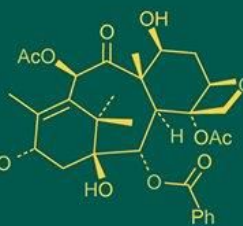


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2025; SP-9(1): 772-778
www.biochemjournal.com
Received: 12-11-2024
Accepted: 18-12-2024

Smita Shweta
Ph.D Scholar, Jharkhand Rai
University, Ranchi,
Jharkhand, India

Dr. RP Singh Ratan
Professor & Dean, Faculty of
Agriculture, Jharkhand Rai
University, Ranchi,
Jharkhand, India

Significance of fisheries extension approach to enhance the fish production and productivity in context to Jharkhand state: A review

Smita Shweta and RP Singh Ratan

DOI: <https://doi.org/10.33545/26174693.2025.v9.i1Sj.3606>

Abstract

Many extension approaches for augmenting production and productivity of fishes from different water bodies are taken up by Government and Non-Government Organizations of India for rural farmers and aqua-entrepreneurs. It has been found that government schemes and supportive benefits of non-organizations are getting failed to reach out the target groups. It has been identified that the extension services provided by government agencies are very weak due to many factors such as lack of rapport among the farming communities, mainly accessible to fish -cooperatives and limited numbers of farmers with all schemes, trainings and financial aids. Moreover, the organizational structure, manpower, and extension capabilities of the Departments of Fisheries were found to be insufficient, leading to a gap between the services offered and the needs of the aquaculture community. The Non Government organizations approach fish farmers as well as women group with fisheries inputs, infrastructure, capacity-building programs, financial assistance, and miscellaneous support. It has been observed that NGOs are able to create awareness to utilize available untapped water resources with the aim to bridge the knowledge gap and empower fish farmers to make informed decisions, thereby enhancing productivity and sustainability within the sector. The NGO interventions mainly focused on training and continuous support, which have led to a higher adoption rate of modern fish farming technologies. The limited number of Non Government Organisation are insufficient to bring the enterprises more sustainable. Therefore, to make the fisheries programme sustainable and effective the present extension system of both sectors (Govt. & NGOs) should be collaborative to meet the emerging challenges to bridge initial knowledge and investment gaps for fish farmers. This paper represents the review of different aspects of extension practices in fisheries sector.

Keywords: Extension approach, government and non-government sectors, sustainable fish farming, production & productivity, capacity building

Introduction

Fisheries development plays an important role in development of rural areas of the country. Jharkhand has vast inland water resources. Fish serves to supplement the nutrition and food requirement of the people. It generates additional income and employment opportunities and thus improves the socio-economic conditions of the rural farming community. About 60-65% of people in the State consume fish and shell fish products. The present annual demand is 251997 MT in rural area and 97437 MT in urban area. The present fish production is 210000 MT. The department aims to produce 373000 MT of fish in the FY 2024-25. The state is presently deficient in domestic fish production to meet the present level of annual demand. Rest of the demand is met mainly with fishes from Andhra Pradesh and West Bengal. Fisheries also generate additional employment opportunities to a large number of people engaged in harvesting, net and boat making, seed production, transportation and marketing of fish in wholesale and retail markets. (State Fisheries Profile, Jharkhand, 2020) ^[35]

Jharkhand is endowed with vast fresh water resources such as ponds (perennial and seasonal both), reservoirs, check dams and ahars covering a total water area of about 155000 hectares (Govt. ponds under department is 11765 no. covering an area of 9613 hectares, ponds under other departments is 11765 no., covering an area 4843 hectares, private ponds 85000 no., covering an area of 40500 hectares, reservoirs 252 no. covering an area of 115000 hectares, check dams and ahars 1260 no. covering an area 4570 hectares). In spite of suitable agro-climatic conditions Jharkhand fall back the national level of fish productivity.

Corresponding Author:
Smita Shweta
Ph.D Scholar, Jharkhand Rai
University, Ranchi,
Jharkhand, India

Thus against the national average of 2150 kg/ha, the present level of fish productivity in Jharkhand is about 1600 kg/ha. The main reason for this poor performance is that most of the tanks are very old and practically unsuitable for fish culture due to heavy siltation and weed infestation and lack of knowledge in fisheries sector.

To achieve the higher level of fish production use of fisheries technologies by farmers assumes significant importance. Extension and training support to farmers plays main role in this. There is a potential further to increase the present level of fish production atleast two folds. Lack of awareness, lack of knowhow about technologies, constraints in financial support and less active participation of household members are constraining the fish farmers to get higher level of fisheries production. Although some initiatives have been taken through different Government programmes and NGOs. Moreover, Department of Fisheries, Government of Jharkhand has its regular extension services as well as NGOs also have their own fisheries extension programmes. There is thus wide range of state level and area-specific fisheries extension programmes actively involving a number of extension approaches and packages. This includes work to extend integrated fish farming, cage fisheries, composite culture and proper utilization of Govt. ponds. (Thompson *et al* 2002) ^[36]

In the current financial year 2024-2025 the department of fisheries have set the target to produce 373000 MT. Fish farming is being encouraged by the Jharkhand Government and trying to bring more and more farmers in its fold. In addition to public ponds, fish farming is being practiced in privately-owned ponds as well. With the goal of making Jharkhand a leading producer of fish, the Department of Fisheries in the state has been working on three strategies i.e. area expansion, introduction of new technology and promotion of cage culture to increase fish production in the rural area of Jharkhand.

The present study will attempt to look into how the extension and training support provided to the farmers carrying out fish culture in ponds ought to bring improvements in fish production. The study will further look for more details about the important factors which influence increase in fish production adopted by different agencies. Knowledge, information and especially, proprietary technologies would be sorted out and extent of their diffusion through private and government sectors will be worked out. The study will also focus on the constraints being faced by different agencies in dissemination of fisheries technologies as well as constraints being faced by the fish farmers. The outcomes of the review of different authors will provide important points for designing effective strategies to get higher level of fish productivity and subsequent benefits.

Statement of Problem

Fishing community in India, in general and particularly in Jharkhand is at the lower rung of the development. It has been pointed out that the low standard of living of fishing communities is due not only to low productivity caused by primitive production methods and processing technology, but also to the poor socio-cultural and economic conditions make these technologies are unsuitable. Extension work includes attempting to change views, beliefs, norms, abolishing social taboos and exploitation, with the aim of improving the standard of living (Sarkar, 2012) ^[29]. Tietze

(1984) ^[37] suggested areas of activities to be undertaken to achieve the goals like welfare of fishermen as well as conservation and efficient exploitation of fishery. Scope of fisheries extension is evolves throughout time as new challenges, concepts and practices develop. It encompasses many aspects like entrepreneurship development, disaster management, organizational development etc (Sajesh *et al.* 2020) ^[31]. All these aspects will be explored under this study to suggest strategies for strengthening fisheries extension and training activities in Jharkhand and thereby increasing fish production in order to make the state self-reliant in fishes.

Fisheries extension services: An overview

Chowdhury *et al.* (2016) ^[10] reported that fish farmers who maintained contact with public aquaculture extension services significantly outperformed their counterparts in terms of communication media usage, organizational participation, and income from fish farming. He added extension services had a positive influence on farmers' knowledge, attitude towards resource conservation, and overall socioeconomic status. They also highlighted that the lack of regular subsidies, infrequent extension contact, and political interference in the selection of group members were significant challenges hindering the effectiveness of these services. Nonetheless, the study concluded that strengthening extension services could play a pivotal role in improving fish farmers' income and resource management practices.

Nedumaran and Ravi (2019) ^[23] provided an insightful review of the agricultural extension system in India, emphasizing the critical role of extension services in bridging the gap between research and practical application in the field. They highlighted the limitations of the public sector, which, despite being the main provider, is burdened with non-extension duties like distributing subsidies and inputs. The authors stressed that these non-core activities detract from essential extension work, such as promoting farm productivity and enhancing farmers' income. Their analysis further pointed out that the public extension system is heavily skewed towards crop husbandry, neglecting allied sectors like livestock and horticulture. According to their study, a comprehensive overhaul of the system, including hiring more extension personnel, particularly in underserved areas, and enabling private and civil society organizations to participate more fully, is essential to achieving the government's vision of doubling farmers' incomes.

Significance of Extension Approach

Cole (1977) ^[11] has opined that fisheries extension services are mainly intended to achieve all-round development of the fishing sector. An rise in fish output depends upon numerous elements, including expanding the area under fisheries, diversifying of culture technology and cultivable fish species, and a system of information transfer from the research and development centres to the farming households. The prime objective of fisheries/fisheries extension is to persuade and help fishery farmers and fishing communities to improve their socio-economic condition and quality of life through their farming practices for increased fish production and income (Kumar, 1999) ^[20]. Wang (2001) ^[38] noted that effective extension services have contributed to increased fisheries production. He further added that education and training of rural communities to improve their

fisheries skills and capabilities is the core function of fisheries extension system which is expected to perform five major tasks, viz; dissemination of appropriate technology (education), convincing the farming community to adopt such technologies (motivation), collect the farmer's response (feedback), refinement of technology to suit the farming situation (assessment and refinement) and act as a link between the research and user system (liaison).

Wang (2001) ^[38] noted that effective extension services have contributed to increased fisheries production. Extension services today must undertake various responsibilities, including disseminating information regarding technologies, pricing, and market conditions, as well as policies. Additionally, they are tasked with organizing farmers to facilitate the exchange of information, promoting learning from experiences, and offering consultancy for problem-solving to effectively support the agricultural community (Sulaiman, 2003) ^[32]

The initiative could additionally enhance the economic growth and welfare of fishery farmers. In India, while both the central and state governments establish policy guidelines, the states play a crucial role in implementing extension programs at the grassroots level through their respective Departments of Fisheries (DoFs). Furthermore, the Union government offers financial assistance through its various schemes to facilitate the farmers. Kumaran *et al.*, (2003) ^[21] have pointed out the need for a committed and properly structured fisheries extension system in order to propel the growth of the sector. The fisheries have witnessed an influx of private extension sponsored by companies. A well-coordinated public-private extension system can target specific areas and farmer groups and issues. Further, a strong public extension system is quintessential for service as an alternative source of reliable and verified information and services.

The potential of the fisheries sector has not yet been utilised to the optimum level. The women folk are appropriate for implementing community and self-development programmes. Formation of fisherwomen SHGs among the fisher folk is seen to yield encouraging results. Steps should, therefore, be taken to adopt a proper financial plan that would hold the key for empowerment of women. The approach needs a concerted effort by all the individuals concerned for optimal exploitation of fishery resources, which will lead to profitable employment. An important part of this effort is assistance from financial institutions. (Edward, 2005) ^[14].

To address the immediate challenges it is important to adapt an innovation system perspective inclusive of all the actors across the value chain. An innovation system can be defined as the network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the system's behaviour and performance (World Bank 2006) ^[39]. Research and advisory systems form its core. An innovation system platform like producer collective can facilitate the interaction of research and advisory systems with other actors of innovation system. Public sector extension agencies have the onus to play the key role in forging such a system. The local self-governance institutions can function as a key link element in such a system, which can address much of the governance issues.

Farmers now need quality information about technological options in farming to produce and participate better in markets. They need to know not only market prices but also trends about market prices to plan cultivation. In order to address successfully the challenges of WTO, greater attention will have to be paid to information-based technologies. Strengthened means of dissemination will be needed to transmit this information to farmers. To make information transfer more effective, greater use will need to be made of modern information technology and communication among researchers, extensionists and farmers. In the era of information technology, wherein information play a vital and decisive role in strategic decision making, extension personnel will have to acquire latest knowledge as well as skills in use of various electronic devices including computers, multimedia and the internet. The day is not far off when tele/videoconferencing will be common means to interact with larger number of farmers to extend extension messages or sharing market information by extension personnel. In coming years, the area of management and communication skills must be the largest segment for competency building among agricultural extension personnel for supporting farming community. (De, *et al.* 2008) ^[12]

To strengthen the achievements and address the arising challenges, it is essential to establish a robust extension system. This system delivers the necessary information and services sought by farmers and other stakeholders in rural areas through various activities aimed at enhancing their technical, organizational, and management capabilities. Such improvements are crucial for advancing their livelihoods and overall well-being. Fisheries extension encompasses the practical aspects of fisheries development (Ananth, 2010) ^[11].

In India, there exists significant potential for both horizontal and vertical growth in the fisheries sector, as the average production can be enhanced from 3 to 6 tons per hectare, while the total area can be expanded from 1.2 million hectares to 2.5 million hectares. Therefore, the fisheries provide a considerable opportunity for increasing income and employment to a large number of people. Fisheries play a significant role in socio-economic development by generating income and employment opportunities through the utilization of both unutilized and underutilized resources across various regions of the country. Environmentally sustainable fisheries have been recognized as a means to promote rural development, contributing to food and nutritional security for rural populations. (Barik, *et al.* 2014) ^[5].

Currently, there are four primary organizational frameworks dedicated to enhancing inland fish production within the country: (i) the ICAR extension system, (ii) the extension system of the Ministry of Agriculture and State Fisheries Departments, (iii) the extension system associated with the Rural Development framework, and (iv) initiatives undertaken by Non-Governmental Organizations. The scientists and extension professionals affiliated with these institutions serve as the first line of extension, employing a range of extension methods on a limited scale, yet their efforts are sufficiently impactful to catalyze improvements within the extension system. (Bhaumik, 2016) ^[8].

Though lots of planning has been done in fisheries sector by extension units of fish farmers, yet hunger and malnutrition remain amongst the most devastating problems faced by the

poor and needy people throughout the world. Very few studies on problems of fish farming have been reported at the micro level. (Angral, 2017) ^[2].

Freshwater fisheries in India can be classified into two main categories: (a) Pond Fisheries: Organized pond fisheries are virtually nonexistent in the country. However, numerous village tanks and domestic ponds, especially in West Bengal, Bihar, and Orissa, are populated with mixed fry sourced from rivers. Pond culture is also prevalent in Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, and Tamil Nadu. The species commonly introduced into these ponds include catla, rohi, kalabasu, bata, mrigal, mullets, milkfish, pearlspot, and various types of carp. (b) Riverine Fisheries: Approximately one-third of India's total fish production is derived from river systems. Freshwater fishing experiences heightened activity during the winter months, from October to March, particularly in larger rivers as floodwaters recede. West Bengal stands as the foremost producer of freshwater fish, contributing nearly 29 percent of the national total, followed by Bihar and Assam in the second and third positions, respectively. Collectively, West Bengal, Bihar, and Assam account for over 72 percent of India's freshwater fish production (Ghosh, 2019) ^[15, 27].

Mallick, R.K. (2019) ^[22] reported some of the concerns of fish seed growers which affect overall fish productivity. These include; water scarcity, shallow and small size ponds, non-availability of spawns in desired quantity, non-seriousness of the seed growers to pursue fishery as an activity after availing the spawn from fishery department and lack of proper extension and follow-up measures. The financial support given by the government is very nominal according to them considering the services rendered at their level. Due to less remuneration, they are also de-motivated to work. There is also demand for monthly remuneration for them. Due to lack of periodic training and exposure to other fish producing states like Andhra Pradesh, West Bengal and Coastal Orissa, fish farmers lack awareness regarding the various species of fish, the latest technologies and practices for large-scale fish production, disease prevention methods for fish, fish processing techniques, marketing strategies, and the costs and benefits associated with different types of fish production. Due to limited exposure they are unable to replicate successful cases of pisciculture in their own area. In spite of the concerns and complaints of common people and fish farmers on quality of services rendered by Matsya Mitras, following benefits have been accrued to the fisherman community. There has been 180 to 300 percent increase in fish productivity in a year after introduction of the scheme. This also led to 200 to 400 per cent increase in annual income per fish farmer in a year from one acre of land. He further stated that private fish farmers who had previously refrained from engaging in fish farming due to insufficient information and knowledge, as well as fear of potential losses, have now become active fish farmers thanks to the guidance provided by Matsya Mitras. Additionally, some individuals from economically disadvantaged backgrounds have been able to enhance their income by serving as Matsya Mitras in their villages, leading to the utilization of previously unused ponds and tanks for fish farming.

Fisheries extension programmes by government and NGOs in India

Salim and Shinu (2020) ^[33] provided an in-depth analysis of the empowerment initiatives targeting fisherwomen in Kerala, India, focused on the impact of the *Theeramythri*

program, which transitioned activity groups into viable business units, enhancing socio-economic standards among fisherwomen. They further highlighted the role of financial support mechanisms, such as revolving funds and technology funds, which significantly improved sales turnover and repayment rates helped to transform these groups into business units.

Ojha *et al.* (2019) ^[25] proposed a comprehensive framework for developing Aqua-Chamber of Commerce (ACC), designed to support aquapreneurship through business and market development. He focused the involvement of private sector to enhance productivity and address the needs of fish farmers by opting bottom-up approach. This model aimed to create a robust ecosystem for fisheries by addressing production, marketing, and environmental sustainability.

Sajesh *et al.* (2018) ^[30] conducted an analysis of the expenditure trends on fisheries extension in India, highlighting the need for improved financial allocations to meet the sector's growing demands. Their study focused on the role of public and private extension systems in addressing issues such as overfishing, climate change, and low productivity in both marine and inland fisheries. The authors emphasized the importance of capacity building and technology dissemination through extension services to boost aquaculture production. Bhattacharyya *et al.* (2022) ^[6] highlighted that topics such as composite fish culture, fish disease control, and feed preparation were prioritized by the trainees. Using a structured survey, the authors identified significant gaps in knowledge, particularly among farmers with lower education levels, and suggested that targeted training programs tailored to the socio-economic background of the farmers could improve productivity.

Sarkar *et al.* (2018) ^[34] highlighted the low average productivity of Indian reservoirs compared to their potential yield, pointing to factors such as poor management practices and environmental degradation as key challenges. They advocated for the adoption of advanced management strategies, such as eco-friendly culture-based fisheries, improved fish stocking practices, and the use of innovative technologies to enhance fish productivity. Additionally, the study underscored the need for a holistic approach to reservoir fisheries management, incorporating biodiversity conservation, habitat improvement, and community engagement to ensure both ecological sustainability and economic benefits for local communities.

Fisheries Extension Programmes in Jharkhand

Fisheries programmes are effectively running in the state but still many gaps existed which has to be overcome by the effective extension approaches. Department of Fisheries and many NGOs are involved in fisheries development work. Numerous studies have been undertaken in the field of fisheries development. Below are some perspectives expressed by the researchers.

Zafar (2021) ^[40] highlighted on economic viability of fisheries in Ranchi, Jharkhand and analysed benefit-cost ratio of 21.4 and a rate of return of 20.4%. He identified key constraints such as unavailability of quality fish seed, high transportation costs, and limited market access affects the fisherfolk. To overcome these constraints there is need of market structures, better quality inputs, and financial support. Other major constraints faced by the fish farmers are high feed costs and lack of credit (Kachhap *et al.* (2024)) ^[19]. He further suggested that government schemes can promote sustainable fish production in Jharkhand.

Ojha (2017) ^[24] discussed the role of fisheries extension and social entrepreneurship in improving livelihoods among marginalized fishers by emphasizing the need for community-based approaches in fisheries by integrating both social and entrepreneurial aspects. Convergence of government and non-government partnerships can help to achieve long-term sustainability. Ashok and Ojha (2017) ^[24] discussed the importance of both government and non-government initiatives in promoting modern fish farming techniques, such as cage culture, to improve productivity. By addressing the technical training of fish farmers and the provision of necessary resources, the programs help to enhance local livelihoods. Choudhary *et al.* (2016) ^[10] examined the status of the public extension system in Jharkhand, highlighted significant gaps in human resources, with a substantial number of vacancies in various directorates and cadres, which affects the effectiveness of agricultural extension services. This analysis underscores the need for more comprehensive efforts from policymakers to address these deficiencies and ensure sustained agricultural development in the state.

Fisheries extension programs in Jharkhand under the JOHAR project funded by World Bank under JSLPS, Department of Rural Development, Jharkhand helped in enhancement of income and livelihood of rural households through fish culture through women's self-help groups (SHGs) and promotes sustainable fish farming practices across community and private water bodies in large scale. These initiatives have resulted in substantial improvements in fish productivity and household incomes. (Bihari, and Shweta, 2019) ^[9]

Sarkar *et al.* (2018) ^[34] highlighted the low average productivity of Indian reservoirs compared to their potential yield, pointing to factors such as poor management practices and environmental degradation as key challenges. They advocated for the adoption of advanced management strategies, such as eco-friendly culture-based fisheries, improved fish stocking practices, and the use of innovative technologies to enhance fish productivity. Additionally, the study underscored the need for a holistic approach to reservoir fisheries management, incorporating biodiversity conservation, habitat improvement, and community engagement to ensure both ecological sustainability and economic benefits for local communities

Ranjan (2015) ^[28] compared government and NGO-led initiatives and observed that government programs, while robust in terms of financial support, are often critiqued for their lack of personalized training and grassroots involvement. NGO-led programs, in contrast, prioritize community engagement, particularly with marginalized groups, helping to establish cooperatives and self-help groups (SHGs), which have had a positive impact on fish farmer productivity. The study shows that NGO interventions emphasize hands-on training and continuous support, which have led to a higher adoption rate of modern fish farming technologies like cage culture. This stands in contrast to government programs that tend to focus more on infrastructure but may lack the sustained engagement necessary for long-term success. These programs, however, provide necessary subsidies and financial aid that help bridge initial investment gaps for fish farmers.

Deogharia, P. C. (2018) ^[13] focus on the fisheries extension programs in Jharkhand. NGO sector plays important role in promoting modern fish farming techniques, particularly

cage culture, which has led to significant increases in productivity by working closely with local communities, NGOs have also been effective in forming cooperatives and self-help groups, which have helped in providing better market access and collective bargaining power for small-scale fish farmers. These group-based models ensure that the benefits of fisheries extension programs are distributed more equitably among marginalized communities, led to link with government-run programs in terms of adoption rates of new technologies and overall productivity. The involvement of local stakeholders, particularly women, has been a standout feature of these initiatives, making them more inclusive and sustainable in the long term.

Ansary, *et al.* (2018) ^[3] urged that the hierarchical nature of relationships among policy-makers, service providers, and farmers has exacerbated communication gaps, limiting the effectiveness of extension efforts. Although fisheries are a state-level issue in India, the study points out that central government coordination exists, with support schemes co-funded by both state and national governments, underscoring the need for better communication and integrated support

Challenges and Future Directions for Fisheries Extension

Jayasankar (2018) ^[17] provided a comprehensive overview of the advancements and challenges in Indian aquaculture, with a particular focus on technology-driven productivity improvements. The study emphasized the significant role of modern technologies in boosting aquaculture production, including the introduction of genetically improved fish strains, advanced feed formulations, and disease control techniques. Author highlighted that despite the rapid growth of the sector, challenges such as environmental sustainability, disease outbreaks, and the need for improved water management remain critical issues. The author called for a more integrated approach, combining scientific innovations with policy reforms, to ensure long-term sustainability and economic benefits for India's aquaculture industry. By fostering partnerships between government, research institutions, and local communities, author argued that the sector could achieve greater productivity while minimizing ecological impacts.

Huang & He (2019) ^[16] explored the challenges and future directions of fisheries extension, focusing on the management of capture fisheries. The study highlighted several key challenges, such as overfishing, depletion of resources, and environmental degradation due to unsustainable fishing practices. He emphasized the need for innovative management strategies to ensure the sustainable development of the fisheries sector. Future directions proposed include the introduction of a total catch control system, reduction of fishing capacity, and improved resource conservation efforts. They called for enhanced international cooperation and the implementation of right-based fisheries management systems to ensure long-term sustainability. The study also advocated for a stronger regulatory framework and better enforcement of fisheries laws to address the growing ecological concerns

Conclusion

This study aims to fill these gaps by providing critical insights that will inform more effective and inclusive fisheries management and extension strategies, ultimately

benefiting the livelihoods of fishers in Jharkhand. The above study have concluded that Indian fisheries sector faces a multitude of issues including the effective extension programme. The extension approach is very necessary to overcome the underuse of water bodies, improper management of fish stocks, climate change and its consequence on fish catch and livelihood of the rural population. Sustainable fishing practices, fish processing and entrepreneurship development are a few other issues where the extension system has to focus. In Jharkhand, the Department of Fisheries and JHASCOFISH is applying effective extension approach but the things are being limited to fish cooperative members and progressive farmers. The need of an hour is to disseminate information on development initiatives and institutional support is to be spreaded among the clientele. To tackle these challenges, it is essential to disseminate research findings to farmers, necessitating the establishment of an effective extension system. This development requires sufficient human resources and the strengthening of institutions, accompanied by appropriate financial investments. Financial support should focus on the creation of extension methodologies, incorporating both traditional approaches and the application of information and communication technologies (ICTs), along with the development of necessary infrastructure. To tackle these challenges, it is essential to disseminate research findings to farmers, necessitating the establishment of an effective extension system. This development requires sufficient human resources and the strengthening of institutions, accompanied by appropriate financial investments. Financial support should focus on the creation of extension methodologies, incorporating both traditional approaches and the application of information and communication technologies (ICTs), along with the development of necessary infrastructure. The capacity building programme on fisheries proved effective and popular among the rural communities. The non government institutions have proven beneficial to penetrate importance of fisheries and its economic advantage to rural communities and women SHGs group. This drive helped peoples in the fish and fishing industry, through educational procedures in improving fishing, fish farming and fish processing methods, increasing production efficiency and income, and improving their socio-economic condition. Additionally, further research is necessary to assess the long-term sustainability and socio-economic impacts of fisheries extension initiatives, which are currently under-explored.

References

1. Ananth PN. Marine Fisheries Extension. Discovery Publishing House, New Delhi; 2010.
2. Angral C, Gupta K, Gupta SK, Kant K, Kumar D, Sharma M. Constraints faced by fish farmers and implementing agencies of Jammu provinces of J&K. *J Adv Zool.* 2017;38(1):98-108.
3. Ansary K, Tripathi SD, Haylor G, Savage W. How farmers and fishers achieved changes in aquaculture policy and practice: A case study in eastern India. In: *Facilitated Advocacy for Sustainable Development.* Routledge; 2018. p. 28-43.
4. Ashok MV, Ojha P. Jharkhand women's self-supporting poultry federation: A perfect state of cooperation. In: *Catalysing Markets through Collectives: Experiences from the Allied Sector;* 2018.
5. Barik NK, Kumar R, Kumar RN, Krishnan M, Katiha P, Ponnusamy K, *et al.* Freshwater fisheries; livelihood status of fishers in India. Chapter 6; 2014. p. 1-36.
6. Bhattacharyya S, Roy A, Som S, Saha A, Das BK, Das AK. Identifying training needs in inland fisheries management for the fishers in the state of Bihar, eastern India. *Indian J Fish.* 2022;69(1).
7. Anonymous. Management of China's capture fisheries: Review and prospect.
8. Bhaumik U. Fisheries extension: Its status and strategies for development of inland fisheries in the country. In: *International Conference on Aquatic Resource & Sustainable Management, Kolkata, India;* 2016. p. 66-68.
9. Bihari B, Shweta S. *Sumudran Report.* 2019;81:59-63.
10. Chowdhury A, Mamun-ur-Rashid M, Hossain S. Effect of public fisheries extension service on the selected socioeconomic aspects of the clients in two selected sub-districts under Barisal District in Bangladesh. *Asian J Agric Ext Econ Sociol.* 2016;13(1):1-13.
11. Cole CR. Fisheries extension services: Their role in rural development. *Mar Policy.* 1977;1(2):132-142.
12. De HK, Saha GS, Srichandan R, Vipinkumar VP. New initiatives in fisheries extension. *Fish Asia Mag.* 2008;Sustainable Fisheries(July-September):16-19.
13. Deogharia PC. Diversification of agriculture in Jharkhand: Process, pattern & issues. *Jharkhand J Soc Dev.* 2018;10.
14. Loveson EL. Fisherwomen's self-help groups: Their empowerment for fisheries development. A case study in Thoothukudi District of Tamil Nadu. *Fishing Chimes.* 2005;25(6):26-28.
15. Ghosh P. Tag archive/Essay on fishing in India; 2019. Available from: <https://www.shareyouressays.com/tag/essay-on-fishing-in-india>
16. Huang S, He Y. Management of China's capture fisheries: Review and prospects. 2019;4(5):173-218.
17. Jayasankar P. Present status of freshwater aquaculture in India: A review. *Indian J Fish.* 2018;65(4):157-165.
18. Anonymous. 2002.
19. Kachhap S, Umamaheswari T, Rajakumar M, Athithan S, Singh AK, Kumar P. Economic analysis of public sector-sponsored fisheries enterprises in Jharkhand, India. 2024.
20. Kumar D. Trickle down system (TDS) of fisheries extension for rural development. *RAP Publ.* 1999.
21. Kumaran M, Chandrasekharan VS, Kalaimani N. Fisheries extension: The neglected aspect in fisheries development. *Fishing Chimes.* 2003;23(6).
22. Mallick RK, Dash SC. Socio-economic impact evaluation of fishery schemes in Saraikela and West Singhum districts of Jharkhand, India: Strengthening livelihood opportunity. *Int J Fish Aquat Stud.* 2019;7(6):364-373.
23. Nedumaran S, Ravi N. Agriculture extension system in India: A meta-analysis. *Res J Agric Sci.* 2019;10(3):473-479.
24. Ojha SN. Fisheries extension and social entrepreneurship. 2017.
25. Ojha SN, Babu SC. Why convergence of fisheries co-management with agricultural technology management

- agency is significant. In: Agricultural Extension Reforms in South Asia. Academic Press; 2019. p. 329-347.
26. Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India. Handbook on Fisheries Statistics. New Delhi; 2020.
27. Ghosh P. Tag archive/Essay on fishing in India; 2019. Available from:
<https://www.shareyouressays.com/tag/essay-on-fishing-in-india>
28. Ranjan RK. Scope of policy convergence approach to freshwater management in rural Jharkhand. *World J Sci Technol Sustain Dev*. 2015;12(2):129-147.
29. Sarkar P. Verifying the statement of Gordon Scott 1954—The fisherman remains poor in the context of coastal fishery in India. *Int J Sci Eng Res*. 2012;3(12).
30. Sajesh VK, Suresh A, Mohanty AK, Sajeev MV, Ashaletha S, Rejula K, *et al*. Trend and pattern of expenditure on fisheries extension in India: Implications for policy. *Indian J Ext Educ*. 2018;54(2):32-40.
31. Sajesh VK, Suresh A, Mohanty AK, Sajeev MV. Streamlining fisheries extension. In: Model Training Course on 'Pluralistic Extension for Upscaling Secondary Fisheries', ICAR-CIFT, Kochi; 2020. p. 207-217.
32. Sulaiman R, Van den Ban AW. Funding and delivering agricultural extension in India. *J Int Agric Ext Educ*. 2003;10(1):21-30.
<https://doi.org/10.5191/jiaee.2003.10103>.
33. Salim SS, Shinu AM. Transforming activity groups to business units: Emerging fisherwomen managers in Kerala, India. *Asian J Agric Ext Econ Sociol*. 2020;38(12):134-146.
34. Sarkar UK, Sandhya KM, Mishal P, Karnatak G, Lianthuamluaia, Kumari S, *et al*. Status, prospects, threats, and the way forward for sustainable management and enhancement of the tropical Indian reservoir fisheries: An overview. *Rev Fish Sci Aquac*. 2018;26(2):155-175.
35. Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India. State Fisheries Profile (Jharkhand). New Delhi; 2020.
36. Thompson PN, Roos P, Sultana P, Thilsted SH. Changing significance of inland fisheries for livelihoods and nutrition in Bangladesh. *J Crop Prod*. 2002;6(1-2):249-317.
37. Tietze U. Marine fisheries extension services: A training and visit system for southern Asia. *Mar Policy*. 1984;8(4):330-336.
38. Wang Y. China PR: A review of national aquaculture development. In: *Aquaculture in the Third Millennium: Technical Proceedings of the Conference on Aquaculture in the Third Millennium*, Bangkok, Thailand; 2001.
39. World Bank. Enhancing agricultural innovation: How to go beyond the strengthening of research systems. Washington, DC: World Bank; 2006.
40. Zafar S. Economic viability of inland fisheries in Jharkhand: A case of Ranchi. 2021.