Policy Paper 47

From Local to Global

Opportunities to Accelerate Agricultural Exports from India

Raka Saxena
Pratap S Birthal
R C Agrawal
Purushottam Sharma
Ranjit K Paul
Balaji S J
Devesh K Pant
Neha Joshi

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New Delhi - 110 012

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Raka Saxena is the Head & Principal Scientist, Division of Technology & Sustainable Agriculture at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi; Pratap S Birthal is the Director at ICAR-NIAP; R C Agrawal is the Deputy Director General (Agricultural Education), Division of Agricultural Education, Indian Council of Agricultural Research, New Delhi; Purushottam Sharma and Balaji S J are Principal Scientist and Scientist (Senior Scale), respectively at ICAR-NIAP; Ranjit Kumar Paul is Senior Scientist at ICAR-Indian Agricultural Statistics Research Institute, New Delhi; Devesh Kumar Pant and Neha Joshi are Research Associate at ICAR-NIAP. The views expressed in this paper are those of the authors and need not necessarily reflect the official policy or position of the institution to which they are affiliated.

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Foreword

Trade in food and non-food commodities can contribute significantly to the sustainable transformation of the global agri-food system. Agricultural trade not only supports economic growth by improving resource allocation, raising farmers' incomes, and stabilizing food prices but also fosters knowledge and technology exchanges. This can lead to innovations that enhance agricultural productivity and resilience.

Over the past two decades, India has experienced significant improvements in its agricultural exports, reaching approximately US$53 billion in 2022-23, attributable to several factors, including technological advancements in production agriculture, enhancements in supply chains and logistics, trade facilitation measures, and market diversification strategies. Nevertheless, the untapped export potential persists for several commodities due to their lack of price competitiveness. India's exports face challenges in the global market, primarily due to pesticide residues, microbial contamination, the use of prohibited substances, and inadequate product handling. Good agricultural and manufacturing practices are fundamental to ensuring high-quality and safe agricultural exports that meet international standards. Agricultural research can play a significant role not only in improving comparative advantages in production but also in enhancing compliance with sanitary and phytosanitary standards upstream of agri-food systems.

The rapidly evolving trade dynamics in the global agricultural market necessitate a comprehensive assessment of agricultural exports and the factors that influence them. This study provides a systematic analysis of the performance of India's exports of agricultural commodities and their prospects. To harness the untapped export potential, the study underscores the critical role of a robust market intelligence system to enable exporters to better target their products to specific markets, meet consumer preferences in different countries, and understand international standards and regulatory requirements. Furthermore, it emphasizes the transformative potential of blockchain technology to comply with the international standards for building consumer trust.

The publication coincides with a period when India is poised to leverage its agricultural strengths and capabilities to enhance its agricultural potential on the global stage. The findings of this study are expected to offer crucial insights for a wide range of stakeholders, including policymakers, manufacturers, exporters, and farmers.

Himanshu Pathak
Secretary (DARE) &
Director General (ICAR)

Preface

India's agricultural exports have experienced a significant increase over the past two decades, from US$7 billion in 2001 to over US$50 billion in 2023, demonstrating its strategic positioning and capacity to leverage its agricultural strengths in the global market. India has not only maintained its strongholds in traditional export commodities such as rice, sugar, crustaceans, and spices, but has also diversified into new products and markets to mitigate the risks associated with market fluctuations and enhance its export resilience. The remarkable expansion of India's agricultural exports has incentivized agricultural modernization and efficiency improvements, enhanced farmers' incomes, and contributed significantly to global food security. Moreover, India's evolving export portfolio, which now includes a wider range of value-added and processed agricultural products, signals the country's transition towards higher-value exports and its potential to capture a larger share of global agricultural trade.

This study provides insights into the trends and composition of India's agricultural exports, their competitiveness, export destinations, and potential opportunities for expansion. Nonetheless, the country faces several challenges related to quality standards, sanitary and phytosanitary measures, and non-tariff barriers to enhance its standing in the global agricultural market. The study suggests technological solutions, such as precision agriculture, blockchain for traceability, digital platforms for market access, and institutional reforms to streamline export processes and enhance the efficiency of agricultural supply chains. It also suggests policy interventions required to support farmers, promote value addition, and create a conducive environment for export-oriented agriculture.

This study greatly benefited from the expertise and guidance of several esteemed professionals. Dr. Ashok Dalwai, Chairman of the Empowered Body on Doubling Farmers' Income, and Dr. Sachin Kumar Sharma, Professor at the Centre for WTO Studies at the Indian Institute of Foreign Trade, provided valuable suggestions that helped us to bring this study in its present shape. We received significant support and encouragement from Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR. His interest in this study underscores the importance of agricultural research in the context of evolving international trade dynamics.

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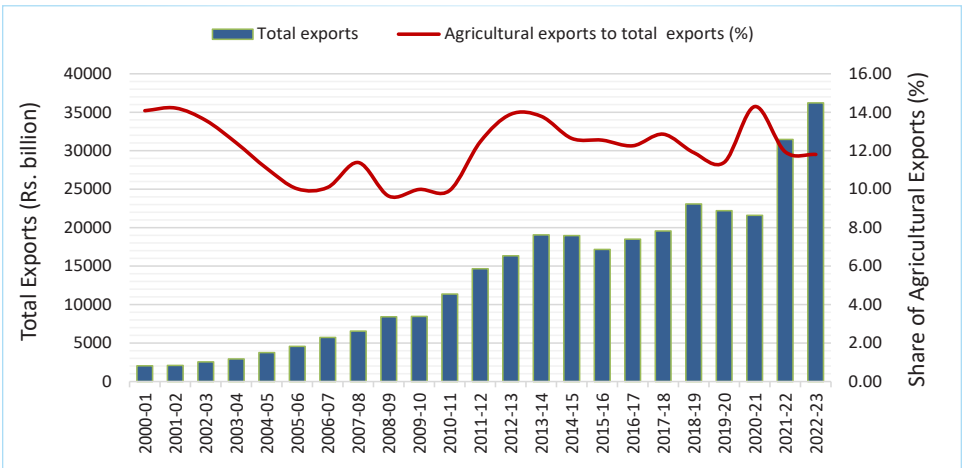
Executive Summary

Agricultural exports constitute approximately 12% of India's total merchandise trade (Figure 1). Over the past two decades, agricultural exports from India have grown substantially, particularly in commodities such as Basmati rice, spices, and crustaceans. However, rapidly evolving trade dynamics necessitate a comprehensive assessment of several factors, including competitiveness, market dynamics, logistics, food standards, and regulations, to maintain or enhance India's position in the global market.

This study presents a comprehensive analysis of India's agricultural exports, encompassing trends, product composition, export markets, competitors, technological, institutional and policy challenges, and prospects for growth. The key findings of this study are as follows.

Growth in India's agricultural exports is appreciable: India's agricultural exports reached US$ 53.15 billion in 2022-23, making it the eighth largest exporter of agricultural products. Despite supply chain disruptions during the COVID-19 pandemic and global geopolitical tensions, India's agricultural exports grew consistently. This impressive performance can be attributed to export promotion and facilitation through government policies, market diversification strategies, and the growing demand for Indian high-value agricultural products.

Figure 1. Trend in India's agricultural exports

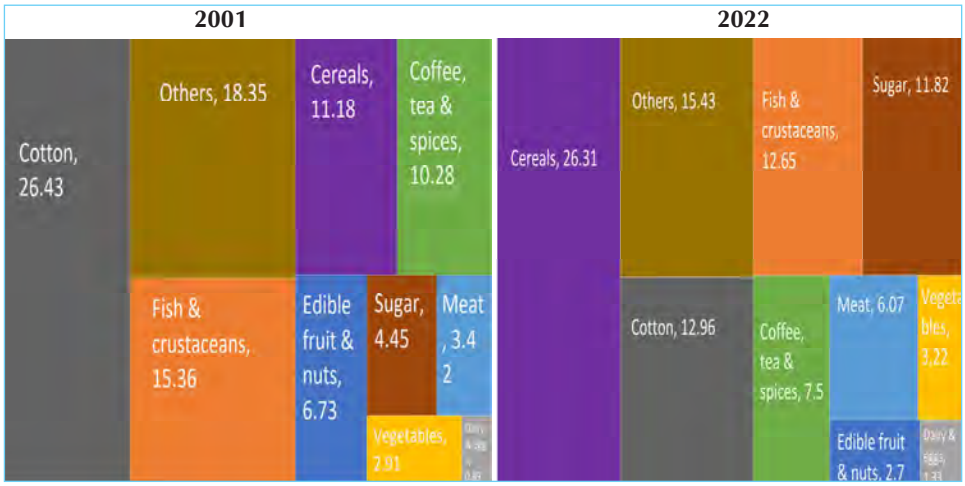


Source: Agricultural Statistics at a Glance, 2023.

India's exports are concentrated on a few commodities: The grains, particularly rice and wheat, constitute approximately 25% of the total agricultural exports valued at US$14 billion. Despite experiencing a decline over the past ten years, cotton occupies a significant position in agricultural export portfolio. There has been a steady increase in the export of seafood like crustaceans, as well as beverages such as tea and coffee, along with various spices.

The composition of India's agricultural exports has undergone significant change over time (Figure 2). In 2001, cotton was the most significant export item (26.4%), followed by fish and crustaceans (15.4%), and grains (11.2%). By 2022, the export landscape transformed, with cereals emerging as the primary export item, comprising approximately 26% of agricultural exports. Nevertheless, cotton has maintained its position as the second-most significant export item.

Figure 2. Changes in India's agricultural export basket (%)



Source: Computed by authors.

India occupies a prominent position in the global food market, particularly for rice and sugar. It shares 38.6% of the global market for semi-milled rice and 18.7% for sugar (Table 1). Furthermore, India maintains a significant presence in the exports of shrimp and prawns, bovine meat (carabeefs), and cotton. The country has a near-monopoly position in exports of castor oil (86%) and cumin (82%).

Table 1. India's global standing in agricultural exports, 2022

Commodities	Exports (US$ billion)	Share in agricultural exports (%)	Global ranking	Share in global exports (%)	Growth in exports (2019-23, %)	Growth in global imports (2019-23, %)
Semi-milled rice	9.40	17.70	1	38.6	11	9
Shrimp and prawns	4.79	9.03	2	21.3	1	5
Bovine meat	2.85	5.39	4	8.1	1	8
Sugar	2.76	5.21	1	18.7	21	16
Cotton	1.20	2.27	4	5.5	-9	6
Wheat	2.10	3.97	9	3.5	21	14
Broken rice	1.20	2.27	1	37.2	47	8
Castor oil	1.09	2.05	1	85.9	7	7
Dried capsicum	0.84	1.59	1	61.9	8	9
Coffee	0.75	1.42	12	2.5	14	15
Groundnuts	0.69	1.31	2	19.4	6	7
Cuttlefish	0.72	1.41	2	9.7	6	6
Black tea	0.64	1.22	2	16.0	-3	0
Onion	0.52	0.99	3	12.0	17	5
Nutmeg	0.02	0.87	2	12.6	20	8
Cumin	0.46	0.87	1	82.0	7	3
Cashew nuts	0.35	0.66	1	62.2	-11	-1
Grapes	0.30	0.58	10	3.2	2	4
Turmeric	0.21	0.40	1	62.8	1	4

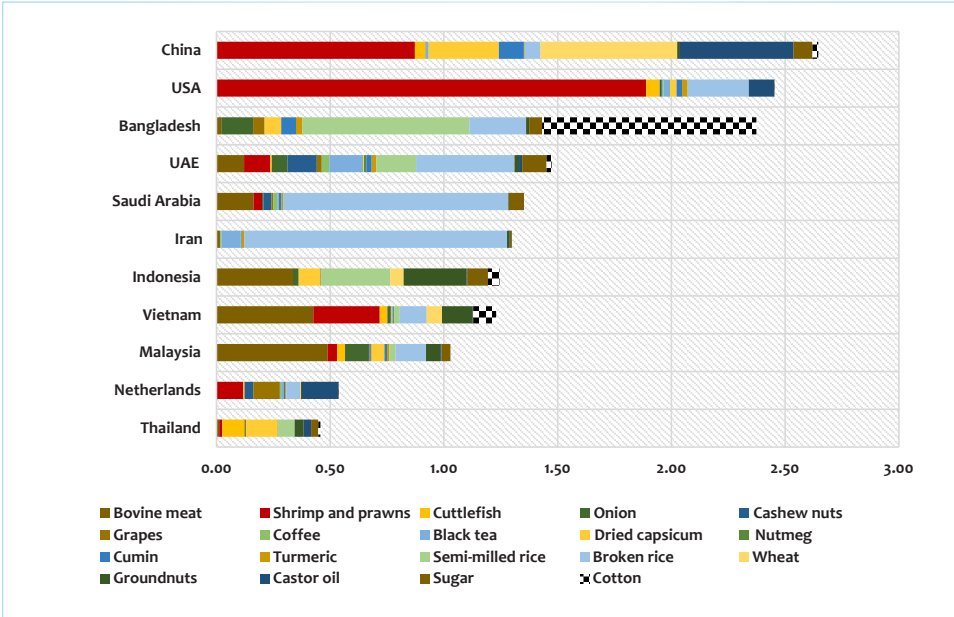
Source: Based on INTRACEN database.

Agricultural exports show market diversification as well as concentration: The principal destinations for India's rice exports comprise Iran and Saudi Arabia for semi-milled rice, and China and Senegal for broken rice (Table 2). Bangladesh and Indonesia are primary destinations for Indian wheat.

The primary export destinations for Indian groundnuts are Indonesia and Vietnam (Figure 3). The market for Indian onions remains predominantly concentrated in Bangladesh, Malaysia, the United Arab Emirates (UAE), and Sri Lanka. Regarding grapes, India has encountered substantial challenges in maintaining a consistent share of the global market.

The United States of America (USA) and the UAE have demonstrated a significant demand for Indian spices, including dried capsicum, cumin, turmeric, and nutmeg. Cumin exports have exhibited consistent growth and successfully penetrated new markets.

Figure 3. India's major trade partners in agricultural exports (US$ billion, 2022)



Source: Computed by authors.

India's sugar exports are highly concentrated on Sudan and Somalia. Bangladesh and Vietnam are the top importing countries of Indian cotton. The destinations for coffee exports have demonstrated variability over time. The principal importers of Indian coffee are Italy, Germany, and Belgium. The black tea market has consistently maintained diversity, although the UAE, Russia, and Iran have been significant purchasers. Cashew nut exports are predominantly directed to a limited number of markets, notably the UAE, Netherlands, and Japan.

The export trends for meat have shown fluctuations, but recently have focused on markets like Malaysia, Egypt, Vietnam, and Indonesia. Likewise, the export diversity of shrimp and prawns has changed, with the USA, China, Japan, and Vietnam emerging as key importing countries.

Table 2. Market concentration in India's agricultural exports

Commodities	Partner countries with an export share of		
	More than 10 %	5-10 %	Less than 5 % (number of countries)
Semi-milled rice	Iran, Saudi Arabia	Benin	71
Shrimp and prawns	USA, China	Japan, Vietnam	37
Bovine meat	Malaysia, Egypt, Vietnam, Indonesia	Saudi Arabia, Philippines	34
Sugar	Sudan, Somalia	Djibouti	52
Cotton	Bangladesh	Vietnam	15
Wheat	Bangladesh, Indonesia	Korea, UAE, Yemen	19
Broken rice	China, Senegal	Vietnam	26
Castor oil	China, Netherlands	USA, Malaysia, France	43
Dried capsicum	China, Thailand, Sri Lanka, Indonesia	Bangladesh, Malaysia	17
Coffee	Italy, Germany, Belgium	Jordan	47
Groundnuts	Indonesia, Vietnam	Philippines, Malaysia, Thailand	32
Cuttlefish	Spain, Italy, Thailand	USA, China	22
Black tea	UAE, Russia, Iran	United Kingdom (UK)	61
Onion	Bangladesh, Malaysia, UAE, Sri Lanka	Nepal	19
Nutmeg	UAE	USA	55
Cumin	China, Bangladesh	USA, UAE, Afghanistan	63
Cashew nuts	UAE, Netherlands, Japan	Saudi Arabia	34
Grapes	Netherlands, Bangladesh	UK, UAE, Russia	36
Turmeric	Bangladesh, USA	UAE, Morocco, Iran	62

Source: Based on INTRACEN database.

Export advantages for most commodities have been consistent: In the early 2000s, several agricultural products, including semi-milled rice, shrimp and prawns, and coffee, exhibited both positive trade balances and comparative advantages (Box 1). Broken rice, grapes, and cuttlefish demonstrate comparative advantages but lack surplus for export. Wheat, cotton, grapes, and cuttlefish display varying degrees of competitive advantages. Consequently, with the

exception of wheat and coffee, India has a surplus for exports and maintains a comparative advantage in the exports of agricultural commodities.

Box 1. Trade advantages in exports of selected commodities

	TE 2003	TE 2012	TE 2022
Comparative advantage and trade balance	Bovine meat, shrimp and prawns, onion, cashew nuts, coffee, black tea, dried capsicum, nutmeg, cumin, turmeric, semi-milled rice, wheat, groundnuts, castor oil, sugar	Bovine meat, shrimp and prawns, onion, cashew nuts, black tea, dried capsicum, nutmeg, cumin, turmeric, semi-milled rice, groundnuts, castor oil, sugar, cuttlefish, cotton	Bovine meat, shrimp and prawns, onion, cashew nuts, black tea, dried capsicum, nutmeg, cumin, turmeric, semi-milled rice, groundnuts, castor oil, grapes, sugar, cuttlefish, cotton, broken rice
Comparative advantage, but no trade balance	Broken rice, grapes, cuttlefish	Broken rice, grapes, wheat, coffee	Wheat, coffee
Trade balance, but no comparative advantage	Cotton		

Source: Computed by authors.

The lack of enforcement of quality standards hinders exports: Food safety concerns have become increasingly important in international trade. In particular, India faces the challenge of a high rejection rate for its exports because of pesticide residues, microbial contamination (including harmful bacteria and fungi), inadequate hygiene standards, the presence of heavy metals and unsafe colors or additives, and the use of prohibited substances in processed foods (Table 3).

Table 3. Rejections reasons (%) of export consignments by the USA and European Union (EU), 2021-23

Commodity/ Product	USA	EU
Rice	Pesticide residue (92%), labeling (4%)	Pesticide residue (83%), mycotoxin (15%)
Wheat	Labelling (64%)	
Groundnut & products	Salmonella (48%), mycotoxin (16%)	Mycotoxin (100%)
Onion	Salmonella (25%)	
Grapes	Pesticide residue (100%)	

Commodity/ Product	USA	EU
Chilli	Salmonella (44%)	Pesticide residue (78%), mycotoxin (10%)
Nutmeg	Mycotoxin (50%)	Mycotoxin (100%)
Cumin	Salmonella (100%)	Pesticide residue (74%)
Turmeric	Salmonella (90%)	Mycotoxin (14%)
Black tea	Labelling (46%), unapproved drug (24%)	Pesticide residue (38%)
Coffee	Microbial contaminant (50%)	
Cashew nuts	Microbial contaminant (100%)	
Shrimp and prawns	Salmonella (43%), filthy (36%)	Biological contaminants (54%), veterinary drug residue (29%)
Cuttlefish	Filthy (84%), Salmonella (18%)	Metals/chemical contaminant (75%)

Source: Computed by the authors based on the USFDA and EURASFF databases.

India is likely to remain dominant in the global market for many commodities: Assuming that current trends continue, India is expected to maintain its leading position in exporting several agricultural products, including semi-milled rice, groundnuts, castor oil, dried capsicum, nutmeg, cumin, and turmeric (Table 4). The wheat export market is expected to be dominated by Russia. The Netherlands is anticipated to maintain its top position in global onion exports. The grapes market is predicted to be led by Chile and Peru. India is expected to remain competitive in grapes exports. Vietnam is set to continue as the primary exporter of cashew nuts, whereas India's market share is set to decrease.

Table 4. Self-transitioning probabilities and projected shares for Indian exports

	Probability	Projected shares (%)		
		2022	2030	
Semi-milled rice	0.72	38.9	38.4	↔
Shrimp and prawns	0.39	21.3	16.3	↓
Bovine meat	0.74	8.1	17.5	↑
Sugar	0.83	19.1	24.0	↑
Cotton	0.46	5.5	13.4	↑
Wheat	0.14	3.5	0.2	↓
Broken rice	0.64	38.3	29.9	↓

	Probability	Projected shares (%)		
		2022	2030	
Castor oil	0.91	85.9	85.0	
Dried capsicum	0.72	62.1	61.0	
Groundnuts	0.11	19.3	20.7	
Nutmeg	0.56	12.7	12.0	
Cumin	0.88	82.3	81.6	
Cashew nuts	0.73	8.8	7.2	
Grapes	0.35	3.2	3.2	
Turmeric	0.86	62.7	66.3	

Source: Computed by authors.

India is set to strengthen its position as a major sugar exporter, with its market share projected to increase from 19.1% in 2022 to 24% by 2030. While the USA is expected to maintain its leadership in the global cotton market, Brazil and Australia are likely to see a decline in their market shares. India's proportion of cotton exports is anticipated to see a substantial rise, indicating more than doubling from 5.5% to 13.4%.

India's market share of bovine meat is predicted to increase from 8.1% to 17.5% by 2030. Ecuador is predicted to maintain its position as the leading exporter of shrimp and prawns, with its market share increasing from 34.4% to 48.6%. Although India is expected to continue to have substantial global seafood exports, its share is also anticipated to decrease significantly.

Driven by factors such as population growth and evolving dietary preferences, global demand for agri-food commodities has increased significantly. This trend is expected to persist as international markets become increasingly integrated, facilitated by enhanced transportation networks, reduced trade barriers, and digital platforms that connect global producers and consumers. This presents a substantial opportunity for India to establish itself as a prominent global market player. To capitalize on this opportunity, India must address several critical factors related to product quality, food safety, and regulatory standards.

Here are some recommendations to enhance the potential of agricultural exports.

Market intelligence system: A robust market intelligence system is a cornerstone for businesses in a fast-changing global marketplace. By systematically gathering, analyzing, and disseminating information about target markets, competitors, and consumer preferences, companies can make informed decisions and stay ahead of industry trends. This system enables organizations

to monitor global supply and demand fluctuations, providing valuable insights into market dynamics and potential disruptions. Additionally, it allows the tracking of prices and trade flows, which is essential for optimizing pricing strategies and identifying lucrative trade routes.

Furthermore, a comprehensive market intelligence system plays a crucial role in assessing regulatory requirements in destination markets, ensuring compliance, and minimizing the legal risks associated with international trade. Through the analysis of market trends, consumer behavior, and technological advancements, organizations can uncover the untapped potential and position themselves to capitalize on new market segments or innovative product categories.

Good agricultural practices: Good agricultural practices (GAPs) are fundamental for ensuring high-quality, safe agricultural exports that meet international standards. Essential GAPs pertain to pest management, hygiene and sanitation, irrigation water quality, fertilizers, harvesting and postharvest management practices, and documentation and record keeping. Furthermore, adherence to maximum residue limits for pesticides, implementation of food safety management systems such as HACCP, acquisition of relevant certifications (e.g., Global GAP), and establishment of traceability are crucial for accessing export markets.

To meet the global dietary trends and food safety standards, it is essential to boost funding for agricultural research. This investment is crucial for improving crop yield, enhancing product quality, and increasing resilience in agricultural production.

Invest in public infrastructure: It is imperative that governments invest in the modernization of transportation and logistics infrastructure to enhance the export capabilities of agri-food systems. This investment should prioritize upgrading ports, airports, and road networks to ensure seamless connectivity between production centers and export hubs. The digitalization of logistics processes and the implementation of smart tracking systems can significantly improve supply chain efficiency.

Value addition and processing: Investment in value addition and food processing is essential for accelerating agricultural exports. Enhanced processing capabilities facilitate the production of higher-value products that can command premium prices in the international markets. Investments in cold-chain infrastructure, quality testing laboratories, and modern processing facilities are necessary to maintain product quality and meet international food safety standards. Industry-academia collaboration can drive innovation in food processing, leading to more efficient production methods, improved

food safety measures, and the development of novel food products that address evolving consumer preferences and dietary requirements.

Quality control and food safety standards: Comprehensive tracking, monitoring, and traceability systems for agricultural products, along with adherence to international standards and regular updates on permitted pesticides, are essential for enhancing the competitiveness and reliability of agricultural products in global markets. Furthermore, adopting advanced technologies, such as blockchain, can position the country at the forefront of agricultural trade innovation, potentially attracting more investments and partnerships in the sector.

Building brand identity: To boost credibility in global markets, it is crucial to develop a strong national brand identity that highlights the unique characteristics of agricultural products while also implementing quality control measures and traceability systems.

Effective marketing: Digital commerce platforms are becoming increasingly essential for facilitating agricultural exports by providing farmers and producers with direct access to global consumers and marketplaces. These internet-based sales channels enable agricultural enterprises to showcase their products, enhance brand visibility, and establish connections with international clientele without intermediaries. Furthermore, participation in global trade exhibitions and food industry conferences complements online strategies by offering opportunities for face-to-face networking and cultivating relationships.

♦♦♦

1 Introduction

The international trade in food and agricultural products can significantly influence global food security. This contributes to the mitigation of localized food shortages and the stabilization of food prices resulting from natural disasters and geopolitical tensions. Furthermore, it can facilitate the exchange of technologies, knowledge, and best practices, leading to higher crop yields, resource efficiency, and agricultural productivity. Thus, agricultural trade not only contributes to global food security but also promotes economic stability in participating countries.

The impact of agricultural exports extends far beyond. An expanding export industry has the potential to stimulate economic expansion, generate employment opportunities, and foster innovation in related industries. Consistent growth in agricultural exports facilitates public and private investments in storage, transportation, food safety protocols, and traceability mechanisms, thereby contributing to the development of efficient and high-quality supply chains. Moreover, it typically results in the establishment of market intelligence systems and trade networks, which enable governments and enterprises to anticipate global market fluctuations, adapt to evolving consumer preferences, and navigate intricate international regulations and trade requirements.

The benefits of expanding agricultural exports are evident across several countries, with India as an example that has strategically positioned itself in the global market for certain commodities, such as rice, bovine meat, and seafood. As a net importer of food in the 1960s and the 1970s, India emerged as a dominant supplier of rice, crustaceans, cotton, and bovine meat in the international market. This transformation occurred due to a combination of factors, including technology-driven increase in agricultural surplus, domestic market reforms, trade liberalization, and targeted strategies. The economic reform process that commenced in the early 1990s contributed significantly to shaping India's agricultural export trajectory. Prior to these reforms, India's volume of agricultural exports was minimal and limited primarily to commodities, such as tea, coffee, and spices. These reforms, in conjunction with advancements in supply chains and logistics, facilitated diversification

of the export portfolio, aligning with evolving consumer preferences in the global market.

India has significant potential to consolidate its agricultural exports, given its untapped export potential for farm products and favorable conditions in the global market. The diversity of agro-climatic conditions is an advantage for the production of a wide range of crops and animal-source foods. The global demand for agri-food commodities has grown substantially over the last 20 years, and this trend is expected to persist owing to population growth and rapid urbanization, particularly in developing economies across Asia and Africa. Additionally, these countries are witnessing a transition towards diets rich in protein and processed foods.

While this combination of domestic production capabilities in agriculture and international demand creates a favorable environment for Indian agricultural exports, India's agricultural export industry is at a critical juncture, facing significant concurrent challenges. These challenges stem from various factors, including inadequate infrastructure, particularly in refrigerated storage facilities, and suboptimal processing, packaging, branding, and logistic systems. In addition to these domestic constraints, the industry also faces external pressure. It encounters stringent phytosanitary requirements from importing countries, compliance with which is cumbersome and capital intensive. Compounding these challenges, frequent policy changes in the domestic market create uncertainty for exporters and erode trust among importers.

To address these complex challenges and capitalize on opportunities, the Government of India has developed a strategic approach in the form of the Agricultural Export Policy (AEP) 2018 to accelerate agricultural exports. One of the focus areas is the integration of farmers into global value chains through a cluster-based commodity approach, leveraging regional specialties and economies of scale to improve competitiveness in the global market. Furthermore, AEP 2018 places significant emphasis on improving supply chain efficiency and enhancing quality standards by focusing on the modernization of infrastructure, streamlining logistics, and implementing advanced technologies to reduce postharvest losses and ensure the timely delivery of fresh produce to international markets. The policy also seeks to strengthen quality assurance protocols and to encourage compliance with global food safety regulations.

Against this backdrop, this study conducts a comprehensive analysis of India's agricultural export performance. It covers a wide range of products, including cereals, fruits, vegetables, oils, oilseeds, spices, plantation crops, sugar, cotton, meat, and fish. This analysis extends beyond mere export figures by delving into the intricacies of India's comparative advantages, export surpluses, and relationships with its key trading partners and competitors. Specifically, it addresses the following issues.

(i) How have India's agricultural exports performed across different product categories, and what factors influence their performance?

(ii) What are the key challenges that India faces in maintaining and enhancing its competitiveness in agricultural exports?

(iii) How can India leverage its strengths to improve its position in the global market?

A critical examination of these questions will elucidate the underlying factors influencing the competitiveness of India's exports of various commodities, and facilitate the development of strategies to harness their unexploited export potential.

♦♦♦

2 Data and Methods

This chapter discusses the data and methodological approaches employed to assess India's agricultural export performance. Initially, it establishes the criteria for selecting commodities, emphasizing their significance in agricultural exports, and subsequently discusses methods for examining their trade advantages and future prospects.

2.1 Data and selection of commodities

Data on India's major agricultural exports have been sourced from the INTRACEN database of International Trade Centre (ITC). India exports a wide range of products to several countries. Commodities are categorized using the Harmonized System (HS) of trading, classifying them at different levels of aggregation: HS-02, 04, 06, 08, and above. For this study, the selection of commodities was done utilizing a two-tier filtration process, as outlined by Chand and Saxena (2014). Initially, 2-digit broad groups are identified, and subsequently from each group, specific commodities at the 6-digit level were selected based on their respective export shares.

Further, based on their contribution to India's agricultural exports in 2022, ten major commodity groups were selected at the HS-02 level. These collectively account for approximately 91% of India's total agricultural exports. From each HS-02 group, key commodities were identified at the HS-06 level, based on their contribution to each HS-02 commodity group. A total of 19 commodities were identified, constituting approximately 65% of exports. Table 5 presents the list of these commodities. The export portfolio was analyzed for the period 2001–2022, with emphasis on major export destinations, key competitors, and export potential.

Adherence to the food safety standards of importing countries is essential to prevent export rejections. Consequently, to investigate the causes of export rejections, we obtained data from the United States Food and Drug Administration (USFDA) and the European Union's Rapid Alert System for Food and Feed (EURASFF) for 2001–2023.

Table 5. List of selected commodities

HS Code (6-digit)	Product label	Short name	Exports (BE 2022, US$ million)	Share in the selected commodity group exports at HS-02 (%, BE 2022)	Share in agricultural exports (%, 2022)
100630	Semi-milled or wholly milled rice, whether or not polished or glazed	Semi-milled rice	8880.74	18.36	17.70
030617	Frozen shrimps and prawns, even smoked, whether in shell or not, incl. shrimps and prawns in . . .	Shrimp and prawns	4973.11	10.28	9.03
020230	Frozen, boneless meat of bovine animals	Bovine meat	2897.95	5.99	5.39
170199	Cane or beet sugar and chemically pure sucrose, in solid form (excl. cane and beet sugar containing . . .	Sugar	2554.63	5.28	5.21
520100	Cotton, neither carded nor combed	Cotton	1942.94	4.02	2.27
100199	Wheat and meslin (excl. seed for sowing, and durum wheat)	Wheat	1913.29	3.96	3.97
100640	Broken rice	Broken rice	1120.54	2.32	2.27
151530	Castor oil and fractions thereof, whether or not refined, but not chemically modified	Castor oil	1070.18	2.21	2.05
090421	Fruits of the genus Capsicum or of the genus Pimenta, dried, neither crushed nor ground	Dried capsicum	909.61	1.88	1.59
090111	Coffee (excl. roasted and decaffeinated)	Coffee	689.36	1.43	1.42
120242	Groundnuts, shelled, whether or not broken (excl. seed for sowing, roasted or otherwise cooked)	Groundnuts	688.10	1.42	1.31
030743	Cuttle fish and squid, frozen, with or without shell	Cuttlefish	663.81	1.37	1.41
090240	Black fermented tea and partly fermented tea, whether or not flavoured, in immediate packings . . .	Black tea	606.65	1.25	1.22
070310	Fresh or chilled onions and shallots	Onion	487.02	1.01	0.99
090811	Nutmeg, neither crushed nor ground	Nutmeg	454.19	0.94	0.87
090931	Cumin seeds	Cumin	454.19	0.94	0.87
080132	Fresh or dried cashew nuts, shelled	Cashew nuts	391.53	0.81	0.66
080610	Fresh grapes	Grapes	314.79	0.65	0.58
091030	Turmeric "curcuma"	Turmeric	220.17	0.46	0.40
Total				**64.57**	**59.20**

Note: BE stands for biennium ending. The commodities are sorted based on their exports.

2.2 Analytical procedures

2.2.1 Comparative advantage

Comparative advantages are analyzed by calculating the revealed symmetric comparative advantage (RSCA) and trade balance index (TBI). The RSCA index developed by Datum et al. (1998) is used, it is a variant of the revealed comparative advantage (RCA) index (Equation 1). The RCA can be represented as

$$\mathrm{RCA_{ij}} = \frac{\left(\frac{X_{ij}}{X_i}\right)}{\left(\frac{X_{wj}}{X_w}\right)} \ldots\ldots\ldots (1)$$

where X_{ij} is the value of country i's export of product j, X_i is the value of country i's agricultural exports, X_{wj} is the value of world export of product j, and X_w is the value of global agricultural exports.

The RSCA index is a modification of the RCA index and addresses the issue of asymmetric distribution (Equation 2).

$$RSCA_{ij} = \frac{RCA_{ij}-1}{RCA_{ij}+1} \ldots\ldots\ldots (2)$$

The RSCA index ranges from -1 to +1, with positive values indicating comparative advantage and negative values otherwise.

Changes in the comparative advantage were studied by calculating the kernel density of the RSCA indices. This approach allows for monitoring shifts in competitiveness and determining the commodities that are becoming more or less competitive in the global market. Kernel density determines the probability density function of a continuous random variable without making assumptions about its underlying distribution. Equation 3 presents the kernel density estimator for a random sample (x_1, …, x_n) obtained from an unknown probability density function, f(x).

$$f(x) = \frac{1}{n}\sum_{i=1}^{N} K_h(x - x_i) = \frac{1}{nh}\sum_{i=1}^{N} K\left(\frac{x-x_i}{h}\right) \ldots\ldots\ldots (3)$$

In this equation, K represents the kernel function, whereas the smoothing parameter, also referred to as the bandwidth, is denoted by $h > 0$. To generate the kernel density curve, we employed the Epanechnikov Kernel Function.

Further, we calculate TBI to determine whether a country is primarily an exporter or importer of a particular commodity (Equation 4).

$$TBI_{ij} = (x_{ij}-m_{ij}) / (x_{ij}+m_{ij}) \text{ ..... (4)}$$

where TBI_{ij} is the trade balance index of the i^{th} country for the j^{th} product, x_{ij} represents exports of the j^{th} product from the i^{th} country, and m_{ij} represents imports of the j^{th} product from the i^{th} country. TBI ranges from -1 to +1. A negative TBI value for a product indicates that the country is a net importer of the product or vice versa (Ishchukova and Smutka 2013; Widodo 2009).

By combining TBI and RSCA, agricultural products were categorized into four groups (Box 2). Group A comprises items with both a positive trade balance and a comparative advantage, making it the most favorable for exports. Group B includes products with a comparative advantage, but lacks an exportable surplus. Group D contains items without a comparative advantage and lacks a positive trade balance. Group C consists of products with a positive trade balance, but no comparative advantage. Products may shift between groups based on technological progress and measures that facilitate exports.

Box 2. Product mapping scheme

Group B: TBI < 0, RSCA > 0 Net importer Comparative advantage	**Group A**: TBI > 0, RSCA > 0 Net exporter Comparative advantage
Group D: TBI < 0, RSCA < 0 Net importer Comparative disadvantage	**Group C:** TBI > 0, RSCA < 0 Net exporter Comparative disadvantage

Source: Widodo (2009).

2.2.2 Spatial diversification of exports

The diversification of commodities and destination markets mitigates trade-related risk. To optimize the benefits of international trade, countries should diversify their exports in terms of both the product range and destination markets. This approach mitigates the risks associated with overreliance on a limited number of commodities or a small number of trading partners. Considering both markets and products, an export diversification index (DXI) can be calculated as in Equation 5:

$$DXI_j = \sum(h_{ij} - x_i) / 2 \text{ ..... (5)}$$

where h_{ij} is the share of the i^{th} commodity in the total exports of the j^{th} country and x_i is the share of the commodity in world exports. This study utilizes the concentration index or Hirschman (H) index using the shares of all partner countries in a country's exports as in Equation 6:

$$H_j = \sqrt{\sum(x_i / X_t)^2} \text{ ..... (6)}$$

where x_i is the jth country's exports of the ith product and X_t is the jth country's total exports. A lower H value indicates a lower concentration or vice versa.

2.2.3 Export projections

To predict changes in the export share of a commodity, we employ a first-order Markov chain model (Equation 7). This involves creating a transitional probability matrix (P), where each element P_{ij} indicates the likelihood of export transitions from country i to country j during a given period. The diagonal elements, represented as P_{jj}, are the self-transitioning probabilities that reflect the chances of specific exporters maintaining their export status.

For each commodity, nine major exporting countries were identified, with the remaining countries aggregated into a category designated as 'others.' The mean exports to each country are considered random variables based on historical data.

$$E_{jt} = \sum_{i=1}^{r} E_{jt-1} P_{ij} + e_{jt} \ldots\ldots\ldots (7)$$

where E_{jt} and E_{jt-1} represent exports from j^{th} country in the year t and t-1, respectively. P_{ij} is the probability of export shift from country i to country j, e_{jt} is the error term that is statistically independent of e_{jt-1}, and r is the number of exporting nations.

The transitional probability P_{ij} arranged in a (c × r) matrix has the following properties.

$$\sum_{i=1}^{t} P_{ij} = 1 \text{ for all } i \ldots\ldots\ldots (8)$$

$$0 \leq P_{ij} \leq 1$$

The anticipated export share of each country at time 't' is computed by multiplying the export quantities from the preceding period by the estimated transition probability matrix P. This matrix was developed using a linear programming (LP) framework by minimizing the mean absolute deviation (MAD) (Equation 9-12).

$$\text{Min } O\,P^* + Ie \ldots\ldots\ldots (9)$$

Subject to,

$$XP^* + V = Y \ldots\ldots\ldots (10)$$

$$GP^* = 1 \ldots\ldots\ldots (11)$$

$$P^* \geq \phi \ldots\ldots\ldots (12)$$

where P* represents a vector of transition probabilities P_{ij}, O denotes a null vector, I signifies an appropriately dimensional vector of ones, e represents the vector of absolute errors, Y indicates the vector of exports from each country, X denotes a block diagonal matrix of lagged values of the export vector Y, V represents the vector of errors, and G signifies a grouping matrix that aggregates the row elements of P arranged in P* to unity (ensures the sum of probabilities in each row equals one). P* should be non-negative (probabilities cannot be less than zero). ϕ is a small positive number ensuring non-negativity.

The resulting P* vectors constitute the transitional probability matrix, which elucidates the overall structure of export transitions. This matrix delineates the dynamics of export changes with individual probabilities P_{ij} representing the likelihood of a transition in exports from country i to country j.

2.2.4 Export potential

The export potential of commodities has been drawn from export potential maps, using the methodology developed by the ITC. The following formula quantifies the untapped export potential (Equation 13):

$$Untapped\ export\ potential = \left(1 - \frac{Actual\ exports}{Export\ potential}\right) \times 100 \quad \text{..... (13)}$$

Untapped export potential helps countries boost exports to existing markets and tap into new markets. The facilitative measures for exports by the Government of India are anticipated to boost export volumes and unlock further levels of unexplored export potential.

♦♦♦

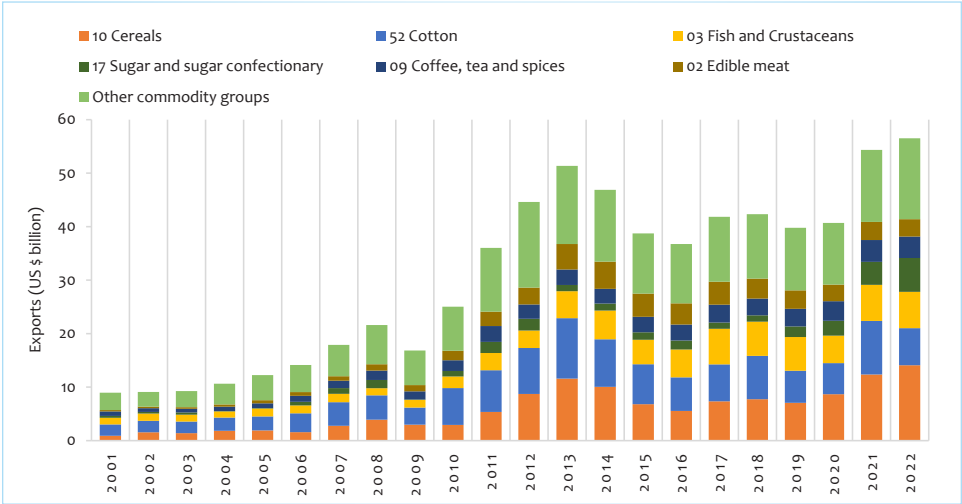
3 Mapping Agricultural Exports

3.1 Trend and composition

India's agricultural exports have experienced substantial growth, particularly since 2012, in terms of increased export volumes of a wider range of commodities. The total value of agricultural exports rose dramatically from approximately US$7 billion in 2001 to US$40 billion in 2012 and further exceeded US$50 billion by 2022. Between 2001 and 2022, cereal exports skyrocketed, reaching approximately US$14 billion (Figure 4).

In 2001, cotton was India's primary export commodity. Despite occasional fluctuations, it saw considerable growth post-2010, reaching a high of approximately US$11 billion in 2013, before settling at US$6 billion in 2022. Sugar also witnessed a remarkable increase after 2011, with exports increasing from US$1 billion to over US$6 billion by 2022.

Figure 4. Trend and composition of agricultural exports from India



Source: Computed by authors.

Fish and crustacean exports have experienced steady growth, reaching approximately US$7 billion by 2022. Similarly, exports of coffee, tea, and spices have increased significantly, whereas exports of edible meat have demonstrated moderate growth.

It is worth noting that agricultural exports from India have seen a substantial rise, even during the COVID-19 crisis. Although individual commodity exports fluctuated, overall exports increased, signifying India's growing importance in the global food market.

3.2 Export contours of selected commodities

India maintains a dominant position in the international market for semi-milled rice and sugar, accounting for 38.6% and 18.7% of the global exports, respectively (Table 6). However, Thailand, Vietnam, and Brazil are significant competitors. For shrimp and prawns, India commands a 21.3% share of the global market but faces competition from Ecuador and Vietnam. Consequently, over the past five years, India has experienced only a modest growth of 1% in its exports compared to a 5% growth in global demand.

India is the fourth-largest exporter of bovine meat, mainly carabeefs. It accounts for approximately 8% of the global market. This growth has continued despite competition from Brazil, Australia, and the USA. India maintains a dominant position in the global market for castor oil, dried capsicum, cumin, and turmeric. On the other hand, India's cotton exports have declined despite an increase in global demand. Its exports of coffee, grapes, and groundnuts compete with those of Brazil, Peru, and Argentina. Overall, India's agricultural export portfolio demonstrates considerable strength in staple and specialty products, with certain exceptions.

Table 6. India's position and partners in agricultural exports, 2022

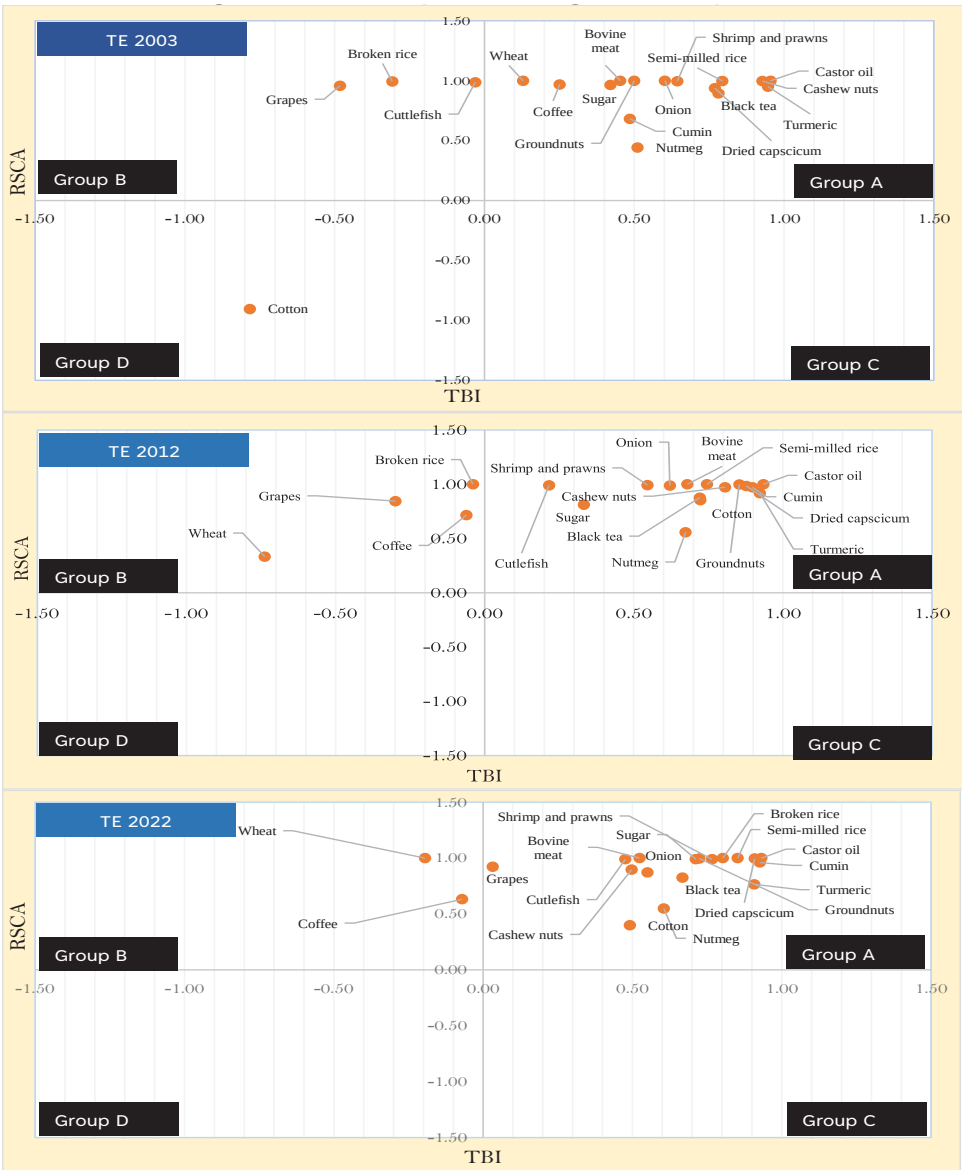
Short name	Exports (US$ billion)	Global ranking of India	Share in global exports (%)	Top-5 competitors of India	Growth in exports (2019-23, %)	Growth in global imports (2019-23, %)
Semi-milled rice	9.40	1	38.6	Thailand, Vietnam, Pakistan, USA, Italy	11	9
Shrimp and prawns	4.79	2	21.3	Ecuador, Vietnam, Indonesia, Argentina, Thailand	1	5
Bovine meat	3.18	4	8.1	Brazil, Australia, USA, New Zealand, Argentina	1	8
Sugar	2.76	1	18.7	Brazil, Thailand, France, Germany, Poland	21	16
Cotton	1.20	4	5.5	USA, Brazil, Australia, Turkey, Benin	-9	6
Wheat	2.10	9	3.5	Australia, Canada, Russia, USA, France	21	14
Broken rice	1.20	1	37.2	Thailand, Pakistan, Vietnam, Myanmar, Brazil	47	8
Castor oil	1.09	1	85.9	Netherlands, France, Germany, USA, Brazil	7	7
Dried capsicum	0.84	1	61.9	China, Peru, Mexico, Myanmar, Germany	8	9
Coffee	0.75	12	2.5	Brazil, Vietnam, Colombia, Honduras, Ethiopia	14	15
Groundnuts	0.69	2	19.4	Argentina, Brazil, Sudan, USA, Netherlands	6	7
Cuttlefish	0.72	2	9.7	China, Indonesia, Peru, Spain, Morocco	6	6
Black tea	0.64	2	16.0	Kenya, Sri Lanka, China, Malawi, Uganda	-3	0
Onion	0.52	3	12.0	Netherlands, China, Mexico, USA, Spain	17	5
Nutmeg	0.02	2	12.6	Indonesia, Sri Lanka, Netherlands, Germany, Belgium	20	8
Cumin	0.46	1	82.0	China, Turkey, Syrian Arab Republic (Syria), Egypt, Netherlands	7	3
Cashew nuts	0.35	1	62.2	Vietnam, Netherlands, Cote d'Ivoire, Germany, Nigeria	-11	-1
Grapes	0.30	10	3.2	Peru, Netherlands, Italy, China, Chile	2	4
Turmeric	0.21	1	62.8	Netherlands, Myanmar, Fiji, Germany, Indonesia	1	4

Source: Based on INTRACEN database.

3.3 Product maps

Different commodities grouped based on the RSCA, and the TBI offer a comprehensive view of export performance. During the triennium ending (TE) of 2003, semi-milled rice, shrimp and prawns, cashew nuts, coffee, sugar, and black tea had a positive trade balance and comparative advantage (Figure 5).

Figure 5. Product maps of India's agricultural exports



Source: Computed by authors.

Broken rice, grapes, and cuttlefish demonstrated a comparative advantage but no trade balance, indicating their export potential. However, cotton had the least comparative advantage and a negative trade balance.

India's agricultural export landscape has undergone a significant transformation over the past two decades. During TE 2012, cotton enhanced its comparative advantage and trade balance owing to the introduction of Bt cotton, resulting in a substantial increase in production. Cuttlefish also exhibited improved comparative advantages. Conversely, grapes and wheat experienced a decline in their export surplus. By TE 2022, most of the selected commodities, except wheat and coffee, had a positive trade balance and comparative advantage. Wheat and coffee maintained a comparative advantage but had a negative trade balance.

3.4 Trade concentration and partners

Trade concentration indicates the distribution of a country's exports among its trading partners. High concentrations indicate that a large share of exports goes to a small number of countries, whereas lower concentrations indicate a more diversified export market. The export of bovine meat from India was heavily concentrated in Malaysia, Egypt, Vietnam, and Indonesia (Table 7). Similarly, the USA and China are the main importers of Indian shrimp and prawns, with Japan and Vietnam as secondary markets. Cuttlefish exports also focus on specific regions, primarily Europe and Asia, with Spain, Italy, and Thailand being major importers. In contrast, onion exports are largely targeted to neighboring countries, including Bangladesh, Malaysia, the UAE, and Sri Lanka.

India supplies several plantation commodities to international markets. Countries such as the UAE, Netherlands, and Japan import cashew nuts from India. The global distribution of Indian coffee and black tea is also widespread. Italy, Germany, and Belgium are major destinations for Indian coffee, whereas the UAE, Russia, and Iran are the main importers of Indian black tea. Indian spices, such as dried capsicum, cumin, turmeric, and nutmeg, have a wide market presence, both regionally and globally, with strong demand in the USA and UAE. India has significant opportunities to expand its market presence in underdeveloped regions, particularly in smaller markets that currently account for less than 1% of its exports.

India's sugar exports are primarily directed towards Sudan and Somalia, while there is high demand for Indian cotton in Bangladesh and Vietnam. Castor oil is mainly shipped to China and the Netherlands, and groundnuts to Indonesia and Vietnam. Countries such as the USA, Malaysia, France, and the Philippines account for 5-10% of Indian oilseed exports, along with numerous smaller markets. However, cereal exports are also concentrated in certain markets; Iran and Saudi Arabia are major importers of semi-milled rice, whereas China

and Senegal are major importers of broken rice. Bangladesh and Indonesia are the main importers of wheat.

Table 7. India's market concentration of agricultural exports

Commodities	Partner countries with an export share of		
	More than 10 %	5-10 %	Less than 5 % (number of countries)
Semi-milled rice	Iran, Saudi Arabia	Benin	71
Shrimp and prawns	USA, China	Japan, Vietnam	37
Bovine meat	Malaysia, Egypt, Vietnam, Indonesia	Saudi Arabia, Philippines	34
Sugar	Sudan, Somalia	Djibouti	52
Cotton	Bangladesh	Vietnam	15
Wheat	Bangladesh, Indonesia	Korea, UAE, Yemen	19
Broken rice	China, Senegal	Vietnam	26
Castor oil	China, Netherlands	USA, Malaysia, France	43
Dried capsicum	China, Thailand, Sri Lanka, Indonesia	Bangladesh, Malaysia	17
Coffee	Italy, Germany, Belgium	Jordan	47
Groundnuts	Indonesia, Vietnam	Philippines, Malaysia, Thailand	32
Cuttlefish	Spain, Italy, Thailand	USA, China	22
Black tea	UAE, Russia, Iran	UK	61
Onion	Bangladesh, Malaysia, UAE, Sri Lanka	Nepal	19
Nutmeg	UAE	USA	55
Cumin	China, Bangladesh	USA, UAE, Afghanistan	63
Cashew nuts	UAE, Netherlands, Japan	Saudi Arabia	34
Grapes	Netherlands, Bangladesh	UK, UAE, Russia	36
Turmeric	Bangladesh, USA	UAE, Morocco, Iran	62

Source: Based on INTRACEN database.

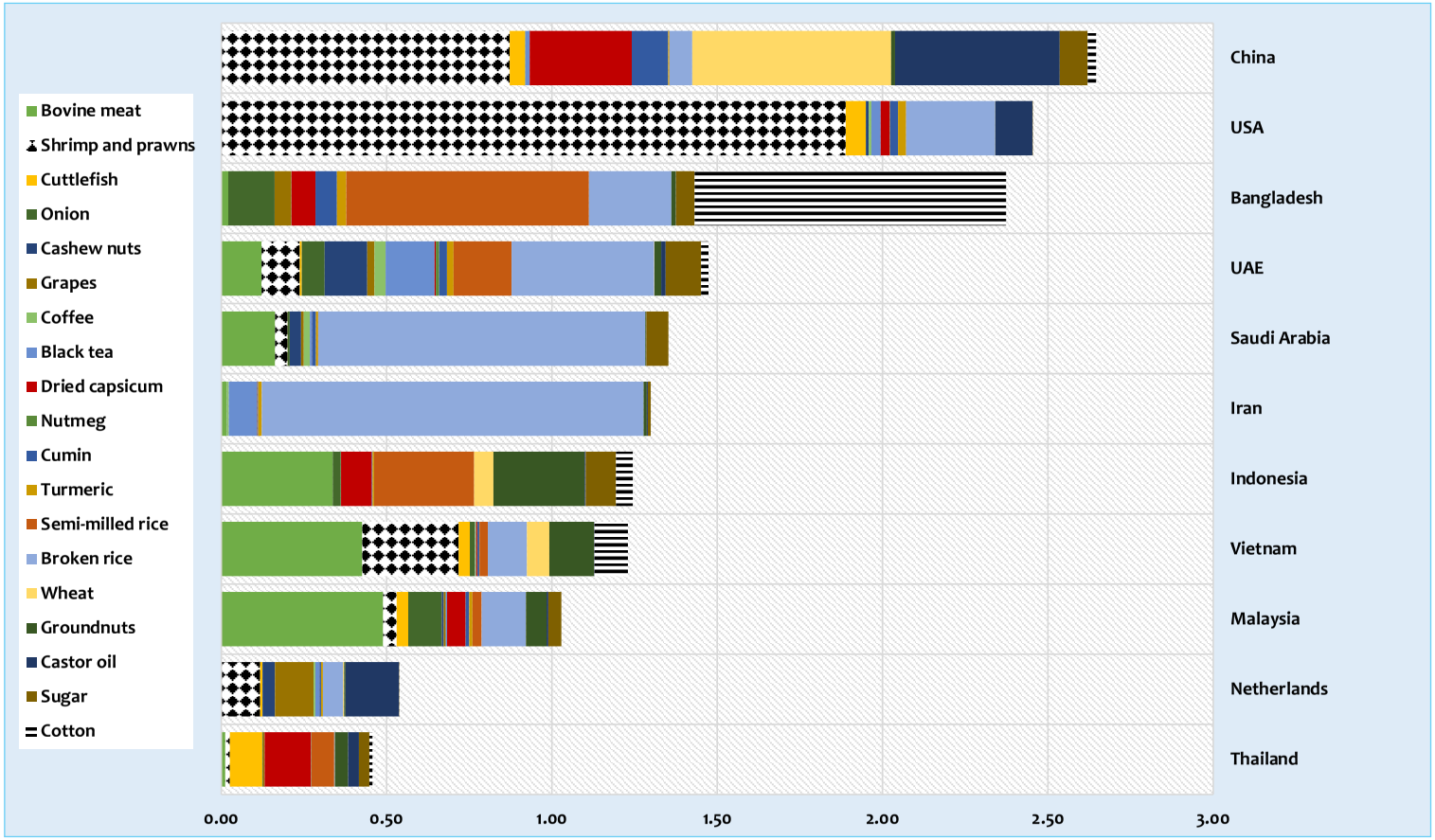
3.5 Market concentration

The commodity-wise breakdown of India's agricultural exports is shown in Figure 6. China is the leading importer, purchasing approximately US$3.0 billion worth of selected agricultural products from India. It imports shrimp and prawns, wheat, castor oil, and dried capsicum. The USA imports agricultural goods, mainly shrimp and prawns, worth US$2.5 billion. Bangladesh ranks third, importing mainly semi-milled and broken rice and cotton. The UAE, Saudi Arabia, and Iran also import substantial quantities of broken rice from India. Southeast Asian countries are among the top ten importers of bovine meat.

India has the potential to capitalize on its comparative advantage in both staple foods and high-value commodities. This can be achieved by focusing on establishing robust trade relationships across North America, Southeast Asia, and the Middle East by enhancing the supply chain infrastructure, complying with food safety standards, and negotiating new trade agreements.

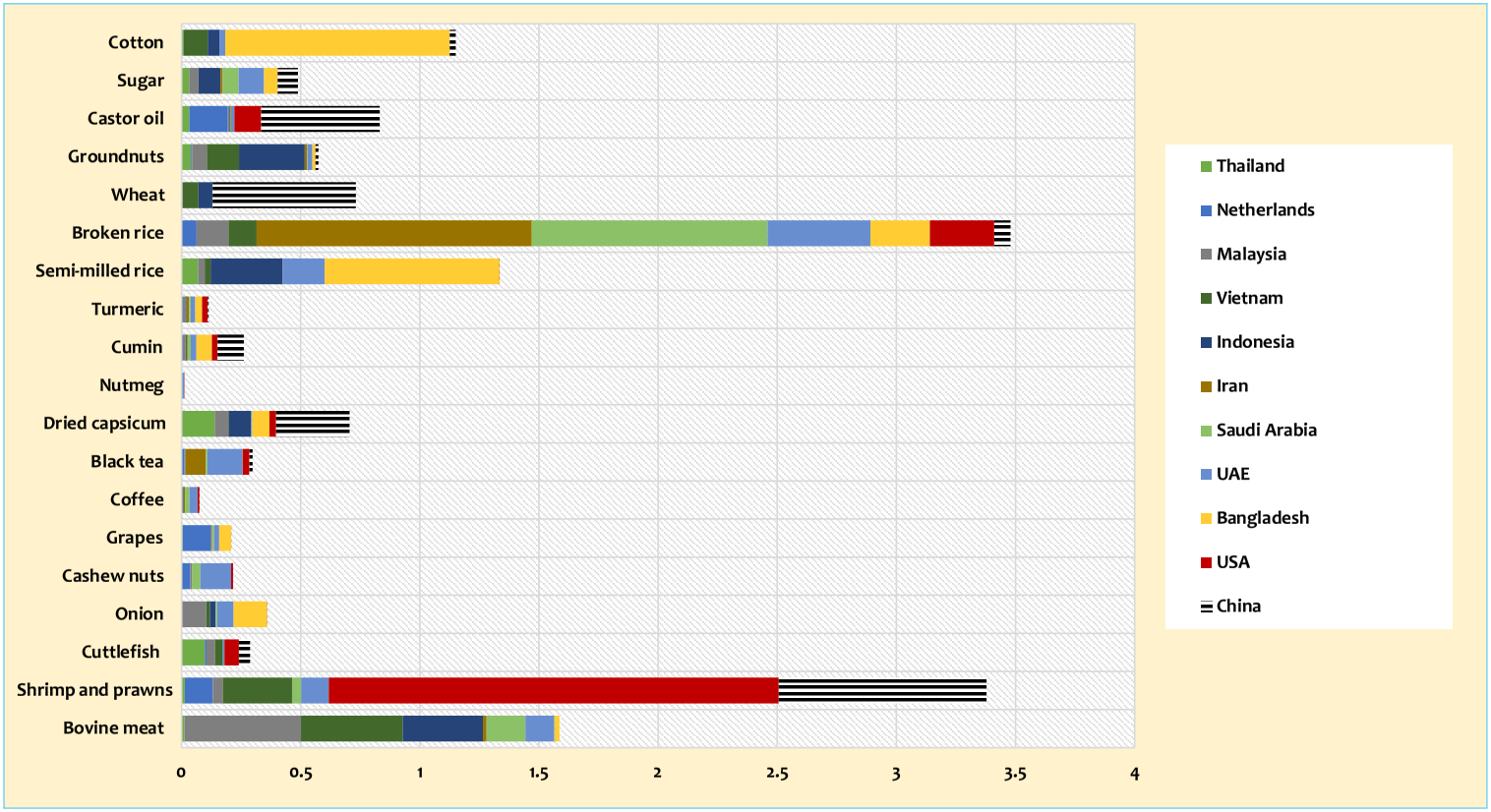
As depicted in Figure 7, India's primary agricultural export is broken rice, with a significant portion shipped to Iran, Saudi Arabia, the UAE, the USA, and Bangladesh. This underscores India's crucial role in ensuring the food security of the Middle East. India has a strong position in the global seafood market, with shrimp and prawns being the second-largest agricultural export, primarily shipped to the USA and China. Southeast Asian countries, including Malaysia, Vietnam, and Indonesia, are the key importers of bovine meat. Semi-milled rice and cotton are primarily shipped to Bangladesh. Furthermore, specialty products such as castor oil, turmeric, cumin, and groundnuts have notable markets in the USA, Iran, and the UAE.

Figure 6. Commodity concentration across major trade partners (US$ billion, 2022)



Source: Computed by authors.

Figure 7. Major destinations for selected commodities (US$ billion, 2022)

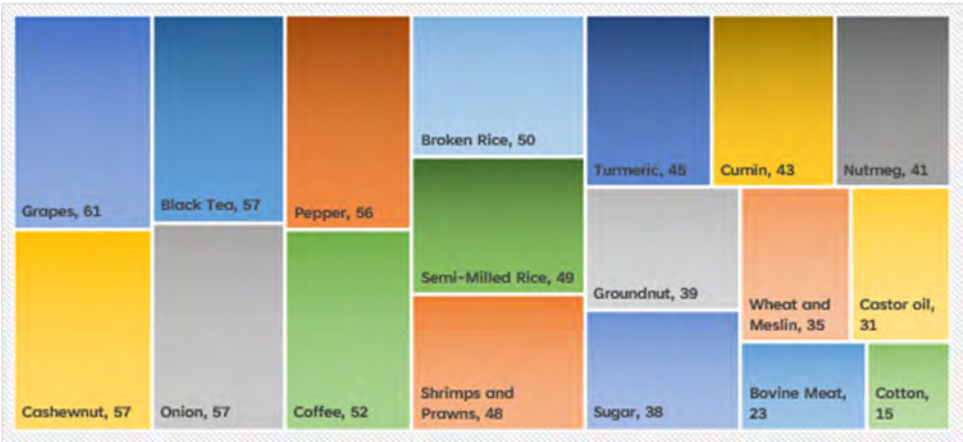


Source: Computed by authors.

3.6 Export potential

We assess India's untapped export potential by employing the ITC's export potential indicator (EPI) framework. Several commodities exhibit significant untapped potential, including grapes (61%), onions (57%), cashew nuts (57%), and black tea (57%) (Figure 8). Even for products where India has an established global presence, such as shrimp and prawns, semi-milled rice, sugar, and coffee, considerable export potential remains untapped. To fully exploit the untapped potential, there is a need to improve production efficiency and engage in negotiations with trade partners to lower trade barriers. Improving the export competitiveness of cashew nuts, black tea, and coffee requires advancements in value addition, including quality certification and enhancements in processing and packaging techniques.

Figure 8. India's untapped export potential, 2022 (%)



Source: Computed by authors.

The unexploited export potential of various commodities suggests significant opportunities for further growth and diversification of agricultural exports. If properly leveraged, this potential could lead to increased market share in existing export destinations and expansion into new market.

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4 Cereals

Cereals, the primary source of calories, play a crucial role in ensuring food security, particularly in developing countries. Over the past two decades, India's cereal production has increased by more than 1.5 times, reaching 308.05 million tons in 2023-24, establishing the country as the world's second-largest producer of rice (137.82 million tons) and wheat (113.29 million tons) (GOI 2024d). In recent years, the global grain trade has experienced significant expansion, driven by the increasing demand for food, feed, and fuel. By 2022, the value of global grain exports reached US$180 billion, with wheat being the predominant commodity, followed by corn and rice. This chapter presents a comprehensive analysis of mostly exported cereals such as semi-milled rice, broken rice and wheat.

4.1 Major global exporters

Global cereal trade constitutes approximately 17% of global cereal consumption (OECD-FAO 2024). Countries in Asia and Africa have historically relied on imports of cereals from Europe and the USA to meet their increasing food and feed requirements. By 2033, the demand for cereals is projected to increase by 16% (OECD-FAO 2024).

The global export market for semi-milled or wholly milled rice is controlled by a few countries, with India at the forefront (Table 8). India's dominance in the global rice trade can be attributed to factors such as the cultivation of diverse rice types (e.g., Basmati and non-Basmati), competitive pricing, and effective trade strategies. Thailand, Vietnam, Pakistan, and the USA are also important players in global rice exports. India is a key player in the export of broken rice (Table 8). Broken rice is in high demand in feed and brewing industries. Thailand and Pakistan have also significantly contributed to the supply of broken rice in the international market. Other key exporters of broken rice include Vietnam, Brazil, and the USA. Australia, the USA, and France have led global wheat export markets (Table 8). Ukraine, Canada, and Russia also play crucial roles in global wheat exports. India is emerging as an important exporter of wheat.

Table 8. Major global exporters for cereals, 2022

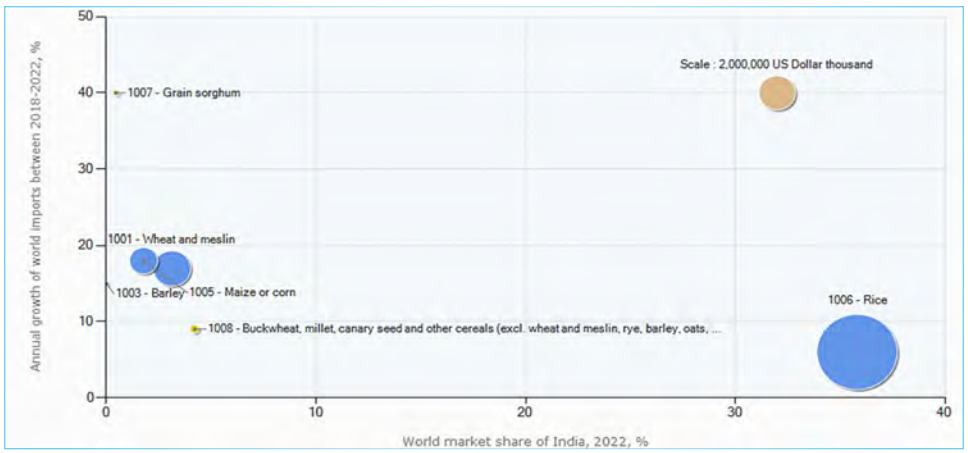
Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Semi-milled rice	India	1	9.40	38.64
	Thailand	2	3.55	14.58
	Vietnam	3	2.92	11.99
	Others		8.45	34.77
Broken rice	India	1	1.20	37.21
	Pakistan	2	0.39	11.9
	Thailand	3	0.34	10.6
	Others		1.30	40.21
Wheat	Australia	1	10.03	14.90
	USA	2	8.35	12.47
	France	3	6.65	11.15
	India	9	2.11	3.54
	Others		32.31	54.34

Source: Based on INTRACEN database.

4.2 India in the global cereal basket

India has maintained a significant presence in the global cereal export market, with exports reaching approximately US$14.08 billion in 2022. The country's rice exports have shown substantial growth in terms of both quantity and value (Figure 9).

Figure 9. India's penetration in the global market and growth in international demand for cereals, 2022



Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share of this product. The yellow bubble signifies a decline in India's global market share.

Source: INTRACEN database.

However, India's wheat exports declined because of increased competition. While the global demand for maize and wheat saw a moderate increase of 10-20% from 2018 to 2022, India's contribution to exports remains under 10%. Among these commodities, rice is India's most competitive product, whereas maize and wheat have not achieved comparable levels of competitiveness (Saxena et al. 2017; Saxena et al. 2023a).

4.3 Mapping of major commodity exports

India's semi-milled rice exports experienced a significant increase, reaching US$9.4 billion in 2022, with a 19% increase from 2018 (Table 9). Iran is the top importer, sharing 12.3% of its exports despite imposing a high 26% tariff. Meanwhile, India maintains fluid trade relationships with Saudi Arabia and the UAE, both of which have zero import duty for semi-milled rice.

Table 9. India's major cereals importers, 2022

Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ ton)	Annual export growth in quantity (2018-22 (%))	Share of partners in global imports (%)	Average tariff faced by India (%)
Semi-milled rice	Total exports	9400.1	100.0	17866.1	526	19	100.0	-
	Iran	1154.8	12.3	1244.8	928	-3	8.0	26
	Saudi Arabia	989.2	10.5	1011.8	978	-2	5.4	0
	Benin	546.0	5.8	1615.2	338	30	2.4	10
	UAE	431.4	4.6	537.4	803	-2	2.1	0
	Côte d'Ivoire	383.3	4.1	1092.8	351	37	2.5	10
Broken rice	Total exports	1203.8	100.0	3893.7	309	58	100.0	-
	China	601.3	49.9	1921.4	313	1624	32.0	10
	Senegal	312.4	26.0	1042.7	300	30	11.4	10
	Vietnam	67.5	5.6	230.4	293	-	2.3	10
	Indonesia	58.1	4.8	173.7	335	3	3.6	7.8
	Djibouti	49.8	4.1	159.8	312	31	1.3	8
Wheat	Total exports	2106.0	100.0	6724.6	313	196	100.0	-
	Bangladesh	733.7	34.8	2359.8	311	410	2.4	2.5
	Indonesia	302.8	14.4	939.2	322	-	6.7	3
	Korea	198.1	9.4	657.4	301	-	3.2	1.5
	UAE	175.3	8.3	545.1	322	280	1.0	0
	Yemen	141.3	6.7	444.8	318	-	1.8	0

Source: Based on INTRACEN database.

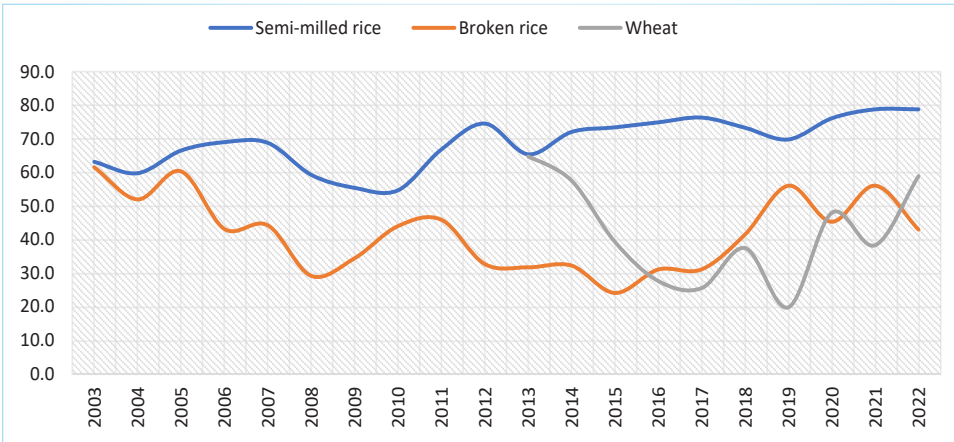
Between 2018 and 2022, India's broken rice exports increased by 58%. This significant growth is attributed to robust demand from China, which constitutes approximately half of India's broken rice exports. Senegal, the second largest importer, accounts for approximately one-quarter of India's broken rice exports.

Recently, India has also demonstrated its presence in the global wheat market. Bangladesh is the primary importer of Indian wheat, accounting for 34.8% of the total exports. Indonesia follows, accounting for 14.4% of exports. Notably, imports of Indian wheat by the UAE have experienced a substantial increase of 280% since 2018.

4.4 Market diversification

The Indian government implemented a strategy to diversify exports by encouraging traders to seek new markets. This approach proved to be highly effective for both rice and wheat exports, as shown in Figure 10. Working in conjunction with APEDA and various other partners, the government's initiatives expanded India's presence in the global cereal market, especially between 2020 and 2021. This expansion, occurring during the COVID-19 pandemic, demonstrates India's ability to address disruptions in global supply chains. Programs such as the Rice Export Promotion Forum (REPF) have played a crucial role in boosting exports (Saxena et al. 2022).

Figure 10. India's spatial export diversification for cereals (%)



Source: Computed by authors.

4.5 Comparative advantages

India demonstrates a strong comparative advantage in exports of semi-milled rice (Figure 11). The competitiveness of India's broken rice is expected to

increase notably in 2022. However, recent restrictions on rice exports have led to a decline in its market share, from 41% in 2021 to 34% in 2023 (ICRA 2024). The effects may be mitigated if India continues to allow non-Basmati rice exports to neighboring countries or if the restrictions are lifted. Nonetheless, a more stringent or prolonged ban could significantly impact food security in countries that rely heavily on rice imports from India (Glauber and Mamun 2023). This highlights that India must strike a delicate balance between ensuring domestic food security and capitalizing on its competitive edge in the global market (Saqib and Taneja 2005; Huot and Kakinaka 2007; Sahini 2014; Kahouli 2016; Saxena et al. 2023b; Kumar et al. 2024).

India's wheat export competitiveness has fluctuated over time (Figure 11). From 2001 to 2004, policies promoting wheat exports enhanced competitiveness. However, a significant decline was observed between 2005 and 2011. The subsequent lifting of the export ban in 2011 resulted in a partial recovery, indicating persistent challenges in re-establishing a robust comparative advantage. By 2022, its exports could show modest improvement, albeit with the advantage remaining tenuous.

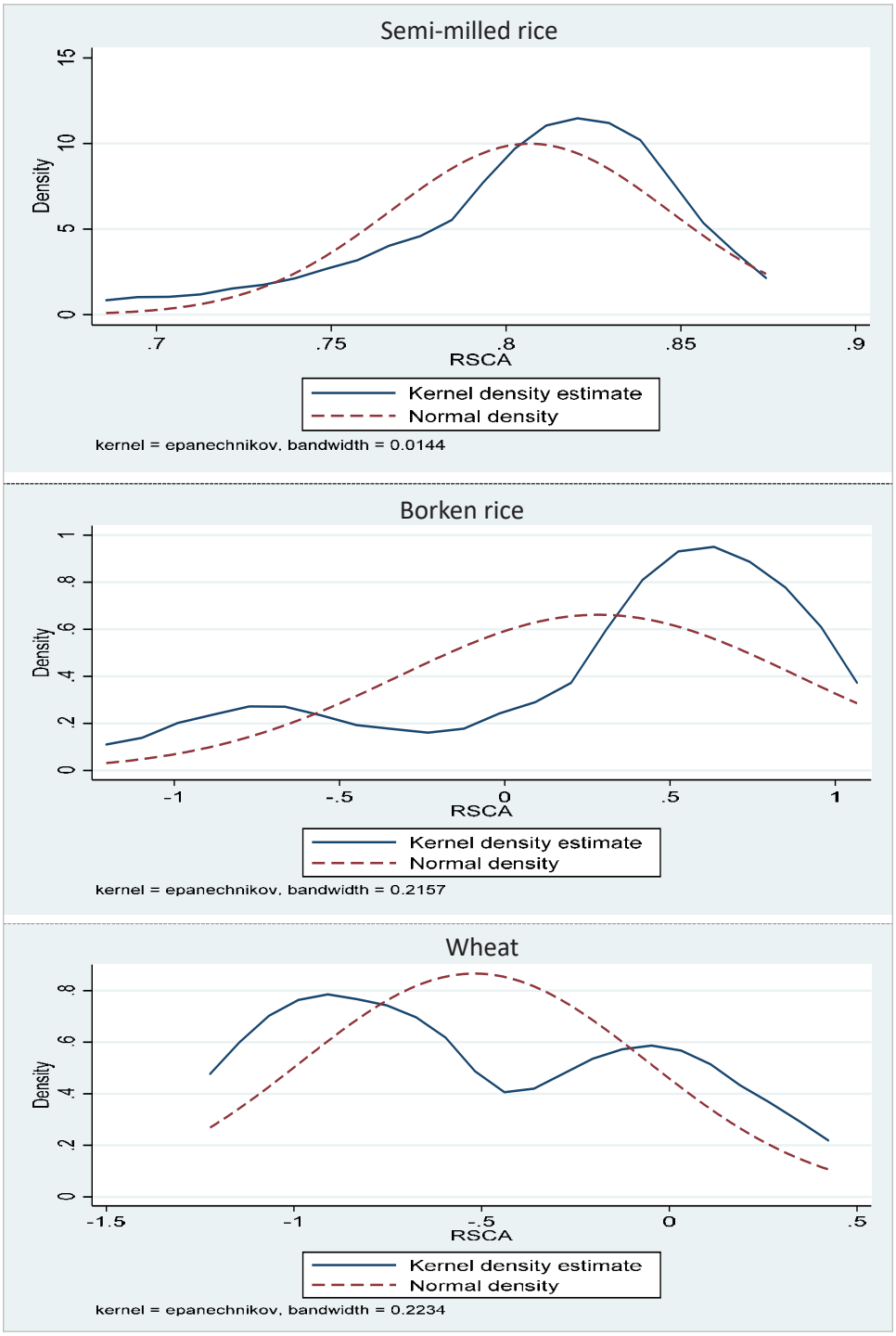
4.6 Export projections

Semi-milled rice

The dynamic nature of trade, encompassing gains and losses, has been studied using the Markov chain model. The initial step of the transitional probability matrix for global exports of semi-milled rice elucidates the stability and competitive dynamics between 2010 and 2022 (Figure 12). This graphical representation provides significant insights into the probability of countries maintaining their export positions or transitioning to alternative export destinations. India has established itself as a global leader in the semi-milled rice export market with a high self-transition probability of 0.72, suggesting that it will sustain its export position. India's enduring presence in the global market can be credited to its customer base in countries, such as Iran and Saudi Arabia (Satishkumar et al. 2016). This is further evidenced by its influence on other markets, particularly China, where India has a significant transition probability of 0.345. This underscores India's ability to adapt to changing market conditions and maintain a strong foothold in the global rice trade.

Thailand has demonstrated considerable market stability and consistent export performance, as evidenced by its high self-transition probability of 0.703. In contrast, Vietnam's exports exhibit a lower self-transition probability of 0.478. Export probabilities may be influenced by factors such as climate change, technological innovation, and evolving international relations. Continuous monitoring of these trends is essential for predicting and addressing shifts in the global rice trade.

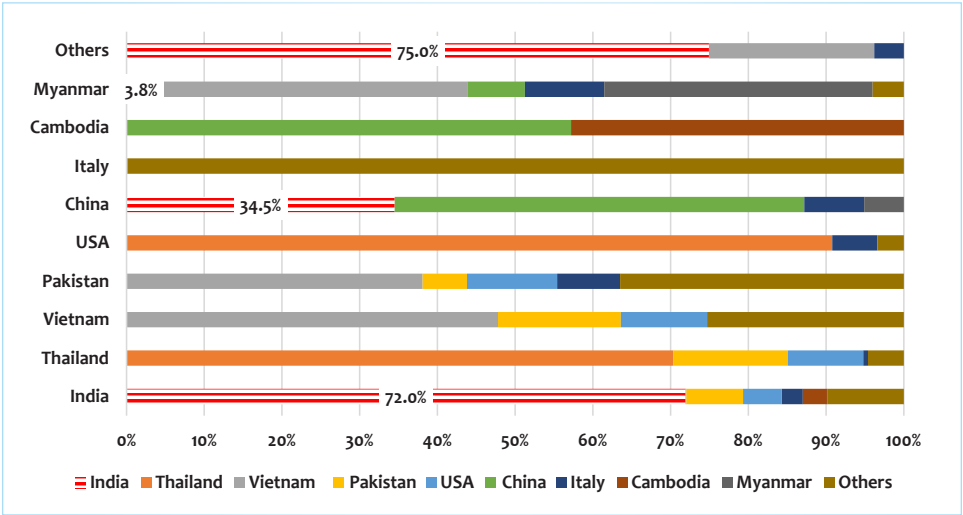
Figure 11. Kernel density distributions of RSCA for cereals



Source: Computed by authors.

The projected market share for semi-milled rice exports by 2030 indicates that India will maintain its dominant position in the global rice market, with its export share remaining constant at 38% (Table 10). Water scarcity and shifting agricultural priorities may affect India's long-term rice production and export capacities. Concurrently, Thailand is expected to experience a slight increase in its market share, from 14.7% in 2022 to 16.9% in 2030.

Figure 12: Transitional probabilities in global exports of semi-milled rice, 2010-22



Source: Computed by authors.

Table 10. Projected export shares of major trading nations for semi-milled rice (%)

	India	Thailand	Vietnam	Pakistan	USA	China	Italy	Cambodia	Myanmar	Others
2022	38.9	14.7	12.1	7.1	4.8	3.0	2.9	1.7	1.6	13.2
2030	38.4	16.9	11.0	7.4	5.6	2.6	2.8	2.1	0.2	13.0

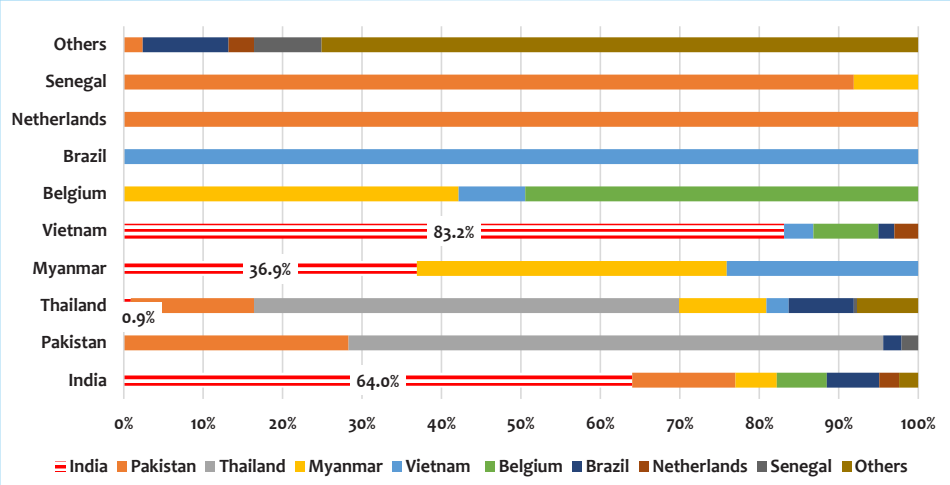
Source: Computed by authors.

Broken rice

A select few countries dominate the world market for broken rice, with India, Pakistan, Thailand, Myanmar, and Vietnam leading the pack. India has a high probability of sustaining its export position (0.640). Thailand shows moderate consistency (0.535), while Myanmar and Vietnam display more erratic export trends. Notably, India also exerts a considerable influence on other exporters. There is a high probability of India capturing the market shares of Vietnam

(0.83) and Myanmar (0.37). Thailand strikes a balance between consistency and flexibility with a 0.535 probability of maintaining export status. Furthermore, Thailand has strong potential (0.673) to gain the market share previously held by Pakistan (Figure 13).

Figure 13: Transitional probabilities in global exports of broken rice, 2011-22



Source: Computed by authors.

The export market landscape for broken rice is anticipated to undergo a substantial transformation (Table 11). India, previously a significant contributor, is expected to experience a decline in its market share, from 38.3% in 2022 to 29.9% in 2030. Conversely, Thailand is projected to exhibit a considerable increase in its share. Pakistan is likely to maintain a relatively stable market share of approximately 13%.

Table 11. Projected export shares of major trading nations for broken rice (%)

	India	Pakistan	Thailand	Myanmar	Vietnam	Belgium	Brazil	Netherlands	Senegal	Others
2022	38.3	12.3	11.0	8.9	7.7	5.5	4.9	1.8	0.9	8.8
2030	29.9	12.8	18.5	9.6	8.4	5.1	4.9	1.3	1.1	8.5

Source: Computed by authors.

Wheat

Global trade patterns for wheat exports exhibit significant spatial shifts (Table 12). While the export shares for Germany and Argentina are projected to remain stable, India is expected to experience a decline of approximately 3% by 2030. Conversely, the USA is expected to observe a modest 1% increase, with Ukraine and Russia increasing by 4% and 8%, respectively. Russia is predicted to emerge as the dominant wheat exporter, commanding 16% of global exports by 2030. Australia is likely to face a 6% decrease. These projections align with those presented by the OECD-FAO (2024).

Table 12. Projected export shares of major trading nations for wheat (%)

	Australia	USA	France	Canada	Russia	Argentina	Ukraine	Germany	India	Others
2022	16.9	14.1	11.2	10.4	8.5	5.2	4.5	3.7	3.5	22.0
2030	10.5	15.1	10.0	11.2	16.2	5.6	8.4	3.8	0.2	19.1

Source: Computed by authors.

4.7 Export rejections

A review of export rejection data reveals a rising trend in the number of Indian rice shipments that were denied entry from 2001 to 2015. Between 2001 and 2010, the USA rejected rice shipments because of the presence of filthy substances (Table 13). However, from 2021 to 2023, excessive pesticide residues were the main reasons for rejection, accounting for 94% of cases.

Indian rice shipments witnessed a steady increase in rejection from 2001 to 2015. Aflatoxin contamination was the primary cause of rejection between 2006 and 2010, responsible for 79% of cases. From 2011 to 2015, pesticide residues were the main reason for 71–83% of rejections, followed by aflatoxins at 12–16%, and issues related to adulteration, unsafe additives, and coloring agents. Other reasons for rejection included unsanitary conditions, contamination, and failure to adhere to good manufacturing practices (28%), as well as inadequate labelling and documentation (3%). The use of prohibited additives or unapproved ingredients, contamination, and a lack of proper registration for importers or manufacturers also led to rejections. Since 2016, rejections have significantly decreased because of the various measures implemented to enhance commodity supply chains.

Table 13. Rejections of cereal consignments by the USA and EU

Country	Reasons		2001-05	2006-10	2011-15	2016-20	2021-23
Rice							
EU	Reasons	Pesticide residue	0	2	36	73	97
		Aflatoxin/ mycotoxin	0	11	8	11	18
		Others	0	1	9	8	4
	No. of rejections		0	14	51	92	117
USA	Reasons	Filthy	82	176	317	34	2
		Pesticide residue	0	2	924	480	87
		Labelling/ branding	7	22	34	29	4
		Others	10	10	15	5	3
	No. of rejections		97	191	1249	531	95
Wheat							
USA	Reasons	Filthy	0	5	28	9	0
		Labelling/ branding	6	17	2	8	7
		Others	2	0	1	3	4
	No. of rejections		8	20	30	17	11
EU	Reasons	Pesticide residue	0	0	0	0	8
		Others	0	0	1	0	1
	No. of rejections		0	0	1	0	9

Note: The number of rejections may not tally due to multiple reasons for a given consignment or commodity.

Source: Computed by the authors based on the USFDA and EURASFF databases.

The number of Indian wheat shipments rejected gradually increased until 2015. During the first decade of the 21st century (2001-2010), most rejections were attributed to administrative and documentation issues. Specifically, inadequate labelling, incorrect branding, and missing paperwork were the primary reasons why shipments were turned away. However, a shift in reasons for rejection occurred from 2011 to 2015, with uncleanliness becoming the predominant cause of refusal.

Key Extracts

The global cereal trade is expanding, with India (for rice), the USA, Canada, Russia, and Australia (for wheat) being major suppliers. In 2022-23, India's cereal exports reached US$14.08 billion. India's market diversification strategy bolstered its global cereal presence. The country shows a strong comparative advantage in semi-milled and broken rice but faces challenges in wheat exports. Projections suggest that India will continue to dominate semi-milled rice exports but may lose market for broken rice. Export rejection of Indian rice is mainly caused due to pesticide residues and aflatoxin contamination.

India's strong advantage in semi-milled rice exports suggests opportunities for further market dominance and specialization. However, the projected decline in broken rice market share necessitates strategic planning to sustain competitiveness. The increasing export rejections due to pesticide residues and aflatoxin contamination highlight the need for improved quality control and adherence to global food safety standards. Addressing these quality issues is crucial for India to maintain its position in the global rice market and to avoid economic setbacks. Challenges in wheat exports underscore the need for targeted efforts to enhance competitiveness in this segment.

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5 Oilseeds and Vegetable Oils

India ranks as the fourth largest oilseed producer globally, with a production of 39 million tons in 2023-24 (GOI 2024d). Substantial growth has been observed in the export of oilseeds and oils, particularly groundnuts, castor oil, sesame oil, and oil meal. India is also the second-largest consumer and leading importer of edible oils. Approximately 60% of India's edible oil demand is met through imports, predominantly palm oil, from Indonesia and Malaysia. However, the government aims to enhance domestic production to reduce dependence on imports. This chapter presents a comprehensive analysis of exports of groundnuts and castor oil, two majorly exported items under this category.

5.1 Major global exporters

In 2022, Argentina, India, Brazil, the USA, and Sudan dominated global groundnut exports, collectively accounting for more than two-thirds (68.7%) of the total. Argentina led global groundnut exports, followed by India and Brazil (Table 14). China, the Netherlands, Indonesia, Vietnam, and Mexico constituted the top five groundnut importers in 2022, representing 46.9% of the world's groundnut imports.

In 2022, the global exports of castor oil reached US$1.27 billion, with India, France, and the Netherlands, together accounting for approximately 93% of it (Table 14). India has a share of more than 85%. Germany, the USA, Brazil, Spain, and Italy are among the nations that also export castor oil.

Table 14. Major global exporters for oilseeds and vegetable oils, 2022

Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Groundnuts	Argentina	1	0.74	20.72
	India	2	0.70	19.3
	Brazil	3	0.33	9.25
	Others		1.81	50.63
Castor oil	India	1	1.09	86.2
	France	2	0.05	3.88
	Netherlands	3	0.04	3.39
	Others		0.08	6.84

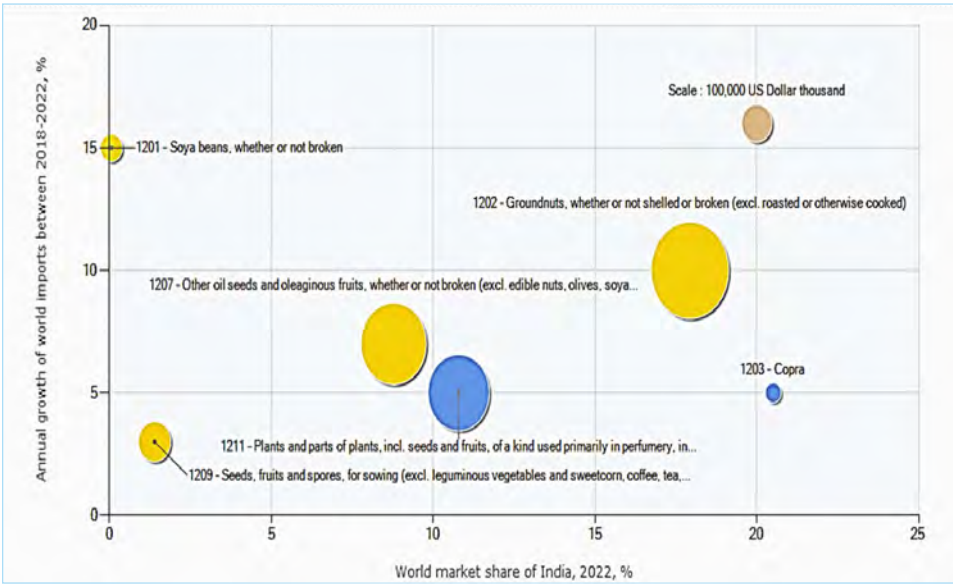
Source: Based on INTRACEN database.

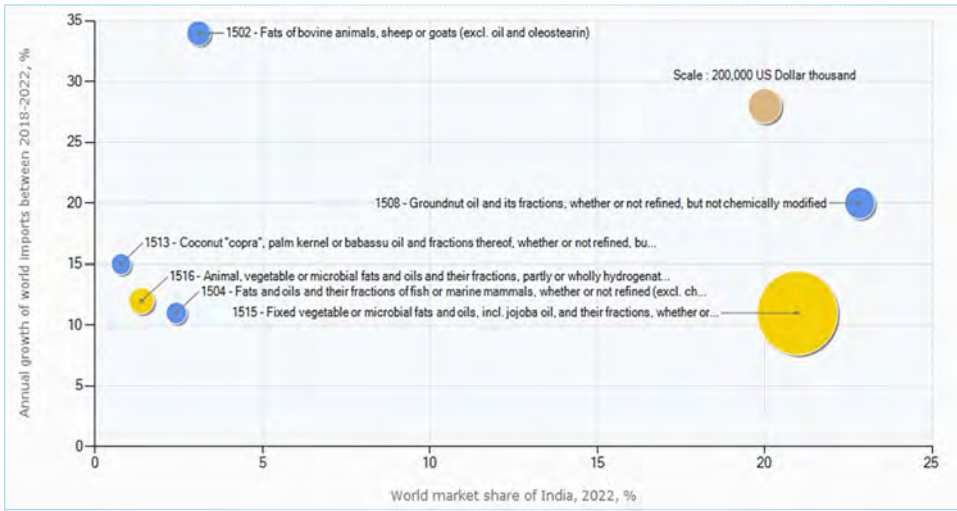
5.2 India in the global oilseeds and vegetable oils basket

The prominent role of India in the global export market for certain oilseeds, notably groundnuts and copra, highlights its current market dominance and the potential for future export expansion (Meena 2014; Meena et al. 2015; Mehta 2015). As the global demand for groundnuts surged by approximately 10% between 2018 and 2022, India capitalized on this trend, securing more than 15% of its market. With approximately 20% of the global copra market share, India maintains a significant presence despite exporting a smaller quantity of copra than groundnuts (Figure 14). Soybean and other oilseeds make up a smaller share of India's oilseed exports. Notably, soybean experienced the highest demand growth, indicating potential opportunities to expand its market presence. On the other hand, groundnut oil, with a robust annual growth of 20% in global demand, highlights India's role as a prominent supplier in the global market, holding over 20% of its market share.

Although animal fat has experienced the highest growth in demand, India's involvement in this segment remains minimal. However, the country has achieved significant success in exporting other fixed vegetables or microbial fats, and oils, accounting for approximately 20% of the market share.

Figure 14. India's penetration in the global market and growth in international demand for oilseeds and vegetable oils, 2022





Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share of this product. The yellow bubble signifies a decline in India's global market share.

Source: INTRACEN database.

5.3 Mapping of major commodity exports

In 2022, India's exports of groundnuts reached US$0.695 billion. Indonesia is the primary purchaser, accounting for approximately 40% of India's groundnut exports (Table 15). Vietnam is the second-largest importer, accounting for approximately 20% of the total exports.

Table 15. India's major oilseeds & vegetable oils importers, 2022

Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (thousand tons)	Unit value (US$/ ton)	Annual export growth in quantity (2018-22 (%)	Share of partners in global imports (%)	Average tariff faced by India (%)
Groundnuts	Total exports	695.7	100.0	560.9	1240	4	100.0	-
	Indonesia	276.2	39.7	225.7	1223	5	12.1	5
	Vietnam	134.9	19.4	104.5	1291	20	3.9	3
	Philippines	62.4	9.0	49.3	1265	1	1.3	15
	Malaysia	62.2	8.9	49.5	1256	14	1.9	0
	Thailand	40.1	5.8	30.5	1311	4	1.3	30
Castor oil	Total exports	1090.1	100.0	581.7	1874	-	100.0	-
	China	497.9	45.7	269.3	1849	2	39.8	10
	Netherlands	161.9	14.9	87.9	1842	2	4.6	0.8
	France	112.5	10.3	60.7	1855	7	10.3	0.8
	USA	112.0	10.3	59.7	1876	3	9.6	0
	Thailand	32.6	3.0	17.4	1876	-5	2.8	10

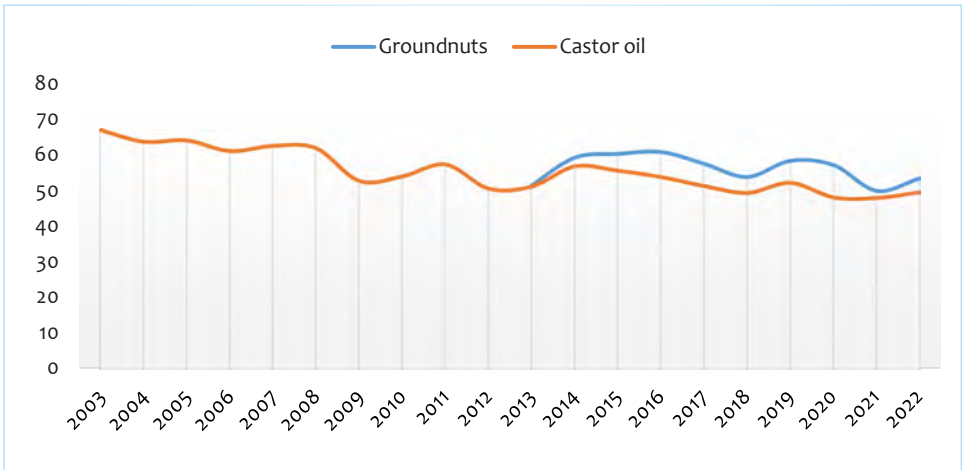
Source: Based on INTRACEN database.

China is the dominant purchaser of Indian castor oil, accounting for more than 45% of total exports in 2022. The Netherlands and France follow, with 14.9% and 10.3% share, respectively. The export landscape of Indian castor oil is significantly shaped by the tariffs imposed by importing nations. While China and Thailand levy a 10% tariff, countries such as the Netherlands, France, and the USA apply lower rates.

5.4 Market diversification

The export diversification patterns of groundnuts and castor oil from India exhibit distinct trends (Figure 15). Between 2013 and 2016, groundnut exports experienced a significant increase in market diversification. However, after 2016, groundnut exports became more concentrated in the key markets. In contrast, India's castor oil exports initially demonstrated a broader market distribution but gradually became more concentrated. This shift may be attributed to increasing dependence on primary importers or the development of stronger bilateral trade relationships with importing countries.

Figure 15. India's spatial export diversification for groundnuts and castor oil (%)



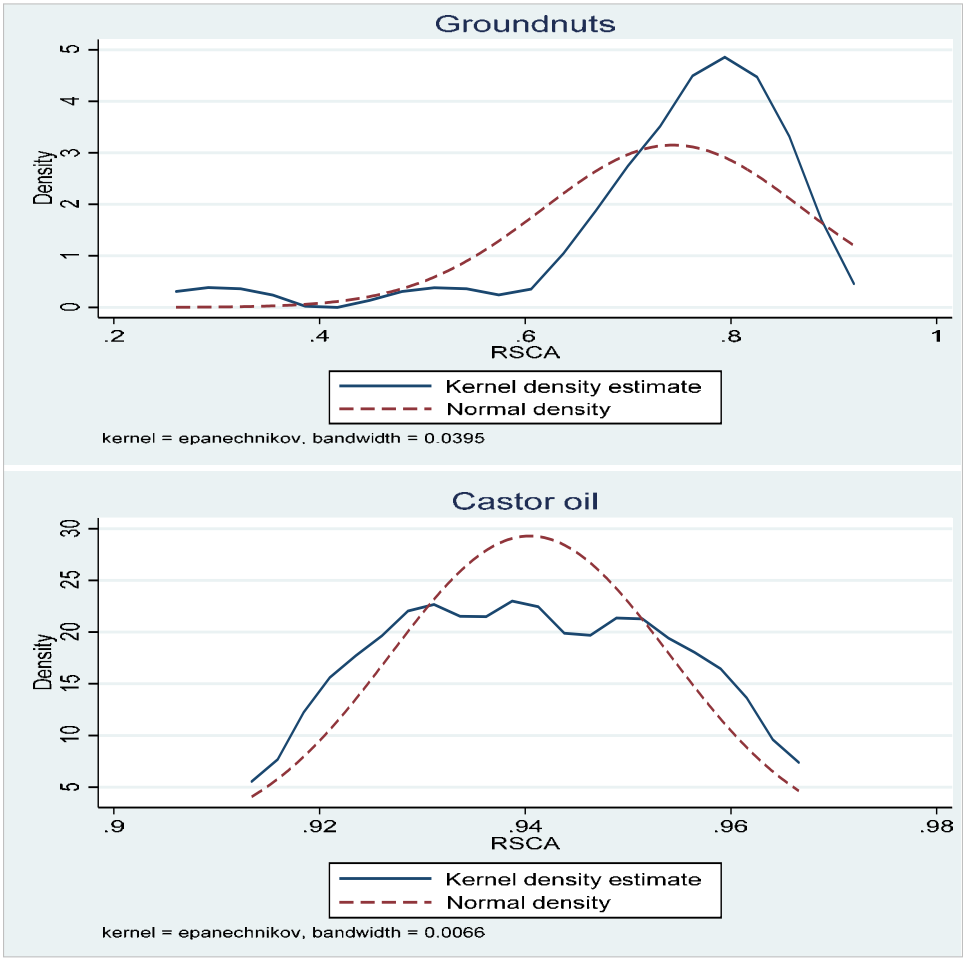
Source: Computed by authors.

5.5 Comparative advantages

India has maintained a significant comparative advantage in the export of groundnuts and castor oil (Figure 16). However, India's groundnut export performance has fluctuated over time and is influenced by changes in global demand, domestic production, and international trade regulations (Kannan and Sundaram 2011; Sengupta and Roy 2011).

India is the predominant producer of castor, accounting for 87.53% of the global output. This establishes India as the primary exporter of castor oil, contributing to approximately 86% of the global market share. Castor oil has maintained exceptional stability in its comparative advantage in exports (Figure 16). Future prospects for India's castor oil exports appear favorable, supported by robust production capabilities and sustained demand (Kumari et al. 2017; Gondalia et al. 2020).

Figure 16. Kernel density distributions of RSCA for groundnuts and castor oil



Source: Computed by authors.

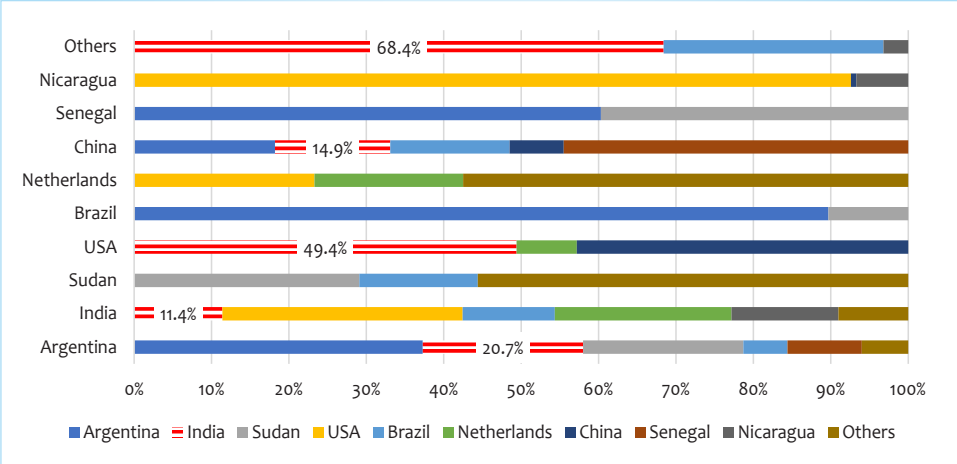
5.6 Export projections

Groundnuts

Analysis of groundnut export trends using a transitional probability matrix reveals Argentina as the most consistent exporter, with a 37.3% likelihood of

maintaining its global export share. Sudan, Brazil, and Senegal follow closely behind (Figure 17). In contrast, India struggles to sustain its position among leading exporters.

Figure 17. Transitional probabilities in global exports of groundnuts, 2016-22



Source: Computed by authors.

Argentina, India, Sudan, the USA, and Brazil dominate the global groundnut export market, collectively accounting for more than 70% of the global exports. However, future projections indicate potential shifts in relative market positions (Table 16). Argentina and India are anticipated to maintain their dominance, retaining approximately one-fifth of total exports by 2030. The USA is expected to strengthen its position, surpassing that of Sudan. Furthermore, the Netherlands and China are projected to increase their market share.

Table 16. Projected export shares of major trading nations for groundnuts (%)

	Argentina	India	Sudan	USA	Brazil	Netherlands	China	Senegal	Nicaragua	Others
2022	20.6	19.3	11.8	9.3	9.2	5.8	3.9	3.8	3.0	13.3
2030	18.4	20.7	9.0	11.2	9.1	6.9	5.2	4.1	3.5	11.9

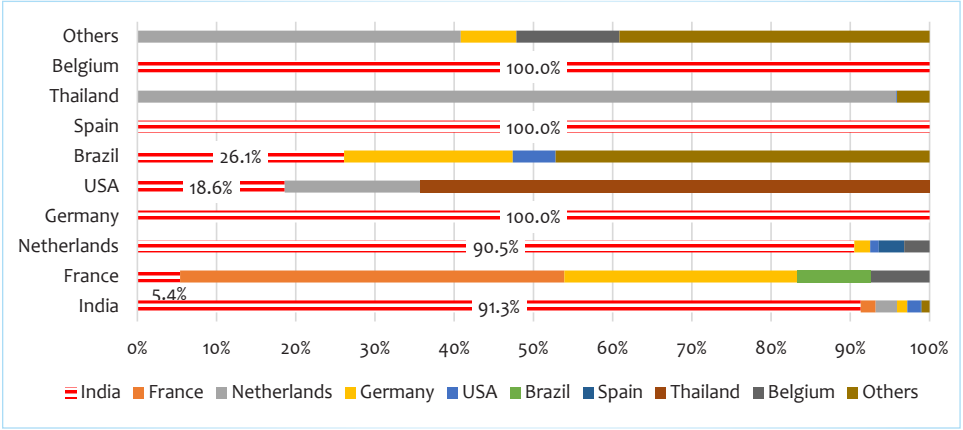
Source: Computed by authors.

Castor oil

India's castor oil exports show remarkable resilience, as evidenced by its exceptionally high self-retention probability of 0.913 (Figure 18). Moreover, India's success in capturing market share from well-established exporters, such as the Netherlands, Brazil, and the USA, underscores its increasing dominance in the global castor oil market. India's acquisition of 90% of the

Netherlands' market share is particularly noteworthy, considering the latter's long-standing presence in the global market. Additionally, it will secure 26% of Brazil's and 19% of the USA's market share.

Figure 18. Transitional probabilities in global exports of castor oil, 2010-22



Source: Computed by authors.

The forecasts suggest that India will maintain its dominant position in the global castor oil industry (Table 17). The market shares of France and the Netherlands are expected to remain steady, indicating a consistent European demand and well-established commercial relationships. Currently, minor exporters such as the USA and Brazil show potential for increased market presence.

Table 17. Projected export shares of major trading nations for castor oil (%)

	India	France	Netherlands	Germany	USA	Brazil	Spain	Thailand	Belgium	Others
2022	85.9	3.9	3.4	2.2	0.9	0.8	0.8	0.4	0.3	1.5
2030	85.0	3.2	4.2	2.3	1.5	0.3	0.2	1.0	0.6	1.8

Source: Computed by authors.

5.7 Export rejections

Exports of groundnuts from India have faced multiple rejections, especially in EU markets. The number of rejections rose from 27 during 2001-05 to 274 in the 2011-15 period, mainly due to mycotoxin contamination, before declining to 74 between 2021 and 2023 (Table 18). From 2001 to 2015, Indian groundnut consignments were turned away from the USA because of mycotoxins and excessive pesticide residues. After 2016, rejections were primarily linked to Salmonella, mycotoxins, improper labelling or documentation, and unsanitary conditions. Additionally, the USA rejected the shipments of castor oil from India because of labelling problems and the use of unapproved drugs.

Table 18. Rejections of oilseed and oil consignments by the USA and EU

Country	Reasons		2001-05	2006-10	2011-15	2016-20	2021-23
Groundnut and products							
EU	Reasons	Aflatoxin/ mycotoxin	27	45	256	87	74
		Adulteration	0	0	15	16	0
		Labelling/ misbranding	0	0	15	16	0
		Others	0	1	5	4	0
	No. of rejections		27	46	274	107	74
USA	Reasons	Pesticide residue	3	11	14	0	0
		Aflatoxin/ mycotoxin	7	22	8	4	4
		Salmonella	0	0	1	13	12
		Others	2	0	0	12	9
	No. of rejections		9	22	23	21	19
Castor oil							
USA	Reasons	Labelling/ misbranding	7	3	2	0	0
		Unsafe additive/ colour	1	0	0	0	0
		GM food/ unapproved drug	0	3	0	0	1
	No. of rejections		8	6	2	0	1

Note: The number of rejections may not tally due to multiple reasons for a given consignment or commodity.

Source: Computed by the authors based on the USFDA and EURASFF databases.

The frequent rejection of oilseeds and oils underscores the need to implement rigorous quality assurance protocols across the supply chain. Furthermore, insufficient documentation and inadequate traceability systems have resulted in rejections as nations importing these products require comprehensive information regarding their origin and processing standards. To mitigate rejection, the Indian Oilseeds and Produce Export Promotion Council (IOPEPC) must ensure appropriate pesticide usage and strict adherence to standard operating procedures (SOPs).

Key Extracts

India has significantly increased its exports of groundnut and castor oil. Projections indicate that by 2030, India and Argentina will account for 20% each of groundnut exports, and India maintaining its dominance in castor oil.

The rejections of groundnuts shipments underscore the need for improved quality control and adherence to global standards to remain competitive. Similarly, castor oil rejections in the USA highlight the importance of meeting the regulatory requirements in foreign markets. These export challenges necessitate focused interventions for quality assurance, regulatory compliance, and diversification of export destinations to mitigate risk of rejection. Addressing contamination and residue issues in groundnut exports may require better agricultural practices, storage, and handling to meet international standards and to maintain market access.

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6 Fruits and Vegetables

India is the second largest producer of fruits and vegetables and has experienced robust growth over the past two decades. In 2022-23, India produced 110.21 million tons of fruits and 212.55 million tons of vegetables (GOI 2024a). Their exports too have been increasing steadily, reaching US$1.79 billion in 2022 (GOI 2024c), which can be attributed to the country's diverse climatic conditions, and the advancements in cold chain infrastructure, and post-harvest techniques. This chapter presents a comprehensive analysis of exports of onions and grapes, the two most significant export oriented commodities.

6.1 Major global exporters

The Netherlands, China and India are the leading suppliers in the global onion export market (Table 19). The USA and Spain also maintain a substantial presence in the onion market, while Brazil, Australia, and Egypt have a moderate presence.

Chile stands out as the top player in the global grapes export market, with its exports valued at US$1.7 billion (Table 19). This is followed by Peru, Italy, the USA, and Spain. Brazil, South Africa, Australia, and China also have considerable market shares. India, exporting grapes worth US$0.31 billion, ranks among the ten leading grapes exporting nations.

Table 19. Major global exporters for fruits and vegetables, 2022

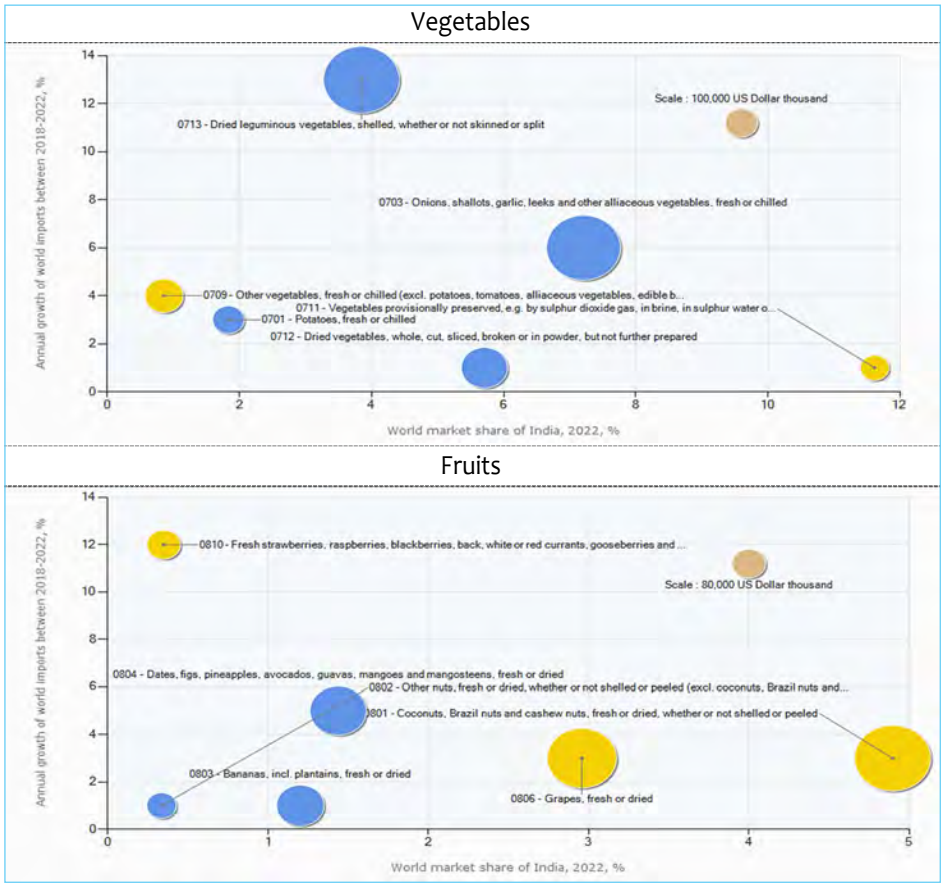
Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Onion	Netherlands	1	0.85	19.47
	China	2	0.56	12.89
	India	3	0.52	11.98
	Others		2.44	55.83
Grapes	Chile	1	1.73	17.97
	Peru	2	1.35	13.98
	Italy	3	0.77	8.00
	India	10	0.31	3.17
	Others		54.8	56.85

Source: Based on INTRACEN database.

6.2 India in the global fruits and vegetables basket

Recent trends in the global vegetable trade have demonstrated significant growth in the dehydrated vegetable sector, with alliums such as onions, shallots, and garlic following closely behind (Figure 19). This trend presents an opportunity for Indian exporters to increase their share of global export. To capitalize on this, India should prioritize expanding exports of dried vegetables, onions, garlic, and leeks, while addressing production and quality challenges. Conversely, provisionally preserved vegetables still constitute a substantial 12% of the global market but are experiencing a decline in their market share.

Figure 19. India's penetration in the global market and growth in international demand for fruits & vegetables, 2022



Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share of this product. The yellow bubble signifies a decline in India's global market share.

Source: INTRACEN database.

In recent years, the demand for berries (such as strawberries, raspberries, and blackberries) has increased by 12%. Nevertheless, these share only approximately 1% of global fruit exports. Dates, figs, pineapples, avocados, and guavas are also experiencing rising demand, but India's share in global exports remains below 2%. To enhance its share, it is crucial to adopt high-yield cultivars and good agricultural practices (GAP) that adhere to sanitary and phytosanitary standards.

6.3 Mapping of major commodity exports

India's onion exports are directed to neighboring countries, including Bangladesh, Malaysia, the UAE, Sri Lanka, and Nepal. Bangladesh is the primary importer, receiving 26.7% of India's onion exports (Table 20). Although Malaysia and the UAE are significant importers, they have experienced minor declines between 2018 and 2022. Sri Lanka and Nepal continue to be important markets for the Indian onions.

Table 20. India's major fruits & vegetables importers, 2022

Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ton)	Annual export growth in quantity (2018-22 (%))	Share of partners in global imports (%)	Tariff faced by India (%)
Onion	Total exports	524.6	100.0	2124.6	247	5	100.0	-
	Bangladesh	139.9	26.7	699.8	200	35	3.5	12.5
	Malaysia	101.4	19.3	332.6	305	-3	5.1	0
	UAE	69.0	13.1	258.8	266	-2	2.8	0
	Sri Lanka	58.1	11.1	241.9	240	-1	2.0	17
	Nepal	34.4	6.6	167.9	205	12	1.2	9
Grapes	Total exports	306.1	100.0	275.5	1111	12	100.0	-
	Netherlands	116.8	38.2	77.9	1500	7	7.1	6.3
	Bangladesh	50.5	16.5	89.8	562	139	0.8	25
	UK	22.4	7.3	13.4	1664	-4	6.2	6.3
	UAE	21.7	7.1	17.7	1226	10	0.8	0
	Russia	19.2	6.3	14.2	1348	-15	4.0	3.8

Source: Based on INTRACEN database.

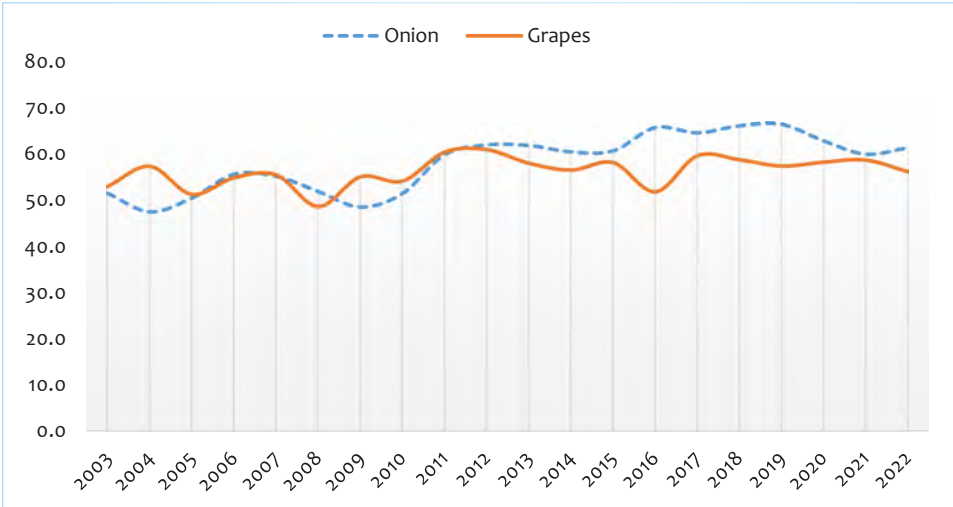
India's exports of grapes reached US$0.31 billion in 2020, with the Netherlands emerging as the primary destination, receiving approximately 38% of total shipments. Despite imposing a higher tariff rate of 25%, Bangladesh is the

second largest market for Indian grapes. Over the past five years, the quantity of grapes exports to Bangladesh has increased by 139% annually.

6.4 Market diversification

An examination of India's onion export diversification shows a consistent expansion over time, with occasional downturns and successful penetration into new markets (Figure 20). In comparison, the export diversification of grapes is more volatile. These contrasting trends indicate that India has been more effective in diversifying in onion exports, probably due to consistent demand and successful market approaches. However, grapes face significant challenges in sustaining their presence in the international markets.

Figure 20. India's spatial export diversification for onion and grapes (%)



Source: Computed by authors.

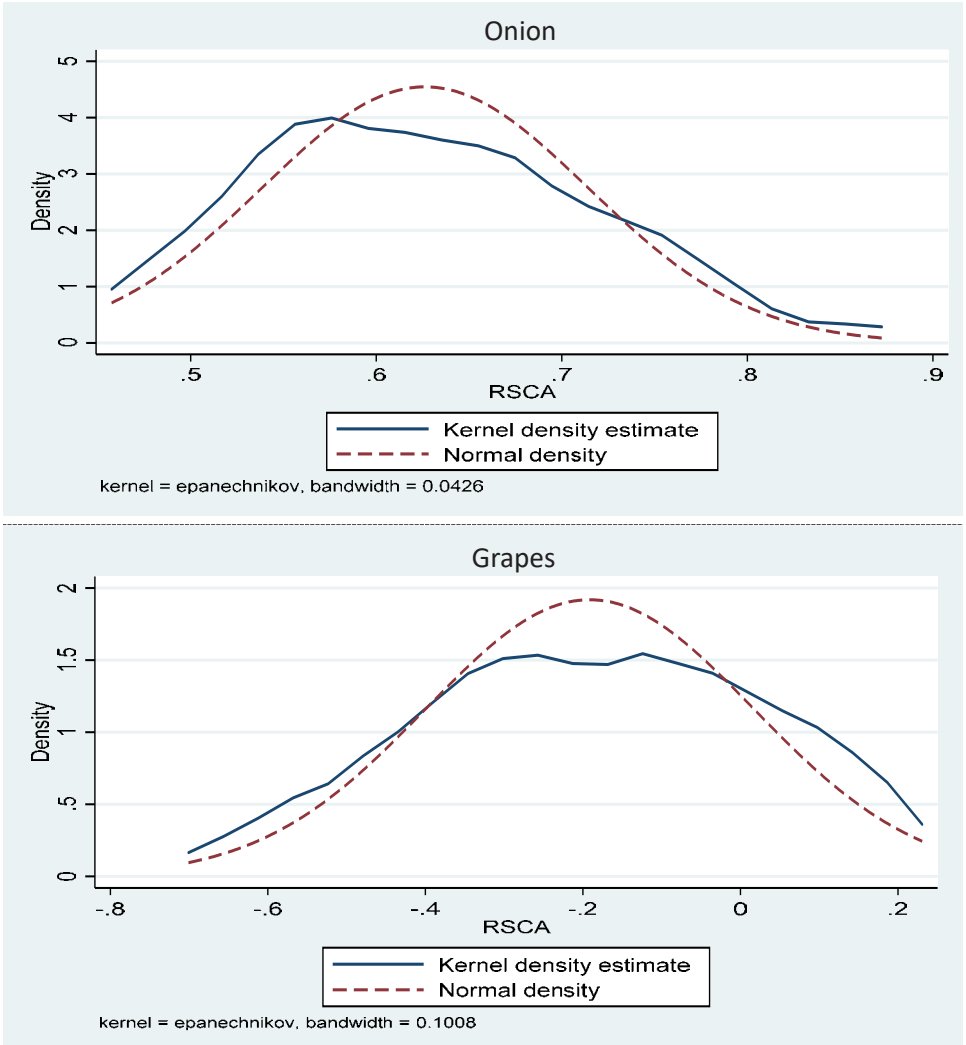
6.5 Comparative advantages

India has maintained a robust comparative advantage in the global onion market (Figure 21). Nevertheless, challenges persist mainly because of the lack of a stable policy environment. The imposition of bans and minimum export prices (MEP) are frequently used measures to manage domestic supply and stabilize prices (Sharma et al. 2024). Despite these challenges, Indian onions have generally sustained considerable comparative progress (Katoch and Singh 2021).

However, India's ability to compete in the fresh grape market exhibits considerable fluctuation. India encounters challenges in maintaining its

competitive advantage owing to intense competition from Australia, South Africa, and the USA (Bhattacharya 2019; Raman et al. 2023). Nevertheless, India commenced strengthening its competitive position from 2019 onwards. The volatility of the comparative advantage is evident in the kernel density. This finding suggests India is struggling to establish a robust presence in a highly competitive market. To remain competitive, India must prioritize several key areas: enhancing quality control measures, improving cold storage infrastructure, increasing productivity, and developing market research and intelligence capabilities.

Figure 21. Kernel density distributions of RSCA for onion and grapes



Source: Computed by authors.

6.6 Export projections

Forecasts for onion exports by 2030 indicate that the Netherlands, a leading exporter, is expected to retain approximately 19% of global onion exports. China, Mexico, Egypt, and Spain are likely to experience marginal increase in their market shares (Table 21). India, the USA, Poland, and Peru face difficulties in maintaining their shares.

Table 21. Projected export shares of major trading nations for onion (%)

	Netherlands	China	India	Mexico	USA	Egypt	Spain	Poland	Peru	Others
2022	19.5	12.9	12.0	9.9	7.3	5.0	4.2	2.6	2.4	24.1
2030	18.7	13.0	11.5	10.9	6.7	5.5	4.5	1.4	2.1	25.6

Source: Computed by authors.

According to the projections, Chile and Peru are anticipated to maintain their dominance in the global grapes market (Table 22). However, Chile's market share is forecasted to decrease substantially, from 18.1% in 2022 to 12.2% in 2030. Conversely, Peru is expected to strengthen its position, reaching 15.5% share. With the exception of Chile, South Africa, and Spain, all countries are predicted to see an increase in their market shares. Although India's market share remains relatively small (3.2%), it remains consistent.

Table 22. Projected export shares of major trading nations for grapes (%)

	Chile	Peru	Italy	South Africa	USA	Netherlands	China	Spain	India	Others
2022	18.1	13.5	8.1	8.0	8.0	7.8	7.6	4.4	3.2	21.3
2030	12.2	15.5	9.0	6.4	9.7	8.1	7.8	4.3	3.2	23.7

Source: Computed by authors.

6.7 Export rejections

In recent years, India has faced multiple instances of onion and grapes exports being turned away due to food safety concerns. The EU has primarily rejected Indian onions because of Salmonella contamination, presence of metal fragments and chemicals, and excessive pesticide residues (Table 23). EU rejections of Indian onion shipments rose from two in the 2006-2010 period to 13 between 2021 and 2023. Similarly, in the USA, Indian shipments have been rejected owing to high pesticide residue levels, inadequate labelling, unsanitary conditions, and failure to secure necessary registrations.

Table 23. Rejections of onion & grapes consignments by the USA and EU

Country	Reasons		2001-05	2006-10	2011-15	2016-20	2021-23
Onion							
EU	Reasons	Salmonella	0	2	1	2	3
		Others	0	0	0	2	12
	No. of rejections		0	2	1	4	13
USA	Reasons	Salmonella	0	4	1	0	0
		Others	0	11	2	2	0
	No. of rejections		0	10	3	2	0
Grapes							
EU	Reasons	Pesticide residue	19	21	4	5	1
		Others	0	0	1	0	0
	No. of rejections		19	21	5	5	1

Note: The number of rejections may not tally due to multiple reasons for a given consignment or commodity.

Source: Computed by the authors based on the USFDA and EURASFF databases.

Indian grapes exports have encountered challenges, particularly in the EU, where consignments have been rejected owing to high levels of pesticide residues. However, the frequency of EU rejection of Indian grapes has markedly declined.

Key Extracts

India's fruit and vegetable exports, particularly onions and grapes, reveal both opportunities and challenges. While India has shown strong growth and has maintained a comparative advantage in onion exports, it faces policy instability and food safety issues. India struggles with market volatility and fierce international competition for grapes. To capitalize on the growing global demand for fruits and vegetables, India must focus on improving quality control, enhancing cold storage infrastructure, boosting productivity, and developing market intelligence. Additionally, addressing food safety concerns and complying with international standards is crucial for reducing export rejection and maintaining market access. These efforts are essential for India to expand its market share, diversify its export destinations, and establish a more stable presence in the global market for fruits and vegetables.

♦♦♦

7 Spices

Globally, India is the top spice producer, consumer, and exporter. In 2022-23, its spices production reached 11.83 million tons (GOI 2024a). In the realm of Indian spice exports, dried capsicum, nutmeg, cumin, and turmeric play a dominant role, with each commanding a substantial share of the global market. Specifically, Indian exports of dried capsicum accounts for 61.9%, nutmeg for 62.8%, cumin for 82%, and turmeric for 62.8% of their respective global exports. This chapter presents a comprehensive analysis of exports of these four spices.

7.1 Major global exporters

India dominates the global export of dried capsicum. In 2022, it exported dried capsicum valued at US$0.84 billion (Table 24). China and Peru account for 17 and 12% of the global market, respectively. Other exporting countries include Mexico, Myanmar, Germany, Zambia, Pakistan, the Netherlands, and Vietnam. Indonesia is the predominant exporter of nutmeg. In 2022, the country exported nutmeg valued at US$0.091 billion (Table 24). India is also a significant contributor, exporting US$0.02 billion worth of nutmeg. Sri Lanka accounts for over 6% of the global market. Additional exporters include the UAE, the Netherlands, Germany, and Belgium. India occupies a predominant position in the global cumin market (Table 24). In 2022, it exported cumin valued at US$0.46 billion. Other exporting countries include Syria, Turkey, Pakistan, the USA, Brazil, Spain, and China. India is the global leader in turmeric exports, accounting for about 63% of the global turmeric exports (Table 24). Myanmar, the Netherlands, Fiji, Indonesia, Germany, Vietnam, Bangladesh, and the USA also export turmeric.

Table 24. Major global exporters for spices, 2022

Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Dried capsicum	India	1	0.84	61.91
	China	2	0.17	12.14
	Peru	3	0.12	9.16
	Others		0.22	16.77

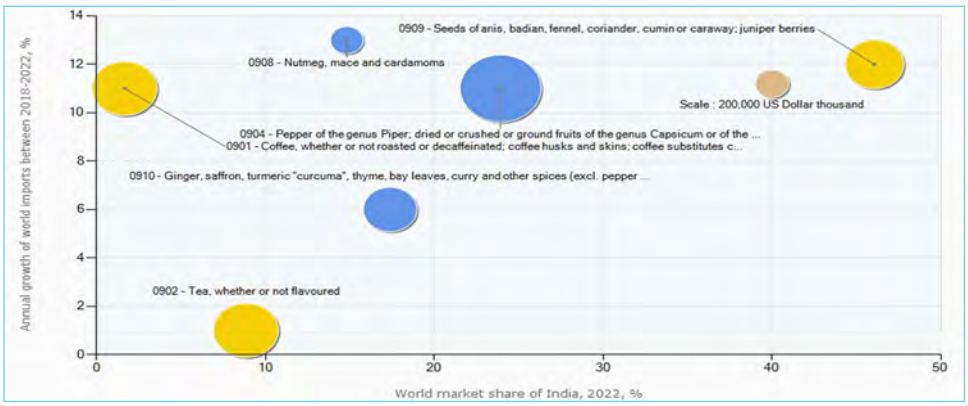
Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Nutmeg	Indonesia	1	0.09	62.80
	India	2	0.02	12.61
	Sri Lanka	3	0.01	6.16
	Others		0.03	18.42
Cumin	India	1	0.46	82.02
	Syria	2	0.02	3.19
	Turkey	3	0.02	3.15
	Others		0.66	11.62
Turmeric	India	1	0.21	62.78
	Myanmar	2	0.02	5.04
	Netherlands	3	0.01	4.19
	Others		0.09	27.97

Source: Based on INTRACEN database.

7.2 India in the global spices basket

India maintains its predominant position in the global spice export market (Figure 22). It holds the largest share (40%) of the exports of seed spices, such as anise, fennel, and coriander (HS-0909). Its share in the exports of pepper and capsicum (HS-0904) is estimated to be approximately 15%. India holds a share slightly exceeding 10% in exports of ginger, saffron, turmeric, and other spices (HS-0910) and the nutmeg, mace, and cardamom markets (HS-0908).

Figure 22. India's penetration in the global market and growth in international demand for spices, 2022



Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share of this product. The yellow bubble signifies a decline in India's global market share.
Source: INTRACEN database.

7.3 Mapping of major commodity exports

India has established itself as a major player in the global spice export market, with notable shipments of dried capsicum, nutmeg, cumin, and turmeric. Dried capsicum exports alone amounted to US$844.3 million. China is the leading destination, receiving 36.5% of India's dried capsicum exports, while Thailand and Sri Lanka import 16.5% and 12.5%, respectively (Table 25).

India's nutmeg exports reached US$18.4 million in 2022. The UAE is the predominant importer, accounting for 55.9% of India's nutmeg exports, followed by the USA, Vietnam, Iraq, and Brazil. The favorable tariff structures in these countries provide a conducive environment for the potential expansion of Indian nutmeg exports.

In 2022, India exported cumin worth US$459.5 million, with China emerging as the primary importer, accounting for a 24% share. Notably, China's cumin imports have increased by 232% between 2018 and 2022. Other significant importers include Bangladesh, the USA, the UAE, and Afghanistan.

In 2022, India's turmeric exports amounted to $214.8 million, with Bangladesh and the USA as key importers, accounting for 13.1% and 11.3% of the total, respectively.

Table 25. India's major spices importers, 2022

Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ ton)	Annual export growth in quantity (2018-22, %)	Share of partners in global imports (%)	Tariff faced by India (%)
Dried capsicum	Total exports	844.30	100.0	320.23	2637	2	100.0	-
	China	308.48	36.5	115.97	2660	35	21.4	10
	Thailand	139.45	16.5	49.67	2807	-5	12.4	10
	Sri Lanka	105.33	12.5	46.47	2266	-3	6.9	18.7
	Indonesia	92.96	11.0	32.30	2878	2	6.1	4.1
	Bangladesh	72.45	8.6	33.12	2187	93	4.5	15
Nutmeg	Total exports	18.35	100.0	2.38	7700	1	100.0	-
	UAE	10.25	55.9	1.31	7804	16	7.8	5
	USA	1.04	5.7	0.11	9560	6	4.2	0
	Vietnam	0.75	4.1	0.07	10053	-41	13.4	5
	Iraq	0.56	3.1	0.12	4683	32	1.3	-
	Brazil	0.53	2.9	0.07	7571	43	1.7	10

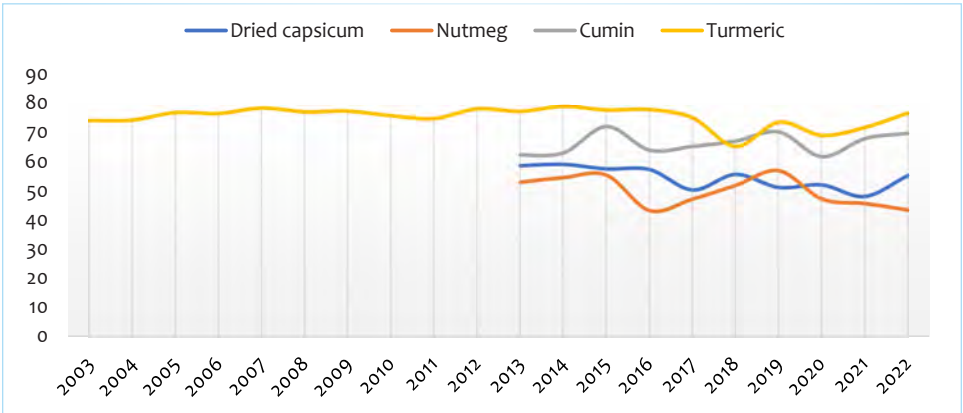
Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ ton)	Annual export growth in quantity (2018-22, %)	Share of partners in global imports (%)	Tariff faced by India (%)
Cumin	Total exports	459.53	100.0	178.26	2578	1	100.0	-
	China	110.31	24.0	37.98	2904	232	21.0	7.5
	Bangladesh	64.94	14.1	35.43	1833	7	12.8	25
	USA	23.71	5.2	7.72	3070	-3	5.9	0
	UAE	23.53	5.1	9.43	2493	5	4.6	5
	Afghanistan	22.76	5.0	8.57	2654	15	4.5	10
Turmeric	Total exports	214.81	100.0	160.74	1336	7	100.0	-
	Bangladesh	28.17	13.1	28.22	998	77	7.7	7.5
	USA	24.34	11.3	7.01	3469	0	13.4	0
	UAE	19.88	9.3	18.50	1075	36	2.5	5
	Morocco	11.78	5.5	10.23	1152	1	4.2	6.3
	Iran	10.67	5.0	10.36	1030	-20	8.0	10

Source: Based on INTRACEN database.

7.4 Market diversification

India's exports of turmeric are the most consistent and widespread, maintaining a robust market presence despite demand fluctuations (Figure 23). Exports of dried capsicum initially exhibited stability but post-2013 experienced significant variability. Nutmeg exports showed a notable decrease from 2013 to 2016, encountering challenges in maintaining market share, with only a partial recovery by 2022. In contrast, cumin exhibited expansion and successful market penetration, particularly between 2013 and 2019, maintaining a robust export presence despite fluctuations.

Figure 23. India's spatial export diversification for spices (%)



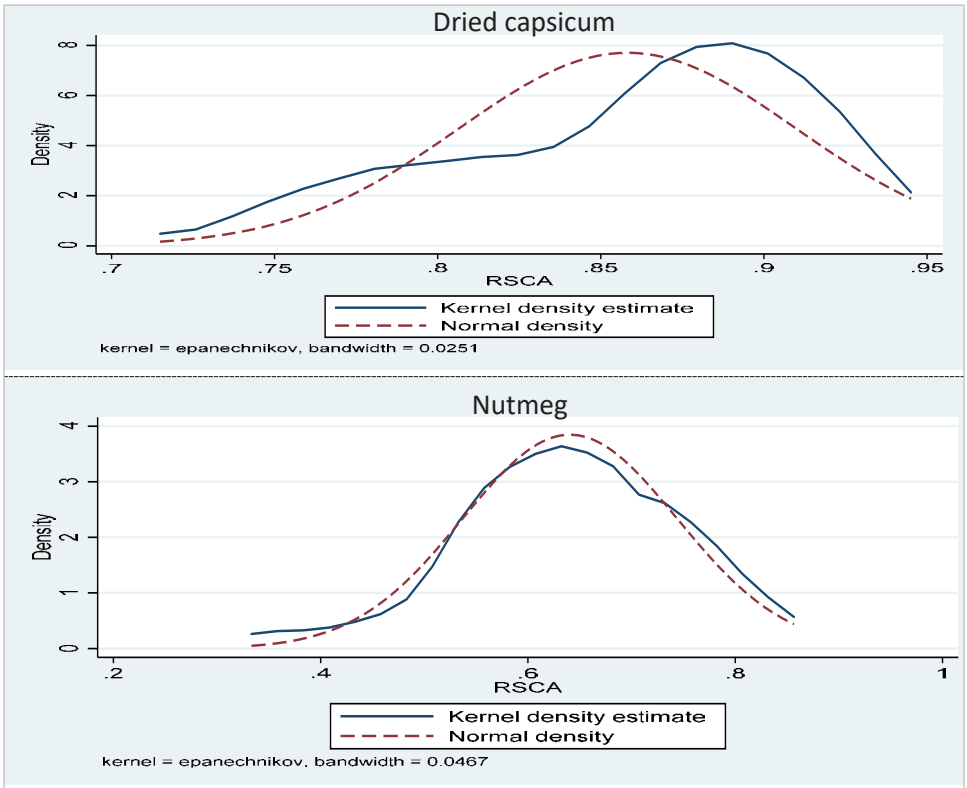
Source: Computed by authors.

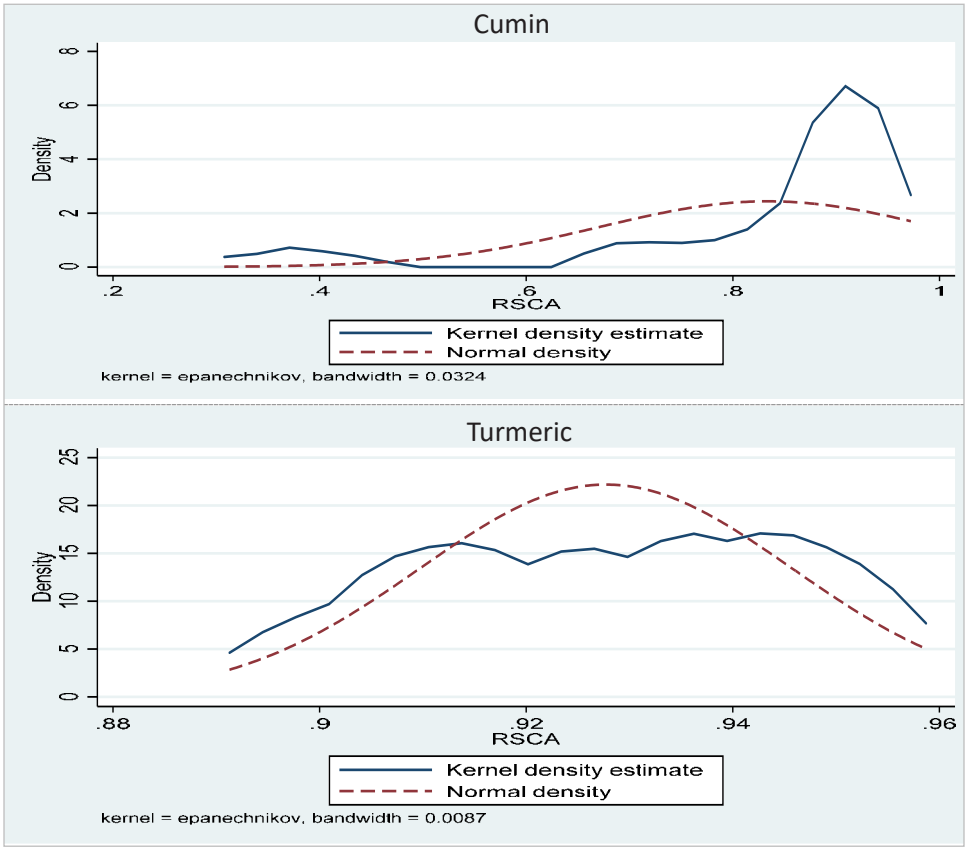
7.5 Comparative advantages

The competitiveness of dried capsicum exports from India has undergone a substantial transformation over time. Historically, India has held the dominant position in the global dried capsicum market. However, India's share of global dried capsicum exports declined from 2003 to 2013 and Vietnam and Indonesia emerged as formidable competitors. Studies conducted by Thomas and Sanil (2019), and Sebastian and Praveen (2019) have documented this shift, noting that India's comparative advantage in the export of dried capsicum has diminished relative to other Asian countries. Nevertheless, more recent data suggest a resurgence in India's exports of dried capsicum (Figure 24).

India's position in the global nutmeg market is characterized by volatility. According to Thomas and Sanil (2019), India's nutmeg export competitiveness exhibited variations, reaching peaks in the mid-2000s as well as in 2009 and 2016 (Figure 24). However, these periods of comparative advantage could not be sustained, indicating the challenges in maintaining a consistent competitive edge in the global market.

Figure 24. Kernel density distributions of RSCA for spices





Source: Computed by authors.

India's comparative advantage in cumin exports has demonstrated a robust and evolving trend. During the early 2000s, its comparative advantage fluctuated; however, from 2005 onwards, there was a substantial improvement, resulting in a stable and dominant position in the global cumin market by 2008. This development reflects India's advancements in agricultural practices and seed quality, a perspective corroborated by Shinoj and Mathur (2006).

India's turmeric exports consistently demonstrate a strong comparative advantage, which can be attributed to consistent production, established export channels, and robust global demand.

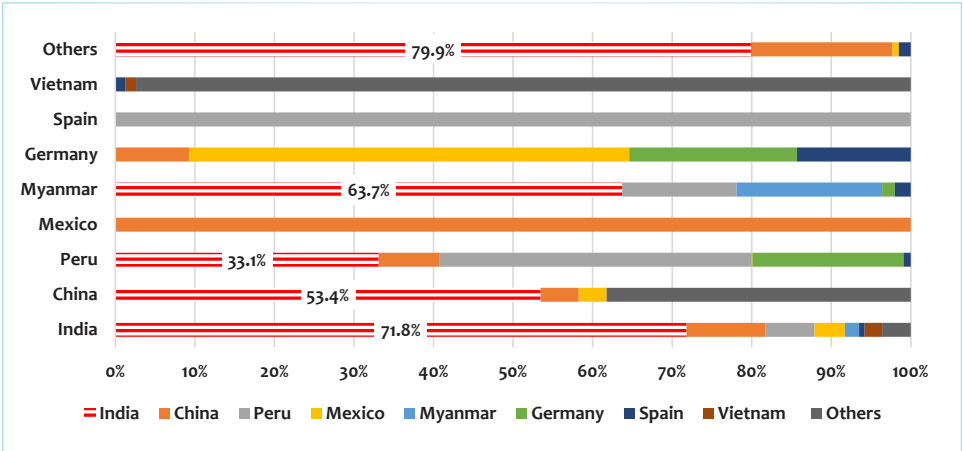
7.6 Export projections

Dried capsicum

An analysis of dried capsicum export trends from 2013 to 2022 highlights patterns in trade retention and changes among major global exporters. India

retains 71.8% of its exports (Figure 25), gaining market share from China, Myanmar, and Peru. This emphasizes India's leading position and growing influence on the dried capsicum market. China, the second-largest exporter, has a low self-retention probability, suggesting substantial trade shifts to its competitors.

Figure 25. Transitional probabilities in global exports of dried capsicum, 2013-22



Source: Computed by authors.

India is projected to maintain its dominant position in the global dried capsicum market (Table 26). Thus, China is expected to secure its second position. These projections indicate a decline in market shares for Peru, and Myanmar. Concurrently, Mexico, Germany, Spain, and Vietnam are expected to maintain marginal market shares.

Table 26. Projected export shares of major trading nations for dried capsicum (%)

	India	China	Peru	Mexico	Myanmar	Germany	Spain	Vietnam	Others
2022	62.1	12.2	8.9	3.8	2.0	1.7	0.9	0.7	7.8
2030	61.0	13.0	8.1	4.0	1.4	2.0	0.9	1.3	8.4

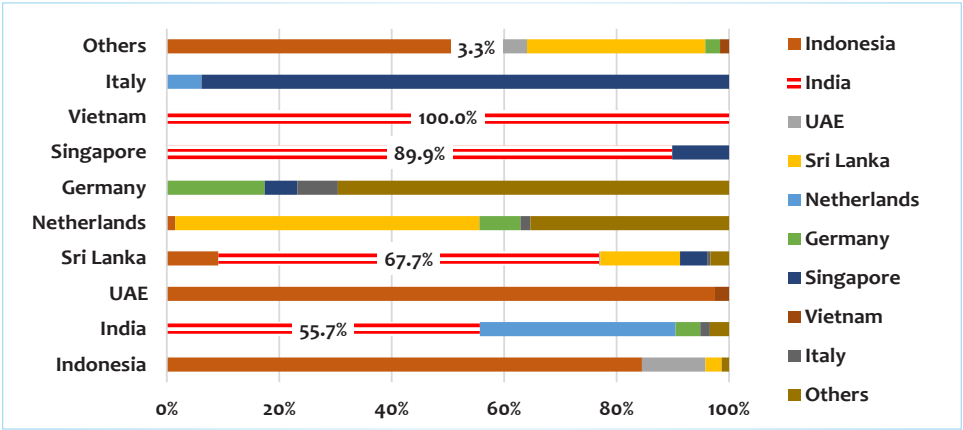
Source: Computed by authors.

Nutmeg

Indonesia, as the primary producer and exporter of nutmeg, demonstrates a high self-transitioning export probability of approximately 0.85 (Figure 26). India maintains a substantial portion of its exports at 55.7% while concurrently experiencing a significant loss of trade (34.8%) to the Netherlands. In contrast,

the UAE, Vietnam, and Italy exhibit zero self-transitioning export probability. Similarly, Sri Lanka, Germany, and Singapore display minimal self-transition probability. It is noteworthy that India acquires substantial market share from Vietnam (100%), Singapore (90%), and Sri Lanka (68%).

Figure 26. Transitional probabilities in global exports of nutmeg, 2013-22



Source: Computed by authors.

According to the market share predictions for nutmeg, Indonesia is likely to retain its leading position (Table 27). India is expected to remain in second place, despite a decline in its market share. The UAE, Sri Lanka, and Netherlands are anticipated to be steady in terms of their market share.

Table 27. Projected export shares of major trading nations for nutmeg (%)

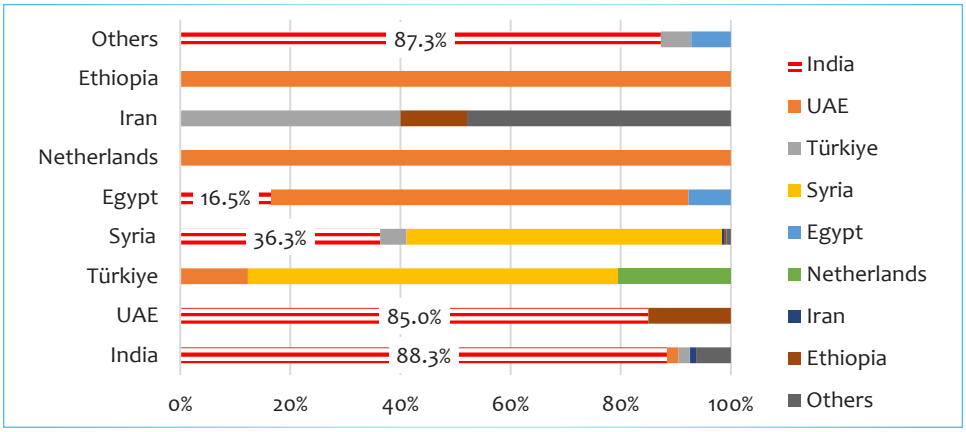
	Indonesia	India	UAE	Sri Lanka	Netherlands	Germany	Singapore	Vietnam	Italy	Others
2022	63.1	12.7	8.3	6.2	2.7	1.2	0.8	0.6	0.6	3.8
2030	63.8	12.0	7.5	6.2	4.2	1.1	0.8	0.3	0.4	3.7

Source: Computed by authors.

Cumin

India maintains a strong hold on its cumin exports, preserving 88.3%, despite minor losses to the UAE and Turkey (Figure 27). The Syria also maintains a significant share of its exports at 57.3%, although it cedes 36.3% of its market share to India. Notably, countries such as the UAE, Turkey, the Netherlands, Iran, and Ethiopia exhibit no self-transition probabilities. The Netherlands and Ethiopia lose their exports to the UAE. In the global cumin market, India gains substantial shares from other countries, including 85% from the UAE, 36.3% from Syria, and 17% from Egypt.

Figure 27. Transitional probabilities in global exports of cumin, 2014-22



Source: Computed by authors.

According to projections, India is anticipated to maintain its dominant position in cumin exports, consistently accounting for approximately 82% of its market share (Table 28). Other nations, including the UAE, Turkey, and the Syria, are expected to retain their current export shares. This trend is likely to extend to Egypt, the Netherlands, Iran, and Ethiopia.

Table 28. Projected export shares of major trading nations for cumin (%)

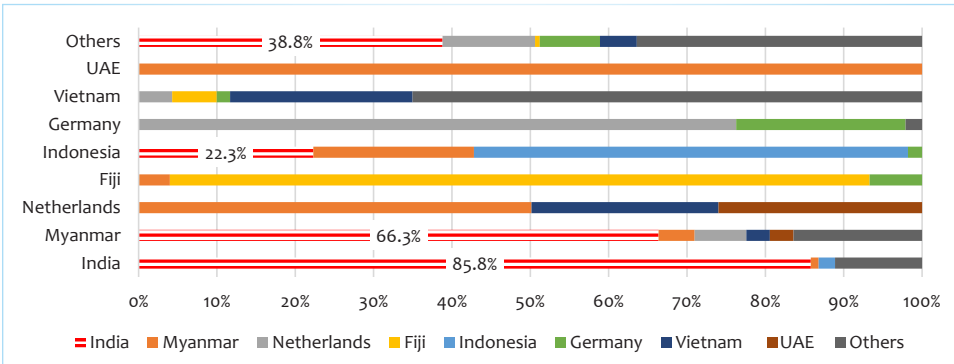
	India	UAE	Türkiye	Syria	Egypt	Netherlands	Iran	Ethiopia	Others
2022	82.3	4.2	3.2	3.0	0.8	0.7	0.6	0.5	4.6
2030	81.6	3.6	2.5	3.9	0.5	0.5	0.9	0.7	5.6

Source: Computed by authors.

Turmeric

India maintains a dominance in turmeric exports (Figure 28). It is poised to strengthen its position by capturing significant market share from Myanmar and

Figure 28. Transitional probabilities in global exports of turmeric, 2012-22



Source: Computed by authors.

Indonesia. India is projected to acquire 66.3% of Myanmar's market share and 22.3% of Indonesia's share. This underscores India's competitive advantage and ability to meet the growing international demand for turmeric.

Among the turmeric exporters, Fiji demonstrates the strongest self-retention rate at 89%, experiencing only minor export losses to Germany and Myanmar. On the other hand, the Netherlands saw its exports primarily diverted to Myanmar and the UAE. Indonesia has managed to retain more than half of its exports, with some trade shifting to India and Myanmar.

Table 29. Projected export shares of major trading nations for turmeric (%)

	India	Myanmar	Netherlands	Fiji	Indonesia	Germany	Vietnam	UAE	Others
2022	62.7	5.0	4.2	2.9	2.7	2.2	2.1	1.7	16.4
2030	66.3	4.5	3.5	2.4	3.2	1.8	2.2	1.1	15.0

Source: Computed by authors.

Commencing with a 62.7% share in global turmeric exports in 2022, India's share is anticipated to steadily increase to 66.3% by 2030 (Table 29). Myanmar and the Netherlands are projected to maintain smaller yet consistent shares. Other nations, including Fiji, Indonesia, Germany, Vietnam, and the UAE are expected to occupy minor positions in the global turmeric export market.

7.7 Export rejections

Indian nutmeg shipments have faced fewer rejections in the USA, mainly due to microbial contamination. However, the EU turned away more shipments during 2006-2010 and 2016-2020. The main reasons for rejection in the EU are the presence of mycotoxins (especially aflatoxins), product adulteration, and problems with labelling or documentation.

The frequency of rejection of Indian cumin by the USA has differed over time. From 2001 to 2005, there were 21 instances of rejection, which increased substantially to 159 between and 2011-2015. However, in recent years, this number has decreased significantly to less than 15. The primary factors behind rejection were the presence of biological contaminants (particularly Salmonella), excessive levels of pesticide residues, improper labelling or documentation, and unhygienic or decomposed conditions. The rejection of Indian cumin consignments by the EU has recently surged, rising from 10 between 2016 and 2020, to 47 between 2021-2023. The main cause of rejection, accounting for 75% of the instances, was the detection of pesticide residues above the permissible limits. The presence of biological contaminants, use of unapproved colors or additives, incorrect labelling, and insufficient documentation are other causes of rejection.

Indian turmeric consignments also faced increased rejection by the US, from

34 rejections during 2001-2005 to 91 during 2006-2010. Subsequently, these declines remain below 25 between 2021 and 2023. These rejections were primarily attributed to contamination by microorganisms, incorrect or inadequate labelling and documentation, and the detection of harmful substances. Rejections by the EU were comparatively lower, but increased to 29 between 2021 and 2023. The primary reasons for these rejections included high levels of pesticide residues, the presence of mycotoxins, and problems with labelling or documentation.

Table 30. Rejections of spices consignments by the USA and EU

Country	Reasons		2001-05	2006-10	2011-15	2016-20	2021-23
Nutmeg							
EU	Reasons	Aflatoxin/ mycotoxin	2	20	24	8	1
		Others	0	9	7	20	0
	No. of rejections		2	21	29	18	1
USA	Reasons	Salmonella	2	1	0	8	3
		Others	4	0	0	1	3
	No. of rejections		4	1	0	9	6
Cumin							
EU	Reasons	Pesticide residue	0	0	5	7	35
		Others	0	5	2	3	12
	No. of rejections		0	3	7	10	47
USA	Reasons	Salmonella	18	81	142	11	12
		Others	5	53	29	5	0
	No. of rejections		21	131	159	15	12
Turmeric							
EU	Reasons	Aflatoxin/ mycotoxin	1	9	7	1	4
		Others	11	4	3	12	25
	No. of rejections		12	13	10	13	29
USA	Reasons	Salmonella	33	86	38	10	18
		Others	1	11	26	14	3
	No. of rejections		34	91	62	23	20

Note: The number of rejections may not tally due to multiple reasons for a given consignment or commodity.
Source: Computed by the authors based on the USFDA and EURASFF databases.

Key Extracts

India's dominant position in the global spices export market, particularly for dried capsicum, nutmeg, cumin, and turmeric, has significant implications for international trade. The projected market shares for these spices suggest potential economic benefits and increased foreign exchange earnings for India. However, recurring export rejection due to issues such as contamination, pesticide residues, and labelling problems highlight the need for improved quality control measures and adherence to international food safety standards. Addressing these challenges could further strengthen India's comparative advantage and ensure a sustained growth in global trade. Additionally, the varying levels of market retention and diversification among different spices indicate a need for targeted strategies to maintain and expand India's market presence in the face of emerging competition from other countries.

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8 Plantation crops

Plantation crops, including coconut, areca nut, rubber, coffee, tea, and cashew nuts, are cultivated under diverse agro-ecological conditions encompassing an area of 4.5 million hectares. Traditionally, India has exported tea, coffee, and cashew nuts. However, in recent years, it has been facing increased competition, particularly from countries with smaller domestic markets (Joseph 2009; Nagoor and Kumar 2010). This chapter presents a comprehensive analysis of cashew nuts, coffee and black tea, three majorly exported plantation crops from India.

8.1 Major global exporters

Vietnam dominates global exports of cashew nuts. It accounts for 62% of total exports (Table 31). India ranks as the second-largest exporter, contributing 9% (US$0.35 billion). The Netherlands, Côte d'Ivoire, Germany, and Brazil collectively constitute approximately 15% of global cashew nut exports. Nigeria and Ghana export cashew nuts, albeit in smaller quantities. Brazil has a dominant position in coffee exports, excluding roasted and decaffeinated varieties, with a total export value of US$8.51 billion (Table 31). Colombia, Vietnam, and India are also among the coffee-exporting countries.

Table 31. Major global exporters for plantation crops, 2022

Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Cashew nuts	Vietnam	1	2.51	62.21
	India	2	0.35	8.68
	Netherlands	3	0.23	5.76
	Others		0.94	23.33
Coffee	Brazil	1	8.51	28.04
	Colombia	2	3.96	13.05
	Vietnam	3	2.82	9.29
	India	12	0.76	2.48
	Others		14.30	47.12
Black tea	Kenya	1	1.35	33.37
	India	2	0.65	16.01
	Sri Lanka	3	0.64	15.82
	Others		1.41	34.78

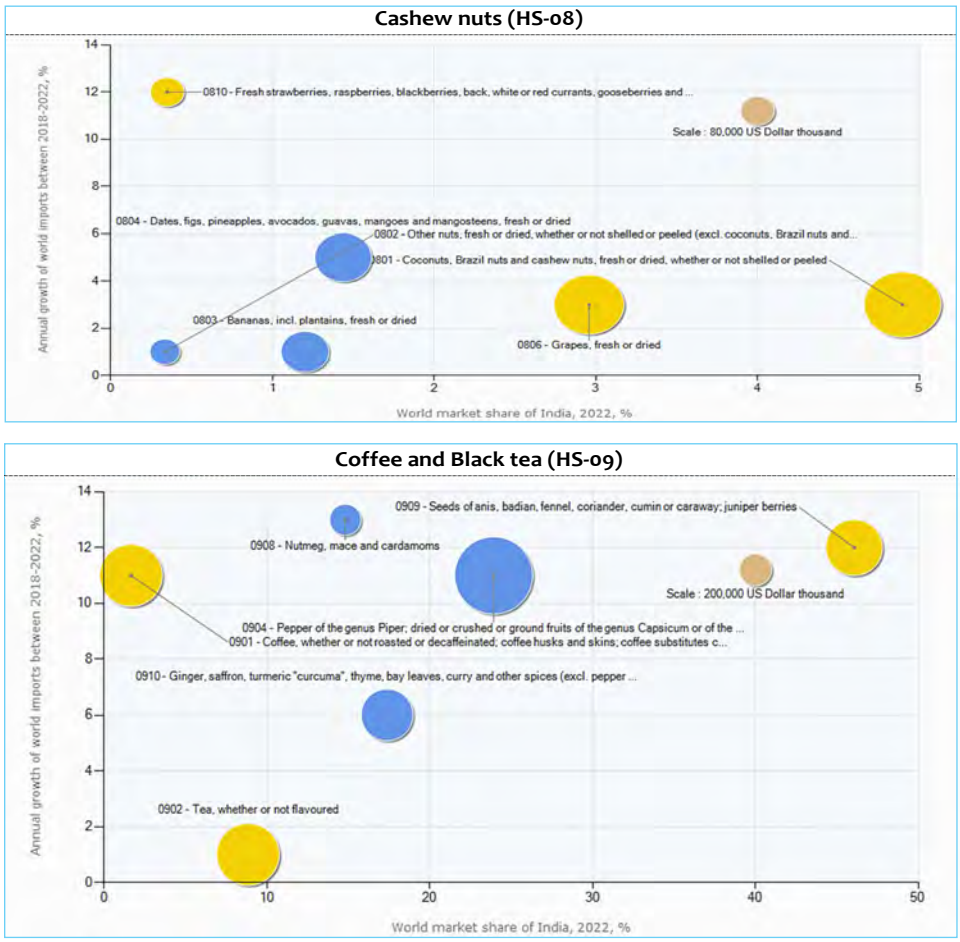
Source: Based on INTRACEN database.

In 2022, the global export market for black tea was valued at approximately US$4.05 billion, with Kenya accounting for US$1.35 billion (Table 31). India surpassed Sri Lanka to attain the second position, with exports totalling US$0.65 billion. China is also a significant exporter of black tea. Ethiopia, Malawi, Uganda, and Vietnam are other exporters of black tea.

8.2 India in the global plantation crops basket

Figure 29 illustrates India's position in the global market. For cashew nuts, which are classified under the category "coconuts, brazil nuts, and cashew

Figure 29. India's penetration in the global market and growth in international demand for plantation crops, 2022



Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share for this product. The yellow bubble signifies a decline in India's global market share of this product.

Source: INTRACEN database.

nuts" (HS-0801), India has consistently maintained an export share exceeding 4%. Indian tea continues to be a major export commodity, capturing about 10% share of the global tea market. However, the global imports have risen by about 2% annually. In contrast, India commands nearly 2% of the global coffee market, with an import growth of over 10%, indicating robust international demand.

8.3 Mapping of major commodity exports

In 2022, cashew nut exports from India totaled US$350.6 million, with the UAE accounting for 36.7% (Table 32). The UAE's import price (US$7,481/ton) is lower compared to other importers like Japan (US$8,024/ton) and Spain (US$8,581/ton). Notably, India's share of global cashew nut exports has decreased between 2018 and 2022.

Table 32. India's major importers for plantation crops, 2022

Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ton)	Annual export growth in quantity (2018-22 (%))	Share of partners in global imports (%)	Tariff faced by India (%)
Cashew nuts	Total exports	350.6	100.0	46.2	7588	-9	100.0	-
	UAE	128.8	36.7	17.2	7481	5	4.7	5
	Netherlands	37.5	10.7	5.2	7143	-13	7.2	0
	Japan	35.3	10.1	4.4	8024	-11	2.0	0
	Saudi Arabia	34.2	9.8	4.5	7670	-11	2.1	5
	Spain	16.9	4.8	1.9	8581	-10	2.2	0
Coffee	Total exports	755.8	100.0	269.9	2800	5	100.0	-
	Italy	142.5	18.9	59.5	2395	-5	7.1	0
	Germany	119.7	15.8	41.5	2881	8	14.6	0
	Belgium	87.9	11.6	28.3	3109	14	4.9	0
	Jordan	57.2	7.6	16.0	3566	18	0.4	20
	UAE	33.9	4.5	11.5	2953	48	0.4	0
Black tea	Total exports	647.8	100.0	210.7	3074	-6	100.0	-
	UAE	147.9	22.8	42.1	3519	23	5.0	0
	Russia	88.6	13.7	43.9	2020	-5	8.0	0
	Iran	85.1	13.1	24.7	3437	-11	13.9	20
	UK	41.4	6.4	11.2	3694	-8	6.9	0
	Germany	31.3	4.8	7.8	3991	-3	2.8	0

Source: Based on INTRACEN database.

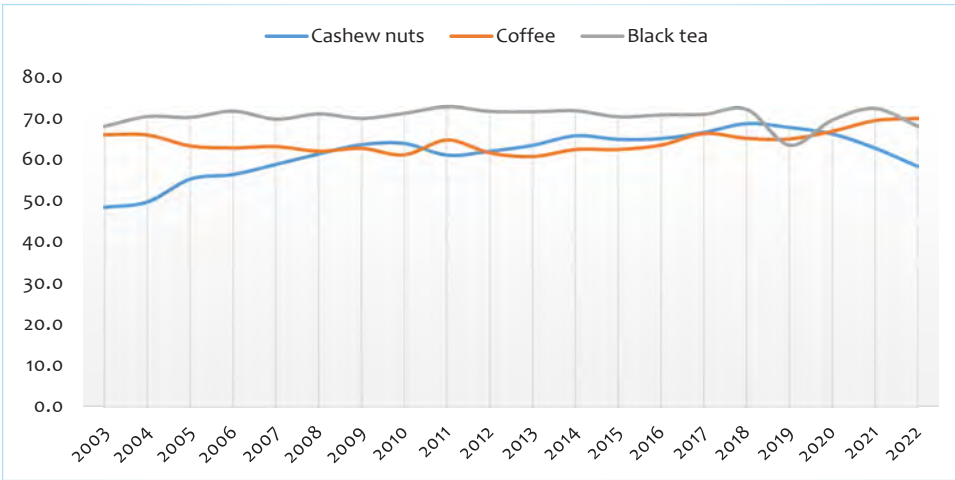
Indian coffee exports reached US$755.8 million in 2022, with an annual increase of 5% from 2018. Italy and Germany are the primary destinations for Indian coffee, accounting for 18.9% and 15.8% of the total exports, respectively. Between 2018 and 2022, exports to Germany increased 8% annually, while exports to Italy declined by 5% annually. Significant expansion in demand for Indian coffee imports is observed in Jordan and the UAE.

India's black tea exports amounted to US$647.8 million in 2022, with the UAE as the leading importer, accounting for 22.8% of total exports. Russia and Iran follow the UAE. While the UAE increased its imports by 23%, Russia and Iran saw a decrease in their imports. The export prices of black tea show significant variation; India realized the highest price at US$3,991 per ton from Germany, whereas realized considerably less at US$2,020 per ton from Russia.

8.4 Market diversification

The export diversification index for cashew nuts showed an upward trend until 2011, reaching its highest at 63.9 in 2010 (Figure 30). This index was consistent after 2018. On the other hand, coffee exports show a more consistent pattern of diversification. Following a decrease until 2010, the diversification index improved gradually. This suggests that India has been actively seeking new markets to maintain stability in coffee exports. Black tea export diversification has shown stability, with an index hovering at around 70. Nevertheless, 2019 saw a notable drop to 63.5, which was followed by recovery in subsequent years.

Figure 30. India's spatial export diversification for plantation crops (%)

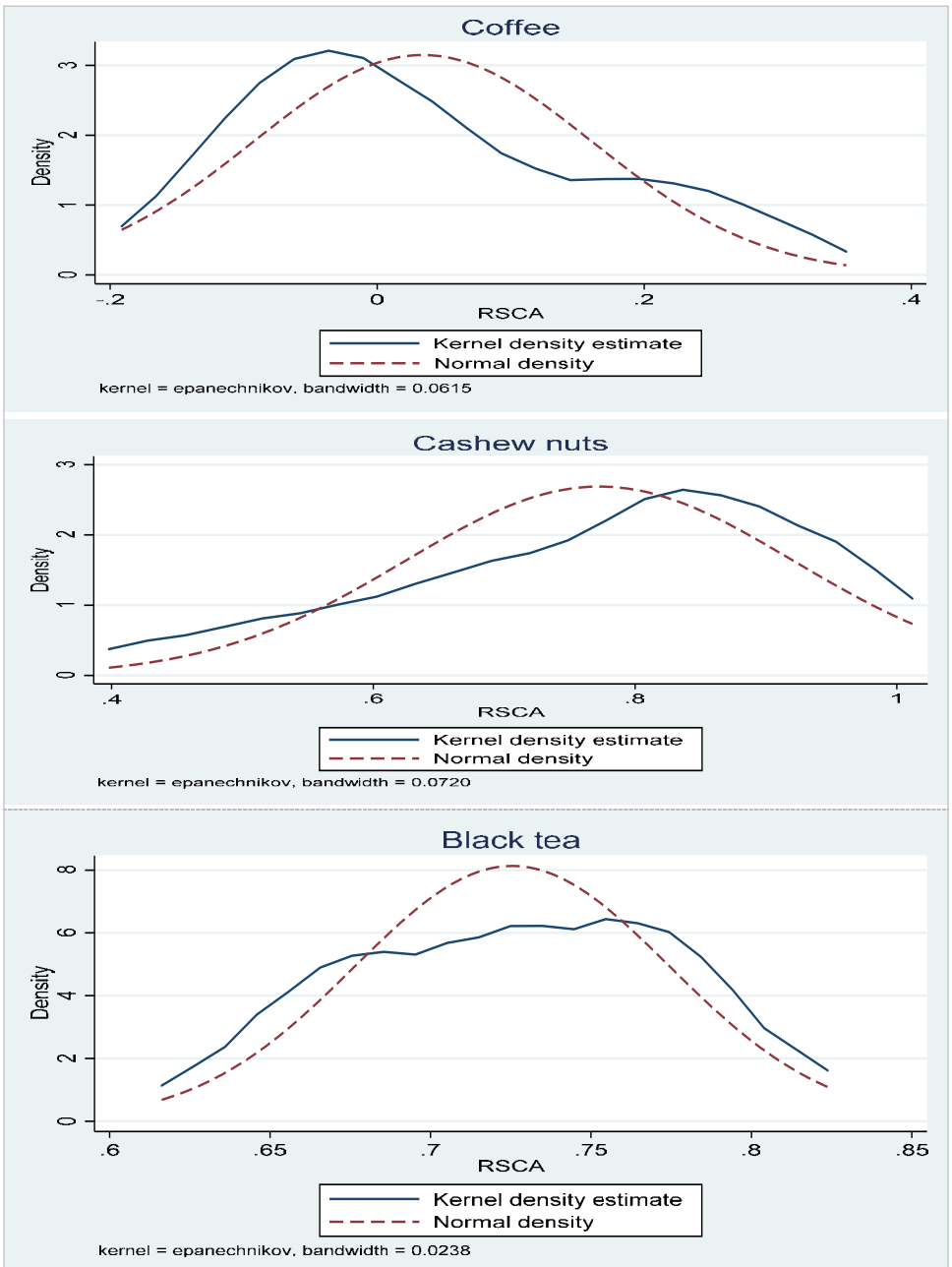


Source: Computed by authors.

8.5 Comparative advantages

India has a moderate yet favorable comparative advantage in cashew nuts exports (Figure 31), indicating that the country maintains its competitiveness,

Figure 31. Kernel density distributions of RSCA for major plantation crops



Source: Computed by authors.

potentially due to lower labor costs and established value-added processing infrastructure (Guledgudda et al. 2014). However, India's competitiveness is challenged by its dependence on imported raw cashew nuts for processing and re-exporting, as domestic production fulfils only 44% of the processing capacity (Yadav 2010). This underscores the importance of enhancing cashew nut productivity (Deepika 2015).

India's comparative advantage in coffee exports is less pronounced. Although India produces premium coffee varieties such as Robusta, it has not fully capitalized on its potential. By contrast, countries such as Germany and Belgium, which do not grow coffee themselves, have realized higher export prices by focusing on value addition and re-export strategies (ICC 2012). The lower market value of Indian coffee highlights the necessity for improved marketing strategies and product enhancement to strengthen its competitive edge in the international market (Deepika 2015; Guledgudda et al. 2014).

Among plantation crops, exports of black tea are the most competitive. Although tea exports have experienced a minor decrease, India continues to hold a prominent position in the global market. This is attributed to the country's effective pricing strategies and marketing efforts (Navitha and Sethurajan 2018).

8.6 Export projections

This projection indicates that Vietnam will maintain its position as a global leader in cashew nuts, with its export share increasing from 62.8% in 2022 to 65.9% by 2030 (Table 33). Conversely, India is anticipated to experience a slight decrease in its market share from 8.8% to 7.2%. The Netherlands, Côte d'Ivoire, the UAE, and Germany are expected to retain their shares.

Table 33. Projected export shares of major trading nations for cashew nuts (%)

	Vietnam	India	Netherlands	Côte d'Ivoire	UAE	Germany	Brazil	Nigeria	USA	Others
2022	62.8	8.8	5.8	4.3	3.8	3.8	1.6	1.2	0.6	7.1
2030	65.9	7.2	5.9	2.7	3.1	4.0	1.8	1.2	0.7	7.5

Source: Computed by authors.

Brazil is anticipated to maintain its dominant position in the global coffee industry, with its market share remaining stable at approximately 28% (Table 34). Conversely, Colombia's share is expected to decrease from 13.1% in 2022 to 12% by 2030. The market shares of Vietnam, Honduras, Ethiopia, and Peru are projected to remain constant. Likewise, India's share is forecasted to remain almost constant, at approximately 2.7%.

Table 34. Projected export shares of major trading nations for coffee (%)

	Brazil	Colombia	Vietnam	Honduras	Ethiopia	Peru	Indonesia	Belgium	India	Others
2022	28.1	13.1	9.3	5.6	5.0	3.9	3.7	3.7	2.5	25.2
2030	27.6	12.0	11.1	5.4	4.2	3.9	4.8	3.4	2.7	25.0

Source: Computed by authors.

According to projections for 2030, Kenya is expected to maintain its dominant position in the global black tea industry, controlling over 33% of the market share (Table 35). Sri Lanka and India are expected to gain marginally, at 18.5% and 16.6%, respectively. In contrast, China's share is forecasted to decrease substantially from more than 10% in 2022 to 7% by 2030.

Table 35. Projected export shares of major trading nations for black tea (%)

	Kenya	India	Sri Lanka	China	UAE	Rwanda	Vietnam	Malawi	Argentina	Others
2022	33.4	16.0	15.8	10.4	2.7	2.5	2.1	2.0	1.6	13.6
2030	33.7	16.6	18.5	7.1	1.7	1.7	2.3	2.0	1.9	14.6

Source: Computed by authors.

8.7 Export rejections

For coffee consignments from India, the USA cited various reasons for rejection, including labelling errors, unregistered producers or importers, unsanitary conditions, and the presence of unsafe additives or unauthorized substances. On the other hand, the EU's main reasons for rejecting Indian coffee shipments were the detection of mycotoxins, microbes, and pesticide residues.

Indian coffee and cashew nuts have been rejected in both the USA and EU markets. The EU turned away Indian cashew nuts primarily because of microbial contamination and the presence of foreign objects or metal pieces. Meanwhile, the USA rejected shipments because of unsanitary processing conditions, improper labelling, and the use of unsafe additives or coloring agents.

There has been an increase in the number of Indian tea shipments turned away by the USA and EU, albeit for various reasons (Table 36). In the USA, the primary causes of rejections include inaccuracies in product labels or paperwork, the discovery of unauthorized or banned substances, the use of hazardous additives, and unsanitary production conditions. However, the EU has refused shipments due to multiple factors: excessive pesticide residue levels, the detection of heavy metals, chemical contamination, and the use of unapproved additives.

Table 36. Rejection of plantation crop consignments by the USA and EU

Country	Reasons		2001-05	2006-10	2011-15	2016-20	2021-23
Coffee							
EU	Reasons	Microbial contaminant	1	0	0	4	1
		Others	0	1	0	3	1
	No. of rejections		1	1	0	5	2
USA	Reasons	Labelling/ branding	0	2	2	9	0
		Others	1	1	1	1	0
	No. of rejections		1	2	3	9	0
Cashew nuts							
EU	Reasons	Microbial contaminant	1	3	3	1	0
		Others	0	9	9	0	0
	No. of rejections		1	8	5	1	0
USA	Reasons	Filthy	0	1	5	0	0
		Others	0	0	3	2	0
	No. of rejections		0	1	6	2	0
Tea							
EU	Reasons	Pesticide residue	0	1	7	14	6
		Others	3	3	2	0	10
	No. of rejections		3	4	9	14	16
USA	Reasons	Labelling/ branding	2	4	11	46	19
		GM food/ feed/ unapproved drug	0	0	5	23	10
		Others	0	0	11	11	25
	No. of rejections		2	4	21	74	41

Note: The number of rejections may not tally due to multiple reasons for a given consignment/ commodity.

Source: Computed by the authors based on the USFDA and EURASFF databases.

Key Extracts

Examining India's standing in the global marketplace for plantation commodities such as cashew nuts, coffee, and black tea yields significant insights into the nation's export tactics and competitive edge. The varying diversification indices across these crops underscore the importance of market diversification in maintaining steady exports. India must continue to seek new markets, particularly cashew nuts and black tea, to reduce the risks linked to market concentration. Although India has a comparative advantage in the export of cashew nuts and black tea, it has encountered growing competition from other nations. This indicates the need for concentrated efforts to boost productivity, quality, and value addition in these sectors to sustain and enhance their global market position.

The forecasted market shares suggest that India may struggle to substantially expand its global presence in these crops by 2030. This implies the need for strategic interventions to increase competitiveness, such as enhancing production efficiency, investing in R&D, and improving marketing approaches. The increasing number of export rejections, especially for tea, emphasizes the need to address quality control issues, improve adherence to international standards, and enhance food safety measures throughout the supply chain to ensure continued access to key markets, such as the USA and EU. The differing price realized for Indian exports across various markets point to opportunities for price optimization and targeted marketing strategies to capture higher-value segments in specific countries. India's dependence on imported raw cashew nuts for processing indicates the need to increase domestic production to decrease vulnerability to external supply fluctuations and potentially improve profit margins.

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9 Sugar and Cotton

Globally, 80% of the sugar supply is derived from sugarcane and the rest is derived from sugar beets. India is the largest consumer and the second-largest producer of sugar globally, accounting for approximately 15% of sugar consumption and 20% of its production (GOI 2023). India is also the largest exporter, accounting for 15% of global sugar exports.

India is the 2nd largest producer of cotton, with an estimated production of 5.52 million tons in 2023-24 (GOI 2024d), and ranks fourth in global cotton exports, accounting for 5.49% of the total exports. The introduction of Bt cotton has revolutionized the cotton and textile industries in India.

9.1 Major global exporters

In 2022, India led global sugar exports with a value of US$2.8 billion (Table 37). Thailand and Brazil are the next largest exporters, each shipping sugar worth more than US$1.38 billion. France, Germany, South Africa, Egypt, and Russia are also important exporters.

The US dominates the global market for uncarded and uncombed cotton exports, with exports valued at US$9.04 billion (Table 37). Brazil is the second-largest exporter (US$3.6 billion), while India's cotton exports amount to US$1.2 billion. Although China and Pakistan are significant cotton producers, their raw cotton exports are relatively low.

Table 37. Major global exporters for sugar and cotton, 2022

Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Sugar	India	1	2.77	18.72
	Thailand	2	1.56	10.53
	Brazil	3	1.48	9.98
	Others		8.98	60.75
Cotton	USA	1	9.04	41.28
	Brazil	2	3.68	16.78
	Australia	3	3.08	14.04
	India	4	1.20	5.49
	Others		4.90	22.38

Source: Based on INTRACEN database.

9.2 India in the global sugar & cotton basket

India plays a significant role in the global sugar market (Figure 32). India accounts for 19% of the global market. Despite a 12% growth in the demand for molasses, India's molasses exports remained comparatively modest.

India's cotton export landscape presents a mixed picture, with strong performance in high-value variants and erosion of the market share of the other variants. For products such as uncarded and uncombed cotton (HS-5201) and cotton yarn containing over 85% cotton by weight (HS-5205), India holds a substantial share of the global market. However, despite growing international demand, India has experienced a decline in its market share, potentially because of increased competition. In contrast, for products such as woven fabrics of cotton weighing 200 g/m² or less (HS-5208), where India's exports are relatively small, the country has successfully expanded its market share.

Figure 32. India's penetration in the global market and growth in international demand for sugar & cotton, 2022

Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share for this product. The yellow bubble signifies a decline in India's global market share of this product.

Source: INTRACEN database.

9.3 Mapping of major commodity exports

India's sugar exports in 2022 amounted to US$2.77 billion, with Sudan being the largest buyer, accounting for 26.6% of the total (Table 38). Sudan purchased 1.43 million tons of sugar from India. Other key importers include Somalia, Djibouti, and Sri Lanka. Although Pakistan accounts for only 3.9% of India's sugar exports, it has experienced a notable increase since 2018.

India's cotton exports reached $1.2 billion in 2022, with Bangladesh being the primary recipient, accounting for 78.2% of the total. Bangladesh imported over 326 thousand tons of cotton, at an average price realized of US$2,887 per ton. Conversely, since 2018, China's cotton imports from India have fallen sharply, by 59%.

Table 38. India's major sugar & cotton importers, 2022

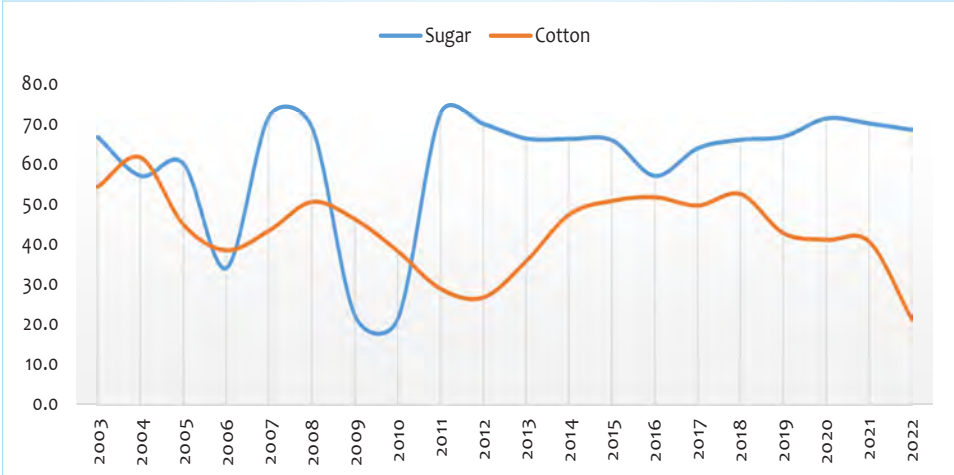
Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ ton)	Annual export growth in quantity (2018-22 (%)	Share of partners in global imports (%)	Tariff faced by India (%)
Sugar	Total exports	2767.3	100.0	5597.8	494	23	100.0	-
	Sudan	737.1	26.6	1433.4	514	23	6.4	-
	Somalia	284.2	10.3	587.1	484	20	2.1	-
	Djibouti	205.2	7.4	421.3	487	18	1.6	6.5
	Sri Lanka	115.8	4.2	231.5	500	0	1.6	12.8
	Pakistan	108.1	3.9	232.3	465	112	0.04	15.5
Cotton	Total exports	1203.8	100.0	427.5	2816	-8	100.0	-
	Bangladesh	941.9	78.2	326.3	2887	5	12.0	0
	Vietnam	100.8	8.4	43.9	2294	-5	16.0	0
	Indonesia	50.6	4.2	20.2	2505	12	5.6	0
	Oman	28.6	2.4	9.3	3079	124	0.1	5
	China	25.4	2.1	7.8	3271	-59	22.0	20

Source: Based on INTRACEN database.

9.4 Market diversification

India's export market diversification for sugar and cotton reveals varying degrees of stability and change across markets. Despite occasional downturns, India's sugar exports maintained a steady diversification (Figure 33). This indicates that, despite short-term volatility, India's sugar exports have steadily penetrated new markets.

Figure 33. India's spatial export diversification for sugar & cotton (%)



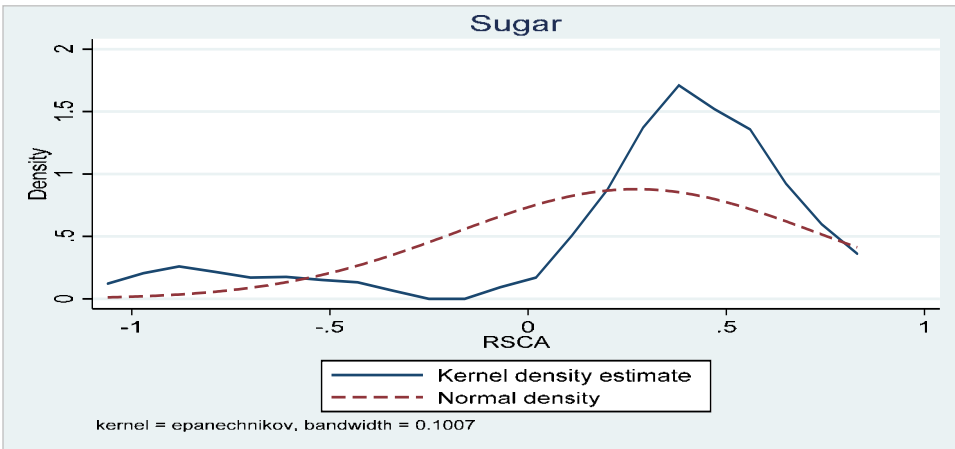
Source: Computed by authors.

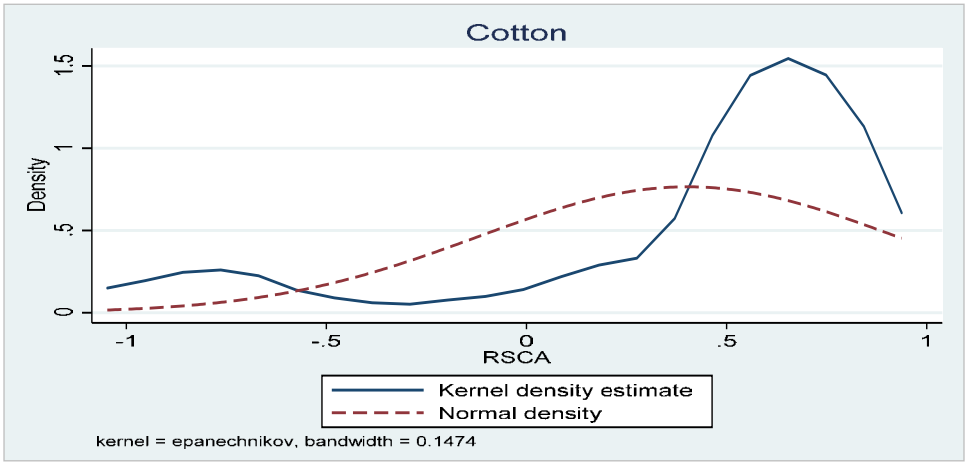
Nevertheless, the market diversification of cotton exports exhibited substantial variability, especially in the 2000s. From 2011 onwards, the diversification index has shown some stability. This trend suggests heightened competition or excessive dependence on a few importing countries such as Bangladesh and Vietnam.

9.5 Comparative advantages

Figure 34 illustrates the variations in India's comparative advantages in sugar and cotton exports. Brazil and Thailand have emerged as competitors in the global sugar market. Nevertheless, India has maintained its standing by capitalizing on its advantageous geographical position and competitive pricing strategies (Narayan and Bhattacharya 2019).

Figure 34. Kernel density distributions of RSCA for sugar & cotton





Source: Computed by authors.

In the early 2000s, India encountered significant challenges in effectively competing with the global cotton market because of its low productivity. However, a substantial shift occurred in 2005, when India's competitiveness improved markedly. This transformation was primarily due to the implementation of more liberal export policies and the elimination of restrictions (Suresh and Mathur 2016). India has emerged as a prominent exporter of cotton, capitalizing on robust global demand.

9.6 Export projections

Forecasts for the global sugar market share indicate that India will continue to be a key player, with its share increasing from 19.1% in 2002 to 24.0% in 2030 (Table 39). Although Thailand and Brazil will maintain their positions, their share is predicted to decrease slightly. Despite having smaller shares, countries such as France, Germany, Guatemala, Saudi Arabia, Morocco, and the UAE are expected to experience improvements in their market share.

Table 39. Projected export shares of major trading nations for sugar (%)

	India	Thailand	Brazil	France	Germany	Guatemala	Saudi Arabia	Morocco	UAE	Others
2022	19.1	10.8	10.2	7.5	5.9	3.1	3.1	3.0	2.8	34.4
2030	24.0	8.0	9.8	6.2	4.6	3.7	3.4	3.9	3.8	32.7

Source: Computed by authors.

Forecasts of cotton exports from 2022 to 2030 reveal changes in the market share of key exporters. While the USA retains its dominant position, the shares of Brazil and Australia are predicted to decrease (Table 40). Conversely, India's contribution is anticipated to increase significantly, from 5.5% to 13.4%, by

2030. Other countries, such as Greece, Benin, Burkina Faso, and Turkey, are expected to continue playing a small but consistent role in the global cotton export market.

Table 40. Projected export shares of major trading nations for cotton (%)

	USA	Brazil	Australia	India	Greece	Benin	Burkina Faso	Türkiye	Others
2022	41.4	16.8	14.1	5.5	3.0	2.4	2.1	1.8	12.8
2030	38.7	12.0	10.1	13.4	2.9	2.7	2.2	1.1	17.0

Source: Computed by authors.

Key Extracts

An analysis of India's sugar and cotton export trends implies significant opportunities and challenges for the country's agricultural export sector. India's strong position in the global sugar market, with a projected increase in market share to 24% by 2030, suggests potential for sustained economic growth and increased foreign exchange earnings. However, the declining market diversification in cotton exports, coupled with increased reliance on a few key markets, such as Bangladesh, indicates a need for strategic interventions to broaden the export base and mitigate risks associated with market concentration. The fluctuating comparative advantage in cotton exports, particularly post-COVID-19, implies the need for policy measures to enhance competitiveness and adapt to changing global market dynamics. These trends underscore the importance of continuous innovation, market diversification strategies, and adaptive trade policies to maintain and strengthen India's position in the global agricultural commodity markets.

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10 Livestock and Fisheries

Over the past three decades, global demand for animal-source foods, including milk, meat, eggs, and fish, has increased significantly. The livestock sector has emerged as a rapidly growing industry with an annual growth rate of 7.38% in the past decade. Its contribution to agricultural gross value added (GVA) increased from 24.32% in 2014-15 to 30.38% in 2022-23 (GOI 2024b). While India's share in global dairy product exports remains minimal, it contributes approximately 10% of global bovine meat exports. India's seafood industry has also flourished, contributing 6.72% of the agricultural GVA in 2022-23. India is the second-largest exporter of shrimp and prawns, accounting for 22% of global exports. It also holds the second position in cuttlefish exports, with a market share of 10%. This chapter presents a comprehensive analysis of bovine meat, shrimp and prawns, and cuttlefish, majorly exported livestock and fisheries products from India.

10.1 Major global exporters

With an export value of US$10.9 billion, Brazil maintains a dominant position in bovine meat exports (Table 41). After Brazil, the USA, Australia, and India represent the next most significant exporters. India has emerged as a prominent supplier to Middle Eastern and Southeast Asian markets.

Table 41. Major global exporters for livestock and fisheries products, 2022

Commodities	Major global exporters	Global ranking	Exports (US$ billion)	Share in world exports (%)
Bovine meat	Brazil	1	10.92	30.75
	USA	2	4.57	12.88
	Australia	3	4.26	11.99
	India	4	2.86	8.05
	Others		12.89	36.31
Shrimp and prawns	Ecuador	1	7.77	34.42
	India	2	4.80	21.25
	Vietnam	3	2.26	9.99
	Others		7.75	34.33
Cuttlefish	China	1	2.31	30.96
	India	2	0.73	9.72
	Indonesia	3	0.59	7.84
	Others		3.84	51.46

Source: Based on INTRACEN database.

Ecuador occupies a preeminent position in the global shrimp and prawns export market, with exports valued at US$7.7 billion in 2022 (Table 41). India follows in close proximity, with exports valued at US$4.8 billion, which is attributed to its robust aquaculture sector. Vietnam and Indonesia are also significant contributors to the global seafood market.

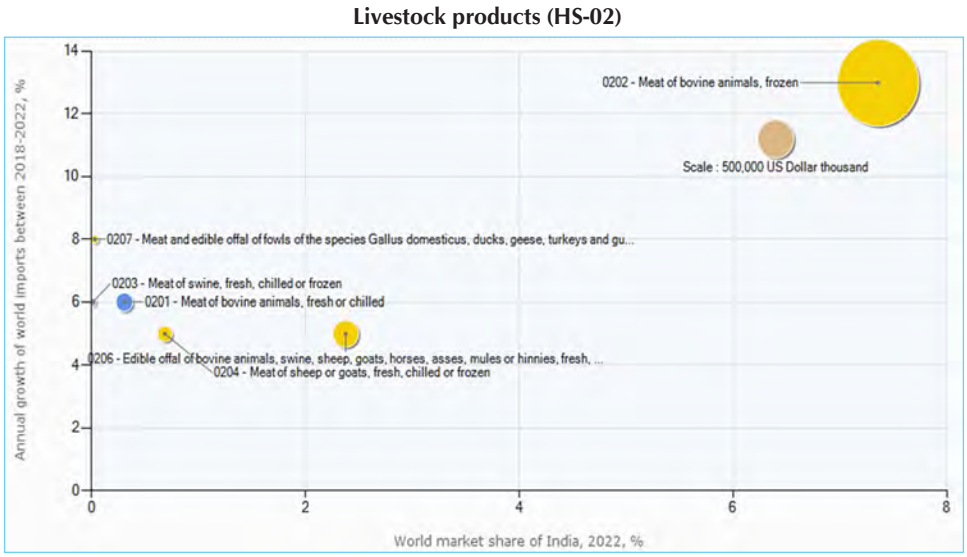
China dominates global cuttlefish exports, accounting for US$2.3 billion worth of cuttlefish exports by 2022 (Table 41). India occupies the second position with exports valued at US$0.727 billion. The other significant exporters include Indonesia, Peru, and Spain. This distribution demonstrates the concentration of cuttlefish exports in a limited number of countries.

10.2 India in the global livestock & fisheries products basket

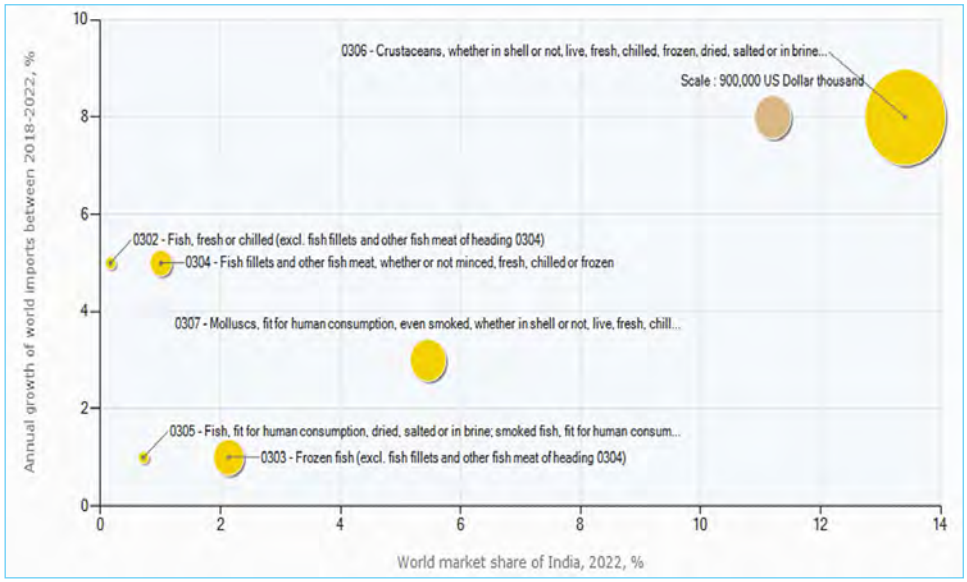
Frozen bovine meat (HS-0202) is the leading export product within the HS-02 meat category, accounting for 8% of global meat exports. Between 2018 and 2022, its exports grew at an annual rate of roughly 12% (Figure 35). Exports of fresh or chilled bovine meat, poultry, and edible organ meats, show slight increases.

India's crustacean exports (HS-0306) constitute 13% of the global market. However, due to intense competition, India's share of the crustacean market has declined. Conversely, the market shares of fish fillets and other fish meat products (HS-0304) has experienced a modest increase.

Figure 35. India's penetration in the global market and growth in international demand for livestock & fisheries products, 2022



Fisheries products (HS-03)



Note: The bubble size corresponds to the export value. The blue bubble indicates an increase in India's global market share for this product. The yellow bubble signifies a decline in India's global market share of this product.

Source: INTRACEN database

10.3 Mapping of major commodity exports

Malaysia is the primary importer of Indian bovine meat, accounting for approximately 17% of the country's exports. Since 2018, a significant annual increase of 11% has been observed (Table 42). Egypt is the second largest importer, representing 16% of India's bovine meat exports. Indonesia and Iraq have maintained consistent demand for Indian bovine meat. Conversely, Vietnam's imports from India have decreased substantially.

Shrimp and prawns constitute the predominant component of India's seafood exports, with a value of US$4.8 billion in 2022. The USA is the primary destination, receiving 39.4% of India's exports, followed by China (18.2%). Other significant importers of Indian seafood include Japan, Vietnam, and Belgium.

Spain is the leading importer with a 28% share of India's cuttlefish exports. Italy, Thailand, and the USA are significant buyers of Indian cuttlefish.

Table 42. India's major livestock & fisheries products importers, 2022

Commodities	Countries	Exports (US$ million)	Share in India's exports (%)	Quantity exported (Thousand tons)	Unit value (US$/ ton)	Annual export growth in quantity (2018-22 (%))	Share of partners in global imports (%)	Tariff faced by India (%)
Bovine meat	Total exports	2859.5	100.0	1036.3	2759	-2	100.0	-
	Malaysia	489.4	17.1	173.4	2823	11	1.8	0
	Egypt	461.9	16.2	174.2	2652	56	2.8	0
	Vietnam	426.3	14.9	141.4	3015	-32	2.1	12
	Indonesia	336.9	11.8	113.8	2961	6	2.1	5
	Iraq	217.9	7.6	92.6	2353	8	0.6	-
Shrimp and prawns	Total exports	4797.5	100.0	632.3	7587	2	100.0	-
	USA	1888.5	39.4	219.3	8609	1	26.1	0
	China	872.4	18.2	137.3	6354	21	24.6	3
	Japan	330.8	6.9	38.3	8646	2	6.6	0
	Vietnam	291.4	6.1	45.7	6382	-17	2.1	10.3
	Belgium	174.2	3.6	22.7	7666	12	2.1	4.8
Cuttlefish	Total exports	727.2	100.0	135.1	5381	-5	100.0	-
	Spain	200.8	27.6	36.0	5577	7	19.0	3.5
	Italy	116.6	16.0	18.9	6162	3	12.1	3.5
	Thailand	98.1	13.5	19.6	4990	-12	7.0	-
	USA	61.1	8.4	7.9	7694	10	5.3	0
	China	46.8	6.4	11.5	4049	1	13.4	10

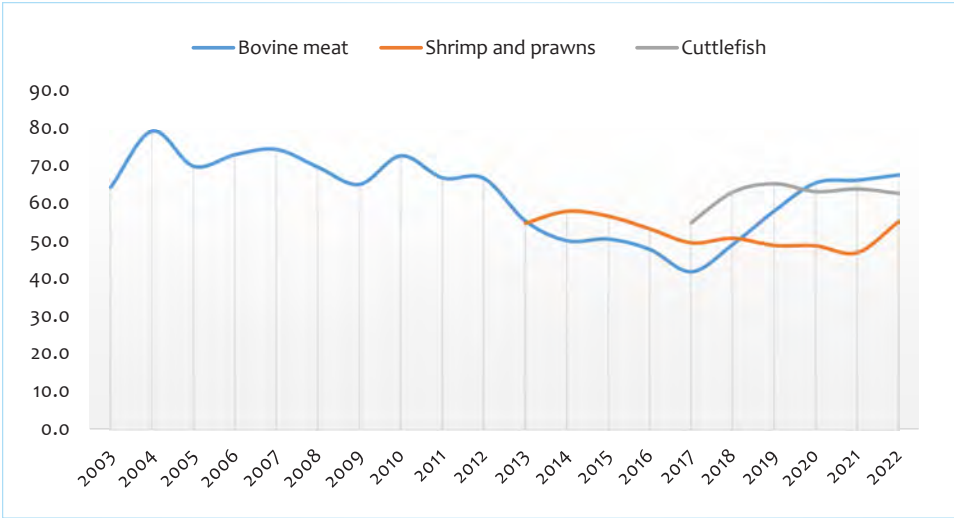
Source: Based on INTRACEN database.

10.4 Market diversification

The diversification index of the bovine meat market fluctuated considerably (Figure 36). Initially, Indian bovine meat exports targeted several destinations. However, these values gradually narrowed, suggesting concentrations at fewer destinations. Export diversification revived in 2017.

However, export diversification patterns for shrimp and prawns have maintained a relatively steady trend. Similarly, the diversification trend in cuttlefish exports has exhibited notable consistency, particularly in recent years.

Figure 36. India's spatial export diversification for livestock & fisheries products (%)



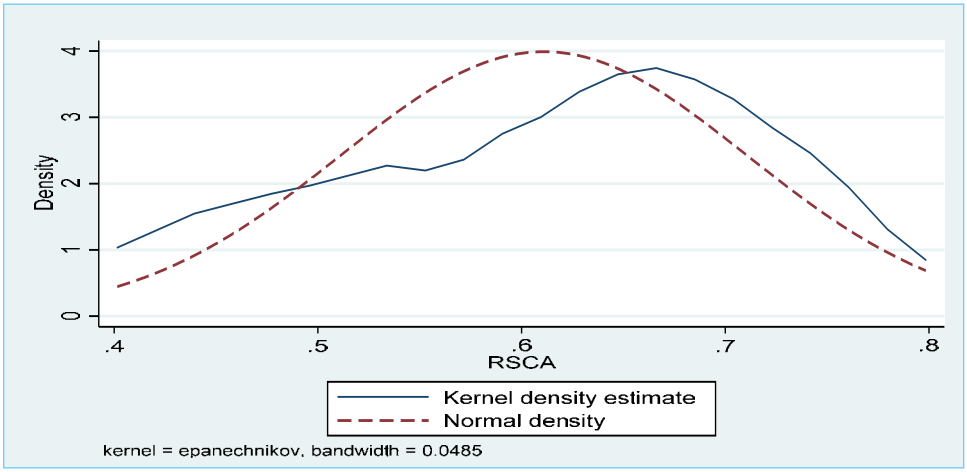
Source: Computed by authors.

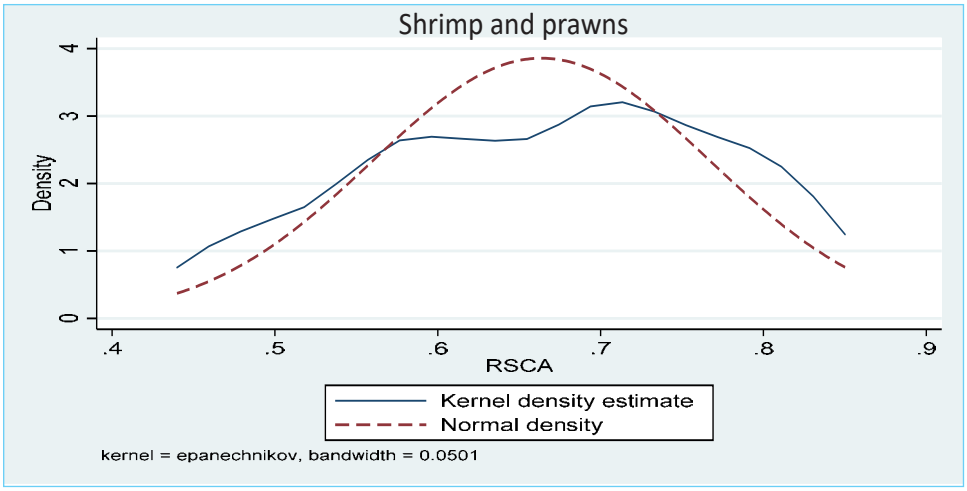
10.5 Comparative advantages

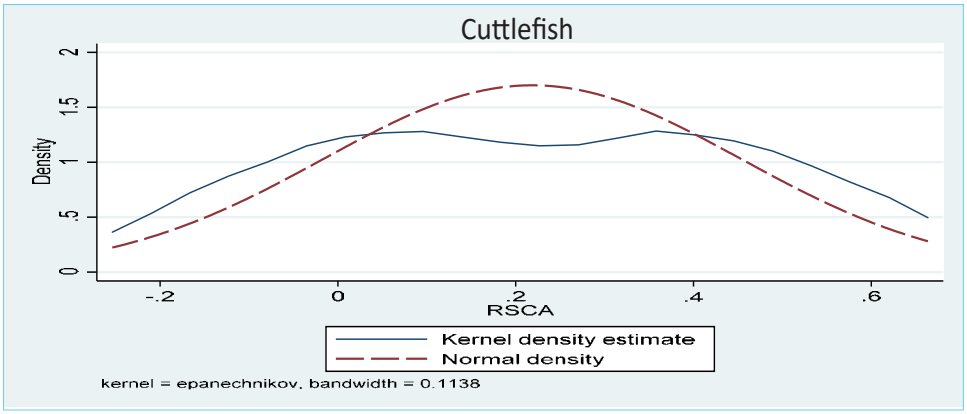
The kernel density of bovine meat reveals that India has a substantial comparative advantage in its exports (Figure 37). However, the meat export industry faces several challenges, including fluctuating prices, regulatory hurdles (Raghuram and Asopa 2008), and intensifying competition.

India has a comparative advantage in shrimp and prawn exports. Nevertheless, as noted by Jeyanthi and Gopal (2012), global regulations regarding food safety and environmental protection present significant challenges. Regarding cuttlefish, India initially lacked a comparative advantage; however, from 2007 onward, its position in the cuttlefish market began to improve.

Figure 37. Kernel density distributions of RSCA for livestock & fisheries products







Source: Computed by authors.

10.6 Export projections

The global market for bovine meat is anticipated to undergo significant transformation over the next decade (Table 43). Brazil is projected to experience a steady decline in its market share. The USA and Australia are expected to maintain their positions. Conversely, India is forecasted to exhibit a substantial increase in its market share, from 8.1% in 2022 to 17.5% by 2030, surpassing that of the USA and Australia. To maintain competitiveness in the global bovine meat export market, India must prioritize the improvement of sanitary and phytosanitary measures, enhancement of supply chain efficiency, and identification of new market opportunities.

Table 43. Projected export shares of major trading nations for bovine meat (%)

	Brazil	USA	Australia	India	New Zealand	Argentina	Uruguay	Paraguay	Ireland	Others
2022	30.8	12.9	12.0	8.1	6.8	6.7	5.2	2.4	1.9	13.4
2030	22.2	10.8	15.9	17.5	7.2	4.0	4.8	2.7	1.4	13.7

Source: Computed by authors.

Projections for shrimp and prawns indicate that Ecuador will maintain its dominance in the international market, increasing its market share from 34.4% to 48.6% (Table 44). Most countries, including India, Vietnam, and Indonesia, are anticipated to experience a decline in their market share. India's market share is projected to decrease from 21.3% to 16.3%. This suggests that India should improve its infrastructure, implement advanced aquaculture technologies, adopt sustainable fishing practices, and pursue market diversification strategies. Regarding cuttlefish, no substantial changes are expected in market shares (Table 44).

Table 44. Projected export shares of major trading nations for shrimp and prawns, and cuttlefish (%)

	Shrimp and prawns								
	Ecuador	**India**	**Vietnam**	**Indonesia**	**Argentina**	**Thailand**	**Spain**	**China**	**Others**
2022	34.4	21.3	10.0	6.4	3.9	2.9	1.7	1.5	17.8
2030	48.6	16.3	7.1	4.8	4.1	2.3	1.2	1.9	13.6
	Cuttlefish								
	China	**India**	**Indonesia**	**Spain**	**Peru**	**Falkland Islands**	**Morocco**	**Thailand**	**Others**
2022	31.0	9.7	7.9	7.6	5.9	4.6	4.2	3.2	26.0
2030	31.1	9.2	7.4	7.0	7.0	4.4	4.7	3.4	25.8

Source: Computed by authors.

10.7 Export rejections

From 2001 to 2005, the USA rejected 446 shipments of shrimp and prawns from India (Table 45). This figure dropped to 161 over the next five years but saw an increase until 2020. However, a downward trend was observed in the aftermath of the COVID-19 pandemic. Frequent causes of refusals include the detection of Salmonella contamination, residues of veterinary drugs, unsafe additives, unhygienic conditions, and incorrect labelling. In the EU, there was an upsurge in their rejections, reaching a maximum of 145 during 2006-10, but it declined to 24 in 2021–23. In the EU, products were primarily rejected owing to several factors: excessive levels of veterinary drug residues, contamination with Salmonella, deterioration of the product, use of dangerous additives, and substandard hygiene practices.

Table 45. Rejections of fisheries consignments by the USA and EU

Country	Reasons		2001-05	2006-10	2011-15	2016-20	2021-23
Shrimp and prawns							
EU	Reasons	Vet drug residue	83	106	43	41	8
		Biological contaminants	34	26	3	13	7
		Others	9	15	17	24	13
	No. of rejections		121	145	61	71	24
USA	Reasons	Filthy	293	107	91	93	71
		Vet drug residue	14	5	43	133	46
		Salmonella	323	66	188	199	85
		Unsafe additive/ colour	1	13	48	70	62
		Others	39	4	5	65	35
	No. of rejections		446	161	294	419	196
Cuttlefish							
EU	Reasons	Unsanitary condition/ control	0	9	9	6	0
		Metals/ chemical contaminant	18	22	13	28	12
		Others	22	7	4	9	4
	No. of rejections		39	36	26	40	16
USA	Reasons	Filthy	4	3	27	46	0
		Salmonella	5	6	1	10	0
		Others	1	0	0	0	0
	No. of rejections		9	8	28	55	0

Note: The number of rejections may not tally due to multiple reasons for a given consignment/ commodity.
Source: Computed by the authors based on the USFDA and EURASFF databases.

Prior to 2010, the USA rarely rejected cuttlefish shipments from India, with only a few cases owing to Salmonella contamination and unsanitary conditions. However, in subsequent years, the number of rejections increased significantly. The main reason for rejection was an unsanitary or filthy condition, with Salmonella being the second most common cause. The EU rejected between 30 and 40 shipments of cuttlefish and squid from India during each period. The main reasons for these rejections included the presence of heavy metals and Salmonella, contamination with other disease-causing microorganisms, and substandard quality control measures. Addressing these challenges requires strengthening the food safety management practices across supply chains. Key areas for improvement include enhancing quality control measures, ensuring compliance with import documentation and labelling requirements, and upgrading essential infrastructure.

Key Extracts

Examining India's export patterns in livestock and fisheries sector reveals both promising prospects and obstacles to the nation's future in international markets. India has already established a strong presence in the export of bovine meat, shrimp and prawns, and cuttlefish. However, forecasts indicate potential changes in the market dynamics. Specifically, India is anticipated to significantly expand its market share of bovine meat exports, possibly overtaking the USA and Australia by 2030. To leverage this growth opportunity, India must concentrate on enhancing sanitary protocols, optimizing supply chain efficiency, and broadening its market reach.

The recurring cycle observed in bovine meat exports, combined with the high usage of export capacity, suggests that India may need to concentrate on enhancing production efficiency and seeking new market opportunities to stimulate further growth in this industry. Moreover, the broader implications indicate that India's achievements in these export markets hinge on its capacity to respond to evolving global demands, enhance product standards, and successfully manage regulatory hurdles in international commerce.

In the realm of seafood exports, particularly shrimp and prawns, India may experience a decline in market share owing to growing competition. This underscores the urgent need for India to upgrade its aquaculture infrastructure, embrace cutting-edge technologies, implement eco-friendly practices, and expand its market reach to remain competitive. An examination of export rejection emphasizes the necessity of tackling food safety and quality control challenges throughout the supply chain. The varying rejection patterns by key importers, such as the USA and EU, suggest that India must continually enhance its food safety management protocols, quality assurance measures, and adherence to global standards to ensure sustained export growth and maintain access to international markets.

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11 Conclusions and Implications

India has become the eighth-largest agricultural exporter, experiencing significant export growth. The export portfolio is concentrated on specific commodities, with grains, notably rice and wheat, comprising approximately 25% of total agricultural exports. The composition of exports has changed over time, with cereals emerging as primary exports. India has established a strong presence in commodities, such as rice, sugar, bovine meat, seafood, and spices.

Most agricultural products consistently maintain their export advantages. Forecasts suggest that India is expected to maintain its dominant export position for several commodities over the next decade. While opportunities exist for India to expand its agricultural exports, it must address challenges, such as enhancing product quality, complying with food safety standards, and developing market intelligence capabilities.

To enhance agricultural exports, the Indian government has implemented several initiatives, including i) Agriculture Export Policy 2018 to diversify export baskets and destinations while promoting high-value and value-added agricultural exports; ii) Agricultural and Processed Food Products Export Development Authority (APEDA)'s Financial Assistance Scheme to support exporters in developing export infrastructure and markets; and iii) Pradhan Mantri Matsya Sampada Yojana to enhance the export competitiveness of marine product exports.

Furthermore, export-oriented clusters have been developed to ensure necessary physical and quality standards for exports. To support infrastructure development, the government launched the Trade Infrastructure for Export Scheme (TIES), which provides financial assistance in the form of grants-in-aid to Central and State Government-owned agencies or their joint ventures with majority government ownership. This support aimed to establish or upgrade export infrastructure projects with strong export linkages, such as Border Haats, land customs stations, quality testing and certification labs, cold chains, trade promotion centers, export warehouses, packaging facilities, and cargo terminals at ports and airports.

The signing of the World Trade Organization (WTO) agreement brought Indian agriculture under the framework of a multilateral trading system, paving the way for India to sign a range of Preferential Trade Agreements (PTAs) and Free Trade Agreements (FTAs), such as agreement on South Asian Free Trade Area (SAFTA) and Asia-Pacific Trade Agreement (APTA). To deepen the trade network, India launched a Market Access Initiative (MAI) scheme designed with a product-specific and country-focused approach to identify and develop particular markets and products through comprehensive market studies and surveys.

The study suggests the following measures for the long-term facilitation and sustenance of agricultural exports from the country:

Enhancing productivity and quality

- *Promote advanced farming techniques*
- *Enforce quality standards*
- *Evolve a coordinated regulatory framework*

A value-system perspective across commodities is imperative for enhancing productivity and product quality. The implementation of rigorous quality control measures and certification processes is essential for mitigating export rejections to premium markets. The high pesticide residue levels found in crops indicate a need for more sustainable agricultural practices and stricter adherence to the maximum residue limits (MRLs) set by importing countries. Similarly, the presence of veterinary drugs in fishery and aquaculture products suggests inadequate regulation and monitoring of animal health practices in these areas. The detection of pathogenic microorganisms and mycotoxins further highlights issues in post-harvest handling, storage, and processing of agricultural and food products.

The development and continuous updating of commodity and location-specific production (Good Agricultural Practices) and post-production technologies (Good Handling Practices) are essential for improving food safety compliances for export-oriented commodities. It is necessary to facilitate collaboration among farmers, processors, exporters, and policymakers to reduce costs and improve quality as well as to develop traceability systems to monitor and ensure compliance with international regulations. A transition towards bio-pesticides, bio-agents, and sustainable aquaculture practices can reduce chemical dependency and meet global safety standards.

The role of APEDA, the Marine Products Export Development Authority (MPEDA) and the Food Safety and Standards Authority of India (FSSAI) is critical in ensuring compliance. Inter-ministerial and inter-departmental coordination and synergy are crucial for the effective implementation of export regulations. Climate change adversely affects agricultural exports. The development and promotion of crop varieties that exhibit resilience to adverse climatic conditions is of paramount importance.

Focus on value-added novel products

- *Promote high-value commodities*
- *Invest in processed food exports*
- *Target niche and specialty markets*

It is imperative to prioritize the cultivation of high-demand crops, including fruits, vegetables, spices, and organic products, to capitalize on the expanding international market. Furthermore, it is advisable to enhance processed food exports by fostering investments in food processing to add value to primary agricultural products, such as ready-to-eat foods, dehydrated vegetables, and frozen fruits, which possess higher export value. India exhibits a rich regional diversity and cultivates various specialty products, many of which are already Geographical Indication (GI) products, which could be targeted to niche markets to leverage comparative advantage.

Smart agri-logistics

- *Build cold chain infrastructure*
- *Improve ports and logistics*
- *Invest in rural infrastructure*
- *Modernize processing and testing facilities*
- *Implement traceability systems*

A substantial proportion of our exports comprises sensitive commodities necessitating meticulous attention throughout the distribution process. To preserve product integrity prior to and during transportation, it is imperative to enhance the value-chain infrastructure through the implementation of pre-cooling facilities, refrigerated transport, and appropriate storage units. The improvement of port logistics is also of paramount importance. Furthermore, numerous goods now require mandatory testing at airports, a protocol that must be strictly adhered to.

Ease of doing business

- *Favorable trade agreements*
- *Engaging in export promotion*
- *Simplifying export documentation*
- *Providing financial support and export insurance*
- *Reducing compliance costs*

India engages in trade with various nations while maintaining 8-12 key strategic partnerships, including those with the USA, Bangladesh, China, Middle Eastern countries, and the EU. The preservation of these relationships is of paramount importance. To enhance export opportunities, India may participate in bilateral and multilateral trade negotiations aimed at improving market access, reducing tariffs, and minimizing non-tariff barriers. Furthermore, leveraging PTAs with Middle Eastern, African, and Southeast Asian countries could expand market reach. Targeted promotion and marketing initiatives in specific nations can foster stronger connections with global consumers. Streamlining export procedures and documentation may facilitate more efficient value chains. Additionally, incorporating financial and insurance instruments into these value chains could mitigate associated risks.

Skill development

- *Comprehensive farmer training programs*
- *Encouraging agripreneurs*
- *Technical assistance and export readiness*

Comprehensive training programs, targeted mentorship, and technical support for value-chain participants are essential for comprehending international market requirements. Providing farmers and agripreneurs with the requisite technical skills, such as post-harvest management, value-added processing, and packaging, as well as practical training in contemporary agricultural techniques, traceability systems, and certifications, would be crucial.

Market intelligence and digital agriculture

- *Leveraging e-commerce platforms*
- *Harnessing data analytics*
- *Market intelligence platforms*

Stakeholders in the value chain require access to solutions driven by real-time data and policy insights based on empirical evidence. To facilitate informed decision-making, it is imperative to establish a "Global Market Intelligence Cell" that analyzes global market conditions, consumption patterns, price fluctuations, and logistics network dynamics. Exporters can optimize their strategies for specific markets by utilizing digital tools such as platforms, dashboards, and applications.

Promote "Brand India"

- *Create a distinct global brand*
- *Promote ethnic GI-tagged products*
- *Highlight quality and sustainability*

It is imperative to promote "Brand India" for products and goods intended for export. A comprehensive branding strategy should emphasize the distinctive characteristics and comparative advantages of various products. By highlighting items with GI tags, such as Darjeeling tea, Alphonso mangoes, and Pashmina wool, it is possible to significantly enhance their international recognition and market value.

Foster industry-academia partnerships

- *Leverage public-private partnerships*
- *Strengthen industry-academia collaborations*
- *Drive innovation and technology transfer*
- *Create knowledge exchange platforms*

Collaboration with private sector entities has the potential to stimulate investment in agricultural infrastructure, research and development, and market accessibility programs. Public-private partnership frameworks facilitate the aggregation of resources, knowledge, and risks, resulting in more efficacious and scalable agricultural solutions. It is imperative to enhance connections between academic institutions, universities, and agri-businesses to promote innovation and augment export competitiveness. Through the facilitation of cooperation, novel technologies and methodologies can be developed and implemented, thereby improving the overall productivity and performance of agricultural exports. Establishing robust linkages between research centers, higher education institutions, and the agribusiness industry is crucial. Research institutes and universities can provide cutting-edge studies, data analysis, and technological advancements, while agri-businesses contribute practical insights and real-world challenges. Collaborative research initiatives, innovation centers, and joint development programs can serve to bridge the gap between academic research and practical applications.

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ICAR - NATIONAL INSTITUTE OF AGRICULTURAL ECONOMICS AND POLICY RESEARCH
(Indian Council of Agricultural Research)
Dev Prakash Shastri Marg, Pusa, New Delhi - 110 012, INDIA
Ph: +91(11) 2584 7628, 2584 8731 Fax: +91 (11) 2594 2684
Email : director.niap@icar.gov.in, Website : www.niap.icar.gov.in