



Development of mobile based fishery advisory prototype: An experience with fisher tribes of Garo Hills in North-Eastern Himalayan region of India

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ABSTRACT

Meghalaya is one of the major fish consuming states in India, but fish is in short supply in the state due to inadequate domestic production to match its growing demand. Farmers of north-eastern hilly region of India, particularly the Garo Hill farmers are very much in need of scientific information on fish farming techniques, capacity building and training for sustainable fish farming in the area. The present study attempted to develop a mobile based fishery advisory prototype in Garo Hills of Meghalaya as an alternate method of fishery extension to deliver right information at right time for Garo tribal farmers. Two thousand farmers from 65 villages (1000 farmers each from West Garo Hills District and South-West Garo Hills District) were registered in Interactive Voice Response System (IVRS) with their farm details and mobile numbers. The major features of the system were to deliver the farm advisories (Pull Based) and information services (Push Based) using the software platform 'Interactive Information Dissemination System (IIDS 2.0)'. The study revealed that majority of the farmers were seeking information on source of fingerling (31.85%), information on training in fisheries (19.32%), feeding management (10.18%) and subsidies/schemes (9.66%) respectively. The seasonal distribution of calls received revealed that majority of queries were received from the farmers during monsoon season. It was also found that clarity (4.5) and usefulness (4.5) of messages ranked highest in terms of average perceived credibility scores in 5 point continuum against different parameters. Further, the inclusion of need based training programme and convergence with public and private extension system helped to develop an ICT based Stakeholder Interface (Experts-Line Departments-Fishpreneurs-Fish Farmers) in the region.

Keywords: Fishery advisory services, Fishery information, Garo Tribe, Information and Communication Technology, Mobile extension, Pushed message credibility

Introduction

There is a tremendous potential for developing aquaculture in Meghalaya due to its vast inland fishery resources. Total land under fish ponds in Meghalaya was estimated to be about 2500 ha in 2014, out of which Bheel and Lake areas were 399.6 ha and water area suitable for composite fish farming was 404.6 ha (DoF, 2014). The state produced about 4500 t of fish during 2010-12, which remained stagnant from early 1990s. On the contrary, number of fingerlings produced in the state increased from 4.0 lakhs in 1988-89 to 29.6 lakhs in 2010-11 (DoF, 2014). Thus, the state was far behind in exploiting the potential of these natural resources. Meghalaya is one of the major fish consuming states in India, but fish is in short supply due to inadequate domestic production to match its growing demand. The share of fisheries in total state agricultural GDP in Meghalaya was only 1.15% against 5.2% of the national average in the year 2010-11 (DoF, 2014). The *per capita* annual consumption of fish was 6.425 kg in Meghalaya in 2004-05 against 7.096 kg of national

average. The total consumption in the state was estimated at 19,000 t in 2011. Thus, there was a gap of about 14,500 t between demand and supply (DoF, 2014). To address this issue, Govt. of Meghalaya started Meghalaya State Aquaculture Mission (MSAM) under 12th five year plan (2012-17), aiming at area and productivity expansion of fisheries and aquaculture in the state under various mini missions. Capacity building and human resource development programmes were undertaken under the Mini Mission-IV by addressing capacity building of the stakeholders as well as creating and strengthening the training infrastructure. The programme also had Management Information System (MIS) applications providing managers with information about sales, inventories and other data that would help in managing the enterprise for registration of beneficiaries, financial data, reports and management decisions (MBDA, 2014). But, the programme did not make any serious attempt to develop a well organised fishery advisory system to disseminate need based, timely, authentic and continuous

delivery of scientific information to the fish farmers in the state. Fisheries research and extension systems need integration in their functioning for the regular flow of information in both the directions (Kumaran *et al.*, 2012). There are always some issues in fisheries management when dealing with multiple and conflicting objectives, diverse and competing claims of resources and production and high levels of uncertainty in the production process (Smith *et al.*, 1999). Easy access to right information in the right format at the right time and from the right source for the stakeholders in general and fish farmers in particular may help to deal these issues more efficiently (Opara, 2008).

Farmers of north-eastern hilly region of India, particularly of Garo Hills are very much in need of scientific fish farming information, capacity building and training exposure for sustainable fish farming in the area. The Garo tribe, who call themselves *A'chik*, is mainly found in different areas of Garo Hills located in the western part of Meghalaya. They also live in some patches in other north-eastern states and also in some parts of Bangladesh (Kar, 1982). Garo tribes in the rural areas mostly depend on agrarian economy, where fisheries and aquaculture are an integral part. Garo Hills are blessed with a number of small rivers, rivulets, hilly streams and the river Brahmaputra flowing in the western end of Garo Hills. Fishing is carried out in these water bodies. On the other hand, aquaculture is mostly done in the water bodies in low lying areas fed by the prolonged monsoon rains as it is one of the wettest parts in the world. Fisheries extension in Garo Hills and in the state as a whole is carried out through conventional system of fisheries line department. The formal fishery advisory services are backed by the administrative structure of Superintendent of Fisheries, Fishery Officer, Fishery Supervisor and Fishery Demonstrator (DoF, 2014). However, the conspicuous impact of the efforts of line departments in farm advisory services is questionable as a previous study suggested that the main sources of information to the farmers about farming in Garo Hills were progressive farmers, friends, line departments and radio (Lahiri, 2016).

The use of information and communication technology (ICT) has been identified as an important means in social change process (GoI, 2001). Information seeking, dissemination and knowledge acquisition process for development needs innovative approaches, which are being provided by ICTs in different parts of the world (GoI, 2001). Telecommunication, especially mobile phones have the potential to provide pragmatic solution to the existing information asymmetry in various deprived sectors and mobile phones evolved as significant contributors to facilitate governance, education,

commerce and economic affairs (Brewer *et al.*, 2005; Mittal and Tripathy, 2009). Majority of the state funded services (60%) in India are beyond access for farmers and the majority of resource poor farmers have restricted access to these services (Ferroni and Zhou, 2012). Mobile phones have been one of the most commonly used ICT tools in India and its popularity is growing among the fish farmers. Among various ICT initiatives implemented in the fisheries sector, the use of mobile phone ranks first in disseminating information and knowledge to fisher folk (Vimala and Ravisankar, 2012). Mobile phones are also used in coordinating the fishing ventures (Adogla, 2009), marketing and for safety measures (Anon., 2008). Mobile phones have become one of the powerful tools in sustainable community based management approach (Ifejika, 2013). The popularity and utility of mobile phones among farmers, particularly among rural youth in Meghalaya have been increasing rapidly as it is more accessible and cost effective to farmers (Syiem *et al.*, 2016). There is stiff increase in the wireless telephone (mostly mobile phone) connectivity in North-East India in recent years. The total number of wireless telephone subscribers increased to 2,96,35,734 in 2015-16 from 1,88,55,288 in 2010-11 and the percentile increase (57.17%) was much higher than that of national increase (27.42%) during same period. The total number of wireless telephone subscribers in Meghalaya was 19,02,567 which was 71.79% of total population in the state. Moreover, 5,14,230 subscribers were using internet connectivity (both wired and wireless) in 2015-16 (DoT, 2017). Mobile phone as a communication tool also provides immense help to fishers for better deal to get remunerative prices of their catches. By using mobile phone, fishers can save their time, raise their income and even can use as an option to reduce the risks (Foss and Couclelis, 2009; Chhachhar and Omar, 2012). The higher literacy rate in the north-east region and in Meghalaya than that of national average prepares a perfect lay-off for mobile based advisory system in fisheries. The mobile based advisory system has relative advantage in terms of accessing information by the farmers even from disadvantaged and low education backgrounds (Fu and Akter, 2016). It also enables fishers, traders and transporters for quick disposal of the catch based on the market demand and helps in price fixation and prevention of wastages (Rashid and Elder, 2009). But the replacement of traditional extension methods through ICT based approaches may not create expected development (Obayelu and Ogunlade, 2006; Heeks, 2010; Sudharshan and Selvamathy, 2012). Rather, ICT may supplement the existing system with the new role of extension agents and assistance from information technology in addressing the farmers' needs (Anastasios *et al.*, 2010). Integration of ICT tools such as mobile phones and internet. with

conventional extension minimises time requirement by sixteen fold in availing and three fold in delivering the farm information to the farmers in comparison to the conventional extension approaches in North-Eastern India (Saravanan, 2013). Thus, development and customisation of mobile based fishery advisory prototype in Garo Hills and North-East India in general may help to address the issue of demand-supply asymmetry in fisheries and aquaculture through delivery of right farm information related to fisheries and aquaculture practices, credit and input facilities, disease management, weather information, market intelligence and value addition from authentic sources in real time basis with live interactions with the experts.

Understanding the need to provide right information at right time to Garo tribal fish farmers and to supplement the process of fishery extension in the area, the study was designed with the objectives to develop mobile based fishery advisory prototype in Garo Hills of Meghalaya. The study evaluated the utility of mobile based fishery advisory services among fish farming communities of Meghalaya and also assessed the perceived credibility of messages provided to the fish farmers

Materials and methods

Features of IIDS 2.0

The major features of the system was to deliver the farm advices (Pull Based) and information services (Push Based) by using the software platform 'Interactive Information Dissemination System (IIDS 2.0)', which is an integration of toll free Interactive Voice Response System (IVRS), Smart Phone Application, text and voice messaging in mobile phone and web based fishery

advisory system, which was developed by Digital India Corporation (Formerly Media Lab Asia), New Delhi. IIDS 2.0 is a pull and push based system where fishery related information can be pulled by the fish farmers, using the mobile phones. There is a mobile phone interface at front end and web interface at the back end. Information can be disseminated through voice, text, images and videos from both ends (farmers to expert and *vice versa*). To enable farmers' specific advisory, experts at back end (web application) have access to the database of the farmers when the farmers connect to the expert as shown in Fig. 1 and 2.

Contextual dimensions for the Study

A careful intervention was needed for considering different components of mobile based agro-advisory prototype for the fish farming communities in the hilly terrains of North-East India. Various contextual dimensions like, policy framework, types of fish production system, market dynamics, capacity of potential service providers and characteristics of local communities in relation to fishing practices should be given utmost care in framing mobile based agro-advisory system (Birner *et al.*, 2009). These features were given due consideration and different components were incorporated for the deployment of mobile phone fishery advisory prototype for the fish farming communities of Garo Hills of Meghalaya (Lahiri *et al.*, 2017a), which is evident from the flow diagram of the m4AgriNEI project activities (undertaken by Central Agricultural University, Imphal) as shown in Fig. 3.

Research functionality under m4AgriNEI

The laboratory team comprised of Research Associates from different disciplines who worked as

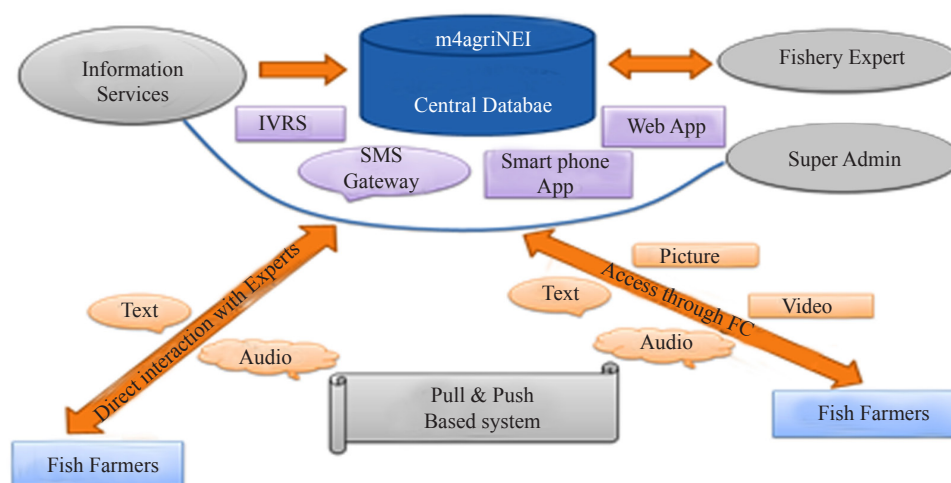


Fig. 1. Fishery-Advisory System architecture (Source: Yerapalli *et al.*, 2014)

Level-I experts to disseminate query based advisory services to the farmers. There were also Level-II experts, who were scientists from different ICAR research stations and agricultural universities. The Level-I experts received guidance from Level-II experts. The unique feature of the approach was to assign Field Coordinators to develop a link between the farmers and the experts, which provided a more human face in the system. Smart phones with internet connection were provided to these field coordinators and their role was to visit a village at least twice in a week to help the fish farmers. They used to sensitise the fish farmers to create demand for information through mobile phone; to collect field based problems and pass on to

the laboratory; to assess the need of the farmers and to organise need based training for the farming communities.

Selection of study locale, beneficiaries and research parameters

Out of five districts in Garo Hills of Meghalaya, West Garo Hills and South-West Garo Hills districts were selected due to their easy accessibility to conduct the study for developing the prototype. Two thousand farmers from 65 villages (1000 farmers from each district) were selected through snowball sampling method (Johnson, 2014). The villages and farmers were selected based on the availability of mobile phone network in the village;

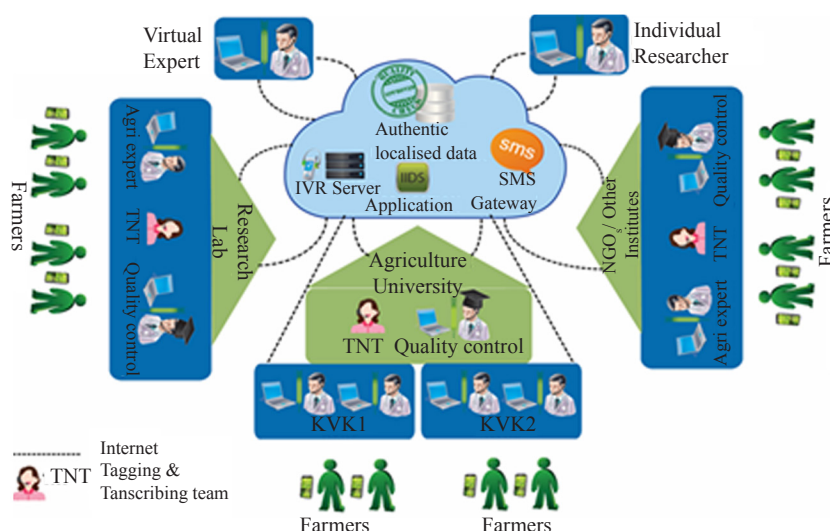


Fig. 2. IIDS Architecture for m4AgriNEI (Source: Yerapalli *et al.*, 2014)

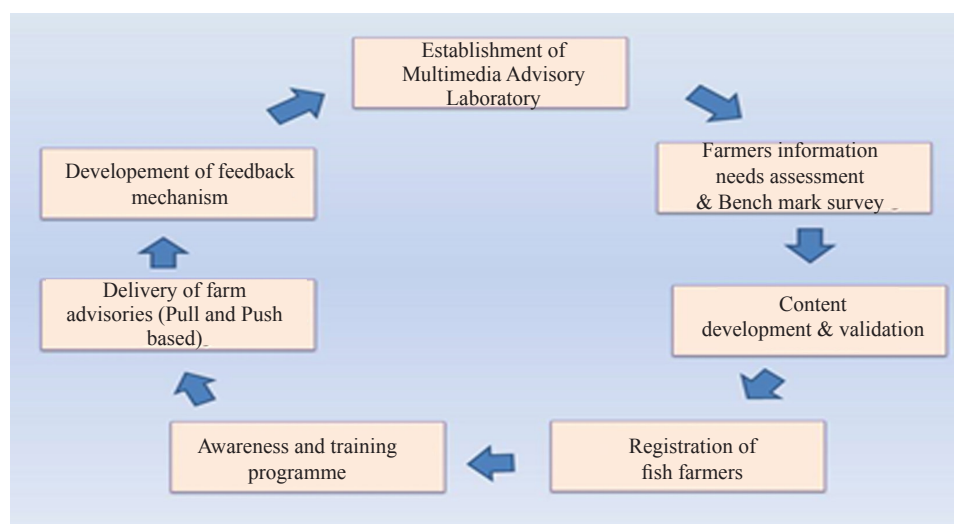


Fig. 3. Flow diagram of m4AgriNEI Project activities

number of fish farmers in the village; fish farming as a major source of livelihood; less access to scientific farm information and possession of mobile phone by the farmers.

A study was also conducted to assess the perceived credibility of messages, provided to the fish farmers. Five hundred registered fish farmers were selected by simple random sampling method (without replacement) from 2000 registered fish farmers, who received the messages delivered from the advisory laboratory. The messages pushed in the month of August 2016, were shown to the farmers and perceived credibility of the messages were measured against different credibility parameters such as: need based, pragmatic, timeliness, usefulness, briefness, ability to understand and clarity. Data were collected in 5-point Likert Type scale (Likert, 1932) ranging from very good to very poor (+5 to +1). The average credibility score was also determined by adding the responses of the farmers against all the parameters.

The data were analysed with frequency and percentile distribution and are presented as, bar diagram, pie diagram and radar diagram. Data analyses were done using Microsoft Excel 10.

Results and discussion

Pull based advisories

The study was initiated in July 2015 and an advisory laboratory was established at Central Agricultural University (Imphal), Tura, Meghalaya. The bench mark survey and need assessment study were also conducted on sample farmers to provide need based advisories. The registration of 2000 farmers from the study location was done and entered in IIDS 2.0 system.

The advisory to the registered fish farmers started from March 2016 as farmers started calling in the toll free number from March 2016. The distribution of advisory according to the queries received in various subject domains during the period of March 2016 to June 2017 is presented in Fig. 4. The study revealed that majority of the farmers were seeking information on the source of

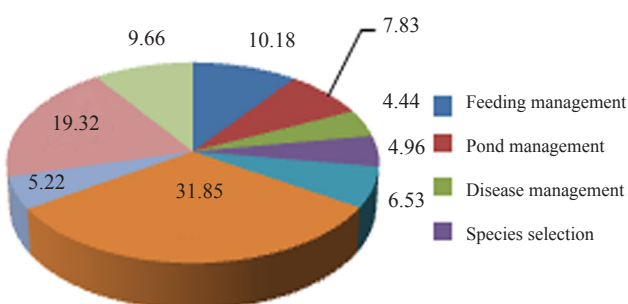


Fig. 4. Distribution of advisory provided (March 2016-June 2017)

fingerling (31.85%), followed by information in training on fisheries (19.32%), feeding management (10.18%) and subsidies/schemes related to fisheries (9.66%) respectively. Due to less number of hatcheries in Garo Hills, farmers often face shortage of fish seeds and fish farmers also lacked knowledge and skills in modern scientific inland fish farming practices, which were the main reason for getting more number of calls in those two areas.

An innovative approach was taken under the project activity to address the problem of fish seeds for the registered fish farmers. A registered farmer had developed a fish hatchery (WERAM Hatchery) in his village with assistance from Department of Fisheries, Govt. of Meghalaya in 2014 after receiving training from ICAR-Central Inland Fisheries Research Institute (ICAR-CIFRI), West Bengal on 'Seed production and culture technique of carps for entrepreneurs of Meghalaya' in 2012. The farmer stocks 8 lakh carp fingerlings annually in his farm. Earlier, he faced the problem of marketing produce due to poor marketing infrastructure in Garo Hills, which was solved later when the project team facilitated this farmer by pushing messages to all the registered fish farmers on the availability of fish seeds in his hatchery. The attempt successfully solved the marketing problem of fish seeds of this registered farmer to a large extent and at the same time catered the need for fish seeds from the registered fish farmers of the project through mobile phone based ICT mediated fishery extension approach.

The seasonal distribution of advisories provided to the registered fish farmers as per queries received over a period of one year (May 2016-April 2017) depicted that maximum number of fishery advisories were provided in the month of August 2016 (125), followed by October 2016 (32) and July 2016 (32) respectively as evident from Fig. 5. It was also evident that majority of the queries received from the farmers were during July to November, when the monsoon showers peaked in North-East India. There are a number of temporary water bodies created in Garo Hills during the south-west monsoon and majority of fish farming during this period is done in these water bodies in the region. This is one of the main reasons for receiving more queries from fish farmers during this period (Lahiri *et al.*, 2017b).

Push based advisories

Push based advisories, namely text and voice messages were pushed to the farmers to create demand for information among the registered fish farmers. Location specificity, seasonality and needs of the farmers were given due consideration during the development of content of the messages. Twenty two messages with regard to fishery

management practices were sent during the period from March 2016 to June 2017 (Fig. 6).

Most interestingly, the perceived credibility of messages provided to the fish farmers shows that there was a considerable increase (31.5%) in number of queries received from the farmers in subsequent two days of pushing the messages. It proved the worth of push based advisories in creating demand for farm information among the farmers. All messages pushed were found 'very good' against all the credibility parameters (Fig. 7) as responded by majority of farmers (46.8, 58.2, 64, 50, 66.6 and 76% in case of need based, pragmatic, usefulness, brevity, ability to understand and clarity respectively) except timeliness (17%). Timeliness was ranked 'good' by majority of the farmers (64.6%) and no farmer ranked 'very poor' against any parameter. The Radar Diagram (Fig. 8) states that clarity (4.5) and usefulness (4.5) of messages ranked highest in terms of average perceived credibility scores against different parameters, while other parameters were hovering around 4 and above, which was also a fairly high score against 5-point continuum.

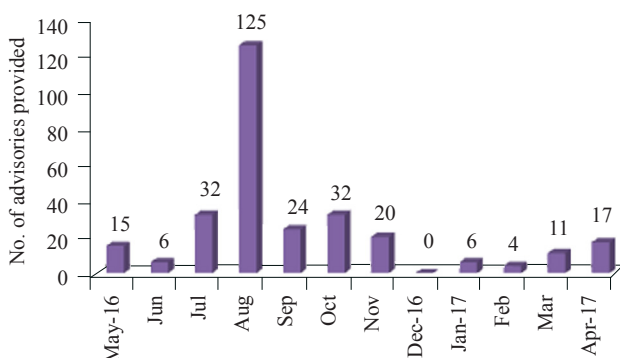


Fig. 5. Seasonal distribution of advisories provided

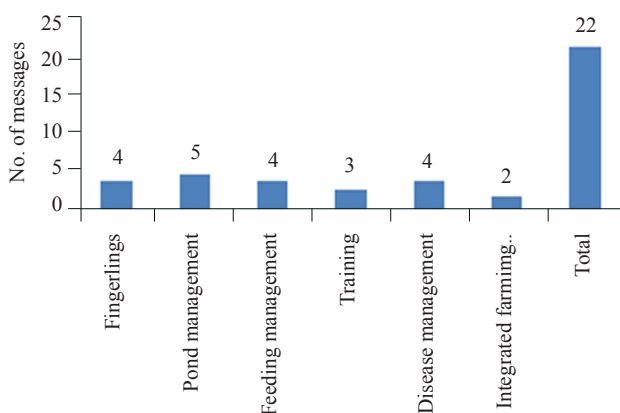


Fig. 6. Types of messages pushed to fish farmers (March 2016-June 2016)

The feedback responses from the fish farmers regarding the advisory provided were also recorded in the IVRS against pre-recorded prompt in local dialect (Garo) after providing each advisory. During the period March 2016-June 2017; 67 feedbacks were received from the fish farmers as shown in Fig. 9. It shows that majority of the fish farmers (71.64%) were satisfied with the advisory provided and only 14.935% were not satisfied with the advisories, which indicated further scope of improvement regarding quality of advisories. However, Field Coordinators were regularly in direct contact with the farmers regarding qualitative aspects of feedback responses from the farmers.

Several similar initiatives like Kisan Call Centre and e-KIRAN have been providing mobile based farm advisories through IVRS based applications in Garo Hills and other regions of North-East India. Most of these initiatives have been providing generic information without maintaining any database of the farmers and proper knowledge management system and thus quality of advisory process suffered in the process (Lahiri *et al.*, 2017b; Rana, 2017). The m4AgriNEI initiative was

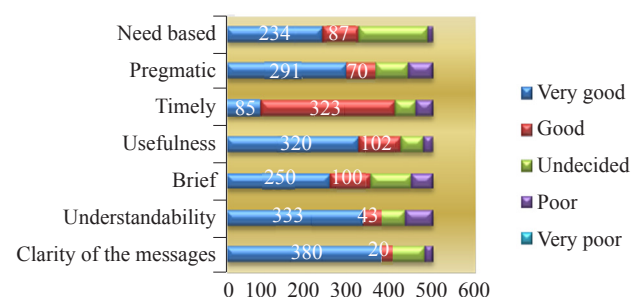


Fig. 7. Frequency of perceived credibility of messages pushed against different credibility parameters

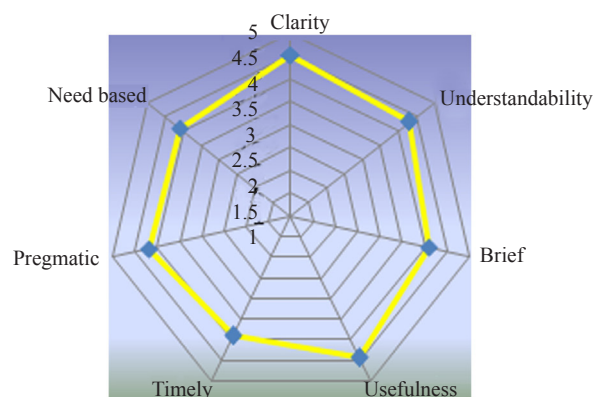


Fig. 8. Radar diagram of perceived credibility scores against different parameters

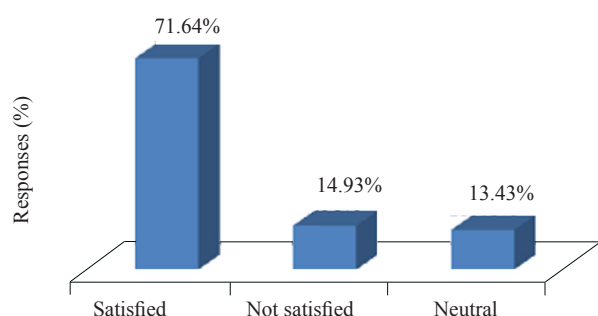


Fig. 9. Feedback responses from fish farmers (March 2016 - June 2017)

successful in addressing the problem and created a demand for scientific fish farming information among the registered farmers across the Garo Hills due to its innovative approach, designed from the experience of previous initiatives. A notable rise in interest and enthusiasm was observed from the resource and information poor Garo fish farming communities towards mobile based advisory services. Further, the inclusion of need based training programmes and convergence with public and private extension system helped to develop an ICT based Stakeholder Interface (Experts-Line Departments-Fishpreneurs-Fish Farmers) in the region. This study also came out as a successful prototype with room for improvement and further refinement, particularly with regard to timely delivery of messages and quality of advisories. At the same time it also offers an opportunity to replicate this model for the development of inland fish farming and increasing the farm income of resource poor fish farming communities in the difficult hilly terrains across the globe.

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