

Research Article

Profile, technology adoption and constraints of coconut enterprises in Kasaragod district, Kerala

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Abstract

Kerala remains India's leading coconut-producing state, accounting for approximately 35 per cent of the country's coconut-growing area and 28 per cent of total production. It also records the highest demand and consumption of coconut. The crop's adaptability to intercropping makes it an important source of livelihood for small and marginal farmers. Despite interventions such as the Coconut Development Board's Technology Mission on Coconut (TMOC), which has promoted 235 coconut enterprises, the sector continues to face shrinking cultivated area, price fluctuations, and declining productivity. Evaluating the enterprise-level outcomes of TMOC is therefore crucial for strengthening the coconut value chain and bridging the extension–market gap. Against this backdrop, the present study examined the profile, product portfolio, technological capability, financial support, and operational constraints of 31 TMOC-supported coconut enterprises in Kasaragod district, Kerala. The enterprises were predominantly young (0-5 years old), micro-scale, sole proprietorships, and male-owned. Only 6.5 per cent had received institutional technological support, whereas 58 per cent had accessed financial assistance, primarily through nationalized and cooperative banks and the Mudra loan scheme. Coconut oil and copra remained the principal products, with only limited diversification into value-added products such as virgin coconut oil and coconut paste. Kendall's coefficient of concordance revealed strong agreement among enterprises regarding the severity of procurement and processing ($W=0.65$) and marketing ($W=0.63$) constraints, indicating a common and interconnected set of challenges across the sector. The findings underscore the need to strengthen targeted credit access, technology dissemination, and gender-inclusive entrepreneurial support to enhance the sustainability and competitiveness of coconut enterprises in the district.

Keywords: *Cocos nucifera*, Coconut Based Enterprises, Coconut Products, MSMEs, Value Addition

Introduction

Coconut (*Cocos nucifera* L.) is one of the most important plantation crops in tropical regions, providing food, raw materials, employment, and income to millions of farming households. Indonesia, the Philippines, and India are the world's leading coconut-producing countries. In India, coconut contributes substantially to agricultural output and rural livelihoods, generating crop output valued at ₹10,707 crore during 2021-22 and supporting nearly 12 million people through cultivation, processing, marketing, and allied industries (Jayasekhar *et al.*, 2024). Coconut cultivation is concentrated in the southern states, which account for nearly 90 per cent of national production. Among them, Kerala occupies a unique position as the country's leading coconut-growing state, contributing approximately 35 per cent of the cultivated area and about 28 per cent of national production while also recording the highest domestic demand and consumption.

The importance of coconut in Kerala extends beyond agriculture. The crop is deeply embedded in the state's economy, culture, and food systems, serving as a source of edible products, oil, fibre, timber, and raw materials for a wide range of industries. Its suitability for intercropping enables cultivation even on small and marginal holdings, making it a vital component of livelihood security. Despite its significance, the sector has experienced persistent challenges, including declining cultivated area, fluctuating market prices, increasing production costs, labour

shortages, and stagnant productivity. These constraints have reduced farm profitability and highlighted the need for value addition, product diversification, and enterprise development to improve the economic resilience of coconut growers.

Recognizing these challenges, the Government of India and the Government of Kerala have implemented several programmes to strengthen the coconut value chain. The Coconut Development Board (CDB) has played a central role through initiatives promoting improved production technologies, post-harvest management, processing, and entrepreneurship. Among these, the Technology Mission on Coconut (TMOC) seeks to enhance value addition by supporting the establishment of coconut-based enterprises through financial assistance, technology dissemination, and capacity building. Complementing these efforts, schemes such as the Entrepreneur Support Scheme (ESS) of the Directorate of Industries and Commerce provide capital subsidies for micro, small, and medium enterprises engaged in coconut processing and manufacturing. Together, these initiatives aim to improve enterprise viability, generate rural employment, and increase farmers' income through value-chain development (CDB, 2024; DIC, 2024).

Kasaragod district, situated in the northern part of Kerala, offers a suitable setting for examining the performance of coconut enterprises. Although the district accounts for only a modest share of the state's coconut cultivation, it possesses a well-developed institutional

ecosystem supporting entrepreneurship and value addition. The ICAR-Central Plantation Crops Research Institute (CPCRI), through its Agribusiness Incubation (ABI) Centre, promotes technology commercialization, entrepreneurship development, and business incubation for coconut-based enterprises (CPCRI, 2024). Similarly, the Regional Agricultural Research Station (RARS), Pilicode, of Kerala Agricultural University has established a Centre of Excellence in Post-Harvest Technology that focuses on developing and disseminating technologies for value-added coconut products while providing technical guidance and entrepreneurial training (Satheeshan *et al.*, 2020). These institutions, together with coconut producer organisations and financial institutions, provide technical, financial, and extension support to emerging entrepreneurs in the district.

Despite the availability of such institutional support, relatively little empirical evidence exists on how these initiatives have influenced the performance of coconut enterprises at the field level. Information on enterprise characteristics, technological capability, access to financial and technical support, product diversification, and the operational constraints faced by entrepreneurs remains limited. Such evidence is essential for assessing whether public investments in entrepreneurship development are effectively translating into sustainable enterprise growth and for identifying gaps in extension and market support.

Against this background, the present study was undertaken in Kasaragod district of Kerala to examine the socio-economic and structural characteristics of coconut enterprises, assess their product portfolio, technological capability, and access to financial and institutional support, and identify the major constraints encountered in procurement, processing, and marketing. The study also evaluated the degree of agreement among enterprises regarding these constraints using Kendall's coefficient of concordance. The findings are expected to provide insights for strengthening coconut-based enterprises and improving policy interventions aimed at enhancing value addition, entrepreneurship, and the overall competitiveness of the coconut sector.

Material and methods

A total of 31 coconut-based enterprises were selected at random from the district and surveyed using a structured questionnaire. This questionnaire was designed to capture comprehensive information on their operations, starting from basic profile details to specific aspects of production, procurement and distribution. The profile section recorded the age, size, year of establishment, registration type, ownership pattern and gender status of each enterprise, along with the number and type of employees (regular, contract, seasonal), disaggregated by gender.

Information was also collected on the major products and by-products, average monthly production and production costs. Entrepreneurs were asked about their procurement process, including sources (farmers, traders), quality standards, payment methods, and constraints faced

during procurement, along with suggestions for overcoming these challenges. Details on processing, grading and packaging technologies including year of installation and assistance received for technology adoption were also recorded, as was information on financial assistance (loans, grants or subsidies) received from any organisation.

Data on raw-material storage, storage capacity and reasons for storage were gathered, along with average monthly sales of products and by-products by distribution channel (e.g., wholesalers, retailers) and information on annual investment and turnover. Enterprises were also asked to describe constraints faced during production, processing and marketing including market access, distribution-channel limitations, price competitiveness and logistical challenges together with suggestions for improvement.

To assess the level of agreement among enterprises on the relative severity of the constraints identified, respondents were asked to rank the listed procurement-processing constraints and, separately, the marketing constraints, in order of severity. Inter-respondent agreement in these rankings was tested using Kendall's coefficient of concordance (W), which ranges from 0 (no agreement) to 1 (complete agreement) and indicates whether independent respondents converge on a common ranking of constraints. Kendall's W was computed as:

$$W = 12S/[m^2(n^3 - n) - mT]$$

where, S = sum of squared deviations of the observed rank sums from the mean rank sum; m = number of respondents; n = number of constraints ranked; and T = a correction factor for tied ranks (Kendall & Gibbons, 1990).

Result and discussion

Profile of enterprises in Kasaragod

The survey results indicated that the establishment of coconut enterprises in the district dates back to the early 1900s. As shown in Figure 1, the number of new enterprises has increased markedly in recent years, particularly since 2009, with the highest number (seven enterprises) established in 2021. This trend reflects a growing level

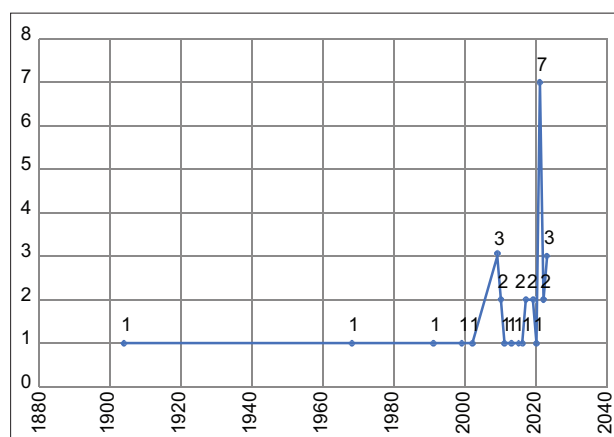


Figure 1: Distribution of years of enterprise establishment

of entrepreneurial activity, likely driven by favourable economic conditions, technological advancements, and supportive government policies. The survey further revealed that entrepreneur-support initiatives, particularly the Central Government's Mudra Loan Scheme, have played a significant role in facilitating the establishment of these enterprises.

The profile of coconut-based enterprises in Kasaragod (n=31) is presented in Table 1. Despite the increase in the number of enterprises established since 2009, the majority of enterprises in the district remained relatively young (Table 1). Among the enterprises surveyed, fifteen were 0-5 years old, while only five fell within the 5-10-year age category. This suggests that many ventures experienced difficulties in sustaining their operations beyond the initial years, likely due to market competition, financial constraints, and operational challenges commonly encountered by new businesses. The number of enterprises increased again to eleven among those operating for more than 10 years, indicating that enterprises surviving beyond a decade tend to be more stable and resilient. Such resilience may be attributed to the development of an established customer base, refinement of business models, and the accumulation of managerial and operational experience, enabling these enterprises to navigate challenges more effectively. The observed pattern of a large proportion of young enterprises and comparatively fewer in the 5-10-year age group is consistent with the operational and financial management challenges reported by Veerakumaran and Vinayakumar (2019) and Jayasekhar *et al.* (2024), viz., inadequate working capital and limited professional capacity.

Most of the enterprises surveyed were micro enterprises (29), with only two classified as small enterprises, indicating that coconut-based businesses in the district operate predominantly on a micro scale. This finding is consistent with the dominance of micro enterprises in Kerala's coconut sector reported by Ashwini *et al.* (2020). The sharp disparity between the number of micro and small enterprises highlights the challenges faced by micro enterprises in scaling up their operations, which may be attributed to financial, operational, and market-related constraints.

Table 1: Profile of coconut-based enterprises in Kasaragod (n=31)

S. No.	Particulars	Percentage (No.)
1	Age	
	0-5 year	48.39 (15)
	5-10 year	16.13 (5)
	>10 year	35.48 (11)
2	Gender basis of Owner	
	Male owned	93.55 (29)
	Female owned	6.45 (2)
3	Size of enterprise	
	Micro	93.55 (29)
	Small	6.45 (2)
4	Type of Enterprise	
	Private Ltd enterprise	93.55 (29)
	Cooperative Enterprises	6.5 (2)

n=number of enterprises surveyed

Private enterprises dominated the sector, accounting for 93.5 per cent of the enterprises surveyed, including Farmer Producer Companies (FPCs) registered as private limited companies. Among these, sole proprietorships constituted the largest share (74.2%), followed by joint family businesses (19.4%) and FPCs (6.4%). Co-operative societies (3.2%) and self-help groups (3.2%) accounted for only a small proportion of the sample. This distribution is broadly consistent with the state-level pattern, where the majority of micro-category coconut-based MSMEs in Kerala operate as sole proprietorships (Ashwini *et al.*, 2020; Shilpa, 2021). The predominance of the private proprietorship model may be attributed to its greater flexibility, ease of management, and higher degree of individual control over decision-making and profits. In contrast, the relatively small number of co-operative societies may reflect the organisational and operational challenges currently faced by co-operative enterprises in the coconut sector.

A significant gender disparity in enterprise ownership was evident. Of the 31 enterprises surveyed, 29 were owned by men, while only two were owned by women. This finding is consistent with the Global Entrepreneurship Monitor Report (GEM, 2023), which reported a substantial gender gap among established business owners, and with Shilpa (2021), who found that 92 per cent of entrepreneurs in Kerala's coconut sector were male. The low proportion of female-owned enterprises may be attributed to barriers such as limited access to finance, mentorship, and professional networks, as well as the challenges of balancing business and family responsibilities (Waqailiti, 2018). These findings underscore the need for targeted policies and support mechanisms to promote female entrepreneurship in the coconut sector.

On average, each enterprise surveyed employed seven workers. A total of 204 employees were identified across the 31 enterprises, of whom 138 (67.6%) were men and 66 (32.4%) were women, indicating a predominance of male employment. This gender imbalance may be attributed to the physical nature of certain processing activities, prevailing socio-cultural norms, and existing recruitment practices. These findings suggest the need for measures to enhance women's participation in coconut-based enterprises through improved access to skill development, employment opportunities, and supportive workplace policies. The results are in line with the findings of Ashwini *et al.* (2020) and Shilpa (2021), who reported that coconut-based enterprises with an annual turnover below ₹25 lakhs typically employed between one and ten workers, the majority of whom were men.

Finance and technology support

Fifty eight percent of the surveyed enterprises had received financial assistance, while 13 (42%) had not. Although the majority of enterprises had accessed financial support through various schemes (Figure 2), the substantial proportion operating without such assistance highlights the persistent challenges in obtaining institutional finance. These challenges may stem from limited awareness of

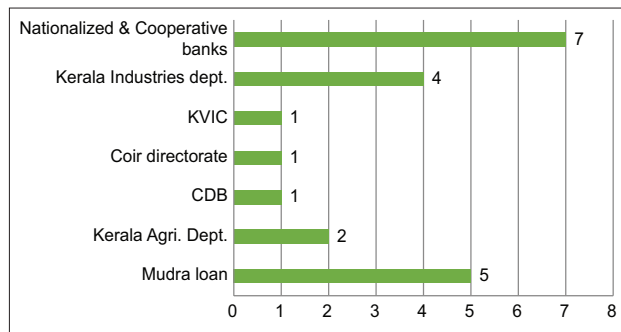


Figure 2: Distribution of enterprises across various financial support schemes

available schemes, stringent eligibility requirements, and complex application procedures. Financial institutions often perceive MSMEs as high-risk borrowers, limiting their access to formal credit (Ambrose, 2012). Similarly, Shilpa (2021) reported that coconut-based micro enterprises in Kerala face a severe shortage of institutional credit. These findings underscore the need to improve awareness of financial support programmes, simplify access to credit, and strengthen institutional mechanisms to ensure equitable financing opportunities and promote the sustainable growth of the coconut enterprise sector (Jayasekhar *et al.*, 2024).

An analysis of the sources of financial assistance revealed that most coconut enterprises in the district obtained financial support from nationalized and co-operative banks, either directly or through the Mudra Loan Scheme. In contrast, the Kerala Industries Department provided financial assistance to only four of the surveyed enterprises. As illustrated in Figure 3, this distribution highlights the varying levels of institutional support available to coconut enterprises in the district. The predominance of bank-based financing indicates the important role played by formal banking institutions in promoting entrepreneurship, while the comparatively limited involvement of the Kerala Industries Department suggests scope for strengthening the outreach and utilization of its support programmes.

From the results it was noted that only 2 of the 31 surveyed enterprises had received technological support from the Central Plantation Crops Research Institute (CPCRI), while the remaining 29 enterprises had not received any such assistance. This indicates that the penetration of institutional technology support among coconut enterprises in the district is extremely low, with only 6.5 per cent of the enterprises benefiting from it, leaving 93.5 per cent without access to such support.

The limited reach of technological support suggests the existence of barriers such as inadequate awareness of available services, insufficient outreach by supporting institutions, and the reluctance of enterprises to adopt new technologies. This finding is consistent with Shilpa (2021), who reported that coconut-based enterprises in Kerala continue to rely largely on traditional technologies for value addition. The low level of technological integration may adversely affect the productivity, efficiency, and competitiveness of the sector. Therefore, strengthening

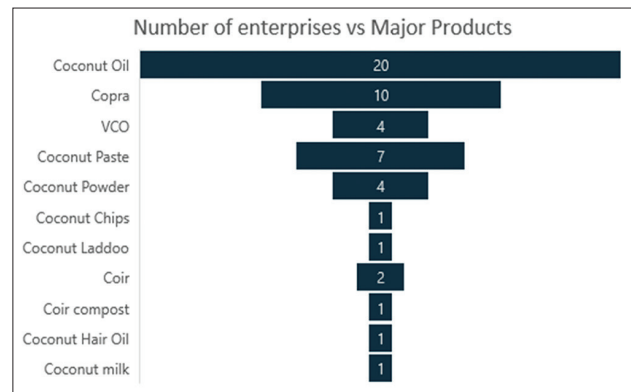


Figure 3: Distribution of enterprises across major product categories

extension and outreach activities, improving awareness of technology support programmes, simplifying access to technical assistance, and providing training and incentives for technology adoption could significantly enhance the technological capabilities and long-term sustainability of coconut enterprises in the district.

Average production and production capacity of CBEs in Kasaragod

As shown in Figure 3, the analysis of the product profile revealed that coconut oil was the most commonly produced product, with 20 of the 31 surveyed enterprises engaged in its production. Copra ranked second, with 10 enterprises involved in its production. Coconut oil and copra also recorded the highest average production volumes, underscoring their continued dominance in the product portfolio of coconut-based enterprises in Kasaragod district. In contrast, products such as coir fibre, coconut paste (a wet-ground coconut preparation commonly used as a base for curries and gravies), and virgin coconut oil were produced by comparatively fewer enterprises, although they still represented important value-added products.

On average, the surveyed enterprises produced 120,830 kg of coconut oil and 53,750 kg of copra per month. The average monthly production of different coconut-based products is presented in Figure 4. The findings indicate a strong concentration of production in a few conventional product categories, particularly coconut oil and copra, reflecting the continued reliance of enterprises on traditional coconut processing activities. The relatively limited production of diversified value-added products suggests considerable scope for product diversification, technological innovation, and market expansion, which could enhance the competitiveness and profitability of coconut-based enterprises in the district.

Although coconut paste and virgin coconut oil (VCO) were produced by seven and four enterprises, respectively, their average monthly production volumes were comparatively low. In contrast, enterprises engaged in coir fibre production recorded an average monthly output of approximately 35,000 kg (Figure 4), while coconut powder was produced in the smallest quantity among all the

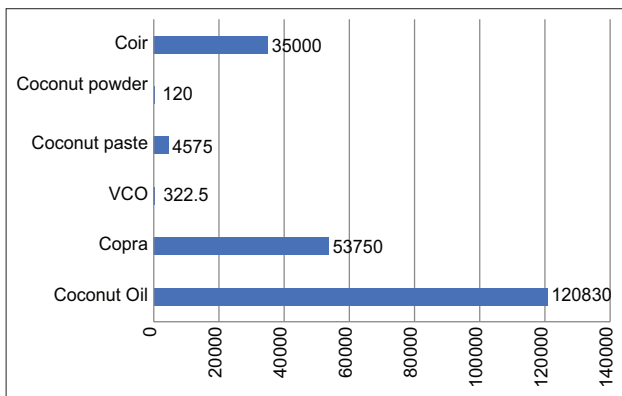


Figure 4: Distribution of products by average monthly production (kg)

products surveyed. This distribution highlights the scope for greater product diversification within the coconut industry, enabling enterprises to cater to a wider range of market segments and evolving consumer preferences. Promoting the production of diverse value-added coconut products could enhance the economic resilience, profitability, and long-term sustainability of these enterprises.

As illustrated in Figure 5, oil cake was the principal by-product, accounting for approximately 51 per cent of the total by-products generated, reflecting the predominance of coconut oil production among the surveyed enterprises. Other major by-products included low-grade copra, coconut shell, and lamp oil. This pattern suggests that, despite technological interventions and process standardization efforts undertaken by various agencies, coconut processing in the district continues to be dominated by a limited range of traditional products, particularly coconut oil, coconut paste, and virgin coconut oil (Shilpa, 2021). Greater diversification into high-value coconut products could improve the economic viability of coconut farming while reducing the sector's vulnerability to price fluctuations in traditional commodity markets (George & Kuruvila, 2023). However, the successful commercialization of emerging products, such as Neera, continues to face challenges related to marketing, branding, consumer awareness, and competition from established products and industries (Kochukalam, 2016).

The relatively low share of value-added and niche products in total average production indicates that their level of commercialization remains modest. This distribution reflects the continued dependence of coconut enterprises on traditional, high-volume products with well-established market demand and relatively standardized processing systems (Soundharya & Josephine Lourdes De Rose, 2025). At the same time, the limited production of diversified products suggests the existence of constraints related to technology adoption, market development, process standardization, and investment capacity. From both scientific and policy perspectives, these findings indicate that although product diversification has emerged within the sector, production intensity remains uneven, with enterprises continuing to concentrate on a few economically established products (Priyadharshini & Palani, 2023).

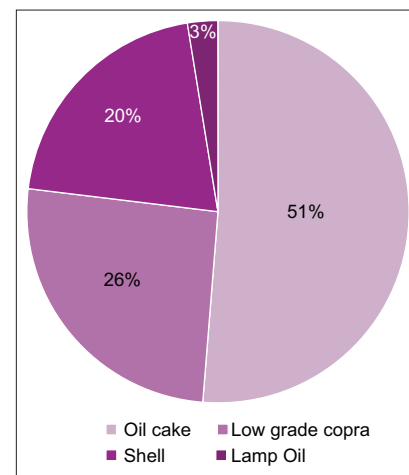


Figure 5: Distribution of enterprises according to By-product

Strengthening technical support, improving market linkages, facilitating access to finance, and promoting scalable processing technologies for emerging coconut products could broaden the production base, enhance value addition, and improve the resilience and competitiveness of coconut-based enterprises. A similar case was witnessed in case of the product 'Neera' where inadequate market positioning constrained its commercial success despite significant institutional efforts (Thamban *et al.*, 2020).

Annual turnover of coconut-based enterprises in Kasaragod

The annual turnover of the enterprises surveyed was almost evenly distributed across the sample, with 16 enterprises reporting an annual turnover above the median value of ₹43,20,000 and 15 reporting turnover below it. This near-equal distribution is consistent with the predominance of micro enterprises in the sector and reflects the considerable variation in the scale of enterprise operations. The observed pattern also highlights both the challenges and opportunities within the coconut enterprise sector. Constraints such as the declining area under coconut cultivation and fluctuations in production continue to limit enterprise growth, while increasing demand for value-added and processed coconut products presents significant opportunities to enhance enterprise profitability and strengthen the sector's contribution to the regional economy (Kochukalam, 2016).

Constraints faced by coconut-based enterprises in the district

The major constraints encountered by coconut-based enterprises in procurement and processing included fluctuations in market prices, limited storage capacity, wastage of procured coconuts due to poor quality, seasonal shortages of raw materials, the absence of a fixed Minimum Support Price (MSP), procedural difficulties in accessing government services, and technology-related issues such as the availability of unregulated and substandard machinery. The principal marketing constraints identified were the presence of adulterated products in the market,

compliance requirements related to FSSAI regulations and laboratory testing, seasonal fluctuations in demand, inadequate working capital, price volatility, the absence of a stable market, the rebranding of banned products, competition from imported coconut products, delayed payments from buyers, unreliable buyers and sellers, intense brand competition, the absence of an MSP for value-added products, limited consumer awareness of the diversity of coconut products, and high processing costs.

The Kendall's coefficient of concordance (W) value of 0.65 for procurement and processing constraints indicates a moderate to strong level of agreement among respondents regarding the relative importance of these constraints, suggesting that they are closely interconnected. Similarly, the Kendall's W value of 0.63 for marketing constraints indicates a comparable degree of agreement, implying that these challenges tend to occur simultaneously and reinforce one another. Consequently, addressing one major constraint is likely to generate positive spill-over effects on other related constraints. For example, greater stability in market prices could improve inventory management and reduce storage losses and wastage. Likewise, streamlining government procedures and promoting the adoption of standardized processing technologies could enhance operational efficiency and product quality. Improved market stability would also facilitate better working capital management and reduce the adverse effects of seasonal demand fluctuations. Strengthening regulatory compliance, quality assurance systems, and market surveillance could further mitigate the problems associated with product adulteration and unfair competition. These findings suggest that an integrated policy approach addressing procurement, processing, and marketing constraints simultaneously would be more effective than isolated interventions in improving the resilience and competitiveness of coconut-based enterprises.

Conclusion and perspectives

The findings indicate that a supportive entrepreneurial ecosystem, particularly the Central Government's Mudra Loan Scheme, has facilitated the establishment of coconut-based enterprises in Kasaragod district. However, the low survival rate beyond the first five years highlights persistent challenges in enterprise sustainability, underscoring the need to strengthen post-establishment support. Inadequate working capital and limited managerial capacity remain major constraints, reflected in the predominance of micro enterprises.

Scaling enterprises beyond the micro level requires greater access to finance, improved management, and stronger market linkages. Compared with sole proprietorships, partnerships, Farmer Producer Companies (FPCs), and other corporate structures offer better opportunities for resource mobilization and economies of scale, provided the regional entrepreneurial ecosystem can support their growth. The pronounced gender gap in enterprise ownership and employment further calls for gender-responsive policies, including targeted finance,

entrepreneurship development, skill enhancement, and gender-inclusive budgeting.

Although many enterprises have accessed institutional finance, credit is concentrated through nationalized and cooperative banks, particularly under the Mudra Loan Scheme, while support from state development agencies remains limited. Strengthening inclusive credit mechanisms and institutional support is therefore essential, especially for micro enterprises that face difficulties in accessing formal finance.

Despite sustained interventions by institutions such as CPCRI and the Coconut Development Board (CDB), most enterprises continue to rely on conventional technologies and products, mainly coconut oil. Greater product diversification is essential for improving resilience and reducing vulnerability to price fluctuations, as diversified enterprises consistently demonstrate superior economic and operational performance. However, diversification remains constrained by challenges in procurement, processing, and marketing.

The experience of Neera illustrates these constraints, with inconsistent quality, limited shelf life, and weak market positioning restricting its commercial success. Addressing these challenges requires integrated interventions in branding, worker skill development, managerial capacity building, and improvements in processing technologies, value addition, logistics, and supply chain management. Continued adaptation of technologies to local techno-economic and socio-cultural conditions, together with stronger collaboration among CPCRI, Kerala Agricultural University (KAU), the Coconut Development Board, the State Department of Agriculture, private research organizations, and Farmer Producer Organisations (FPOs), will be critical for fostering innovation, technology diffusion, and the long-term sustainability of coconut-based enterprises in the district.

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