J. Indian Soc. Coastal Agric. Res. 43(1):83-94(2025) https://doi.org/10.54894/JISCAR.43.1.2025.165838

Institutional and Technological Support for Dry Fish Processors in Tamil Nadu: An Empirical Assessment

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Received: 10.03.2025 Accepted: 30.05.2025

The dry fish sector in India is a vital component of the fisheries value chain systems, transforming low-value fish into higher-value, high-demand dried fish, contributing to food security, livelihoods, and exports. Despite this transformation driven by dry fish processors (DFPs), the sector experienced a 38.64% decline in population between 2005 and 2016. For this purpose, this study assesses the extent of institutional and technological support available to DFPs in coastal Tamil Nadu. A stratified random sampling method was employed to collect data from 300 DFPs across 14 coastal districts. The findings indicated that among the surveyed population, 41.7% were part of Self-Help Groups (SHGs) and 21% were members of fisheries cooperatives. Yet, the processors relied on traditional sun drying, and 63.3% of the DFPs population still struggled with access to drying yards, highlighting infrastructure and institutional support gaps in the sector. Despite these challenges, 80% of DFPs were willing to adopt solar dryer techniques, yet only 25% had received training in value addition, limiting their competitiveness in evolving markets. The institutional support remains fragmented and uneven, reaching only a small portion of the DFP community. Strengthening targeted training programs, enhancing infrastructure, and scaling up access to appropriate technologies like solar dryers are essential for improving the dry fish sector's resilience and long-term sustainability.

(***Key words:*** *Dry fish processor, Institutional support, Solar dryer, Technological adoption)*

The dry fish sector is integral to India's blue economy, contributing significantly to marine product exports and supporting livelihoods and food security (Singh *et al.,* 2014). In the 2023-24 fiscal year, the sector exported 3,00,966 MT of dry fish, generating $496.21 million. Between 1990 and 2024, dry fish exports grew tremendously (13.86%), with exponential growth in recent years significantly outpacing the overall marine products compound growth rate (6.52%) (MPEDA, 2024) (Fig. 1). Approximately 17% of India's total marine catch is used for dry fish production, surpassing the global average of 12% (FAO, 2022). This sector predominantly relies on sun drying, which is a traditional, cost-effective preservation method that requires minimal equipment or specialized skills and makes it accessible to small-scale processors along India's extensive coastline (Belton *et al.,* 2022).

Dry fish production is critical in supporting marginalized communities, including women, widows, and individuals with disabilities, by providing them with livelihood opportunities (Galappaththi *et al.,* 2023). It also contributes to food security by offering an affordable and highly nutritious protein source for poor and vulnerable populations. The sector is especially vital during the two-month fishing ban period on the Indian coast when fresh fish availability is limited. Dry fish, with its year-round availability, ease of storage, and long shelf life, ensures a stable dietary option for fish-dependent households (Das *et al.,* 2013). Additionally, the sector helps reduce post-harvest losses by utilizing spoiled or low-value catch, making it a sustainable solution in the fisheries value chain, which will help to attain the objectives of PMMSY, which was dedicated to the development of the fisheries sector in India (Surathkal *et al.,* 2023).

However, despite its socio-economic and nutritional importance, the sector faces several challenges. Quality and hygiene issues persist, affecting consumption levels. More critically, India's population of dry fish processors have declined by 34% between 2005 and 2016 (CMFRI,

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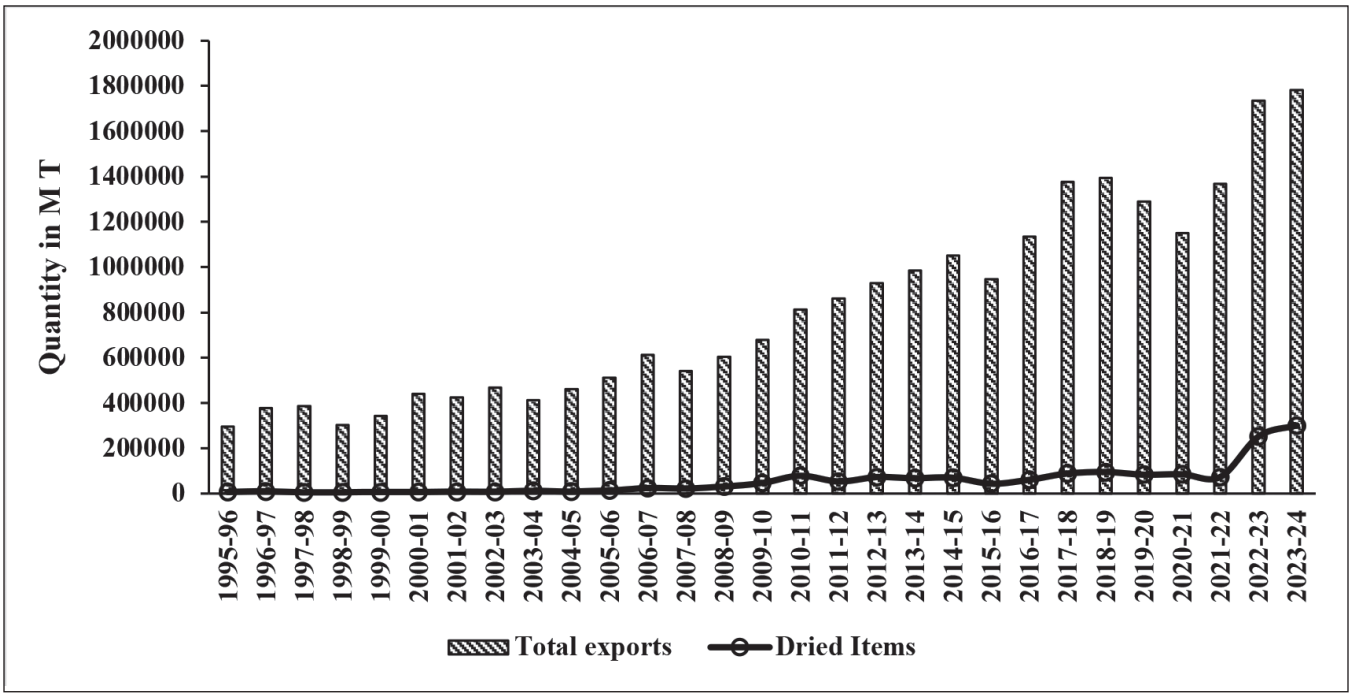

Fig. 1. *Export of dried fish and marine products from India*

2010 and 2016), driven by low profitability, high labor intensity, and inadequate infrastructure. Furthermore, the processors, who depend on this sector's socio-economics, were not satisfactory and deprived of many amenities, and the sector remains underrepresented in government policies and receives minimal support for technological advancements, limiting its potential for growth and resilience (Roy *et al.,* 2017; Seenivasan *et al.,* 2025a). This study aims to address these gaps by assessing the level of technology adoption and government support in Tamil Nadu's dry fish sector. By identifying key challenges and opportunities, the study seeks to propose actionable solutions to revitalize this critical industry and ensure its long-term sustainability.

MATERIALS AND METHODS

The study was conducted in Tamil Nadu, a state with a vast coastline, significant marine fish production, and a high concentration of dry fish processors (Fig. 2). The 14 coastal districts were classified into high, medium, and low potential strata based on factors such as marine fish production, DFP population, fishing fleet size, and consultations with the Department of Fisheries (DoF). Using a stratified random sampling approach, the data on various institutional and technological supports for DFPs were gathered through direct interviews with 300 dry fish processors at drying yards and landing centres, along with key informant interviews involving DoF, MSSRF, ICAR-CIFT, and TNJFU officials.

Institutional support refers to the assistance and resources organizations, institutions, or government/ non-government agencies provide to individuals, groups, or sectors to facilitate their development, operation, or sustainability. It can take various forms: financial, technical, infrastructure, policy and regulatory, market, research and development (Rhoades and Eisenberger, 2002). The institutional support in the dry fish sector was operationalized through multiple dimensions, including access to financial services (credit/loans), availability of technical training, infrastructure support (drying yards, storage), regulatory facilitation (licenses, subsidies), and market linkage support. In addition to that, variables such as socio-economic characteristics, processing practices, technology usage, market access, and perceived challenges were also measured.

Statistical analysis

Statistical analysis was performed using MS Excel,

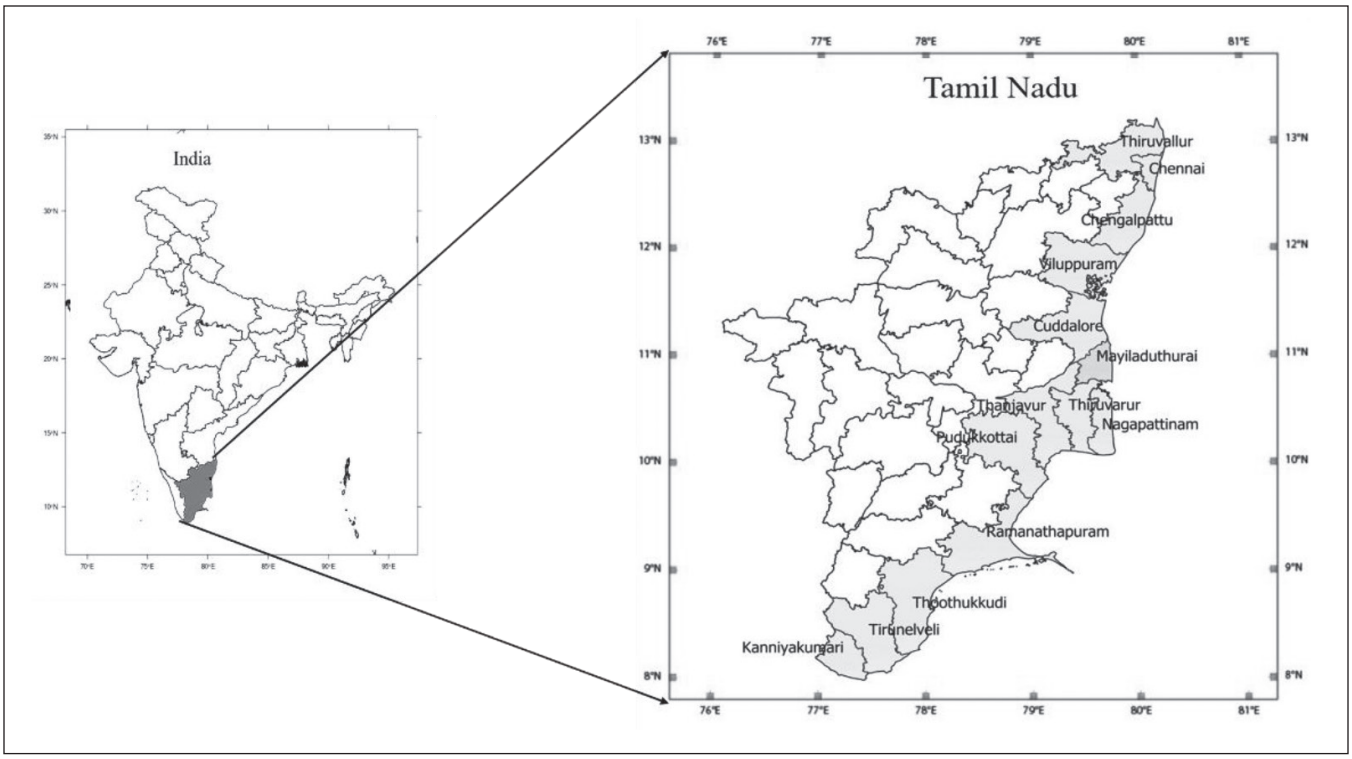

Fig. 2. *Study area*

IBM SPSS (version 25), and R software (2024.04.2-764). The Kruskal-Wallis H test (KWT) was applied to find significant differences in access/ availability of the various institutional and technological support to dry fish processors among the coastal districts of Tamil Nadu. Additionally, the Dunn test was conducted to check the differences between districts.

The KWT formula for comparing medians of more than two groups is:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_i^2}{n_i} - 3(N+1) \quad ...(1)$$

where,

- K = number of groups used for comparison
- N = total size of the sample
- n_i = i^{th} group's sample size
- R_i = total of the ranks related to i^{th} group

Dunn Test (DT):

The Dunn, non-parametric pairwise comparison post hoc test, was conducted using R software. The formula for the z-test statistic for the difference between the two groups is:

$$z_i = y_i / \sigma_i \quad ...(2)$$

where i is one of the 1 to m comparisons, y_i = WA – WB (where, WA is the average of the sum of the ranks for the i^{th} group) and σ_i is calculated as:

$$\sigma_i = \sqrt{((N(N+1)/12) - (\Sigma T^3_s - T_s/(12(N-1)) / ((1/n_A)+(1/n_B))} \ldots(3)$$

where, N is the total number of observations across all groups, r is the number of tied ranks, and T_s is the number of observations tied at the s^{th} specific tied value.

RESULTS AND DISCUSSION

Public distribution system (PDS)

The ration card is the minimum requirement to access any institutional and technological support, and the PDS was very effective and supported food security in Tamil Nadu, which was similar among the coastal population; 100% of the respondents possess

ration cards, showcasing the eligibility in access to governmental support (Amrutha *et al.,* 2024).

MGNREGA

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was considered a primary/ secondary livelihood option for the dry fish processors, as the production was seasonal, and a two-month fishing ban hampered the dry fish production. About 16.7% (50 nos.) of the respondents were beneficiaries of MGNREGA, which provides supplementary income and employment opportunities to the coastal communities (Fig. 3). Upadhyay *et al.* (2021) also reported that employment in the dry fish value chain was the primary source of family income; however, families were also dependent on other sources of income, such as fish auctioneers, fish retailing, agricultural labour and daily wages.

Housing schemes

The coastal communities are highly vulnerable

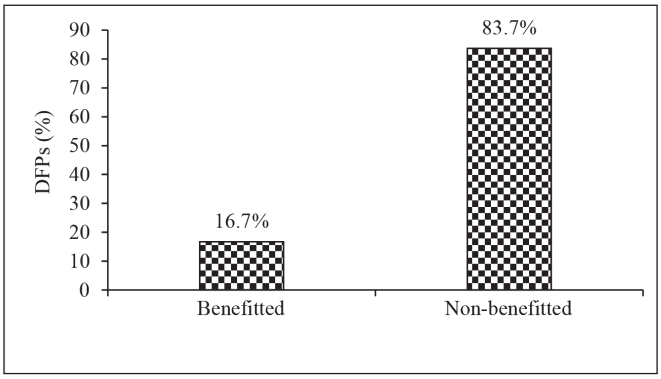

Fig. 3. *Access to MGNREGA*

to climate-related calamities such as tsunamis and cyclones. Due to that, they suffered losses in terms of lives, infrastructure, and other things. The dry fish processors were also affected severely, and the housing support among surveyed respondents revealed that 27% (81) have received government-provided housing assistance, primarily as part of relief measures following the tsunami disaster (Fig. 4).

Membership with SHG and Co-operatives

The SHGs are one of the strongest and most

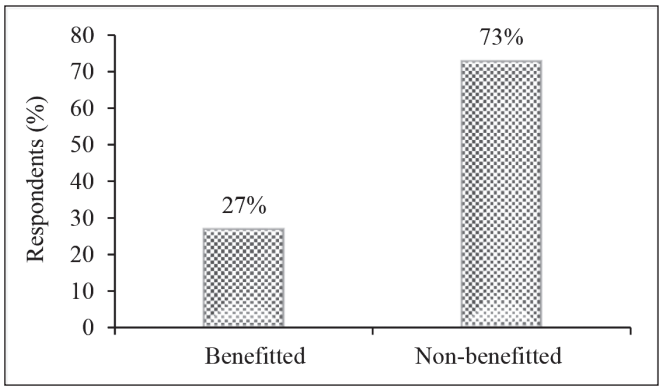

Fig. 4. *DFP availed from the housing scheme*

supportive of rural communities, which is similar to the case of coastal communities. The analysis indicated that 41.7% (125.1) of dry fish processors were part of Self-Help Groups (SHGs). In contrast, 58.3% (174.9) of the majority were not affiliated with such groups (Fig. 5). The membership was a substantial opportunity to enhance collective action, access to credit, and shared resources through increased SHG participation. SHGs improved members' bargaining power, financial security, and knowledge sharing. Expanding SHG membership among dry fish processors could significantly contribute to their socio-economic empowerment and the sector's overall growth (Vipinkumar *et al.,* 2017).

The cooperatives are prominent among the fishers as the fisheries schemes are passed through the cooperative structure in Tamil Nadu, whereas the co-

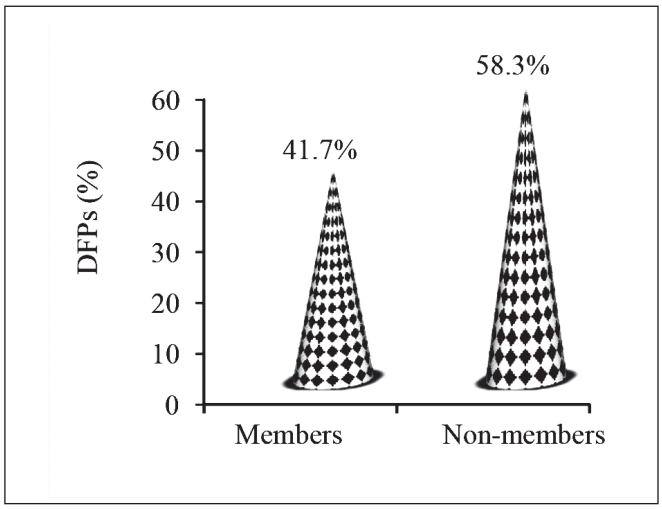

Fig. 5. *Membership with SHG*

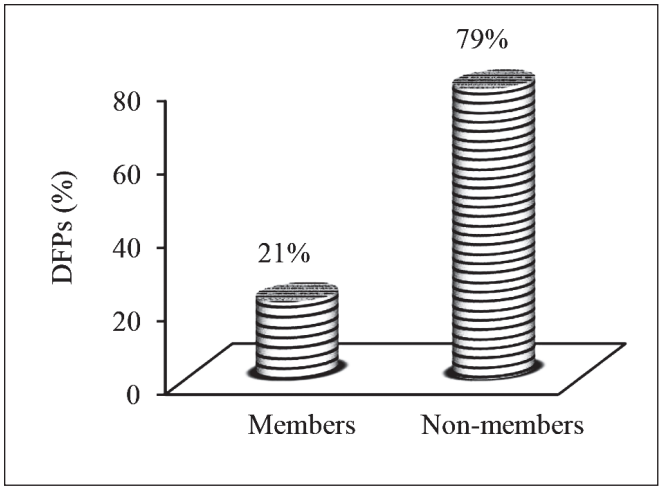

Fig. 6. *Membership with co-operatives*

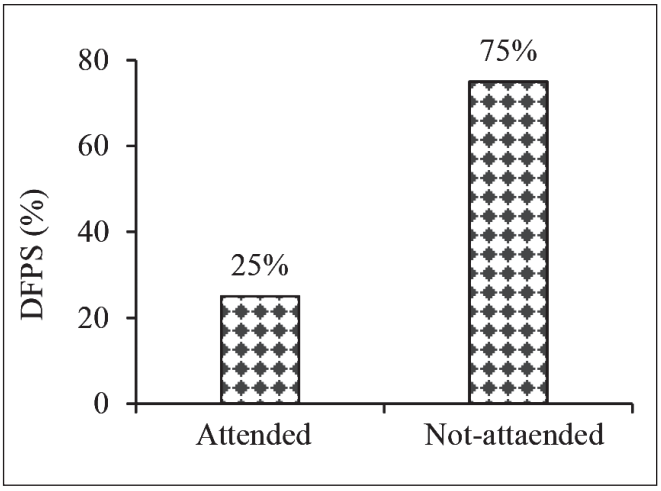

Fig. 7. *Training attended by DFPs*

operative membership among the dry fish processors was only 21% (63), while a significant 79% (237) were not part of fisheries cooperatives (Fig. 6). This indicated limited participation in cooperatives among the processors, which could be a missed opportunity for collective bargaining power could help minimize the influence of intermediaries, shared resources, and better market access. The low participation rate highlights the need to promote awareness about cooperatives' benefits and encourage forming or strengthening such groups to improve the socio-economic conditions of dry fish processors (Tyagi *et al.,* 2013).

Training attended and willing to attend

Only 25% (75) of dry fish processors had undergone training in value addition, dry fish marketing, and post-harvest activities, while 75% (225) had not attended any form of training (Fig. 7). Though the DFPs have sound traditional knowledge and experience in dry fish making, they lack in market/ consumer expectations. Therefore, a significant portion of the processors need to be equipped with essential skills to enhance the value of their products, improve marketing strategies, and manage post-harvest processes more effectively. Training in value addition and marketing can contribute to improved product quality, better market access, and increased income for the processors.

About 70% (210) of dry fish processors were willing to attend training on value addition, post-harvest

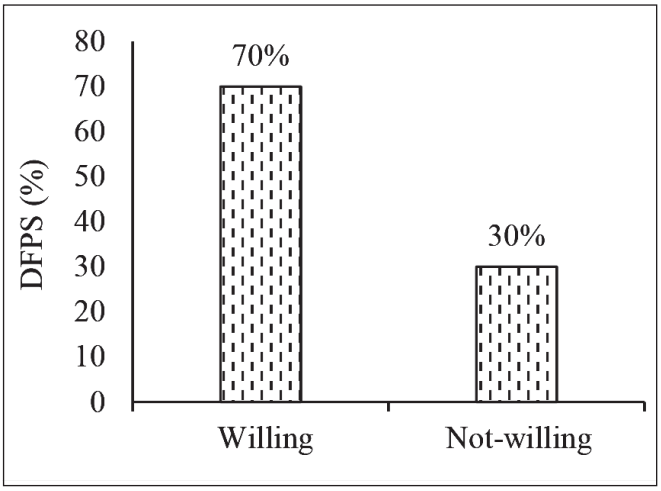

Fig. 8. *Willingness to attend training among DFPs*

management, dry fish production and export, as well as hygiene and sanitation (Fig. 8). Proper training in these areas, provided by governmental and non-governmental organizations, can help dry fish processors improve quality, enhance marketing and packaging, and compete in both local and international markets. Through various training programs, the government can empower small-scale dry fish processors to compete with giant traders and produce high-quality dry fish that commands better prices (Sukumar *et al.,*1991).

Institutional support plays a critical role in addressing the challenges faced by the dry fish sector, particularly in enhancing quality, improving market access, and promoting the active participation of

fisherwomen. However, factors such as low literacy levels, poor exposure, and lack of timely information often prevent fisherwomen from participating in extension programs and training sessions. Furthermore, many training programs are not gender-sensitive, and the lack of awareness about state and central government schemes exacerbates the challenges faced by fisherwomen (Roy *et al.,* 2017; Vipinkumar *et al.,* 2017). Extensive and intensive extension efforts are required to raise awareness among women about developmental schemes and encourage their active involvement (Sethulekshmi and Babu, 2011). The common ideology among consumers is that dry fish is unhygienic and not a quality product. This perception prevents dry fish processors from fetching high prices for their produce, forcing them to sell at very low prices in the local domestic market. Proper training programs and institutional support could help overcome these challenges, enabling processors to produce quality dry fish that meets consumer expectations and improves market opportunities.

Access to the drying yard

The study found that 63.3% (190) of dry fish processors struggled to access dedicated drying yards, while 36.7% of processors had access to drying yard facilities (Fig. 9), which indicated that a majority of processors detriment from structured spaces for drying activities, which were essential for maintaining efficiency and product quality.

Addressing this gap through improved infrastructure enhances the sustainability and productivity of the dry fish processing sector. In a few locations, though the drying yards are available, the processors cannot access the yard as they are far from the fish market/ beaches, which makes them burdened with extra transportation charges/labour and difficulty in accessing raw materials. Though technological advancement is less in the dry fish sector, the basic amenities that are necessarily required for dry fish production, like a drying yard and drying accessories (mat, gloves, and knives), are also not available, which could augment income during fish surplus by imparting better utilities over time, form and space. (Salim *et al.,* 2016; Seenivasan *et al.,* 2025a).

Willingness to adopt a solar dryer

The study found that 80% (240) of dry fish processors were willing to adopt solar dryers, which was a similar case in Malawi, where processors were willing to adopt solar fish dryers (Chiwaula *et al.,* 2018; Kayamba-Phiri *et al.,* 2020). This high willingness to adopt reflects a growing recognition of the benefits of solar drying, including improved drying efficiency, better product quality, and reduced dependency on weather conditions. However, 20% of the processors did not express interest in the solar dryer due to the lack of awareness and limited resource access. Promoting the broader adoption of solar dryers through capacity-building programs and financial support could further enhance the sustainability and profitability of the dry fish sector (Fig. 10).

Although India is the 3rd largest fish production country, there has been no technological advancement

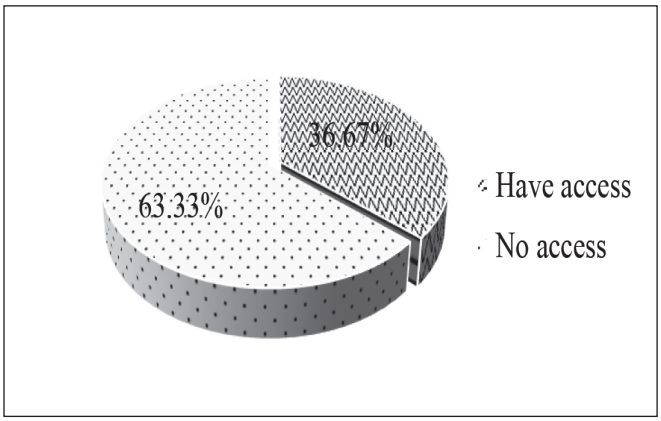

Fig. 9. *Access to the drying yard*

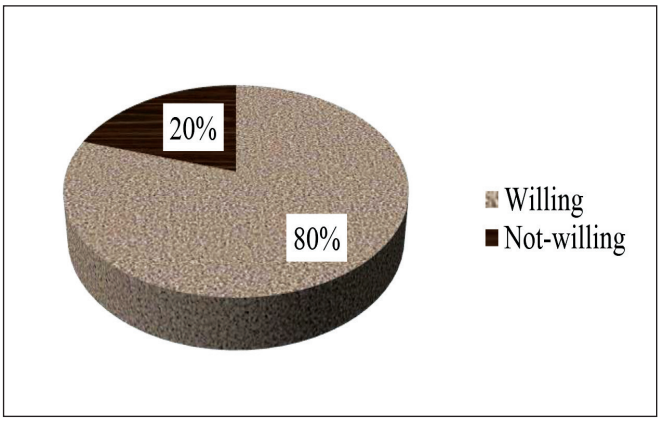

Fig. 10. *Willingness to adopt a solar dryer*

in the fisheries sector, especially the dry fish sector. Still, the processors follow the traditional sun drying method, which provides very little margin/profit due to the unhygienic production method and consumer attitude. Traditional drying methods are unsuitable during the rainy season due to limited covered space and inadequate protection from moisture, making drying and storing fish highly challenging. Therefore, based on the above mentioned problems, improved drying methods, such as low-cost solar dryers, can better solve the issues and enhance their livelihood, thereby promoting their growth and development (Ravi, 2022). The low-cost/subsidised solar dryers were suggested for the development of this sector and the betterment of the processors (Sugathapala *et al.,* 2012; Salim *et al.,* 2016; Vipinkumar *et al.,* 2017), as this sector was unstable and highly affected by external factors like weather and seasonal availability of fish catch. The dry fish processors are also willing to adopt the scientific (solar dryer), which was advantageous in terms of economics/profit and quality. The BCR for scientific drying was 2.26, while traditional indigenous drying was only fetched 0.71 (Malik *et al.,* 2018). The proximate analysis also showed a significant difference between solar tent drying and open sun drying. Organoleptic evaluations showed no physical damage and no discolouration of fish under the solar tent dryer, but dust and insect infestation were observed in open sun-drying conditions. Therefore, solar tent-dried fish products are hygienic compared to open sun-dried products (Sugathapala *et al.,* 2012; Nath *et al.,* 2017).

Other assistance

Only 4% (12) of processors had received government assistance regarding subsidies and solar dryers. (Fig. 11). This highlights a substantial gap in the coverage and reach of governmental welfare programs targeted at this sector. The findings underscore the urgent need for more inclusive and effective policy frameworks to extend support to marginalized communities, particularly those engaged in fisheries and allied activities, to improve their socio-economic conditions and resilience. Though many studies reported that the sector is highly vulnerable and needs governmental intervention, only 40% of DFP in West Bengal availed governmental support (Sahu *et al.,* 2018).

The Kruskal-Wallis and Dunn tests showed that

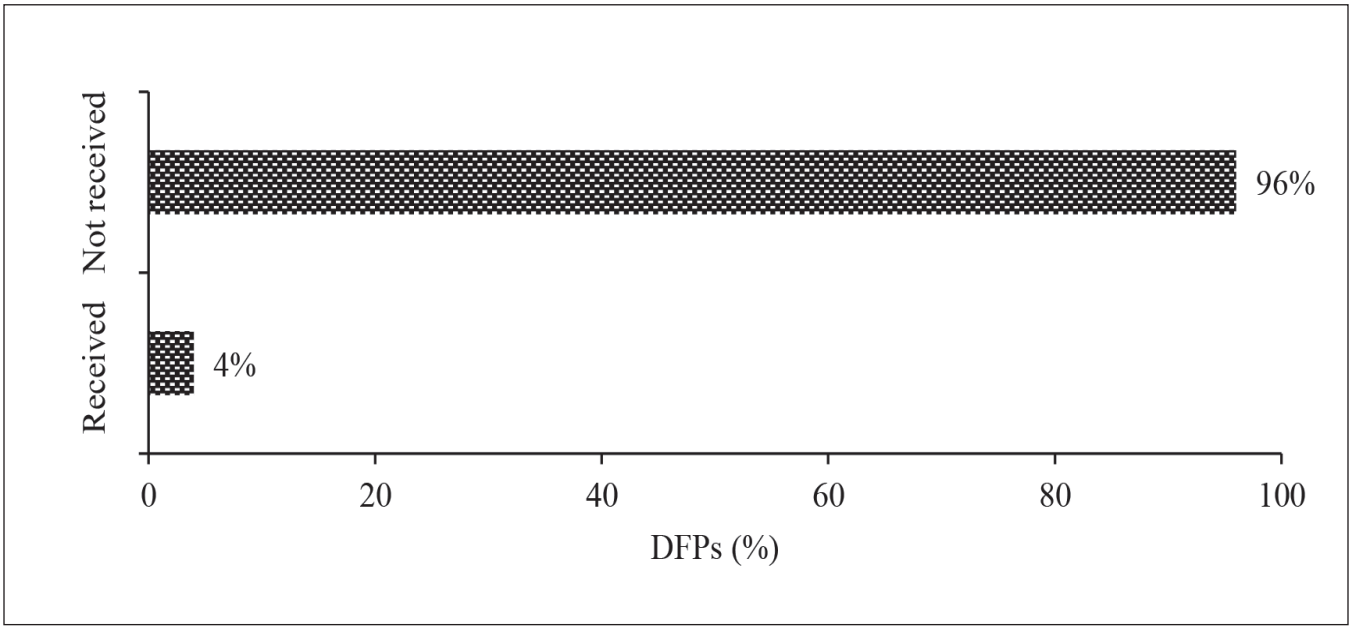

Fig. 11. *Other assistance received by DFPs*

Table 1. *District-wise distribution of institutional support and willingness among DFP*

Variables	Districts	TV	CH	CP	VP	CD	MT	NP	TR	TJ	PK	RP	TK	TNV	KK
	Response (%)	3.33	10	6.67	6.67	10	10	10	3.33	3.33	3.33	10	10	3.33	10
MGNREGA*	Yes	6 (2)	0 30	3 (1)	0 20	0 30	19 (6.3)	20 (10)	0 10	0 10	0 10	0 30	0 30	0 10	0 30
	No	4 (1.3)	(10)	17 (5.7)	(10)	(10)	11 (3.7)	10 (3.3)	(3.3)	(3.3)	(3.3)	(10)	(10)	(3.3)	(10)
Housing*	Yes	10 (3.3)	28 (9.3)	0 10	17 (5.7)	9 (3)	9 (3)	16 (5.3)	10 (3.3)	10 (3.3)	10 (3.3)	30 (10)	30 (10)	10 (3.3)	30 (10)
	No	0	2 (0.7)	(3.3)	13 (4.3)	21 (7)	21 (7)	14 (4.7)	0	0	0	0	0	0	0
SHG membership*	Yes	8 (2.7)	7 (2.3)	13 (4.3)	9 (3)	19 (6.3)	16 (5.3)	18 (6)	4 (1.3)	3 (1)	6 (2)	10 (3.3)	11 (3.7)	1 (0.3)	0 30
	No	2 (0.7)	23 (7.7)	7 (2.3)	11 (3.7)	11 (3.7)	14 (4.7)	12 (4)	6 (2)	7 (2.3)	4 (1.3)	20 (10)	19 (6.3)	9 (3)	(10)
Co-operative membership*	Yes	1 (0.3)	8 (2.7)	0 20	0 20	28 (9.3)	0 30	0 30	0 10	3 (1)	6 (2)	10 (3.3)	17 (5.7)	0 10	16 (5.3)
	No	9 (3)	22 (7.3)	(10)	(10)	2 (0.7)	(10)	(10)	(3.3)	7 (2.3)	4 (1.3)	20 (10)	13 (4.3)	(3.3)	14 (4.7)
Other assistance*	Yes	0 10	1 (0.3)	0 20	0 20	10 (3.3)	0 30	1 (0.3)	0 10	0 10	0 10	0 30	0 30	0 10	0 30
	No	(3.3)	29 (9.7)	(10)	(10)	20 (10)	(10)	29 (9.7)	(3.3)	(3.3)	(3.3)	(10)	(10)	(3.3)	(10)
Training attended*	Yes	4 (1.3)	10 (3.3)	4 (1.3)	0 20	17 (5.7)	11 (3.7)	11 (3.7)	0 10	6 (2)	0 10	3 (1)	5 (1.7)	0 10	3 (1)
	No	6 (2)	20 (10)	16 (5.3)	(10)	13 (4.3)	19 (6.3)	19 (6.3)	(3.3)	4 (1.3)	(3.3)	27 (9)	25 (8.3)	(3.3)	27 (9)
Willing to adopt a Solar dryer	Yes	6 (2)	19 (6.3)	19 (6.3)	17 (5.7)	25 (8.3)	26 (8.7)	27 (9)	7 (2.3)	6 (2)	9 (3)	23 (7.7)	25 (8.3)	9 (3)	8 (2.7)
	No	4 (1.3)	11 (3.7)	1 (0.3)	3 (1)	5 (1.7)	4 (1.3)	3 (1)	3 (1)	4 (1.3)	1 (0.3)	7 (2.3)	5 (1.7)	1 (0.3)	22 (7.3)
Access to drying yard	Yes	4 (1.3)	4 (1.3)	10 (3.3)	1 (0.3)	18 (6)	13 (4.3)	10 (3.3)	4 (1.3)	6 (2)	2 (0.7)	13 (4.3)	7 (2.3)	3 (1)	15 (5)
	No	6 (2)	26 (8.7)	10 (3.3)	19 (6.3)	12 (4)	17 (5.7)	20 (10)	6 (2)	4 (1.3)	8 (2.7)	17 (5.7)	23 (7.7)	7 (2.3)	15 (5)

Note: The district-wise socio-economic variables presented in the table and the district share of total surveyed dry fish processors (n=300) were given in parentheses. TV- Thiruvallur; CH- Chennai; CP- Chengalpattu; VP- Villupiram; CD- Cuddalore; MT- Mayiladuthurai; NP- Nagapattinam; TR-Tiruvarur; TJ-Thanjavur; PK- Pudukottai; RP- Ramanathapuram; TK- Thoothukudi; TNV- Tirunelveli; KK- Kanniyakumari

*Significance difference at 0.05 level

most institutional and technological variables are significant at the 5% level, indicating that the support benefits are uneven and benefit only a small group of respondents. On the other hand, willingness to adopt solar dryers and participate in training programs was not significant, as the majority of respondents expressed strong favourability towards both (Table 1).

Supporting agencies in Tamil Nadu's dry fish industry

The dry fish sector in Tamil Nadu benefits from institutional support provided by a range of agencies, each catering to specific needs (Fig. 12).

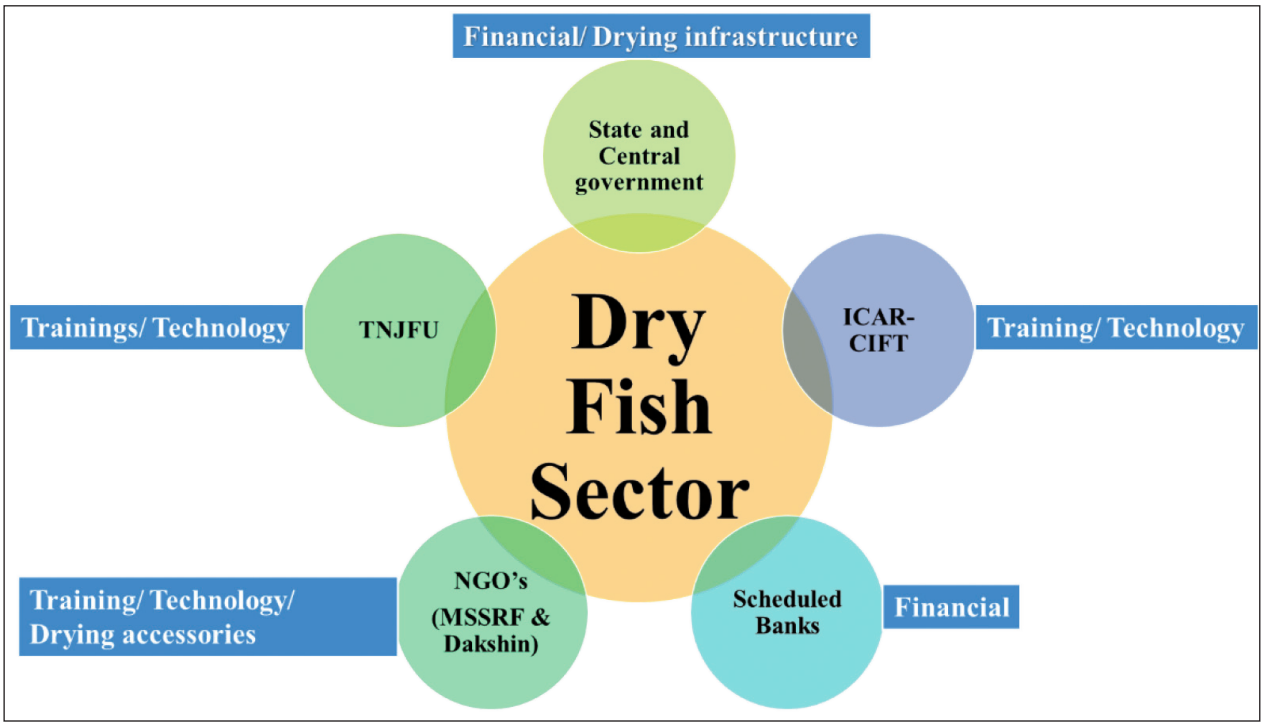

Fig. 12. *Institutional support in the dry fish sector*

State and Central Government: The DoF&FW, TN (Department of Fisheries & Fishermen Welfare, Tamil Nadu), primarily offers financial assistance, subsidies, and drying accessories to improve the economic stability of dry fish processors, which plays a key role in facilitating access to resources for marginalised communities.

ICAR-CIFT (Central Institute of Fisheries Technology): Focuses on technology development and training, ensuring stakeholders have access to modern and efficient fish drying technologies.

TNJFU (Tamil Nadu Dr J. Jayalalithaa Fisheries University): Conducts training programs and promotes solar dryers and eco-friendly and cost-effective fish drying solutions.

Scheduled Banks: Financial institutions provide credit and loans, enabling fishers to invest in equipment and infrastructure. They form an essential pillar for addressing the working capital needs of processors.

NGOs (MSSRF & Dakshin): Non-governmental organizations contribute by organizing training sessions, facilitating the adoption of solar dryers, and providing drying accessories, which focus on community empowerment and sustainable practices.

The sector remains vulnerable despite numerous institutions providing financial, technological, and skill

development support to dry fish processors. There is a pressing need for increased awareness among dry fish processors about these available supports, and these institutions must actively extend their assistance to all dry fish processors along the coastal regions (Seenivasan *et al.,* 2025b)

CONCLUSION

The study highlighted that the institutional and technological support for dry fish processors in coastal Tamil Nadu remains limited in reach and effectiveness. While some have benefited from the support, such as training, subsidies, drying accessories, and solar dryers through various institutions, a significant proportion still face barriers to accessing critical infrastructure like drying yards, warehouses, and storage. This is largely due to limited availability of cemented drying spaces, poor maintenance of existing infrastructure, and unequal access governed by local power dynamics or informal arrangements. Participation in SHGs and cooperatives, though widespread, has not fully translated into improved support outcomes. Despite the challenges, dry fish processors are strongly willing to adopt solar dryers and engage in capacity-building initiatives, pointing to an opportunity to scale appropriate interventions. To bridge existing gaps, targeted government interventions such as subsidized solar dryers, improved infrastructure, and enhanced access to drying facilities are crucial. Strengthening institutional and technological support will not only empower stakeholders but also enhance participation, improve efficiency, and ensure the long-term sustainability of the sector. A collaborative, evidence-based approach to policy and program design will be critical in ensuring the resilience and inclusive development of the dry fish processing sector.

ACKNOWLEDGEMENT

The authors would like to thank ICAR–CIFE for providing the necessary facilities for conducting this study, and gratitude is extended to the study respondents.

CONFLICTS OF INTEREST

The authors declare there are no competing interests.

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