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Empowering women through alternative sustainable livelihood: a case study of ornamental fish farming in India

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Backyard ornamental fish farming provides positive economic returns to many of the rural poor and empowers them socially and financially. To achieve the national goal of Pradhan Mantri Matsya Sampada Yojana (PMMSY) and to promote the development of the Ornamental Fish Industry, ICAR-Central Inland Fisheries Research Institute is working in a mission mode to empower and encourage tribal and Scheduled Caste women to augment self-employment opportunities. The process operates cyclically, including selecting beneficiaries, capacity building, site-specific demonstration, providing inputs, monitoring the farming activities and establishing marketing linkage. Within 5–6 months of fish rearing, women started their first earnings of ₹ 500–1000/month and enhanced their income continuously. Around 58% of the female ornamental beneficiaries established their ornamental farming unit after the ICAR-CIFRI intervention. Women of all ages are motivated to adopt sustainable ornamental fish farming activities with first-hand live-bearers and hand holdings supply. Women said that lack of proper market accessibility is the main constraint for their viable growth. This type of approach is an initiative toward SDG increasing family happiness index, reducing migration of laborers and empowering socially and economically backward downtrodden communities in the rural sector, which would help boost their livelihood and economic security.

KEYWORDS

ornamental fisheries, rural enterprise, SDG, sustainable livelihood, economic security

1 Introduction

The Sustainable Development Goals (SDGs) aim to transform our world into a better version. They are a call to action to end poverty and inequality, protect the planet, and ensure everyone enjoys health, justice and prosperity. Among the 17 SDGs, Gender Equality (SDG 5) is one of the most important chapters to address in India. The gender power model (Connell, 1987; Pratto and Walker, 2004; Pratto et al., 2011) suggests that the power is male-dominant and the female is submissive. Connell (1987) posited that hegemonic masculinities emerged under particular conditions and could be supplanted by emerging forms. Inequalities between men and women are one of the most persistent patterns in power distribution. This gender inequality can be observed in daily life, such as access to education, job opportunities, and economic resources (UNDP, 2015). Gender power relations may manifest as a woman's lack of access to and control over financial and other resources (Aterido et al., 2013; Meeker and

Meekers, 1997; Obiyan and Kumar, 2015; Dimbuene et al., 2018), lack of autonomy and decision-making power (Sia et al., 2014; Sa and Larsen, 2008) and disrespect and abuse of women by health workers during their pregnancy (McMahon et al., 2014; Sando et al., 2016; Kujawski et al., 2015), all of which have been shown to impact maternal health and their health care. Hegemonic masculinities were open to historical change and might be displaced by newer forms.

Globally, women have fewer opportunities for economic and social participation than men, less access to basic and higher education, greater health and safety risks and less political representation (Sen, 2009; World Bank, 2011). Gender inequality is often greater among the poor within and across countries. Though women comprise more than 50% of total world's population, they own 1% of the world's wealth only (Cagatay, 2001). To establish women's equal rights to financial and natural resources and access to ownership and control over property, women have to be self-empowered and economically independent. Women empowerment is considered a process that takes place over time, making women agents who formulate choices, control resources, and make strategic life choices (Lee-Rife, 2010). The life expectancy of women has increased by 20–25 years in developing countries over the past 50 years (World Bank, 2011).

Ornamental fish culture is fast emerging as a major branch of aquaculture globally. Presently global ornamental fish trade is worth US\$ 15 billion and over 2 billion live ornamental fishes are traded worldwide (Satam et al., 2018). The ornamental fish export trade in India is US\$ 1.4 Million (2017–18), a 0.4% share of global ornamental fish export (Parappurathu et al., 2021). India's contribution to the global ornamental fish trade is 0.008 percent which is majorly dependent on wild fish collection from the North Eastern region of India (Parida et al., 2022). However, these wild capture-based trading are not sustainable and are a matter of biodiversity and population conservation. So, the focus of ornamental fish farming should be on culture-based captive production systems. A very good domestic market depends on the domestic breeding of exotic fish species. The overall domestic trade in ornamental fisheries crosses Rs. 10 Crore (12.19 Lakh US\$) and is growing at the rate of 20% annually (Susan, 2014). To empower and encourage women, Scheduled Castes (SCs) and Scheduled Tribes (STs) [The Constitution (Scheduled Castes) Order (Amendment) Act, 2021, Ministry of Law and Justice, Government of India, New Delhi, 13th April 2021/Chaitra 23, 1943] and other economically weaker sections and to provide self-employment opportunities, PMMSY Government of India takes a flagship to promote the development of the Ornamental Fish Industry. PMMSY aims to enhance fish production to 220 Lakh Metric Ton with an investment of over Rs.20,000 crores in the next five years, called "Economic Revolution through Blue Revolution." PMMSY has an allocation of ₹ 576 crores (702.54 Lakh US\$) for catalyzing the ornamental fish industry's growth and generating 7 lakh employments (Pradhan Mantri Matsya Sampada Yojana, Operational Guidelines, 2020). The key production of ornamental fish is from small-scale production units within 1 acre of land and investment within Rs. 3 lakhs per unit (Swain et al., 2020). This sector is considered one of the best platforms for employment generation and forex trade.

The increasing demand for ornamental fish in the national and international markets gives a new face value to many people and

women in society, by empowering themselves financially. Due to congenial climatic conditions, Kolkata and its surrounding districts have emerged as promising breeding centers for ornamental fish, where many small fish farmers and amateurs are engaged in this trade. Less manpower and minimum time involvement enhance the women's engagement in this sector besides their household responsibilities. A small backyard pond, a small aquarium or fish-rearing tank, homemade fish feed and minimum capital cost can give economic independence and decision-making power to marginalized women in rural India. Empowering women is seen as one of the central issues in sustainable development for many nations worldwide (Sen, 1999; OECD, 2012; UNECE, 2012; Gates, 2015). Around the globe, governments and organizations strive to increase women's empowerment by implementing different interventions, such as offering access to microfinance services to promote sustainable development and human rights. To ensure women's active participation and equal opportunities for leadership at all social and economic decision-making levels, ICAR-CIFRI works continuously, especially in rural areas. Therefore, the paper's objective is (a) to empower women to augment self-employment opportunities through backyard ornamental fish farming. (b) to analyze the impact of ICAR-CIFRI initiatives in providing livelihood (percentage of successful running of the ornamental fish farming unit). This paper will provide insights into women's knowledge, practices, and attitudes toward ornamental fish farming, as well as its impact on economic growth.

2 Context and methodology

2.1 Women's empowerment model

Women's empowerment is critical for achieving gender equality. It includes increasing a woman's self-respect, decision-making power, access to opportunities and resources, control over resources and society and ability to effect change. To get a better understanding of women's empowerment, the 3-dimensional model (Kabeer, 1999) proposes that women's empowerment can take place on three distinct dimensions: (1) resources, referring to individual empowerment which not only access but also future claims of both material and social resources; (2) agency, including processes of decision making, as well as the ability to identify and utilize the resources and (3) achievements referring to outcomes in the broader, societal context where societal empowerment can be observed.

2.2 Study area

ICAR-CIFRI is working at 20 different rural places in West Bengal, Odisha and Jharkhand and encouraged 679 marginalized SC and ST people, especially women of the house, to establish ornamental fish farming units as an alternative source of income. In West Bengal 405 SC and ST women in the rural areas of the Sundarbans, hilly Darjeeling, Malda, Murshidabad, and Nadia covered under this project. This ornamental fish farming intervention benefited 159 women from tribal communities in Mayurbhanj, Rishia, and other villages in Cuttack, Bhadrak, and

Bhubaneswar, Odisha. This mission mode approach also includes 115 SC and tribal women from Ranchi, Simdega, Bokaro and Jamshedpur of Jharkhand. In every place, women start home-based ornamental fish farming units with infrastructural and technical support of ICAR-CIFRI.

2.3 Framework for developing ornamental fish farming cluster

The whole process of beneficiaries' selection involved adopting either a wholistic wetland development programme involving their women in ornamental activities or on a cluster basis in the Sundarbans areas or through the recommendation of the state fisheries department by networking SHGs, NGOs and active members of Rotary Clubs. The institute has its way of making an ornamental farming industry establishment for rural women. From motivation to ornamental farming start-up as an alternative livelihood option to make them independent entrepreneurs in the ornamental fish business is a journey of ICAR-CIFRI's mission for livelihood mission (Figure 1).

Considering all the criteria, beneficiaries are selected to make a cluster. A mass awareness programme was organized for every cluster before the start of the intervention and all the beneficiaries and their family members were convinced in the programme to take

up the activity and the benefits they would reap after the interventions. The challenges envisaged in taking up the activity were also informed to them so that they would be ready for the challenges they face. The programme also includes a training programme to inform them of what to do and what not to do. After the mass awareness cum training programme, the ornamental fish units were established. Before the input distribution to the beneficiaries, a process of collecting the Identity proofs (Aadhar Card) and caste certificates of beneficiaries was initiated. A minimum space of 100 sq. ft. is needed to start the ornamental fish culture in the backyard on mini commercial scale. As an initial input 400 L ornamental fish rearing and breeding FRP tank, aerator, thermostat, livebearer fish seed [i.e., Molly (*Poecilia sphenops*), Guppy (*Peocilia reticulata*) and Swordtail (*Xiphophorus helleri*)], good quality ornamental fish feed with 30–35% Protein and Carotenoid pigments, medicine and other required accessories distributed among the women beneficiaries. In establishing an ornamental farming unit in a cluster, the minimal investment provided by the institute is approximately ₹ 18,000/– per beneficiary. The 3–5 days of rigorous residential training or off-campus demonstration and hands-on training are also conducted for the beneficiaries before distribution. When the women started their production on a large scale, ICAR-CIFRI also linked them with the exporter, stakeholders, and ornamental fish market to supply their

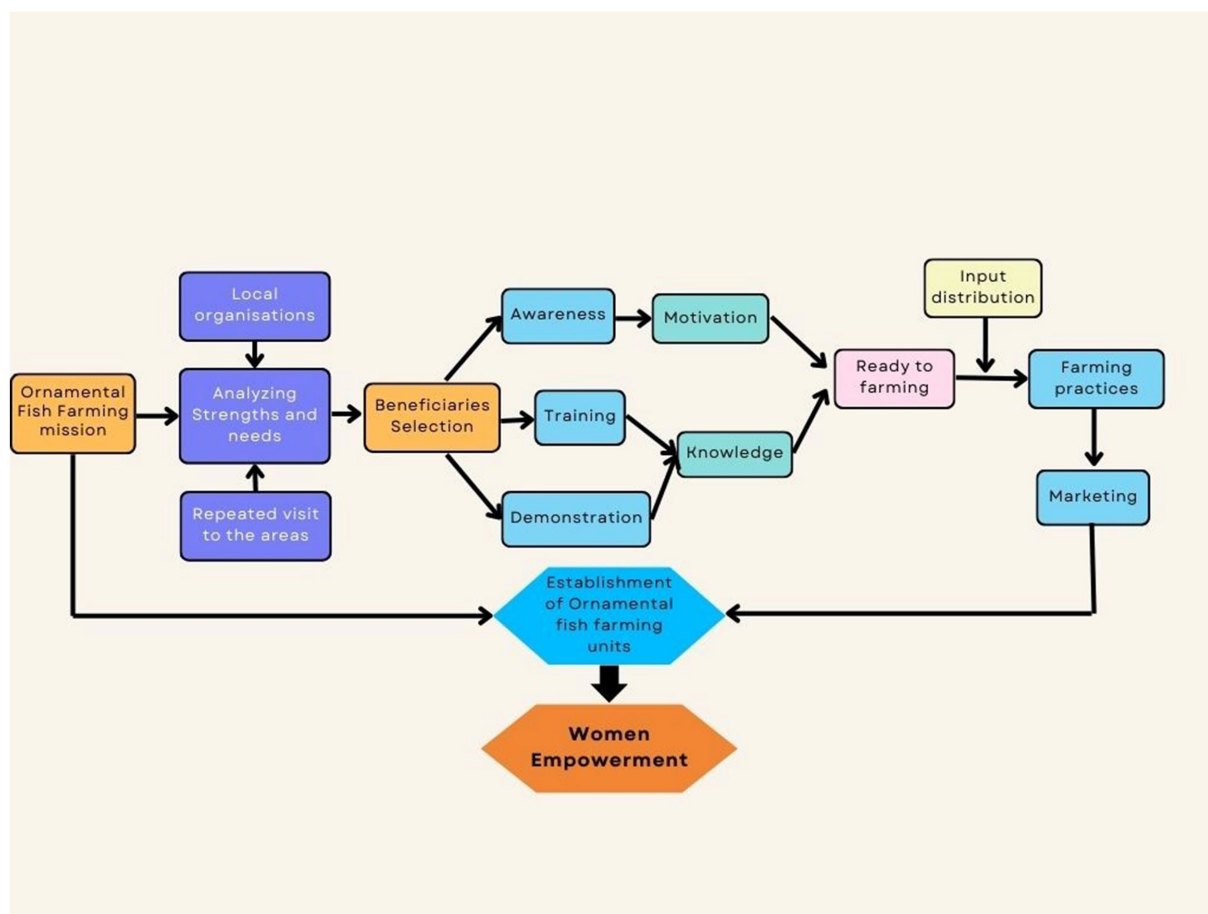


FIGURE 1
ICAR-CIFRI framework for developing ornamental farming clusters.

products. Seller and farmer linkage is the main marketing chain in this sector.

2.4 Criteria for ornamental farming cluster establishment

ICAR-CIFRI visited the proposed site after getting the information from the respective authority and arranged a brainstorming with the local womenfolk about backyard aquaculture and ornamental fish farming for livelihood development and women empowerment. After that, the women will decide on their abilities and utilize the resources. Finally, the experts from ICAR-CIFRI check the suitability of the ornamental fish farming cluster based on certain criteria such as market availability, electricity availability, economic instability and irregular livelihood options of beneficiaries, and self-motivation of the women.

2.5 Data collection method

The study conducted between 2022–23 employed qualitative methods to collect primary data. At first baseline survey of the socio-economic status of 679 families was done by visiting their households. Other data collection methods used included Participatory Rural Appraisal from 679 women which took 30–35 min for each interview. Fish production and marketing data were collected by direct observation in every 3 months interval. After the intervention, regular monitoring and data collection continued from 2022 to 2023. In-depth interviews ($N = 679$) and Focus Group Discussions (FGDs) were conducted using a semi-structured questionnaire to collect the necessary information. The study focused on women's activities, including fish production, fish marketing, and clusters establishment. The collected data was necessary to obtain their economic development, their constraints and strength data.

2.6 Knowledge, attitudes and practices (KAP) analysis

The Knowledge, Attitude and Practices (KAP) survey is a quantitative method (standardized questionnaires) that provides access to quantitative and qualitative information about society. KAP surveys reveal misconceptions that may create obstacles to the new implementation. Sociodemographic factors included gender, age, marital status and the educational status of the beneficiaries collected during the survey. The occupational engagement of the beneficiaries, fishing experience and monthly household income in Indian Rupees were also surveyed. The knowledge, attitudes and practices (KAP) survey is used to measure and monitor the progress of the various cluster interventions in the target communities (Prमितasari et al., 2015). The KAP household survey was conducted after six months of intervention. The main objective of the KAP survey is to (i) measure the level of knowledge gathered from training, demonstration and social media monitoring; (ii) assess the attitudes and norms of primary ornamental fish farming; (iii) generate data on the outcome and some output indicators; (iv)

follow up on the barriers and enablers documented during the baseline survey and to identify other emerging knowledge gaps, cultural beliefs, social norms or behavioral patterns and practices that create barriers for ornamental fish farming and (v) develop specific recommendations and actions.

2.7 Ornamental farming constraints analysis

Garrett's Ranking Technique (Garrett and Woodworth, 1969) was applied to study the change of orders of constraints for ornamental fish farming into numerical scores. The prime advantage of this technique over simple frequency distribution is that the constraints are arranged based on their severity from the respondents' point of view. Hence, the same number of respondents on two or more constraints may have given different ranks. Based on Garrett's Ranking technique, the study had the respondents rank different constraints based on their impact, thereby converting them into score value and rank with the help of the following formula:

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

Where R_{ij} = Rank given for the i th variable by j th respondents; N_j = Number of variables ranked by j th respondents. With the help of Garrett's Table, the percent position estimated is converted into scores by referring to the table given by Garrett and Woodworth (1969).

3 Detail to understand key programmatic elements

3.1 Socio-demographic profile of beneficiaries

All beneficiaries are either Scheduled Caste or Scheduled Tribe communities. They are someone who occupationally (a) catch fish or (b) fish farmers or (c) members of a fishing family or (d) fish sellers. The women member of a family generally help their male members of the house, and sometimes they are involved with different SHG groups (Self Help Group) for handicrafts making, i.e., shari decorating, Bori (dried lentil dumplings) and pickle making, poultry or goatery farming, etc. A large number of women also engaged in agricultural activities. The socio-demographic characteristics of the 679 respondents in 20 research locations throughout West Bengal, Odisha and Jharkhand were recorded and analysed (Table 1). As a less laborious and less time-consuming way to earn income women of different age groups (19 to 64 years) involved in this sector for their economic upliftment (Table 1). The majority of beneficiaries are relatively young, aged between 20 and 45 years and most of them have the least fishing experience. Elderly women above 60 years spontaneously engaged in this sector for a little financial support to their families. The children of the house enthusiastically engage in feeding the colorful fish, and they enjoy the farming system. 70.7% of women have their family responsibility with children and grandchildren.

TABLE 1 Socio-demographic characteristics of the beneficiaries ($n = 679$) under the study taken from 3 states of India mostly dominated by the underprivileged category of women.

Parameters	Characteristics/Features	Frequency	Percentage (%)
Age group	<25 years	125	18.41
	25–35 years	273	40.21
	36–45 years	182	26.80
	46–60 years	85	12.52
	>60 years	14	2.06
Educational qualification	Illiterate	33	4.86
	Can write the name only	185	27.24
	Primary	201	29.60
	Secondary	166	24.44
	HS and above	94	13.84
Family member	3 to 4	198	29.16
	5 to 7	401	59.05
	> 7	80	11.78
Occupation	Students	11	1.62
	Unemployed housewives	94	13.84
	Wild fishers	40	5.90
	Factory labors	31	4.56
	Housemaid	16	2.36
	Agri-farmers	163	24.00
	Aqua-farmers	47	6.92
	Other cottage industry	233	34.31
	Daily labors	26	3.83
	Anganwari cooks (School mid-day meal cook)	18	2.65
Fisheries experience	< 5 years	497	73.19
	> 5 years	182	26.80
Monthly household income	< 2000	93	13.69
	2000–4,000	207	30.48
	4,000–7,000	240	35.34
	>7,000	139	20.47
Marrital status	Married	448	65.97
	Unmarried	152	22.38
	Widow	79	11.63
Family status	Teenagers & newly married	167	24.59
	Having kids	267	39.32
	Having adults and grandchildren	193	28.42
	Old aged	52	7.65

Most beneficiaries had a low education level (according to the study only 38.28% of women above the primary level) and few women could write their names. Most of the women have above four family members, including their spouse, children and in-laws. So they have huge responsibilities toward their family. Some women (10.75%) have been professionally engaged in fisheries for the past few years regarding live fish catch from rivers, juvenile prawn seed collection, fish drying, farming in their household ponds, and fish selling in local markets. Several women also engage in cottage

industries through SHG groups or Govt. intervention. It is observed that most women have some fishing experience through their families, who are involved in fisheries-related activities like backyard ponds for household requirements, riverine catch activities, etc. The income of the majority is below 7,000 (\$ 90), so after feeding everyone in the house, it's very difficult to educate and maintain their basic lifestyle and health issues. So it is a priority for women, to look for a new alternative livelihood option so they can lead their lives easily.

Teenage school and college students are also involved in the ornamental farming sector to bear their study costs. Due to home-based work, new mothers and expecting mothers have also engaged apart from their daily household responsibilities. Some women are also engaged in other activities like agriculture, aquaculture, cloth making, kitchen-gardening and other cottage industries, along with the ornamental fisheries sector as their secondary occupation (Table 1). The data in Table 1 shows that 598 beneficiaries are homemakers, but the majority of them are engaged in different cottage industries and forming small SHG units. But the hard truth is several times the income of women is calculated as family income which is only accessed by the male of the house. But still, the women try to earn more for their families, especially for their children's education and health.

3.2 Knowledge, attitude, and practice toward ornamental farming

Every woman's beneficiary got training on ornamental fish farming and field demonstrations, as well as ornamental fish market and established ornamental fish farm visits also included with their

training schedule. Along with CAR-CIFRI experts are always in contact with them and suggest them through Whats app, video calling and YouTube documents so that they can grow themselves. The detailed knowledge about various aspects of ornamental fish farming and marketing is documented for 679 beneficiaries (Table 2). The survey results showed that most beneficiaries (92.79%) correctly stated about the tank and water management techniques. About 87.03% of women take care of the timing and amount of fish feed.

The knowledge about ornamental fish farming and its economic viability gave some women a positive attitude toward this livelihood opportunity. Whereas some women lose their interest due to tricky marketing strategies. ICAR-CIFRI started to create marketing channels among the producers and businessmen so that they could easily supply their produce to the market.

As shown in Table 2, most of the beneficiaries had a very good attitude (65.09%) toward implementing new livelihood opportunities for economic development. In this study, about 48.6% beneficiaries had a negative attitude toward ornamental fisheries business model establishments and 55.82% of the beneficiaries failed to encourage other neighborhoods to adopt the technology as an alternative livelihood option. The majority had a good attitude toward frequent

TABLE 2 Response to knowledge, attitude and farming practice of rearing and marketing process of ornamental fish farming as an alternative livelihood option.

Variables	Categories (%)		
	Adequate	Some extent	Inadequate
Tank water exchange and cleaning	92.79	7.21	-
Feeding time and amount	87.03	12.97	-
Livebearer fish breeding and larval care	76.14	17.72	6.14
Indigenous fish feed for color	28.32	39.76	31.92
Precautionary measures for infections and medicine	13.65	28.86	57.49
Fish marketing	19.28	45.65	34.07
Egg layer fish breeding	8.39	18.21	73.40
Attitudes			
Adopting new livelihood opportunity	65.09	23.12	11.78
Daily updating with technologies	41.08	28.57	30.34
Conversation and doubt clearing with experts	46.53	31.66	21.79
Group works	31.95	37.70	30.34
Business model establishments	22.97	28.42	48.60
Expand the farming units	28.13	30.93	40.94
Encourage others for this livelihood option	19.58	24.59	55.82
Practice			
Daily fish monitoring	85.86	-	14.13
Feeding regular & appropriate quantity	77.61	-	22.38
Precautionary measures for infections	31.07	-	68.92
Larval rearing	43.29	-	56.70
Regular market survey	18.11	-	81.88
Raising new types of fish	13.99	-	86.01
Saving the income for future	57.87	-	42.12

TABLE 3 Area-specific success rate and income from ornamental fish farming ($n = 679$).

Place	Rate of success (%)	Earnings (₹ /women/month)
Chunakoli, Bhubneswar, Odisha	93	1,000–2000
Satyabhamapur, Cuttak, Odisha	68	800–1,200
Kuliana, Bhadrak, Odisha	84	1,000–1,600
Rishia, Balasore, Odisha	36	150–650
Mayurbhanj, Odisha	51	250–300
Amtoli, Sundarbans, WB	56	550–1,300
Kultali, Sundarbans, WB	76	1,000–1,500
Khalsi, Nadia, WB	44	300–900
Ranchi, Jharkhand	64	200–700
Jamshedpur, Jharkhand	88	850–1800
Bokaro, Jharkhand	47	150–350
Sargachhi, Murshidabad, WB	56	100–300
Habibpur, Malda, WB	68	200–250
Mirik, Darjeeling, WB	54	350–450
Simdega, Jharkhand	24	Not Started yet
Sukhia Pokhri, Darjeeling, WB	15	Not Started yet
Sittong, Darjeeling, WB	68	550–700
Kochukhali, Sundarbans, WB	10	Not Started yet

expert consultation and new technology updation but they showed a negative attitude toward expanding their farming units in the future.

In this study, (Table 2) observed that most of the beneficiaries practiced daily fish monitoring and appropriate feeding for ornamental fish farming. But only 31.07% of beneficiaries practiced the precautionary measures regularly, and the rest of them did it occasionally or never. It is also noticed that only 13.99% of women started expanding their farming practices with different new species.

3.3 Success in ornamental fish farming

After regular monitoring and technical support by ICAR-CIFRI experts, more than 58% of the total women beneficiaries successfully run their ornamental farming units, and 45% of women already started marketing regularly (Table 3). The success rate at Bhubaneswar, Bhadrak, Kultali and Jamshedpur are higher than other clusters. The township in the neighborhood and effective market communication could be the cause of this. Several factors influence the success scenario of the ornamental fish culture industry run by women. The factors are:

- Capacity building: Training and education
- Demographic factors: Age, level of education, marital status and experience
- Economic conditions: Primary income, inflation rates, rate of market and infrastructure
- Social structure: Family dependency, cultural beliefs, religious beliefs and access to assets
- Institutional structure: Government institutions, top-down institutional systems dissemination of knowledge and skills and technical support

- Legal factors: Legal factors for trading and exporting

Assets like land and financial access, and family cooperation are some of the most important factors for a successful woman ornamental entrepreneur. Education, technical and digital knowledge, and attitude are the critical factors for being an entrepreneur. Financial support from any formal and informal lending system (but not from users) or family system can make a successful unit. After 5–6 months of culture, women started fish selling and their earnings started at ₹ 500–2000/month and grew continuously. The women started to produce monthly 350–800 fish fingerlings. However, the income range is fully area-specific (Table 3). In certain regions, such as Bhubaneswar, Jamshedpur, Cuttack, Bhadrak, and Kultali, economic growth has been extremely rapid. In contrast, women in Khalsi, Rishia, and Bokaro are not that much successful in ornamental fish farming. As the establishment of the ornamental fish farming industry is a slow process, the institute is still working to identify these issues and putting a strategic plan into action to increase adoption. Despite the remote location, the women of Amtoli and Kultali of Sundarbans started marketing in local areas, which positively impacted adoption and propagation. Very recently in Mirik of West Bengal hill region, women are enthusiastic about home-based ornamental fish culture and started their units and marketing at the locality. Some places, i.e., Simdega, Jharkhand; Kochukhali, Sundarbans; Sukhiya Pokhri, Darjeeling, have not started their marketing yet, but their ornamental fish rearing units are running successfully. It is hoped that very soon, these units also expand their business. In several places like Kultali, Sittong, Bhubaneswar, and Bhadrak they established an Ornamental Fish Farming Village in collaboration with ICAR-CIFRI, where they started commercial large-scale production and also started training and encouragement for other women of different villages. Almost 28 % of women in all three states (West Bengal, Odisha and Jharkhand)

TABLE 4 Rank and respondent's percentage of all constraints observed for the failure of ornamental fish farming in some areas ($n = 679$).

Constraints	Total	Average	Rank
Knowledge gapping	6,290	62.90	IV
Lack of proper management skill	6,272	62.72	V
Repeated availability of fish seed and fish feed	5,045	50.45	VIII
Less capital to procure fish and feed for cycling operation	7,403	74.03	II
Lack of community cooperation	5,514	55.14	VI
Societal stigma and family obligations	6,697	66.97	III
Lack of proper market accessibility	7,684	76.84	I
Somewhat illiteracy	4,193	41.93	IX
Limited access of the internet and communication	5,245	52.45	VII
Lack of group dynamics	3,331	33.31	X

proved themselves successful on the way to expand their farming and business. In West Bengal, 10.61% and in Odisha, 8.8% of women are still in the process of adopting farming and due to health issues and family issues, they have not yet been successful. The maximum success rate was shown in Odisha (42.76%), and their units were expanded for further development.

3.4 Constraints of ornamental fish farming

Despite several successful cluster formations, some clusters are still struggling for their sustainability. Many constraints are observed in running an ornamental fish farming unit (Table 4). The constraints are ranked between 1 to 10 based on data collected from the women beneficiaries. The non-availability of good market access is one of the key constraints for establishing successful ornamental fish farming units. Family obligations and sociocultural taboos sometimes influence village women to adopt new livelihood practices. As they belong to a marginalized family, financial investment is a great obstacle for them. The educational and digital barrier for village women is one of the basic constraints. For those who have not yet upgraded, ICAR-CIFRI has taken some more initiatives like regular monitoring, further handholding training, etc., for better involvement. The percentage of beneficiaries' responses to the constraints is shown (Table 4).

4 Discussion

Ornamental fish farming can be adopted anywhere in India to enhance economic growth and support livelihoods. It has been shown that women nurture ornamental fish with care and have shown interest in different activities in backyard farming of ornamental fish (Sinha et al., 2012). A total of 165 women from Kultali and Amtoli of Sundarbans, Kuliiana of Bhadrak, Chunakoli in Bhubaneswar and Jamshedpur started supplying their produce to local aquarium shops and also started telly marketing. In Amtoli, the women's cluster started to use their old shop to sell ornamental fish and aquariums. Studies show that some women expand their units into small earthen pots, cemented tanks, backyard ponds, and plastic tubs. Some women clusters expand the ornamental fish farming units in their

neighborhood by giving them ornamental fish and basic technical knowledge free of cost. ICAR-CIFRI ties up the successful clusters with the marketing channel and gives them the next level of culture practice training on egg-layer fish breeding and larval maintenance, facilitating the farming system. The women upgraded themselves step by step and increased their socio-economic status with the help of ornamental fish farming. Huis et al. (2017) the time lag between an intervention and its evaluation may influence when empowerment effects on the different dimensions occur and that the type of intervention influences the sequence in which the three dimensions can be observed. Previous research has highlighted that the act of choice does not necessarily equate to progressive outcomes for women because women's individual choices are historically and structurally conditioned (Budgeon, 2015). A recent study (Dutt et al., 2016) focused on the conception of women's empowerment through collective rather than individual business ownership, thereby adhering to relevant cultural norms emphasizing collective rather than individual growth (Kurtiş et al., 2016).

Indian rural women are constrained by numerous factors preventing them from becoming successful entrepreneurs. It is also very difficult to maintain their livelihood therefore, they become malnourished in their active age to the later stage of their life. Economic return is a key factor in establishing their livelihood systematically, thereby making themselves self-reliant and role to nourished in a difficult situation as well as supporting their family income. To supplement their family income, ICAR-CIFRI has taken an innovative approach to rebuilding their economy through an integrated approach on a cluster basis in which ornamental farming is a key driving force to boost their economy. In the present context, an ornamental farming model with the live-bearer fish with all inputs was supplied to the beneficiaries with an approach of training and capacity building followed by an on-site demonstration, interaction and a subsequent online mode that is WhatsApp, Phone call to make them confident, self-reliant and able to learn to perform the farming at their capacity. This method is generally adopted in various extension methodologies, making the individuals more competent to start the enterprise with the acquired skills (Khan, 2015). The acquisition of knowledge for adoption is a critical factor in the sustainable development of technology (Fu et al., 2018). In the present study, rural women have been given a different way of experience, learning, hands-on training, live demonstration and

one-to-one problem solving to address the key problems faced by the individual woman and develop the management skills in an individual or in the groups which would contribute themselves to solve their issues when faced. This type of module facilitates the development of skills among women as a way for successful adoption. Though there are various factors involved for the successful entrepreneur, the involvement of ICAR-CIFRI to build up the model was successful, which was reflected in around 30% of the women at first instances and the success rate was increasing over time. Ornamental fish farming has already been tried and tested in several countries, states, and organizations for rural development and women's empowerment (Jacob et al., 2021). During 2011–2014, 4.8 Lakhs of ornamental fishes were traded on average per year, generating an average income of Rs. 7,065/– per farmer per year under SHG mode in the adopted clusters of Mayurbhanj, Keonjhar and Sambalpur district of Odisha (Swain et al., 2014). In the Midnapore district, 40 women developed 4 ornamental fish production units in their backyard after taking training from ICAR-CIFA and till 2014, Rs. 60,000/– per annum per unit (Swain et al., 2014). With the intervention of ICAR-CIFA, Bhubneswar 10 women of Ma Tarini SHG of Purunia Village, Keonjhar District, established an ornamental fish farming unit, and they made a gross average income of Rs. 65,000 over two cycles, taking eight to nine months (Swain et al., 2013). The women of different SHGs of three ornamental fish villages were developed at Landijhari, Saruli and Nuagaon of Barkot block, Deogarh District, with the intervention of ICAR-CIFA (Swain et al., 2020). Several families in the Kotatt region, Kerala had a positive attitude toward ornamental fish farming and got better economic opportunities (Jayalal et al., 2016). ICAR-CIFA, Bhubaneswar established an ornamental fish farming and breeding unit for empowering the tribal women of Pragati Self Help Group, in Bhatunia, Keonjhar District, Odisha, which is successfully run by those women from 2010 (Parida et al., 2022). In the coastal region of India, few fisher groups are involved in marine ornamental fish production as an alternative livelihood option (Johnson et al., 2019).

The approach for sustainability and economic enterprise would be more beneficial to a woman living below the poverty line where, along with their family and household work, they can generate an income of ₹2,500 on a small scale, which requires proper marketing strategy and networking. The approach laid by the institute could be useful in the long run for addressing SDG Goal 1 (poverty eradication/ alleviation) and SDG Goal 5 (gender issues on the economic front).

5 Conclusion

Ornamental fish culture represents an innovative farming technology that requires minimal time and investment while yielding high profits, in addition to enhancing water productivity. To empower and motivate rural women and to provide self-employment opportunities, the project is undertaken to promote ornamental fish culture among them. In India, many women have taken up ornamental fish breeding or farming as a backyard activity, especially in rural areas (Sahoo et al., 2011). When the women of the family start their earnings, the literacy percentage increases in that society. The small income of a housewife can contribute to their children's education,

health and hygiene. Considering the proven success of women in developing backyard ornamental fish farming in different rural parts of India, it is necessary to encourage them to create Self Help Groups for their livelihood improvement. The success of women in developing homestead ornamental fish farming businesses is encouraging other self-help groups and NGOs to initiate such enterprises. Women are well-suited to ornamental fish farming because of their inherent patience, but only if they are properly educated. Significant support is required to unlock women's existing and latent empowerment in this sector. More opportunities must be created for women, predominantly through collecting and disseminating information and transferring scientific technology between different states of the country.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SB: Formal analysis, Writing – original draft. BD: Conceptualization, Project administration, Writing – review & editing. AE: Methodology, Writing – original draft. PP: Investigation, Supervision, Writing – review & editing. AR: Supervision, Validation, Writing – review & editing. LL: Writing – review & editing. SC: Data curation, Writing – review & editing. AS: Data curation, Writing – review & editing.

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