several schemes like ATMA, *Matsyakeralam* project *etc.* and through bilateral and multilateral donors and through providing microfinance. NGOs should carry out awareness and skill enrichment programmes to poor fish farmers so that they would be enlightened to take up income generating activities like aquaculture, value addition *etc.*
  14. KVK should come out with aquaculture oriented activities increasingly so that farmers would contact them frequently.
  15. The cooperative and *Panchayath* members could disseminate promptly farmer oriented activities organised by ATMA to farmers because of less staff support in DoF, so that farmers would perceive them to be friendly and would frequently approach them.
  16. The lead bank officer who was a member in GB and MC should freely interact with farmers, which would persuade farmers to approach them without any further thoughts on matters like taking farm loans and subsidy related issues.
  17. DoF staff should concentrate on organising fish farmers to form SHGs and should guide them in making it successful. The venturesome and profitably running SHGs would prompt farmers in visiting them and knowing its activities so that they would also think of taking up similar groups in the anticipation of getting good earnings.
  18. VEW, NGO and BDO should inform farmers on schedule of training, demonstration and exposure visit organised by ATMA, as a result of which more farmers would visit such personnel to inquire about these activities.
  19. Among ATMA support activities, farmer scientist interaction was less, which should be taken

- care of. Through these interactions, farmers could directly ask queries to aquaculture experts on farm culture for which, could they get direct answer and also techniques to boost the production.
20. Extension agents and coordinators should enthusiastically visit farms in each block. In some places farmers were not getting sufficient support from coordinators and such coordinators are to be replaced.
  21. Aqua show could be organised twice a year, so that they could perform well like other successful farmers in an upcoming show.
  22. 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 timely solve the problem of finding resources.
  23. The local community could be involved and informed about farm benefits that could be obtained through ATMA by regularly conducting an exhibition extending for a few weeks. Display boards, motion pictures and stalls of fish farmers selling harvest or cooked items out of harvest could be placed on exhibition to attract farmers towards adopting various culture practices so as to increase their income. Entertainment activities could also be involved in exhibitions, which might attract farmers from distant locales to attend it. Exhibition catalogues could be displayed in public places, where the farmers were likely to visit. In order to capture the curiosity and popularity, catalogues could be distributed among people well in advance. Farmer to Farmer extension approach could be promoted in exhibitions, where successful and innovative farmers could pass information on aquaculture activities to interested rural resource poor farmers. As farmers themselves would be disseminating knowledge they had gained through practical experience in Farmer to Farmer extension approach, another fellow farmer would perceive such transferred information to be credible.
  24. *Kisan Ghoshties* should give preference to fisheries activities, unlike it is now, in the study area.
  25. In leaflets, a message to encourage farmers to contact the state DoF and ATMA officials, for accessing culture related information could be incorporated. Most of the fish farmers were satisfied with information dissemination through leaflets, as they provided basic and concise information on farming related activities, and so it was advisable to distribute more leaflets on various culture and species types.
  26. Softwares should be developed by prominent fisheries institutions, which could help farmers in accessing information through databases, developed which contained details on farm information, pond management, marketing details etc. Most of the local farmers were unaware of fast communication and information dissemination possible through the internet and so enlightenment programs aimed at basic computer and internet training to old as well young farmers was to be done. Educated young farmers could easily catch up with the computer courses offered and they could extend this knowledge to fellow old farmers. Information access to rural women through internet was to be ensured through giving rewards for attending such courses as they used to get sidelined due to low education, male dominance and male oriented extension efforts. Those families who could not afford to buy computers could compensate it through using mobile phones which now could be topped up with nominal charges for getting internet connectivity.

## Conclusion

Contact of farmers with various resource persons was quantified by means of a resource person contact index from the perspective of both farmers and DoF staff, thereafter, to find that there was no significant difference in the resource person contact index scores as perceived by farmers and DoF staff, which furnished adequate rapport between farmers and resource persons. Regularity and satisfaction through aqua shows was ranked highest among farmers through Garrette ranking method, whereas the same for sharing of technology packages through internet ranked last. Around 37 per cent of the farmers depended on extension agents for knowing ATMA scheme. Policy suggestions were proposed at the end to improve the extension activities meant for farmers, which would ultimately help in the development of aquaculture.

## References

Allen, D. R.2004. Customer satisfaction research manage-

- ment: A comprehensive guide to integrating customer loyalty and satisfaction in the management of complex organisations. *Published by Milwaukee: ASQ Quality Press.*
- Anderson, J. and Feder, G. 2003. Rural extension services. World Bank policy research working paper, No. 2976. *Published by World Bank.* Washington DC.
- Cecchini, S. and Scott, C. 2003. Can information and communications technology applications contribute to poverty reduction? Lessons from rural India. *Information Technology for Development.* 10 : 73-84.
- DoF- Department of Fisheries, 2010. Kerala inland fisheries statistics. Government of Kerala. Thiruvananthapuram. [Online]. Available at <http://www.fisheries.kerala.gov.in/images/publications/Inland%20%20Statistics%202010%20Final.docx.pdf>. [Accessed on 19 July 2014].
- Haffkin, N. and Taggart, N. 2001. Gender, Information Technology and development study: An analytic study. [Online]. Available at [https://bearspace.baylor.edu/Hope\\_Koch/Teaching/Leadership/MIS%20Sharepoint/2009010/Research%20Project/Articles/Gender%20Information%20Technology%20and%20Developing%20Countries-An%20analytic%20study.pdf](https://bearspace.baylor.edu/Hope_Koch/Teaching/Leadership/MIS%20Sharepoint/2009010/Research%20Project/Articles/Gender%20Information%20Technology%20and%20Developing%20Countries-An%20analytic%20study.pdf). [Accessed on 16 February 2014].
- Heong, K. L. and Hardy, B. (ed.). 2009. Planthoppers: New threats to the sustainability of intensive rice production systems in Asia in India, *International Rice Research Institute.* Los Baines, pp. 454.
- Heong, K. L., Escalada, M. M., Huan, N. H. and Mai, V. 1998. Use of communication media in changing rice farmers' pest management in the Mekong Delta, Vietnam. *Crop Protection.* 17 (5) : 413-425.
- Hoang, L. A., Castella, J. C., Novosad, P. 2006. Social networks and information access: Implications for agricultural extension in a rice farming community in Northern Vietnam. *Agriculture and Human values.* 23 : 513- 527.
- Khan, A. N. M., Rahman, A. I. and Islam, M. A. 1998. Factors causing difficulty in pond fish culture in a selected area of Mymensingh district. *Bangladesh J. Aquaculture.* 20 : 23-27.
- Korsching, P. F. and Hoban, T. J. 1990. Relationships between information sources and farmers' conservation perceptions and behavior. *Society & Natural Resources: An International Journal.* 3 (1) : 1-8.
- Kumaran, M., Vimala, D. D. Chandrasekaran, V. S., Alagappan, M., Raja, S., 2012. Extension approach for an effective fisheries and aquaculture extension service in India. *The Journal of Agricultural Education and Extension.* 18 (3) : 247-267. DOI:10.1080/1389224X.2012.670442.
- MANAGE, 2007. Agricultural extension approach for XI Five year plan. [Online]. Available at <http://www.manage.gov.in/extnref/XI-RECOMMENDATIONS.pdf>. [Accessed on 17 April 2013].
- Oladeji, J. O. 2011. Farmers' perception of agricultural advertisements in Nigerian newspapers in Ibadan municipality, Oyo State, Nigeria. *Journal of Media and Communication Studies.* 3(3) : 97-101.
- Omoyeni, B. A. and Yisa, J. J. 2005. Enhancement of fish production in Borno state with extension services. In: Araoye, P.A. (ed.), Proceedings of the annual conference of the fisheries society of Nigeria (FISON). Apapa, Lagos, Nigeria: *Fisheries Society of Nigeria.* pp. 658-662.
- Tu, N. V. and Giang, T. T. 2002. Improving the efficiency of aquaculture extension activity in the Southeastern provinces of Southern Vietnam. In: Edwards, P., Demaine, H. and Little, D.C. (ed.), *Rural Aquaculture.* Wallingford, UK: *CABI Publication.* pp. 285-300.
- Udo, M. T., Okon, A. O., Lebo, P. E., Ikpe, G. B. 2005. Improving aquaculture through increased fisheries extension research. In: Araoye, P. A. (ed.), Proceedings of the 19th Annual conference of the fisheries society of Nigeria. Apapa, Lagos, Nigeria: *Fisheries Society of Nigeria.* pp. 54-57.
- Sandhu, A. S., Dhillon, W. S. 2005. Horticultural extension education and training programs for the development of horticulture in Punjab state of India. *Acta Horticulturae.* 672 : 325-330.
- Shanmugasundaram, S. 2004. Improving income and nutrition by incorporating Mung bean in cereal fallows in the Indo Gangetic plains of South Asia, Proceedings of the Final Workshop and Planning Meeting. In: Bains, T. S., Brar, J. S., Singh, G., Sekhon, H. S. and Kooner, B. S., Status of production and distribution of mungbean seed in different cropping seasons, Department of Plant Breeding, *Genetics and Biotechnology.* Punjab Agricultural University, Ludhiana, Punjab, pp. 104-115.
- Wang, Y. 2001. China P.R.1: A Review of National Aquaculture Development. In: *Aquaculture in the Third Millennium, Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok: NACA and Rome: FAO.*
- World Fish Centre, 2011. Aquaculture, fisheries, poverty and food security. Working Paper r2011-65. [Online]. Available at [http://www.worldfishcenter.org/resource\\_centre/WF\\_2971.pdf](http://www.worldfishcenter.org/resource_centre/WF_2971.pdf). [Accessed on 18 June 2014].
- Yirga, C. T. 2007. The dynamics of soil degradation and incentives for optimal management in Central Highlands of Ethiopia, Ph.D. Thesis (unpublished), *Department of agricultural economics, extension and rural development, University of Pretoria.* South Africa.