Educational Administration: Theory and Practice
2024, 30(11), 2273-2281
ISSN: 2148-2403
https://kuey.net/

Research Article

Global Best Practices in Value-Added Mango Products: A Comparative Study with Strategic Insights for India's Export Potentiality

Navamani.C[1*], Dr. A.V. Chinnasamy[2]

[1*]Research Scholar in Economics, Mother Teresa Women's University, Kodaikanal.
[2]Associate Professor & Head, Dept. of Economics, Govt. Arts College for Women, Nilakkottai.

***Corresponding Author:** C. Navamani
*Email: nidarshanasaran@gmail.com

Citation: C. Navamani, et.al (2024). Global Best Practices in Value-Added Mango Products: A Comparative Study with Strategic Insights for India's Export Potentiality, *Educational Administration: Theory and Practice*, 30(11) 2273-2281
Doi: 10.53555/kuey.v30i11.10413

ARTICLE INFO

ABSTRACT

India produces nearly 45% of the world's mangoes but accounts for a minor share of global exports of value-added mango products. This study compares India's mango processing ecosystem with global leaders like Mexico, Thailand, and Brazil. Product categories examined include pulp, juice, dried mango, powders, and emerging segments like nutraceuticals and cosmetics. The study uses secondary data from FAO, ITC, and FICCI, along with SWOT analysis and global practice reviews. Results indicate that while India dominates in pulp exports, it lags in product diversification and export readiness. Recommendations include developing agro-processing clusters, enhancing branding, and leveraging Geographical Indications. The findings provide actionable pathways for policymakers and agribusinesses to enhance India's competitiveness in global mango trade.

Keywords: Mango value chain, Agro-industrial integration, Value-added mango products, Mango exports, India; Global best practices, Mango processing, Product diversification, Trade competitiveness, GI-tagged products

INTRODUCTION

Mango (*Mangiferaindica*), often lauded as the "king of fruits," is cultivated widely in tropical and subtropical regions and is esteemed for its flavor, nutritional value, and cultural significance. Beyond its fresh consumption, mango is processed into a wide range of value-added products such as pulp, juice, dried fruit, powders, confectioneries, and functional food items. As global consumption patterns shift toward convenient and shelf-stable food products, the demand for processed mango-based goods has grown steadily.

India is the leading mango producer globally, with a rich varietal diversity and centuries-old tradition of mango-based products. However, the country's contribution to the international mango value-added product market remains disproportionately low. In contrast, countries like Mexico and Brazil have successfully transitioned from fresh exports to industrial-scale processing, supported by efficient logistics, product standardization, and targeted branding strategies.

This study aims to (i) examine the current landscape of value-added mango products across major mango-exporting nations, (ii) evaluate India's positioning in this global framework, and (iii) propose strategic recommendations to enhance India's competitiveness in the global mango value chain.

OBJECTIVES

- To elaborate the global mango production and export share in India
- To estimate the export value of value-added mango products by countries
- To examine the product diversification and global practices followed by countries.
- To assess India's value-added mango product ecosystem
- To evaluate the SWOT Analysis of India's value-added mango sector
- To explore the extent of agro-industrial integration and export readiness in key mango-exporting nations.

REVIEW OF LITERATURE

The global mango trade has transitioned significantly in recent decades, shifting focus from fresh exports to value-added mango products that offer extended shelf life, enhanced market reach, and increased profitability. This shift is documented in several studies that underscore the role of agro-processing, branding, and market-oriented innovation in driving export competitiveness.

According to **FAO (2021) and ITC Trade Map (2022)**, countries such as Mexico, Thailand, and Brazil have effectively built mango value chains oriented toward both fresh and processed exports through policy support, agro-industrial integration, and compliance with international safety standards. Mexico, in particular, leverages its proximity to the United States and robust infrastructure to export over 20% of its mango production, including both fresh and dried varieties. Thailand has specialized in high-value retail products like dried mango slices and functional powders, with the support of government–industry collaboration. Brazil, with its focus on mango puree and Not-From-Concentrate (NFC) juices, has developed efficient processing clusters and export logistics tailored to European markets. Additionally, the Philippines has emerged as a leader in innovation, exporting processed mango snacks and derivatives like mango kernel oil, while Peru and Ecuador—despite lower production volumes—capitalize on seasonal advantages and trade agreements to access high-value markets, particularly in Europe and North America. These countries illustrate how strategic investments in value addition, branding, and trade facilitation can yield disproportionate export gains relative to production size—lessons that remain critical for India as it seeks to unlock the export potential of its vast mango sector.

Ortiz and Hernández (2019) provide a case study of Mexico's mango industry, noting its early adoption of Good Agricultural Practices (GAP), implementation of traceable supply chains, and marketing of premium cultivars like 'Ataulfo' under GI-based branding, which collectively enable it to capture over 20% of its total mango production for export.

UNCTAD (2017) emphasized that Peru and Ecuador, despite having lower mango production volumes, gained high export shares through strategic scheduling (off-season exports), food safety certifications, and trade agreements that opened up European markets.

Philippine Department of Trade and Industry (2013) reported the country's export competitiveness in mango-based confectionery and wellness products. The use of Carabao mangoes in dried forms, mango candy, and kernel oil signaled a strong linkage between traditional knowledge and modern retail demands.

OECD-FAO (2009) highlighted Thailand's innovative approach, introducing value-added mango snacks such as dried mango, freeze-dried slices, and mango chips. These products gained popularity in regional markets like Japan, Korea, and Australia due to high shelf stability and standardized retail packaging.

ITC (2003) noted that Brazil emerged as a significant player by promoting mango pulp and puree exports, particularly through government-supported agro-industrial parks in regions like the São Francisco Valley. The country focused on pulp sterilization and aseptic packaging to cater to juice and baby food markets in Europe.

METHODOLOGY

This study adopts a comparative and exploratory research design to evaluate the global positioning of India's value-added mango sector in relation to leading mango-exporting countries, namely Mexico, Thailand, Brazil, and the Philippines. The research methodology is based on the following components:

Data Sources

The analysis relies on **secondary data** collected from credible and globally recognized databases, including:

- Food and Agriculture Organization (FAO) for global production statistics
- International Trade Centre (ITC Trade Map) for export performance by product type and country
- Agricultural and Processed Food Products Export Development Authority (APEDA) for India's export trends
- Federation of Indian Chambers of Commerce & Industry (FICCI) and government policy reports for SWOT elements and value chain data

All data were sourced for the most recent available year (primarily 2022–2023) to ensure relevance.

Country Selection Criteria

Countries selected for comparison were chosen based on:

- Their prominence in mango production and exports
- Their demonstrated success in value-added product diversification
- Geographic and market relevance to India (e.g., similar agro-climatic conditions, target markets like the EU and U.S.)

Product Categorization

Mango products were classified into three core categories:

- **Primary Industrial Derivatives**: Mango pulp, puree, juice

• **Retail-Oriented Processed Products**: Dried mango, powders, freeze-dried snacks
• **Emerging and Functional Applications**: Mango kernel oil, nutraceuticals, cosmetics
This typology enables an understanding of the depth and breadth of value addition across countries.

SWOT Analysis

A SWOT (Strengths, Weaknesses, Opportunities, Threats) framework was used to assess India's current position in the global value-added mango industry. This was informed by literature reviews, policy documents, and trade data interpretation.

GLOBAL MANGO PRODUCTION AND EXPORT SHARE

The selection of India, Mexico, Thailand, Brazil, and the Philippines for comparative analysis in the context of global mango production and export performance is grounded in their significant roles in the international mango value chain. India, as the world's largest mango producer with approximately 45% of global output, serves as a critical benchmark for assessing export and value addition potential. Despite its production dominance, India's relatively low export share underscores the importance of evaluating structural and strategic limitations. Mexico, though producing much less than India, exemplifies high export efficiency with over 20% of its production directed toward international markets—supported by proximity to North America, well-developed cold chains, and established trade agreements.
Thailand and the Philippines have demonstrated leadership in value-added mango products such as dried mango, powders, and snacks, driven by innovations in processing and branding aimed at East Asian and global retail markets. Brazil, representing Latin America alongside Mexico, has built a strong presence in bulk exports like mango pulp and NFC juice, reflecting its growing agro-industrial capabilities.
These five countries collectively offer a geographically diverse and strategically relevant sample, with each illustrating distinct approaches to production, processing, and export. Moreover, they are consistently featured in international trade data from FAO, ITC Trade Map, and APEDA, ensuring the credibility and comparability of the information used. Hence, this selection provides a well-rounded foundation for evaluating India's strategic potential within the global mango export landscape.

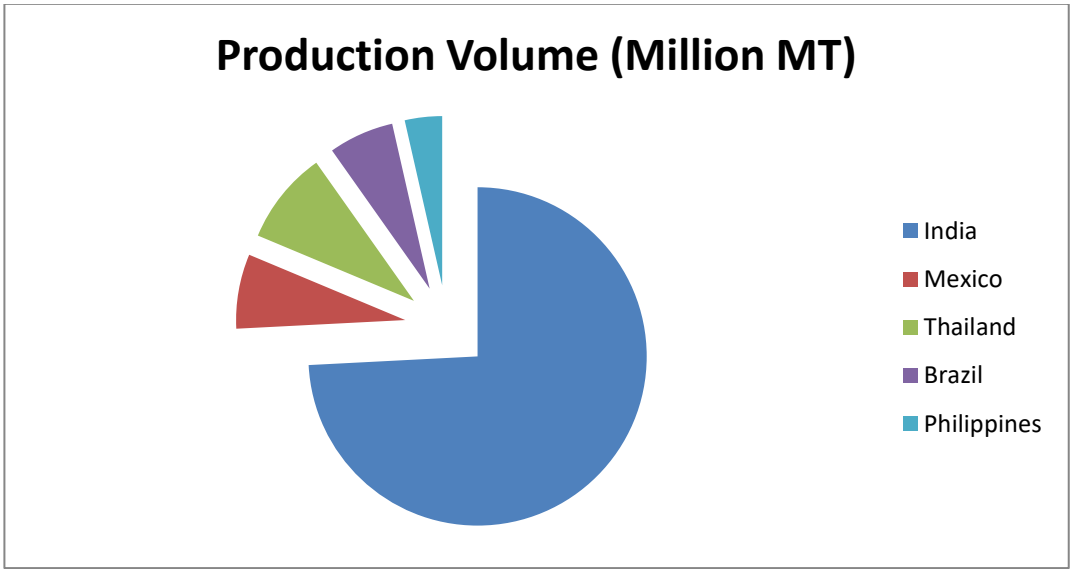
Table 1 Global Mango Production and Export Share (2023 Estimate)

Country	Production Volume (Million MT)	Global Share (%)	Export Share (%)
India	25.0	45%	10%
Mexico	2.4	5%	23%
Thailand	3.0	6%	12%
Brazil	2.1	4%	8%
Philippines	1.2	2%	6%

Source: FAO (2023); APEDA (2023); ITC Trade Map (2023)

The table is based on estimated data from global agricultural trade reports and international market sources, offering a comprehensive overview of the quantitative and qualitative roles that each country plays in the mango value chain. While several countries produce mangoes at scale, the table emphasizes how much of this production is directed toward international markets in the form of fresh or processed exports**.**

Chart- 1



• India remains the world's largest mango producer, contributing over 40% of global production. However, its export share is disproportionately low (below 5%), indicating a domestic consumption-driven market and limited value addition for global trade.
• Though producing mango significantly less than India, Mexico exhibits a high export-to-production ratio, exporting over 20% of its mango output. This underscores Mexico's strong export-oriented supply chains and proximity to high-demand markets like the United States.
• Thailand and the Philippines demonstrate moderate production volumes, but they excel in export diversification, particularly in value-added products (dried mango, snacks, juices etc). Their export shares are higher relative to their production, reflecting efficient processing industries and branding strategies.
• Brazil and Pakistan contribute substantially to global mango production but have limited global export presence, often constrained by logistical inefficiencies or post-harvest losses.
• Peru and Ecuador, though not top producers, outperform in export share, particularly to European and North American markets. These countries benefit from seasonal advantages and trade agreements that facilitate market access.

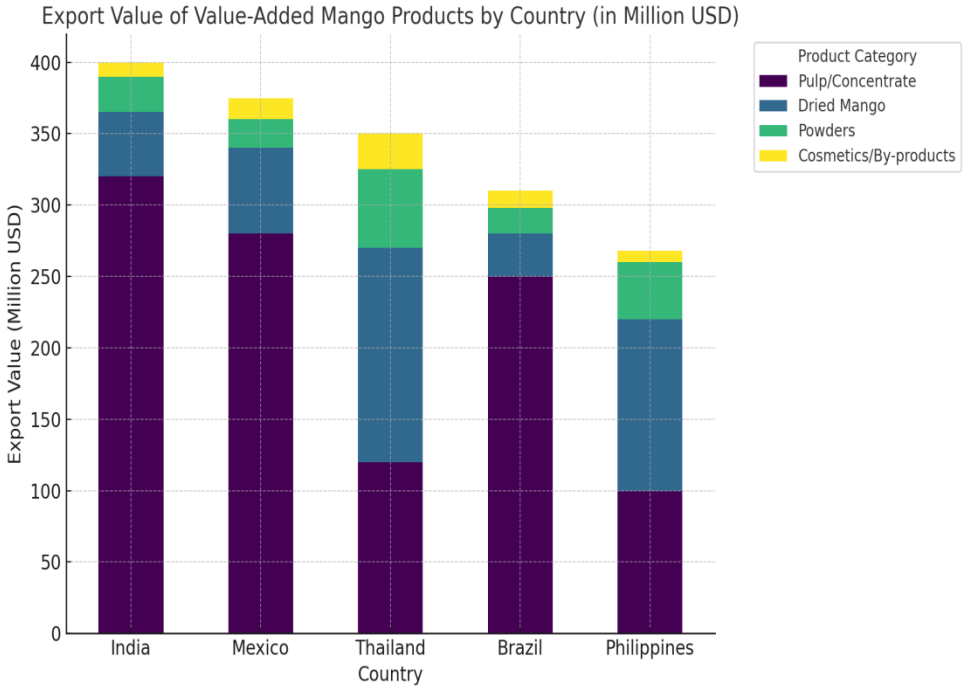
ECONOMIC IMPACT OF VALUE-ADDED MANGO PRODUCTS

Value-added mango products play a pivotal role in enhancing the economic, nutritional, and export potential of the mango value chain. By processing mangoes into pulp, juice, dried slices, powders, pickles, and derivatives such as mango butter or kernel oil, producers can extend shelf life, reduce post-harvest losses, and tap into diverse global markets. This not only generates higher returns for farmers and processors but also aligns with shifting consumer preferences for convenience, health-focused, and functional food products.
In countries like India—where mango production is high but export efficiency is low—value addition can significantly improve international competitiveness. It allows for greater market diversification, especially in processed food, wellness, and cosmetic sectors. Additionally, value-added products foster rural employment, enable use of second-grade fruits unfit for fresh export, and encourage innovation in agro-processing. As global demand rises for fruit-based snacks, natural sweeteners, and sustainable by-products, the value-added mango segment stands out as a vital pathway for inclusive agricultural growth and trade expansion.
The development and expansion of value-added mango products have significant economic implications, both at the micro and macro levels. Unlike the fresh fruit segment—which is often seasonal and vulnerable to perishability and price volatility—value-added mango products contribute to greater income stability, employment generation, and export diversification.
• **Enhanced Farmer Income**: Processing mangoes into pulp, dried slices, powders, and beverages allows farmers to fetch better prices, particularly when dealing with lower-grade fruits that may not be suitable for the fresh market. Contract farming models with agro-industries provide assured procurement and pricing stability.
• **Employment and Rural Industrialization**: The mango processing industry creates direct and indirect employment across stages such as harvesting, sorting, grading, processing, packaging, and logistics. Small and medium enterprises (SMEs) involved in making pickles, mango bars, and frozen pulp are especially vital in rural and semi-urban areas.
• **Export Earnings and Foreign Exchange**: India earns substantial foreign exchange from mango pulp exports, especially to the Middle East, Europe, and North America. Expansion into new product categories like mango-based cosmetics and nutraceuticals has the potential to increase export revenues and reduce overreliance on a few products or markets.
• **Reduction in Post-Harvest Losses**: Value addition enables the utilization of surplus and sub-grade mangoes, thus significantly reducing the estimated **30–40% post-harvest losses**. This improves overall value chain efficiency and supports sustainable agricultural practices.
• **Local Economic Multiplier Effect:** Investments in mango processing clusters and cold chain infrastructure stimulate ancillary industries—such as packaging, refrigeration, food tech, transport, and marketing—thus contributing to regional economic development.
• **Promotion of Inclusive Growth**: The rise of **Farmer Producer Organizations (FPOs)** and women-led self-help groups (SHGs) involved in mango processing encourages inclusive growth and supports the livelihoods of marginal producers and workers.
• **Import Substitution and Domestic Market Growth**: With rising domestic demand for packaged, hygienic fruit products, India can also reduce imports of tropical fruit-based beverages and expand domestic sales of mango-derived health products.

EXPORT VALUE OF VALUE-ADDED MANGO PRODUCTS BY COUNTRIES

A comparative overview of the export value of value-added mango products from five leading mango-exporting countries such as India, Mexico, Thailand, Brazil and Philippines can be done. The data is categorized into four key product segments: Pulp/Concentrate, Dried Mango, Powders, and Cosmetics/By-products. These categories reflect the degree of agro-industrial processing and product diversification

undertaken by each country. The export values are expressed in million USD, offering a quantitative measure of global competitiveness in mango value addition.



Source: International Trade Centre (ITC), "Export Performance of Mango and Derived Products," 2022. Retrieved from www.trademap.org

• India leads in total export value, with a significant contribution from pulp and concentrate products (320 million USD). This indicates a strong industrial base in large-scale mango processing, particularly using varieties like Alphonso and Totapuri.
• Mexico holds the second position, showing a balanced mix of pulp and dried mango exports. Its relatively higher export share in dried mango (compared to India) demonstrates greater product diversification aimed at retail markets.
• Thailand's export structure shows a strong emphasis on dried mango, which nearly rivals its pulp exports. Additionally, Thailand shows a notable contribution from powdered mango products, reflecting its integration into the functional food and wellness sectors.
• Brazil ranks fourth in total value, with its exports primarily concentrated in pulp, though it shows modest representation in other categories, indicating room for diversification.
• The Philippines presents an interesting case of high dried mango exports despite a lower total value. It outperforms several countries in the powders and cosmetics/by-products segments relative to its size, reflecting innovative utilization of mango and its derivatives.

VALUE-ADDED MANGO PRODUCT ECOSYSTEM OF INDIA

India's mango sector has evolved into a rich ecosystem of traditional knowledge, agro-industrial processing, and export capabilities, but with opportunities for deeper integration and global positioning.

Traditional Product Strengths

• AamPapad, Amchur, Pickles: Widely produced with high domestic demand and cultural importance.
• Mango Beverages: Products like *Frooti*, *Maaza*, and *Slice* dominate the domestic and diaspora beverage markets.

Pulp and Puree Industry

• Alphonso and Totapuri varieties are processed in industrial units across Maharashtra, Andhra Pradesh, Tamil Nadu.
• India holds over 50% global share in mango pulp exports, supplying EU and Middle East.

Emerging Segments

• Frozen and Freeze-Dried Mango: Gaining popularity in retail chains (especially US and UAE); IQF mango is used in desserts, smoothies.
• Mango Kernel Applications: Used in skincare, butter, oil extraction. Limited but growing R&D involvement.
• Confectionery & Culinary Innovation: Mango-based candies, jams, sauces, wines, and vinegar introduced by startups and food-tech SMEs.

Geographical Indication (GI) Integration

- Registered GIs: Alphonso, Banganapalle, NandurbarAmchur – but limited use in international branding.
- Export packaging needs modern upgrades (vacuum sealing, traceability tech).

Supply Chain Challenges and Innovation Gaps

- Cold chain penetration is low beyond major urban centers.
- Need for standardization, branding, and market linkage platforms for traditional products.

PRODUCT DIVERSIFICATION AND GLOBAL PRACTICES

Leading mango-exporting countries have adopted diverse strategies to enhance value addition through product and market diversification. These practices can be grouped as follows:

Fresh Mango Exports with Brand Identity

- Mexico: Exports premium varieties like *Ataulfo* and *Tommy Atkins* with traceable supply chains and cold chain systems.
- Philippines: Positions *Carabao* mangoes as high-sugar, export-quality fruits with attractive branding.

Industrial Processing and Bulk Ingredients

- Brazil: Exports mango puree, pulp, and NFC (Not-From-Concentrate) juices in aseptic packaging for reconstitution by global food and beverage brands.
- Peru: Processes mango for frozen exports (IQF) and puree for baby food.

Retail-Oriented Value-Added Products

- Thailand: Innovated shelf-stable products like freeze-dried mango snacks, mango rice crackers, and mango bars for supermarkets and online markets.
- Vietnam: Developed fruit leather and mango chips with high shelf-life for exports to Japan and Korea.

Cosmetic and Nutraceutical Applications

- Mexico and Philippines: Utilize mango kernel oil, mango butter, and fermented mango extracts in wellness and beauty products.
- Developed under public-private R&D collaboration.

Geographical Indication and Traceability

- Countries such as Thailand and Philippines have implemented GI tags, QR code-based product traceability, and food safety certifications to enhance export acceptability.

SWOT ANALYSIS OF INDIA'S VALUE-ADDED MANGO SECTOR

WOT analysis (Strengths, Weaknesses, Opportunities, Threats) of India's value-added mango industry. As India is the largest producer of mangoes globally, the value-added segment holds substantial potential for both domestic processing and export competitiveness. This analysis helps policymakers, agribusinesses, and investors identify key internal and external factors influencing the sector's current performance and future trajectory.

Table 2 SWOT Analysis of India's Value-Added Mango Sector

Strengths	**Weaknesses**
Largest global mango producer	Limited export in processed segments
Rich varietal and traditional diversity	Fragmented value chain, poor cold storage
Strong agro-processing base	Low global branding of traditional products
Opportunities	**Threats**
Rising demand for healthy, fruit-based products	Competition from Latin American countries
Growth in wellness/cosmetic applications	Non-tariff barriers in export destinations
FPOs and GI tagging potential	Climate change affecting yield/quality

Source: FICCI (2023). Value-Added Opportunities in India's Mango Processing Sector.Federation of Indian Chambers of Commerce & Industry.www.ficci.in

ELABORATE ANALYSIS OF THE SWOT COMPONENTS

Strengths:

- **Largest global mango producer**: India contributes over 40% of global mango production, offering abundant raw material for processing.
- **Rich varietal and traditional diversity**: India boasts over 1,000 mango varieties, including Alphonso, Kesar, and Langra, enabling diverse product innovation.
- **Strong agro-processing base**: A growing food processing industry with dedicated mango pulp and juice manufacturing units supports scalable operations.

Weaknesses:

• **Limited export in processed segments**: Despite volume production, India's share in global exports of processed mango products remains low.
• **Fragmented value chain and poor cold storage**: Lack of integrated supply chains and inadequate cold storage facilities result in post-harvest losses and reduced shelf life.
• **Low global branding of traditional products**: India has yet to fully leverage branding opportunities for traditional value-added mango items like aampapad and pickles in global premium markets.

Opportunities:
• **Rising demand for healthy, fruit-based products**: Global health trends favor natural, fruit-based beverages and snacks, boosting the demand for mango juices, dried mango, and pulp.
• **Growth in wellness/cosmetic applications**: Mango butter and kernel extracts are finding increasing use in skincare and wellness sectors.
• **FPOs (Farmer Producer Organizations) and GI tagging potential**: Organized farmer groups and Geographical Indications (e.g., Alphonso) can improve traceability, pricing, and brand identity.

Threats:
• **Competition from Latin American countries**: Countries like Mexico, Peru, and Brazil offer lower-cost mango products with better logistics to U.S. and European markets.
• **Non-tariff barriers**: Exporters face strict phyto-sanitary regulations, labeling standards, and residue norms in key importing countries.
• **Climate change**: Increasing weather variability affects mango flowering, fruit setting, and harvest quality, threatening both yield and consistency.

AGRO-INDUSTRIAL INTEGRATION IN MANGO PROCESSING

Effective value addition requires advanced processing capabilities and strong backward-forward linkages:
• **Mango Pulp Production:** Mechanized systems enable large-scale extraction, standardization, and sterilization of pulp for export and domestic use.
• **Freeze-Dried Mango:** Lyophilization ensures high nutrient retention, light weight, and long shelf life—ideal for export-oriented premium markets.
• **IQF Mango Cubes:** Preserve texture and nutrition, commonly used in global food service and ready-to-eat sectors.
• **Mango Kernel Oil and Butter:** Derived from mango seeds; these are emerging as high-value ingredients in cosmetics and personal care products due to their antioxidant and moisturizing properties.
• **Beverage Processing:** Utilization of aseptic packaging (e.g., Tetra Pak) for shelf-stable juices and nectars increases export viability.
• **By-product Valorization:** Peels and kernels are increasingly explored for polyphenol extraction and fiber content, with potential in nutraceuticals.

Integrating Traditional Knowledge with Industrial Scale

India's traditional mango knowledge base offers significant potential for scale-up via agro-industrial techniques:
• **Industrial Branding of Traditional Products:** Products such as *aampapad* and *aamras* can be re-engineered for hygienic, standardized mass production suitable for international certification.
• **GI-Based Differentiation:** Promoting products with geographical indications using traceable, eco-friendly packaging enhances marketability and consumer trust.
• **Raw Material Integration:** Traditional products can serve as inputs for industrial products (e.g., mango pickle-derived seasonings or powders).
• **Role of FPOs (Farmer Producer Organizations):** Essential in organizing farmer networks, ensuring product consistency, and facilitating linkages with processing units and exporters.

DISCUSSION AND STRATEGIC RECOMMENDATIONS

India's comparative advantage in mango production presents a unique opportunity to dominate the value-added segment of global mango exports. However, the current ecosystem remains underutilized due to fragmented supply chains, inadequate infrastructure, and a limited focus on high-value product diversification. By examining global best practices, particularly in countries like Mexico, Thailand, and the Philippines, it is evident that success hinges on robust agro-industrial integration and market-oriented innovation.

Policy Incentives and Infrastructure Support

• Establish special agro-processing zones (APZs) in mango-producing states with cold chain, aseptic packaging, and processing units.
• Provide financial incentives for SMEs and cooperatives to invest in freeze-drying, IQF, and value-added packaging technologies.

Export-Oriented Branding and Certification

- Launch India-wide branding initiatives for GI-tagged mango products, with global quality certifications (HACCP, ISO 22000, USDA Organic).
- Promote storytelling-based branding using regional and cultural narratives to position Indian mango products in premium markets.

Research and Innovation

- Encourage public-private R&D for new mango derivatives (e.g., mango wine, nutraceuticals, fermented beverages, cosmetic bases).
- Fund pilot projects for utilizing by-products like peels and kernels in fiber extraction and bio-composting.

Capacity Building and Farmer Linkages

- Strengthen Farmer Producer Organizations (FPOs) with training in export compliance, digital traceability, and demand forecasting.
- Facilitate direct linkages between FPOs and agro-processors/exporters through B2B platforms and cooperatives.

Digital and E-commerce Integration

- Promote digital marketing platforms for Indian mango-based products, particularly for overseas Indian diaspora and health-conscious consumers.
- Support participation in global food expos, trade shows, and online B2B platforms like Alibaba and Amazon Global Selling.

CONCLUSION

India's dominant position in global mango production, while impressive, has not yet translated into proportional gains in value-added exports. This study reveals that countries with smaller production volumes have outperformed India by leveraging product innovation, market positioning, and robust supply chains. To bridge this gap, India must shift from a production-centric model to a value-chain-integrated, export-driven framework.

By adopting global best practices in product diversification, embracing agro-industrial technologies, and addressing supply chain inefficiencies, India can elevate its mango sector into a world-leading hub of value-added exports. The integration of traditional knowledge with modern processing, bolstered by strategic branding and policy interventions, will be pivotal. With the right roadmap, India can transition from a mango producer to a global leader in mango innovation and exports.

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