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Entrepreneurial competency of tribal turmeric farmer producer organizations: Current capacities and future potential

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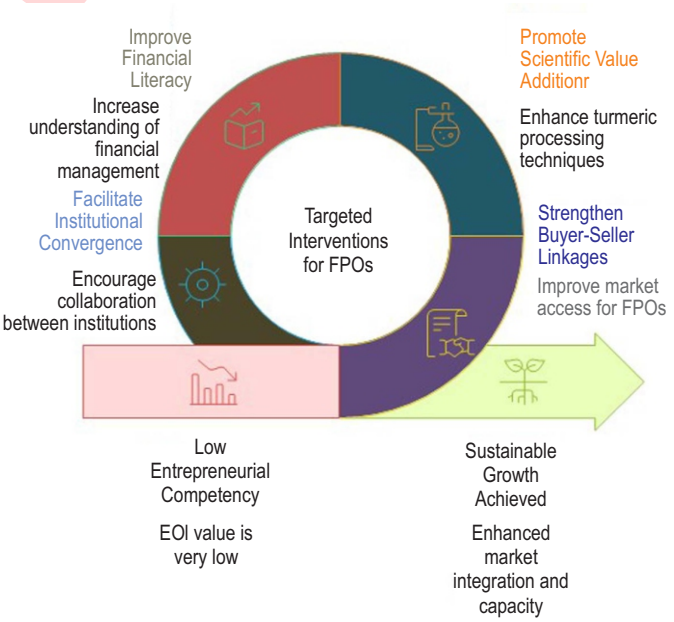
Abstract

Aim: The present study was conducted in the Alluri Sitharama Raju (ASR) district of Andhra Pradesh during 2022–2024 to assess the entrepreneurial competency of tribal Farmer Producer Organizations (FPOs) engaged in turmeric value addition.

Methodology: An ex post facto research design with purposive sampling was adopted to select 15 turmeric-based FPOs. From each FPO, five members along with five officials were randomly selected, resulting in a total sample size of 80 respondents.

Results: The findings revealed a low overall level of entrepreneurial competency, with a composite Entrepreneurial Competency Index (ECI) value of 182.1. FPO-wise analysis indicated that the majority of FPOs (73%) fell under the low competency category, with scores below 248. Three FPOs exhibited moderate competency with scores ranging between 254 and 256, while only one FPO emerged as high performing with a score of 452. The problem–solution matrix identified key constraints such as lack of direct market access (82.5%), poor financial literacy (75%), inadequate processing facilities (72.5%), and limited access to credit (70%). Suggested interventions included strengthening buyer–seller linkages, promoting scientific value addition, improving financial literacy, and facilitating institutional convergence.

Interpretation: The study highlights the urgent need for targeted interventions to improve market integration, financial capacity, and governance mechanisms, along with investments in long-term infrastructure and social capital, to ensure the sustainable growth of tribal turmeric FPOs.



Key words: Entrepreneurial Competency, FPO, Indicators, Tribes, Turmeric

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Introduction

India cultivated turmeric over approximately 3.05 lakh ha, with 10.54 lakh tonnes production and productivity of 3.656 tonnes/ha (ANGRAU, 2024) during the 2023-24 agricultural year. Globally, turmeric production stands at approximately 13.5 lakh tonnes annually, with India leading the sector to the total output. This dominant position underscores India's critical role in meeting both domestic and international demand for turmeric. Other significant producers include China (8%), Myanmar (4%), Nigeria and Bangladesh with around 3% each. In the year 2020, the global turmeric market was valued at USD 58.2 million and is forecasted to experience a CAGR of 16.1% from 2020 through 2028. In terms of production volume, the global output of turmeric was 10.5 lakh tonnes in 2017, with projections indicating it will reach 17 lakh tonnes by 2027 (Mukherjee *et al.,* 2025). This rapid expansion of global demand, particularly for curcumin-rich and traceable turmeric, places increasing pressure on producing regions to simultaneously enhance productivity, quality standards, and market integration.

In Andhra Pradesh, turmeric cultivation plays a prominent role in the state's horticultural and spice crop economy. During the 2023-24 agricultural season, turmeric was cultivated over approximately 22.37 thousand ha in Andhra Pradesh, establishing the state as one of the key turmeric-producing regions in India. The estimated annual production stood at 38.03 thousand metric tonnes, with an average productivity of 1.7 metric tonnes/ha. The state ranked 8th in overall production and 22nd in productivity among turmeric-producing states, indicating scope for enhancing yield through improved agronomic practices and technological interventions (ANGRAU, 2024). Among different districts of Andhra Pradesh, the tribal dominated hilly areas of ASR district occupy major acreage of 8.46 thousand ha. In contrast, the turmeric area in other districts of Andhra Pradesh is considerably lower. Krishna district occupies about 2.01 thousand hectares, followed by YSR district with 1.67 thousand hectares. Bapatla and Guntur districts account for 1.28 thousand hectares and 1.26 thousand hectares, respectively. Relatively smaller areas are observed in Nandyal (0.60 thousand hectares) and Palnadu (0.43 thousand hectares) districts according to Department of Agriculture statistics, Andhra Pradesh for the period 2023-24.

Despite accounting for a substantial share of the state's turmeric area, these regions continue to exhibit relatively low productivity and limited participation in high-value markets, suggesting that the constraints are largely institutional and market-related rather than agro-climatic. Given this concentration of turmeric production, ASR district holds immense potential for commercialization of the crop. However, farmers in these tribal areas often face challenges related to land ownership, lack of access to quality inputs, inadequate infrastructure for post-harvest handling and weak market linkages (Mahesh *et al.,* 2019; Hema *et al.,* 2025). In this context, FPOs can play a transformative role (Patil *et al.,* 2025) by collectivizing producers, facilitating access to institutional support, and promoting value addition and branding of high-curcumin tribal turmeric. As reported by PIB (2025), the Government's Flagship Scheme has successfully established 10,000 FPOs, connecting approximately 30 lakh farmers across the nation, with nearly 40 per cent of these farmers being women. However, there is limited empirical evidence on the spatial distribution, operational strength, and commercialization impact of turmeric-based FPOs in tribal-dominated regions such as ASR district. In this backdrop, a systematic mapping of turmeric area, production, and turmeric-based FPOs is essential to identify regional potential, institutional gaps, and commercialization pathways, thereby providing a strong rationale for the present study.

Materials and Methods

An ex-post-facto research design was adopted for the study conducted in the year 2019-2020. Andhra Pradesh, being one of the leading turmeric-producing states in India, was selected as the study area. Within the state, the tribal-dominated ASR district was purposively chosen due to its prominence in organic turmeric cultivation. Primary data were collected during 2022-2024 through structured interviews with members of tribal turmeric Farmer Producer Organizations (FPOs). Additionally, during 2023-2024, secondary data were obtained from the ASR District Horticulture Department and the Integrated Tribal Development Agency (ITDA). According to these sources, the district had a total of 59 FPOs, of which 25 (42%) were engaged in turmeric production. From these, 15 FPOs involved in value addition activities were purposively selected for the study. Using random sampling, 75 respondents from these FPOs and 5 officials were selected, resulting in a total sample size of 80. The study incorporated both primary data from field surveys and secondary data from official institutions such as the Horticulture Research Station, Chintapalli; Spices Board Field Office; District Horticulture Department; and ITDA, Paderu.

To strengthen the methodological rigor, the study adopted a multi-dimensional analytical approach rather than a single treatment. The assessment framework consisted of six major treatment dimensions, namely technical, operational, financial, marketing, networking, and social competencies of FPOs. Each dimension was operationalized through a set of clearly defined sub-indicators derived from literature review, expert consultation, and field relevance. Responses were measured using a five-point Likert scale (Very Poor to Excellent) to capture intensity and variation across FPOs. Further, a weighted scoring technique was employed to assign differential importance to each competency domain, with technical, operational, financial, and marketing dimensions treated as high-priority interventions, while networking and social dimensions were treated as enabling interventions. Composite Entrepreneurial Competency Index (ECI) scores were computed to enable comparative analysis across FPOs. In addition, a problem–solution matrix was used as a complementary methodological tool to triangulate quantitative findings with farmer-perceived constraints and suggested interventions, thereby enriching the treatment structure of the study.

Statistical Analysis: Data were analysed using descriptive statistics (mean, percentage and ranking) based on the responses obtained through a five-point Likert scale. A weighted composite index method was used to compute the Entrepreneurial Competency Index (ECI) of FPOs. Six indicators *viz.,* technical, operational, financial, marketing, networking and social were assigned differential weights (20% each for technical, operational, financial and marketing; 10% each for networking and social). The weighted scores were summed to obtain a maximum composite score of 500, and FPOs were classified into low, moderate and high competency categories. A problem–solution matrix based on percentage and ranking was used to triangulate quantitative results with farmer-perceived constraints and priorities.

Results and Discussion

For the development of indicators to assess the institutional linkage of FPOs, a participatory and consultative approach was adopted (Shiferaw *et al.,* 2009; Trebbin *et al.,* 2012). Extensive discussions were held with key stakeholders and multiple dimensions of institutional linkage were explored across various functional levels. Initially identified indicators were critically examined, edited, modified and systematically restructured to ensure contextual relevance and clarity. This iterative process resulted in the finalization of six robust indicators (technical, operational, financial, marketing, networking and social) that effectively captured the nature, extent, and quality of institutional linkages influencing the performance and sustainability of tribal turmeric FPOs. The sub-indicators under each indicator were, technical indicator (institutional linkage and rapport, convergence of entrepreneurial thinking, conducive policies, produce quality maintenance, scientific cultivation); operational indicator (homogeneity in membership, transparency in functioning, infrastructure facilities, mutual trust among members and commitment, regular meetings); financial indicator (easy access to credit, financial support from promoting institutions, timely procurement of inputs, equal sharing of profits, regular maintenance of records); marketing indicator (ease of availability of market, demand and customers, in time aggregation, storage facilities, transport arrangements, access to modern infrastructure and processing, best price realization, timely market information); networking indicator (product certification, branding, key influencer, packaging standards, social networking platforms) and social indicator (enterprise diversification and risk-taking nature, innovation and adaptability, leadership and coordination ability, striving for social recognition and group decision making).

Although six major indicators were finally retained, each indicator comprised multiple sub-indicators representing distinct functional and problem domains such as production quality, governance, finance, market access, certification, leadership, social cohesion, and institutional convergence. Thus, the analytical framework comprehensively captured a wide spectrum of constraints and enabling factors affecting FPO performance rather than relying on a limited set of parameters. Further, weights were assigned to the identified indicators and sub-indicators based on their relative importance in contributing to entrepreneurial success. This weighting mechanism allowed the study to differentially highlight critical problem areas such as market access, financial management, processing infrastructure, and governance, thereby enhancing the depth of analysis beyond mere descriptive assessment. Greater emphasis was laid on indicators that had a direct and quantifiable impact on FPO viability and market performance. Specifically, technical, operational, financial, and marketing indicators were each assigned a weight of 20%, reflecting their critical role in enhancing business profitability, managing cash flow, improving market access and returns, and supporting day-to-day decision-making and operational efficiency (Amitha *et al.,* 2021).

Conversely, networking indicators were assigned a relatively lower weight of 10%, acknowledging that while networking remains an important enabler particularly in accessing institutional support and partnerships, it is often less developed in the context of rural and tribal FPOs. Similarly, social indicators were also weighted at 10%, recognizing their foundational importance in building trust, cohesion, and participatory governance within FPOs (Mondal, 2010). However, their influence on direct market outcomes and income generation is more indirect in nature (Adhikari *et al.,* 2021; Singh *et al.,* 2016). Each sub-indicator was evaluated using a five-point Likert scale, designed to capture the performance intensity across a standardized range. The scale was defined as follows: 1 = Very Poor, 2 = Poor, 3 = Average, 4 = Good and 5 = Excellent. This approach provided a structured and quantifiable means to assess the relative strength of each sub-indicator under the broader domains of entrepreneurial competencies and institutional linkages. The average score (on a Likert scale of 1 to 5) for six key indicators evaluated across 15 tribal turmeric Farmer Producer Organizations (FPOs) is given in Fig. 1.

As shown in Fig. 1, technical Indicator (2.08) received the highest average score, which reflects a reasonable level of technical know-how among the FPO members. With a close second-highest score, Marketing Indicator (2.05) indicates that FPOs demonstrate moderate competency in marketing activities, including market linkage, branding, and pricing strategies. Financial Indicator (1.98) with moderate score implies a fair level of financial management within the FPOs, such as maintaining accounts, accessing credit, and handling operational budgets. Operational Indicator (1.89) covering aspects like leadership, governance, and administrative functioning is moderate but slightly weaker compared to other core areas (Venkattakumar *et al.,* 2022; Roy *et al.,* 2018). Social Indicator (1.88) score indicates that while FPOs benefit from some level of social cohesion and member participation, these aspects is not as strong and may require focused efforts to build group trust, participation, and collective decision-making (Ravikishore *et al.,* 2024; Bijman *et al.,* 2016). Networking Indicator (0.33) is the lowest scoring indicator, revealing a significant gap in institutional networking. It suggests

Table 1: Categorization of competency levels of FPOs

Competency Level	% of Total Score	Score Range Calculation with total composite score	Final Score Range
Low Competence	0–50%	0% × 500 → 50% × 500	0 – 250
Moderate Competence	51–75%	251 → 375	251 – 375
High Competence	76–100%	376 → 500	376 – 500

Table 2: Estimation of Weighted Scores

Indicator	Avg. Score	Max. Weight	Weighted Score
Technical	2.08	100	41.6
Operational	1.89	100	37.8
Financial	1.98	100	39.6
Marketing	2.05	100	41.0
Social	1.88	50	18.8
Networking	0.33	50	3.3

minimal engagement with external stakeholders such as research institutions, market actors, financial agencies, and government departments (Kumar *et al.,* 2021; Ortman *et al.,* 2007). The indicator-wise analysis enables identification of specific problem intensities across domains. For instance, low scores under networking and social indicators reveal systemic gaps in institutional linkage, certification, branding, and external collaboration, while moderate scores in financial and operational indicators point to deficiencies in credit access, record maintenance, leadership, and governance mechanisms. Thus, each indicator functions as a diagnostic lens for identifying distinct but interrelated problem areas faced by tribal turmeric FPOs.

For analysing the entrepreneurial competency, a systematic method is essential. Competencies are crucial for enhancing both business performance (Mitchelmore *et al.,* 2010; Rahman *et al.,* 2016) and the effectiveness of governance structures. They are commonly defined as a combination of knowledge, skills, attitudes, and behaviours required to perform a specific job role efficiently (Man *et al.,* 2008; Pranowo, 2020). Entrepreneurial competencies refer to a unique set of abilities that empower an entrepreneur to efficiently manage their business operations, encompassing both financial and non-financial dimensions (Pulikkalakath *et al.,* 2024; Rasmussen *et al.,* 2011). To evaluate the entrepreneurial competencies of FPOs, a weighted scoring method was employed. Each indicator was assessed using a five-point Likert scale, where the score for each sub-indicator (ranging from 1 to 5) was multiplied by its assigned weight to reflect its relative importance. The maximum possible score for each indicator was standardized using an ideal value (i.e., a maximum Likert score of 5), resulting in a benchmark score of 100 for high-priority indicators with 20% weightage (e.g., technical, financial, marketing, and operational) and 50 for lower-weighted indicators with 10% weightage (e.g., social and networking). The actual average score of each indicator obtained from field assessment was then multiplied by its respective weight to derive the weighted score. Finally, the total composite score (500) for each FPO was computed by summing the weighted scores across all six indicators. This composite score represents the overall entrepreneurial competency level of the FPO on a weighted scale, enabling comparison and classification into different performance categories *viz.,* low, moderate, high competency presented in Table 1.

The Entrepreneurial Competency Index (ECI) is an index-based measurement tool to assess and monitor the progress of entrepreneurial competencies within a specific group (Botha *et al.,* 2021). Several previous scholars *viz.,* Fatoki (2010); Mitchelmore *et al.* (2020); Man *et al.* (2002); Morris *et al.* (2013) attempted studies on ECI levels. The composite Entrepreneurial Competency Index (ECI) integrates multiple dimensions into a single diagnostic measure, allowing both inter-FPO comparison and identification of domain-specific weaknesses. Rather than limiting findings, the ECI framework amplifies problem detection by revealing cumulative effects of deficiencies across technical, financial, marketing, social, and networking domains. In the present study, ECI which is an index based measurement tool developed to analyse the entrepreneurial competency of tribal turmeric FPOs. Based on the competency level categorization, Fig. 2 presents the composite entrepreneurial competency index scores of identified Farmer Producer Organizations (FPOs), derived from weighted indicators such as technical, operational, financial, marketing, social, and networking competencies. As depicted in Fig. 2, a total of 11 FPOs fell into the low competency range, with total composite scores between 128 and 162. These FPOs demonstrated weaker performance in most entrepreneurial domains, possibly due to inadequate institutional support, limited technical skills, poor market access, or weak governance mechanisms. This group constituted the majority (11 out of 15 FPOs), indicating a widespread need for targeted capacity building, especially in tribal and resource-constrained areas. Three FPOs were classified under moderate competency,

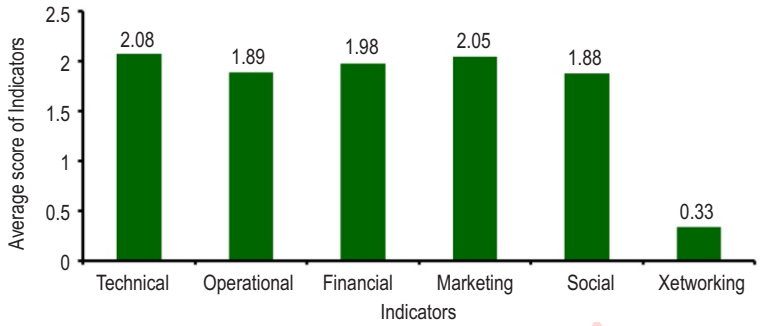
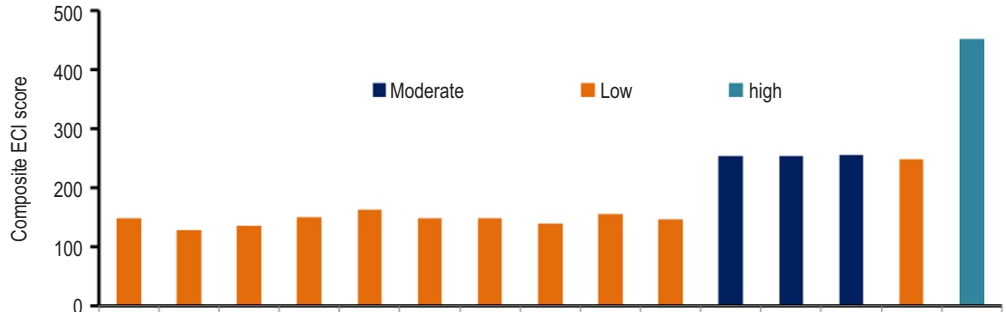


Fig. 1: Indicator-wise average scores of entrepreneurial competency across six dimensions for tribal turmeric FPOs in ASR district, Andhra Pradesh.



	FPO_1	FPO_2	FPO_3	FPO_4	FPO_5	FPO_6	FPO_7	FPO_8	FPO_9	FPO_10	FPO_11	FPO_12	FPO_13	FPO_14	FPO_15
Moderate											254	254	256		
Low	148	128	136	150	162	148	148	138	156	146				248	
high															452

Fig. 2: Classification of tribal turmeric FPOs in ASR district based on composite Entrepreneurial Competency Index scores.

with scores of 254-256 values. These FPOs likely have relatively better access to technical knowledge, improved operational structures, and more active financial and marketing linkages. Their score range indicates emerging potential and an opportunity for up scaling through institutional convergence and targeted mentoring. Only one FPO stands out with a high competency score of 452, significantly outperforming all other FPOs. This suggests strong entrepreneurial capacity, effective institutional linkages and potentially successful implementation of value addition and marketing strategies. This high performing FPO could serve as a model or benchmark for best practices like organic certification, retail outlets, packaging and branding. The Composite ECI is calculated by assigning scores to indicators and then the score is divided by 5 which represents the maximum possible score that can be assigned on the rating for each indicator. The arrived value is multiplied by pre-defined weight, typically based on its perceived importance toward entrepreneurial success in that context. The weighted scores are summed to produce the overall ECI value. It serves as a diagnostic tool that helps identify the strengths and gaps in entrepreneurial capacities, which in turn guides where targeted interventions and capacity-building efforts are most needed. To estimate the overall Entrepreneurial Competency Index (ECI) of tribal turmeric FPOs, the indicator scores from Fig. 2 were considered and convert into weighted scores.

Composite ECI Score

$$ECI = 41.6 + 37.8 + 39.6 + 41.0 + 18.8 + 3.3 = 182.1$$

According to the competency classification framework; (Low Competence = 0-250; Moderate Competence = 251–375 and High Competence = 376–500), the obtained composite score of 182.1 clearly places the tribal turmeric FPOs in the study area were under the low competence category. This index-based approach provides a diagnostic tool to monitor FPO progress and helps identify where targeted interventions are most needed.

Problem-Solution Matrix for Tribal Turmeric FPOs: The Problem–Solution Matrix for Tribal Turmeric FPOs provides a structured framework to capture farmer-identified constraints and link them with feasible solutions and extension or policy actions.

Table 3: Priority Problems and Suggested Solutions for Tribal Turmeric FPOs

Farmer-Identified Problem	Suggested Solution	Extension / Policy Action	% of Farmers Reporting	Rank
Lack of direct market access; dependence on middlemen	Direct buyer linkages with spice companies, Ayurvedic firms, e-commerce	Buyer-seller meets, linking with e-NAM, MoUs with research institutions and buyers	82.5%	1
Poor financial literacy and weak record-keeping	Bookkeeping, costing and pricing training	Intensive NABARD/SFAC-led and Research Institutions based capacity building programmes	75.0%	2
Lack of turmeric processing and value addition facilities	Provide dryers, grinders, packagers	Support via Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme /Micro Small and Medium Enterprises convergence	72.5%	3
Inadequate working capital and credit access	Facilitate loans via SHG–Bank linkage, NABARD, SFAC	Simplified group loans, joint liability	70.0%	4
Poor governance & weak Board of Directors (BoD) management	BoD training on Standard Operating Procedures (SOPs), leadership, member mobilization	Extension/NGO governance workshops	66.7%	5
Absence of branding, certification & traceability	Organic certification, GI branding, QR-based traceability, awareness programmes	Govt certification subsidies, branding campaigns	61.7%	6
Low participation of women & youth	SHG/women groups in turmeric value addition, youth in digital marketing	Entrepreneurship & skill training	60.0%	7
Weak collective trust & low social capital	Promote peer monitoring, group savings, cultural festivals	Strengthen SHG-FPO integration	56.7%	8
Poor infrastructure (roads, storage, electricity) in tribal belts	Cold storage, rural godowns, solar dryers	Convergence with RKVY, Tribal Development Funds	55.0%	9
High dependence on local exploiters for inputs (seed, credit)	Collective procurement through FPO	Bulk purchase linkages with input firms	53.3%	10
Limited access to digital tools & ICT	Promote WhatsApp groups, mobile apps for prices	Digital literacy campaigns, ICT kiosks	51.7%	11
Post-harvest losses due to poor storage & drying	Low-cost dryers, moisture testing kits	Agri-engineering interventions, subsidy schemes	50.0%	12

Table 3 provides evidence-based guidance for policymakers, extension agencies, and development institutions to design context-specific strategies for strengthening entrepreneurial competency in turmeric-based FPOs. To further elaborate and validate the findings, the study complemented indicator-based results with a problem–solution matrix, which directly captures farmer-perceived constraints and ranks them based on severity and frequency. This approach ensures that the study not only quantifies entrepreneurial competencies, but also explicitly identifies operational, institutional, and market-related problems affecting FPO sustainability. The convergence of indicator analysis, ECI scoring, and the problem–solution matrix strengthens the robustness of the findings by triangulating quantitative scores with qualitative farmer perceptions, thereby making the results more comprehensive and problem-oriented.

The ranking shows that market access, financial literacy, processing/value addition, and working capital are the most urgent gaps limiting entrepreneurial competency of tribal turmeric FPOs. These reflect immediate operational constraints directly affecting farmer income. Governance, branding/certification, and participation of women/youth emerge as medium-level priorities, indicating that institutional strengthening and inclusiveness need to complement market and financial interventions. Yamini *et al.* (2024) revealed a complex web of relationships among different stakeholders within the agricultural network through a network graph with inclusion of key communicators. Lower-ranked but still important issues like infrastructure, digital literacy, and post-harvest losses represent enabling conditions that require long-term convergence with government programs rather than short-term fixes. Overall, the statistical ranking suggests that a two-tiered strategy is essential: Address core market-finance-processing gaps to build immediate resilience; and invest in governance, branding, social capital, and infrastructure for sustainable growth of tribal turmeric FPOs.

The study revealed that tribal turmeric FPOs in ASR district possess considerable potential, but are constrained by low entrepreneurial competency and weak institutional linkages, particularly in market access, finance, and value addition. Low

networking and social capital further limits their performance. The Entrepreneurial Competency Index (ECI) has proved to be an effective diagnostic tool for identifying priority gaps. Strengthening market linkages, financial skills, governance, and processing infrastructure is essential to enable tribal turmeric FPOs to emerge as sustainable and market-oriented enterprises.

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Authors' contribution: B. Hema: Conceptualization, data collection, Methodology, Writing–Original draft; **M.S. Madhav:** Supervision; **V. Jyothi:** Methodology and editing; **C. Bindhu:** Identification of respondents; **L.K. Prasad:** Planning and Visualization; **Y. Subbaiah:** Methodology and Sampling; **H. Ravisankar:** Statistical analysis; **V.S.G.R. Naidu:** Revision and Editing; **N.K. Kumar:** Manuscript corrections; **T. Yamini:** Manuscript corrections and Finalization of manuscript.

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Ethical approval: The study is a part of Institute project and ethically approved under Institute Research Committee by ICAR-National Institute for Research on Commercial Agriculture, Rajahmundry, Andhra Pradesh, India. No use of plants or animals or humans are used in the study.

Conflict of interest: No conflict of interest was reported by the author(s).

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Consent to publish: All authors agree to publish the paper in *Journal of Environmental Biology.*

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