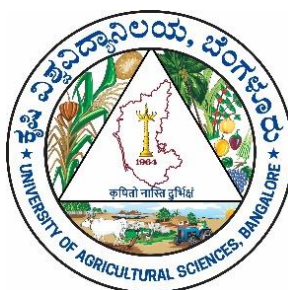


A STUDY ON EXPORT COMPETITIVENESS OF INDIA'S FRESH MANGOES



KARTHICK REDDY, N. R.

MBAM 2013

**INSTITUTE OF AGRI-BUSINESS MANAGEMENT
COLLEGE OF AGRICULTURE, GKVK
UNIVERSITY OF AGRICULTURAL SCIENCES
BANGALORE**

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**A STUDY ON EXPORT COMPETITIVENESS
OF INDIA'S FRESH MANGOES**

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KARTHICK REDDY, N. R.

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BANGALORE**

2024




**INSTITUTE OF AGRI-BUSINESS MANAGEMENT
COLLEGE OF AGRICULTURE, GKVK, BENGALURU
UNIVERSITY OF AGRICULTURAL SCIENCES
BANGALORE**

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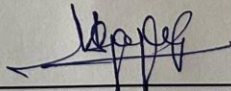
This is to certify that the Project Report entitled, “**A STUDY ON EXPORT COMPETITIVENESS OF INDIA’S FRESH MANGOES**” submitted in partial fulfilment of the requirement for the degree of **MASTER OF BUSINESS ADMINISTRATION IN AGRI-BUSINESS MANAGEMENT** to the University of Agricultural Sciences, Bangalore, is a record of *bona fide* research work carried out by **KARTHICK REDDY, N.R., MBAM 2013** during the period of his study in this University, under my guidance and supervision. The project report has not previously formed the basis for the award of any degree, diploma, associateship, fellowship, or other similar titles.

Bengaluru
November, 2024


(M. S. GANAPATHY)
Major Advisor

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(M. S. GANAPATHY)

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1.



(RANGANATH, G.)

2.

(M. T. LAKSHMINARAYANA)



*Affectionately
dedicated to my beloved
Parents, Teachers,
Friends & Farmers*

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(KARTHICK REDDY, N. R.)

An Empirical Assessment of Export Competitiveness of Indian Mangoes



N. R. KARTHICK REDDY, MBAM 2013

Institute of Agribusiness Management,
University of Agricultural Sciences, Bangalore, CoA, GKVK



INTRODUCTION

India is the world's largest producer of mangoes, contributing approximately 40 per cent of the global mango production. The export of fresh mangoes has become a significant aspect of India's agricultural economy, providing substantial income to farmers and contributing to the country's overall export earnings.

However, the competitiveness of Indian mangoes in the global market is influenced by several factors, including quality standards, price competitiveness, logistics, and compliance with international trade regulations. The increasing demand for high-quality mangoes in foreign markets necessitates a thorough understanding of India's export dynamics and the challenges faced by exporters.

This empirical assessment aims to analyze the export competitiveness of Indian fresh mangoes by examining production trends, export performance, market destinations, and the factors impacting export growth. By identifying strengths and weaknesses in the current export framework, the study seeks to provide insights and recommendations for enhancing India's position in the global mango market.

OBJECTIVES

To analyze the export competitiveness of Indian mangoes.

MATERIALS AND METHODS

Study area: Export destination of Indian mangoes.

Source of data: Secondary data collected from ITC trade map and APEDA.

Analytical tools and techniques:

- Revealed Comparative Advantage and Revealed Symmetric Comparative Advantage

$$RCA_{ic} = \frac{(x_{ic}/X_w)}{(x_{cw}/X_w)} \quad RSCA = \frac{RCA-1}{RCA+1}$$

Where RCA_{ic} = revealed comparative advantage index of commodity group c for country i,

x_{ic} = The value of exports of commodity group c by country i,

x_{iw} = The value of total exports by country i,

x_{cw} = The value of world exports of commodity group c, and

X_w = Is the value of total world exports.

- Compound Annual Growth Rate:**

$$[(\text{antilog of } b)-1] \times 100$$

- Markov chain analysis:** $E_{jt} = \sum_{i=1}^r E_{it-1} * P_{ij} + e_{jt}$

Where,

E_{jt} = Exports from India to j^{th} country during the year t.

E_{it-1} = Exports to i^{th} country during the period t-1.

P_{ij} = Probability that the exports will shift from i^{th} country to j^{th} country.

e_{jt} = The error term which is statistically independent of $E_{jt}-1$.

t = Number of years considered for the analysis

r = Number of importing countries

RESULTS AND DISCUSSION

Table 1: Competitiveness of India's Mangoes exports

Year	RCA	RSCA
2012	1.70	0.26
2013	1.45	0.18
2014	1.34	0.15
2015	1.36	0.15
2016	1.51	0.20
2017	1.28	0.12
2018	1.10	0.05
2019	1.00	0.00
2020	0.52	-0.32
2021	0.68	-0.19
2022	0.71	-0.17
2023	0.82	-0.10

GRAPHS

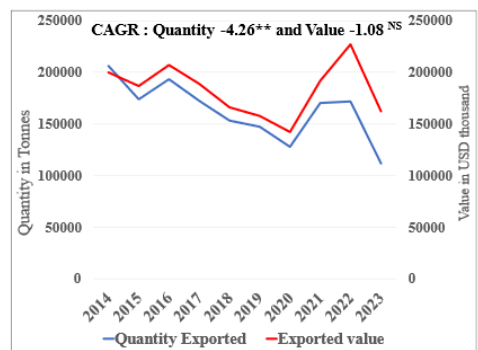


Fig. 1: Mango exports trend from India

Table 2: Transitional Probability Matrix of Mangoes Export from India (2014 -2023)

Importers	UAE	USA	UK	Saudi Arabia	Netherlands	Others
UAE	0.3923	0.0000	0.0000	0.6077	0.0000	0.0000
USA	0.3348	0.2052	0.4599	0.0000	0.0000	0.0000
UK	0.0000	0.1303	0.0000	0.0000	0.0000	0.8697
Saudi Arabia	0.2316	0.0000	0.1030	0.1749	0.1932	0.2972
Netherlands	0.6141	0.1486	0.2372	0.0000	0.0000	0.0000
Others	0.0000	0.0716	0.0708	0.0000	0.1023	0.7553

The competitiveness of mangoes exported from India was analysed using the Revealed Comparative advantage (RCA) and Revealed Symmetric Comparative advantage (RSCA) indices showed a declining trend. RCA values above 1 from 2012 to 2019 indicated a comparative advantage, dropping from 1.70 in 2012 to 1.00 in 2019. RSCA values, initially positive, decreased from 0.26 in 2012 to 0.00 in 2019. Post-2019, RCA values fell below 1, and RSCA values turned negative, indicating a comparative disadvantage in exporting India's mangoes to overseas market. However, by following Good Agricultural practices, Indian mangoes might still find a market on a worldwide scale (Table 1).

The major export destinations for Indian mangoes were UAE, USA, UK, Saudi Arabia, Netherlands as key destinations. UAE and USA were the most stable markets, retaining significant shares of their imports, while the UK and Netherlands were the most unstable (Table 2).

From 2014 to 2023, there has been a noticeable decline in both the quantity and value of mango exports (Fig. 1) and showed a clear declining trend, with a statistically significant drop in quantity exported. The mean quantity and value of exports fluctuated, with a Compound Annual Growth Rate of -4.26 per cent per annum for quantity significant at 5 per cent level and -1.08 per cent for value per annum non significant, indicating a notable decline in export performance.

CONCLUSION

India's export competitiveness for mangoes indicated comparative disadvantage in exporting mangoes from India as indicated by the RCA and RSCA indices. Initially, India had a comparative advantage, with RCA values above 1 and positive RSCA values until 2019. However, post-2019, both indices showed a comparative disadvantage, reflecting a significant drop in competitiveness.

Key export destinations included the UAE, USA, UK, Saudi Arabia, Netherlands, Kuwait and Canada, with the UAE and USA being the most stable markets. Export trends from 2014 to 2023 revealed a significant decline in both the quantity and value of fresh mangoes exported, with the quantity showing a statistically significant drop and a mean export value fluctuating but generally decreasing.

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ADVISORY COMMITTEE

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A STUDY ON EXPORT COMPETITIVENESS OF INDIA'S FRESH MANGOES

KARTHICK REDDY N.R.

ABSTRACT

This study explored the dynamics of India's fresh mango export sector, utilizing secondary data from APEDA and ITC Trade Map, and primary data collected from exporters, farmers, and vendors. Analytical tools, including descriptive statistics, Compound Annual Growth Rate (CAGR), and Cuddy Della Valle's Instability Indices, were employed to assess export trends and trade stability. Markov Chain analysis examined trade direction, while Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) indices measured India's global competitiveness. Key findings revealed that exporters dominated the value chain, capturing 90.39 per cent in Channel I and 91.18 per cent in Channel II, while farmers contributed only 5.31 per cent and 5.32 per cent, respectively. In Channel III, where farmers directly exported, their share increased significantly to 94.76 per cent, demonstrating the benefits of vertical integration. Although export quantities for fresh mangoes and pulp declined (CAGRs of -5.12 per cent and -2.93 per cent), export value rose by 7.75 per cent and 3.34 per cent, indicating that higher prices or value-added products offset lower volumes. Regionally, Oman and the UAE proved to be stable markets, with high export value stability observed in the USA. The study noted a decline in the Alphonso variety (CAGR of -2.75 per cent), contrasted by growth in Kesar and Chausa varieties, which showed positive CAGRs of 18.80 per cent and 25.71 per cent, respectively. Competitiveness indices showed a downward trend, with RCA values decreasing from 1.70 in 2012 to 0.82 in 2023. Sanitary and Phytosanitary (SPS) measures posed major challenges for exporters, emphasizing the need for improved regulatory compliance. This study provided strategic insights to enhance competitiveness and stability in India's mango export sector, highlighting market adaptation, regulatory considerations, and increased farmer participation in the value chain.

November, 2024

Institute of Agribusiness Management
UAS, GKVK, Bengaluru - 560 065

(M.S. GANAPATHY)
Major Advisor

ಭಾರತದ ತಾಜಾ ಮಾವಿನಹಣ್ಣಿನ ರಫ್ತು ಸ್ಪರ್ಧಾತ್ಮಕತೆಯ ಬಗ್ಗೆ ಅಧ್ಯಯನ

ಕಾರ್ತಿಕ್ ರೆಡ್ಡಿ ಎನ್.ಆರ್.

ಸಾರಾಂಶ

ಈ ಅಧ್ಯಯನವು ಭಾರತದ ತಾಜಾ ಮಾವಿನ ರಫ್ತು ವಲಯದ ಡೈನಾಮಿಕ್ಸ್ ಅನ್ನು ಪರಿಶೀಲಿಸಿದೆ APEDA ಮತ್ತು ITC ಟ್ರೇಡ್ ಮ್ಯಾಪ್‌ನಂತಹ ಮೂಲಗಳಿಂದ ದ್ವಿತೀಯ ಮಾಹಿತಿಯನ್ನು ಉಪಯೋಗಿಸಲಾಗಿದೆ. ರಫ್ತುದಾರರು, ರೈತರು ಮತ್ತು ಮಾರಾಟಗಾರರು ಸೇರಿದಂತೆ ಮಧ್ಯವರ್ತಿಗಳಿಂದ ಸಂಗ್ರಹಿಸಿದ ಪ್ರಾಥಮಿಕ ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸಿ, ರೈತರಿಂದ ರಫ್ತುದಾರರಿಗೆ ತಾಜಾ ಮಾವಿನ ಹಣ್ಣಿನ ಮೌಲ್ಯ ಸರಪಳಿಯನ್ನು ದಾಖಲಿಸಲಾಗಿದೆ. ವಿವರಣಾತ್ಮಕ ಅಂಕಿಅಂಶಗಳು, ಸಂಯುಕ್ತ ವಾರ್ಷಿಕ ಬೆಳವಣಿಗೆ ದರ (CAGR) ಮತ್ತು ಕಡಿ ಡೆಲ್ಲಾ ವ್ಯಾಲೆಸ್ ಅಸ್ಥಿರತೆಯ ಸೂಚ್ಯಂಕಗಳು ರಫ್ತು ಪ್ರವೃತ್ತಿಗಳು ಮತ್ತು ವ್ಯಾಪಾರದ ಅಸ್ಥಿರತೆಯನ್ನು ನಿರ್ಣಯಿಸಲು ಬಳಸಲಾಗಿದೆ. ಮಾರ್ಕೋವ್ ಚೈನ್ ವಿಶ್ಲೇಷಣೆ ವ್ಯಾಪಾರದ ದಿಕ್ಕನ್ನು ಪರಿಶೀಲಿಸಿದ್ದು, ರಿವೀಲ್ಡ್ ಕಂಪ್ಯಾರೇಟಿವ್ ಅಡ್ವಾಂಟೇಜ್ (RCA) ಮತ್ತು ರಿವೀಲ್ಡ್ ಸಿಮೆಟ್ರಿಕ್ ಕಂಪ್ಯಾರೇಟಿವ್ ಅಡ್ವಾಂಟೇಜ್ (RSCA) ಸೂಚ್ಯಂಕಗಳು ಭಾರತದ ಜಾಗತಿಕ ಸ್ಪರ್ಧಾತ್ಮಕತೆಯನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡುತ್ತವೆ. ಮುಖ್ಯ ಸಂಶೋಧನೆಗಳು ರಫ್ತುದಾರರು ಮೌಲ್ಯ ಸರಪಳಿಯಲ್ಲಿ ಪ್ರಾಬಲ್ಯ ಹೊಂದಿದ್ದಾರೆ ಎಂದು ಸೂಚಿಸುತ್ತವೆ: ಚಾನೆಲ್ I ನಲ್ಲಿ 90.39 ಶೇಕಡಾ ಮತ್ತು ಚಾನೆಲ್ II ನಲ್ಲಿ 91.18 ಶೇಕಡಾ, ರೈತರು ಕ್ರಮವಾಗಿ 5.31 ಶೇಕಡಾ ಮತ್ತು 5.32 ಶೇಕಡಾ ಕೊಡುಗೆ ನೀಡಿದ್ದಾರೆ. ಚಾನೆಲ್ III ರಲ್ಲಿ, ರೈತರು ನೇರವಾಗಿ ರಫ್ತು ಮಾಡುವಲ್ಲಿ, ಅವರ ಪಾಲು 94.76 ಶೇಕಡಾ ಕ್ಕೆ ಏರಿತು, ಇದು ಲಂಬವಾದ ಏಕೀಕರಣದ ಪ್ರಯೋಜನಗಳನ್ನು ಎತ್ತಿ ತೋರಿಸುತ್ತದೆ. ತಾಜಾ ಮಾವು ಮತ್ತು ಮಾವಿನ ತಿರುಳಿನ ರಫ್ತು ಪ್ರಮಾಣದಲ್ಲಿ ಕುಸಿತವಿದ್ದರೂ (CAGR -5.12 ಶೇಕಡಾ ಮತ್ತು -2.93 ಶೇಕಡಾ), ರಫ್ತು ಮೌಲ್ಯವು 7.75 ಶೇಕಡಾ ಮತ್ತು 3.34 ಶೇಕಡಾ ಏರಿಕೆಯಾಗಿದೆ, ಇದು ಹೆಚ್ಚಿನ ಬೆಲೆಗಳು ಅಥವಾ ಮೌಲ್ಯವರ್ಧಿತ ಉತ್ಪನ್ನಗಳನ್ನು ಕಡಿಮೆ ಸಂಪುಟಗಳಿಗೆ ಸರಿದೂಗಿಸಿದ ಪರಿಣಾಮವಾಗಿದೆ. ಭೌಗೋಳಿಕವಾಗಿ, ಒಮಾನ್ ಮತ್ತು ಯುಎಇ ಸ್ಥಿರ ಮಾರುಕಟ್ಟೆಗಳಾಗಿ ಹೊರಹೊಮ್ಮಿದವು, ಆದರೆ ಅಮೇರಿಕಾ ಹೆಚ್ಚಿನ ರಫ್ತು ಮೌಲ್ಯದ ಸ್ಥಿರತೆಯನ್ನು ತೋರಿಸಿದೆ. ಕೇಸರ್ ಮತ್ತು ಚೌಸಾ ತಾಳಿಗಳ ಬೆಳವಣಿಗೆಯೊಂದಿಗೆ (CAGR 18.80 ಶೇಕಡಾ ಮತ್ತು 25.71 ಶೇಕಡಾ) ಆಲ್ಫೋನ್ನೊ ತಳಿಯ (CAGR -2.75 ಶೇಕಡಾ) ಕುಸಿತವನ್ನು ಅಧ್ಯಯನದಿಂದ ತಿಳಿದುಬಂದಿದೆ. ಸ್ಪರ್ಧಾತ್ಮಕತೆಯ ಸೂಚ್ಯಂಕಗಳು ಕೆಳಮುಖವಾದ ಪ್ರವೃತ್ತಿಯನ್ನು ತೋರಿಸುತ್ತವೆ, ಅಧ್ಯಯನವು ನೈರ್ಮಲ್ಯ ಮತ್ತು ಫೈಟೋಸಾನಿಟರಿ (SPS) ಕ್ರಮಗಳು ರಫ್ತುದಾರರಿಗೆ ಎದುರಾಗಿರುವ ಪ್ರಮುಖ ಸಮಸ್ಯೆ ಎಂದು ಅಧ್ಯಯನದಿಂದ ತಿಳಿದುಬಂದಿದೆ ಗುರುತಿಸಿದೆ, ನಿಯಂತ್ರಕ ಅನುಸರಣೆ ಸವಾಲುಗಳನ್ನು ಒತ್ತಿಹೇಳುತ್ತದೆ. ಒಟ್ಟಾರೆಯಾಗಿ, ಈ ಸಂಶೋಧನೆಗಳು ಭಾರತದ ಮಾವು ರಫ್ತು ವಲಯದಲ್ಲಿ ಸ್ಪರ್ಧಾತ್ಮಕತೆ ಮತ್ತು ಸ್ಥಿರತೆಯನ್ನು ಹೆಚ್ಚಿಸಲು ಒಳನೋಟಗಳನ್ನು ಒದಗಿಸುತ್ತವೆ.

ನವೆಂಬರ್, 2024

ಕೃಷಿ ವ್ಯವಹಾರ ನಿರ್ವಹಣೆ ಸಂಸ್ಥೆ

ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಬೆಂಗಳೂರು - 560 065

(ಎಂ.ಎಸ್. ಗಣಪತಿ)

ಪ್ರಮುಖ ಸಲಹೆಗಾರ

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I INTRODUCTION

Mango, scientifically named *Mangifera indica*, often called the “king of fruits” due to their vibrant colour, rich fragrance, and exceptional sweetness. Originating from northwestern Myanmar, Bangladesh and northeastern India, *Mangifera indica* has been cultivated across South and Southeast Asia for centuries. Persian traders introduced mangoes to East Africa between the 9th and 10th centuries, while the Portuguese expanded mango cultivation to Africa from Goa during the Colonial ERA. By 16th and 17th centuries, mangoes had spread from West Africa to Brazil, eventually reaching the Caribbean and eastern Mexico. Mangoes flourish in tropical and subtropical climates but are unsuitable for cultivation at elevations above 600 meters due to their sensitivity to frost. They require annual rainfall ranging from 85 to 90 cm, with a distinct dry season to promote optimal growth. A dry spell before flowering is crucial for encouraging blooms, while excessive rainfall during flowering can interfere with pollination. The ideal soil for mango cultivation is well-drained, loamy, and alluvial, rich in organic matter, with a pH range of 5.5 to 7.5. These conditions ensure healthy growth and abundant fruit production. Today, mangoes are grown in tropical and subtropical regions worldwide, prized for their versatility in culinary use and cultural significance. This tropical fruit, with around 4,000 varieties worldwide, is especially beloved in Asia, where it is enjoyed both raw and ripe. Mangoes consists moisture (81 %), carbohydrates (17 %) fiber (0.8 %), protein (0.6 %), and fat (0.4 %). Mangoes are rich in essential minerals, including potassium, magnesium, sodium, phosphorous, and sulfur. Mangoes offers several health benefits, such as providing dietary fiber, which is associated with a reduced risk of cancer, cardiovascular diseases and lowering cholesterol levels. Packed with over 20 vitamins and minerals, the mango’s usefulness extends beyond its fruit; the bark, leaves, skin and seed are used in traditional remedies, while the wood serves as timber and dried twigs are used in rituals. Mango kernals, consisting 8 to 10 per cent fat, are used in saponification, and their starch is valuable in the confectionery industry. (Anno, 2023)

1.1 Global Scenario

1.1.1 Global Mango production overview

Mangoes are one of the most widely cultivated fruits globally, grown across tropical and subtropical regions. Worldwide, the total mango production is estimated to be over 55 million tonnes annually, with cultivation spread across Asia, America, Africa, and Oceania. Mangoes are prized for their unique flavor, vibrant color and nutritional benefits, contributing significantly to the economies of many developing countries. India leads global mango production, accounting for around 40 per cent of the world's total output. Other major producers include China, Thailand, Indonesia and Pakistan in Asia; Mexico and Brazil in the Americas; and Nigeria and Egypt in Africa. Despite its massive production, India's contribution to global mango exports remains relatively small due to high domestic demand.

India remains the world leader in mango production, far ahead of other major producers like China (12.9%), Thailand (7.6%), and Indonesia (6.2%). China, the second-largest producer, has a rapidly expanding mango industry driven by both domestic consumption and export demand. In Southeast Asia, Thailand and Indonesia contribute significant portions of global mango output, with well-established export markets across Asia, Europe, and the Middle East. In the Americas, Mexico is the largest mango producer, contributing about 4 per cent to global production. It is a leading exporter, supplying a substantial portion of mangoes to the United States and other global markets. Brazil, another key player in the Americas, also contributes 3.5 per cent of the world's production and is known for its export-quality mangoes. Nigeria and Egypt are Africa's leading mango producers, together accounting for around 5.5 per cent of global production. Nigeria has vast potential for mango cultivation, while Egypt is known for its early-season mango exports to Europe. (FAOSTAT, 2023)

1.1.2 Global mango trade and export

The global mango trade has experienced significant growth in recent decades, driven by increased consumer demand, advancements in transportation and innovations

in post-harvest technologies. In 2023, global mango exports reached approximately 6.5 million metric tons, marking a 15 per cent increase compared to the previous year.

Key exporters in the global mango market include Mexico, India, Thailand, and Brazil. In 2023, India saw a notable 19 per cent rise in mango exports, totaling around 1.2 million metric tons. This increase was particularly pronounced in shipments to the United States, reflecting the growing international demand for premium Indian mango varieties such as Alphonso and Kesar. In contrast, Mexico maintained its position as the largest mango exporter globally, with exports amounting to 1.5 million metric tons. The country continues to supply a diverse range of markets, including the United States and Europe.

Several factors are shaping the global mango market. Rising incomes and shifting consumer preferences towards exotic fruits are major drivers. The availability of mangoes year-round, facilitated by global trade, has also contributed to the market's expansion. Enhanced storage, packaging and shipping technologies have further broadened the global reach of mangoes, enabling countries from both the Northern and Southern Hemispheres to cater to the growing international demand effectively. For instance, advanced cold chain logistics have improved the shelf life and quality of mangoes during transportation, helping to maintain their freshness across long distances.

1.1.3 Global challenges and opportunities of mango exports

1.1.3.1 Challenges associated with global mango exports

- Ensuring consistent quality and meeting international standards;
- Managing the perishability of mangoes and overcoming inadequate infrastructure;
- Addressing pests, diseases and complying with regulatory restrictions;
- Navigating high tariffs and complex regulatory compliance and
- Adapting to changes in weather patterns and resource availability

1.1.3.2 Opportunities associated with global mango exports

- Leveraging increased global popularity and health trends that boost demand for mangoes;
- Exploring potential growth in emerging markets and expanding into value-added products;
- Utilizing advancements in cultivation techniques and cold chain solutions to enhance production and distribution;
- Benefiting from free trade agreements and bilateral deals that facilitate smoother trade and
- Enhancing market appeal through sustainable practices and certifications that attract environmentally conscious consumers.

1.2 Indian Scenario

1.2.1 India mango production overview

India, often referred as the "fruit and vegetable basket of the world," is the second-largest global producer of fruits. In 2023, the country produced 110.21 million metric tonnes MT of fruits from an area of 6.98 million hectares. India's contribution to global fruit production is approximately 12 per cent. The horticulture sector is crucial to the Indian economy, accounting for about 30.4 per cent of the agricultural Gross Domestic Product (GDP) and employing 19 per cent of the labor force.

India is the second-largest fruit producer globally, after China, with a production of 81.2 million tonnes of fruits from approximately 6.9 million hectares. The per capita fruit consumption in India is around 85 grams per day. In Asia, India is renowned as the top mango producer, often called the "king of fruits." The country accounts for nearly 40 per cent of the world's total mango production, surpassing other major producers such as China, Indonesia, Pakistan, and Thailand. In the Americas, Mexico and Brazil are leading mango producers, while Nigeria and Egypt are prominent in Africa. India's mango

production is concentrated in several key states producing different varieties (appendix-1), each contributing significantly to the country's overall output.

For the fiscal year 2023-24, India has over 2.3 million hectares dedicated to mango cultivation, with a production of 24 million tonnes. In India, Uttar Pradesh leads mango production with a substantial 23 per cent share of the total output, driven by its extensive cultivation areas and favorable growing conditions. Andhra Pradesh ranks second, contributing 18 per cent to the national production due to its large cultivation area and effective agricultural practices. Karnataka is the third-largest producer, accounting for 14 per cent of the national output, supported by its diverse mango varieties and efficient growing methods. Bihar contributes 12 per cent of India's mango production, utilizing a combination of traditional and modern cultivation techniques to improve yield and quality. Gujarat holds a 9.5 per cent share, benefiting from significant investments in agricultural technology and innovation. Tamil Nadu provides 8.3 per cent of the country's mango production. Maharashtra contributes 7.9 per cent of the total mango production, known for its diverse varieties and advanced farming practices. West Bengal accounts for 6.9 per cent of the national output, with its agro-climatic conditions supporting steady production. Odisha contributes 5 per cent to India's total mango production, aided by its effective growing methods. Lastly, Madhya Pradesh contributes 4.2 per cent to the national mango production (appendix-II), with its expanding agricultural practices enhancing its industry. (FAO, 2023)

1.2.2 India's mango trade and export

India, renowned as the world's largest producer of mangoes, plays a pivotal role in the global mango trade. The country's mango industry is not only crucial for domestic consumption but also for international markets, making it a key player in global fruit trade. India has seen significant growth in mango exports. In the fiscal year 2023-24, India exported approximately 32,104.09 metric tonnes of fresh mangoes, valued at Rs. 495.46 crores (about 60.14 USD \$ million). This represents a notable 19 per cent increase in exports compared to the previous year, highlighting India's expanding footprint in

international markets (Appendix-III). United States, European Union, Middle East and South East Asia are the major export of Indian mangoes.

For the fiscal year 2023-24, India's mango exports were distributed among various countries with notable quantities and values. The top ten importing countries accounted for 30,039.95 metric tonnes (MT) of mangoes, valued at Rs. 460.61 crore, which represents (93.57%) of the total export quantity and (93.13%) of the total export value. The UAE led as the largest importer with 15,336.51 MT valued at Rs. 189.08 crore, followed by the UK with 4,706.24 MT worth Rs. 93.63 crore, and the USA with 2,113.41 MT valued at Rs. 82.33 crore. Other significant importers include Kuwait, Qatar, Canada, Oman, Nepal, Singapore, and Bahrain. In total, the quantity exported to all countries was 32,104.09 MT, generating a total value of Rs. 495.46 crore. (FAO, 2023)

1.2.3 Challenges and opportunities associated with export of Indian mangoes

1.2.3.1 Challenges associated with export of Indian mangoes

- Meeting international standards consistently can be challenging due to variations in production practices
- Insufficient cold storage and transport facilities can affect the quality and shelf life of mangoes
- India faces competition from other mango-producing countries, which can impact market share and pricing

1.2.3.2 Opportunities associated with export of Indian mangoes

- Growing global demand for exotic fruits, including mangoes, presents opportunities for expanding market share
- There is potential for growth in exports of processed mango products such as pulp, juice and dried mangoes
- Emphasizing sustainable and organic farming practices can enhance market appeal and meet consumer preferences

1.3 International Mango Trade Dynamics

While Asia leads in mango production, its share in global mango trade is comparatively lower. Trade in mangoes tends to occur over shorter distances due to the perishable nature of the fruit.

1.3.1 Key Points on International Mango Trade:

North America sources the majority of its mango imports from Mexico, Haiti, and Brazil. This close proximity reduces transportation costs and helps maintain the quality of the fruit. India and Pakistan dominate the supply to the West Asian market, benefiting from their geographical closeness and well-established trade routes. In Southeast Asia, countries like the Philippines, Thailand, Indonesia, and Malaysia are key suppliers, ensuring a continuous flow of fresh mangoes throughout the year due to their regional proximity. For the European Union, mangoes are imported from both South America and Asia, leveraging less stringent phytosanitary regulations compared to the US market. Significant suppliers to the EU include Brazil, India, and Pakistan, meeting the diverse demands of European consumers. Transportation Costs and Market Proximity: Mexico and Haiti enjoy a strategic advantage in supplying the US market due to their proximity, which allows for fresher mangoes and lower transportation costs. In contrast, the European Union imports mangoes during diverse peak periods, with significant imports occurring from May to July and again from November to December. Within the EU, France experiences its highest import levels in April and May, the UK sees a peak from May to July, while Germany maintains a steady flow of imports throughout the year. This distribution ensures a consistent supply of mangoes to meet varying consumer demands across these regions.

1.3.2 Seasonal Supply Chains

India is a major exporter of mangoes, primarily shipping its produce to international markets in May month. In contrast, Pakistan focuses its mango exports mainly during June and July. For the European Union (EU) market, Brazil is a key supplier from November to December, while South Africa exports its mangoes from January to April. Venezuela provides mangoes to the EU market from April to July, and

the US supplies mangoes to the EU from June to October. This distribution highlights the diverse timing of mango exports, ensuring a steady supply of the fruit throughout the year.

1.4 Need for the Study

The export competitiveness of Indian fresh mangoes represents a critical opportunity and challenge for the country's agribusiness sector. As the world's leading mango producer, India faces the dual task of capitalizing on its production strengths while navigating a competitive global market. To enhance India's position in the international mango market, it is essential to deeply understand the factors affecting export performance and competitiveness.

Recent observations reveal that despite India's vast production capacity, its export share remains relatively modest compared to other major mango-exporting countries. This discrepancy underscores the need for a comprehensive analysis of the current export strategies, market demands and barriers faced by Indian mangoes. Factors such as stringent international phytosanitary regulations, logistical challenges, and competition from other exporting nations need to be thoroughly examined.

This study aims to unravel the complexities influencing India's mango export competitiveness by examining various dimensions including quality standards, market preferences and infrastructure capabilities. We seek to identify the specific challenges and opportunities within the export landscape whether they stem from regulatory hurdles, quality perceptions, or competitive pricing.

By generating actionable insights, this research will empower stakeholders, including mango producers, exporters and policymakers, to develop strategies that enhance India's competitiveness on the global stage. From improving export processes and infrastructure to addressing market-specific requirements and leveraging India's unique production advantages, our goal is to formulate effective solutions that can bolster India's presence in the international mango market. Ultimately, this study is about driving strategic improvements and fostering sustainable growth in India's mango export sector.

It aims to position India more favorably in the global market, ensuring long-term success and profitability. Collaboration and proactive engagement from across the mango industry will be key to unlocking new opportunities and achieving a stronger competitive edge for Indian mangoes.

1.5 Specific objectives of investigation

1. To document the value chain of mango export
2. To analyze the growth and direction of India's fresh mango export
3. To examine the composition of India's fresh mango export
4. To measure the competitiveness of India's fresh mango export

1.6 Hypothesis of the study

1. There is a significantly affect the export price of mango
2. There is a positive growth in India's fresh mango export
3. There is shifting from middle east countries to new destinations of fresh mango export
4. There isa only few specific mango verities are exported
5. There is a positive competitiveness of India's fresh mango export

1.7 Limitations of the Study

The present study is limited to a single crop, mango. Since the current analysis is entirely based on secondary data, the accuracy of the results is dependent on the precision and truthfulness of the data used. Data from different sources may not always agree, so some effort to select the best of them is unavoidable. In making such decisions, special care has been taken to prevent personal bias. The limitations of secondary data, on the other hand, must be acknowledged

1.8 Presentation of the study

The study is divided into six chapters, which are listed below

- **Introduction:** Introduces the research with a brief overview and outlines the specific objectives guiding the study
- **Review of Literature:** delves into relevant literature reviews aligned with the study objectives to provide a theoretical foundation and context for the research.
- **Methodology:** outlines the study area, sampling framework, database, and analytical tools utilized for data analysis, offering insights into the methodology employed.
- **Results and Discussion:** empirical findings derived from the analysis of data are presented, offering insights into the key patterns and trends observed and engages in a critical discussion of the empirical results, providing deeper insights, interpretations, and implications arising from the findings.
- **Summary:** summarizes the major findings of the study and discusses their implications, offering recommendations for future research and action.
- **References:** Relevant references to the current study have been listed

II REVIEW OF LITERATURE

In this chapter, an attempt was done to review the work completed by other researchers regarding to this topic of study. With respect to objectives of the study, the review of literature has been presented under the following headings:

2.1 Document the value chain of mango export

2.2 Analyse the growth and direction of India's fresh mango export

2.3 Examine the composition of India's fresh mango export

2.4 Measure the competitiveness of India's fresh mango export

2.1 Document the value chain of mango export

Ugonaet *al.* (2015) appraised Nigeria's tomato value chain, identifying critical challenges in production and processing. Despite an annual yield of 1.8 million tonnes of fresh tomatoes, over 50 per cent lost due to poor storage, transportation, and limited processing facilities. The study, based on semi-structured interviews with key value chain actors and a literature review, revealed that while Nigeria produces good tomato varieties, few are suitable for industrial processing. Furthermore, Nigeria is not a major exporter of fresh or processed tomatoes, with constraints including inadequate supply of quality seeds and pesticides, limiting the development of the processing industry.

Bidogzaet *al.* (2016) analyzed vegetable value chains in Cameroon their findings showed that vegetable value chains are relatively simple, involving producers, transporters, traders, processors, and exporters, with input suppliers in standard chains. Farmers faced poor access to market support services and credit, with informal credit often favoring men, leading to higher incomes for male farmers. The economic analysis revealed a benefit-cost ratio greater than 1 for production, processing, and marketing, indicating overall profitability despite earning disparities.

Mehdi *et al.* (2016) conducted a comparative study of traditional versus best practices mango value chain in Pakistan. The study collected data from four mango farms identified in a development project," ASLP Mango Value Chain Improvement". A

wholesaler /commission agent was involved and evaluated from the Multan wholesale fruits and vegetable market. Further, an exclusive premium quality mango sale point was established in multan cantonment area and feedback from 100 consumers was collected who bought mango from this outlet. Their findings show the cost per benefits analysis at the whole of chain level that can motivate the growers, traders, entrepreneurs and retailers to deliver premium quality mangoes to the quality conscious consumers. The main findings were quality mangoes can easiest achieve a price premium in the domestic market and growers, traders and modern food retailers have adequate benefits in delivering premium quality mangoes to the consumers.

Senyoloet *et al.* (2018) examined the value chain of African leafy vegetables in Limpopo Province, South Africa, identifying key actors, institutions, and infrastructure. The study found weak relationships among actors, with transactions often occurring in spot markets. Smallholder farmers achieved high gross margins but faced barriers to mainstream markets, including inadequate technical support, packaging, processing services, infrastructure, and finance. Decentralizing or privatizing government services, such as training and seed distribution, could enhance benefits and support market integration for producers.

Pavithra *et al.* (2018) conducted a comparative study on the rice value chain in Davangere district, Karnataka, and East Champaran district, Bihar, both top rice-growing regions. The analysis identified various marketing channels for paddy and its by-products. Two primary marketing platforms were observed, with growers as initial value chain participants. However, they received inadequate returns and had limited opportunities for value addition. The study also highlighted that the rice milling system in these areas was underdeveloped.

Nadoniet *et al.* (2018) studied grape value chain management in northern Karnataka, finding that farmers in Vijayapura were the most productive, followed by those in Belagavi and Bagalkot districts. Vijayapura farmers were more efficient in marketing due to fewer middlemen and lower transaction costs. The Two Stage Value Chain Model indicated that grape growers excelled in production but lagged in marketing. The study

suggested potential for increased earnings by improving marketing strategies. Recommendations included using better inputs, technical guidance, capacity development, improved crop care, and sound agricultural practices.

Sharma (2019) studied the value chain analysis of vegetable subsector for vegetable production in Nepal. Study collected data through survey using questionnaire and checklists for households, traders and consumers. The study found that situation of value chain on vegetable in Nepal is not satisfactory. The producer's share on consumer price was very low than expected and prices are strongly influenced by market syndicates. Therefore, government policy should focus on quality input supply for vegetable producers, improvements on production and marketing to increase producer's share on consumer price and to reduce marketing costs.

Hassan *et al.* (2020) analyzed value chain of horticultural crops in three regions of India viz., North West Himalayan region, North East region and other performer states whose area under horticulture and production of horticulture is significant. Their study found that in the North West and North East Himalayan States, poor connectivity, high terrain and low infrastructural development of the markets were the common obstacles for the growth and development of the sector. In the North East region contributing (4.5 %) of the horticultural produce, the Jhum cultivation and lack of technological development has proven to be major roadblocks in the sector. Lack of marketing opportunities and inadequate processing, both primary and secondary centre's impact the value of the produce. This lowered down the total remuneration accrued to the farmers. Proper infrastructural development like road connectivity, communication networking and adequate agricultural information dissemination at regular intervals was critical for better productivity and production of the horticultural crops in the region.

Gebre *et al.* (2020) conducted a study on analysis of banana value chain in Ethiopia. The study concluded that there were 3 marketing channels, channel-1 (farmer-rural retailer-rural consumer), channel-2 (farmer-travelling traders- wholesaler-urban retailer- urban consumer) and channel-3 (farmer-cooperatives-wholesaler-urban retailer-urban consumer). The largest volume was sold through channel-2 while the smallest

volume was sold via channels-1. The gross margin of the farmer was 29.32 per cent and for wholesaler it was 22.31 per cent. Share of profit margin for the farmer was 17.90 per cent and for wholesaler it was 34.91 per cent. This concluded that the distribution of banana share in value chain was inefficient. And the distribution of value share for farmer across the market channels ranges between 24.83 per cent - 46.67 per cent and for wholesalers it ranges between 29.67 per cent- 34.62 per cent. Major constrained were poor agronomic practices (i.e. over use of irrigation, poor weed management and harvesting practice) and moisture stress due to the El Nino effect in 2015-16.

Shrestha *et al.* (2021) analyzed the mango value chain in Saptari district, Nepal, identifying key actors as input suppliers, farmers, entrepreneurs, wholesalers, retailers, and consumers. Despite a nearly doubled mango production by farmers, they faced low farm prices due to market monopolies by middlemen and lack of value addition practices such as storage, packaging, and processing. Retail prices remained high. Small-scale growers produced diverse mango products like aamil, chutneys, and achar, with 37.7 per cent of farmers selling these items. Farmers' share was 45.12 per cent in short-distance markets and 31.02 per cent in distant markets. Marketing margins were Rs. 55.18 in distant markets and Rs. 30.18 in short-distance markets. Value addition was Rs. 9.76 by farmers, Rs. 10.18 by wholesalers in proximity markets and Rs. 12.68 in distant markets, and Rs. 20.00 by retailers in proximity markets and Rs. 35.00 in distant markets.

2.2 Analyse the growth and direction of India's fresh mango export

Bisht *et al.* (2015) conducted a study to analyze the changes in the direction of export of fresh mangoes. Results reveals that, Saudi Arabia and Bangladesh were the stable markets among the major importers of mangoes from India as reflected by high probability of retention of 0.3439 and 0.3319 respectively i.e., the probability that Saudi Arabia and Bangladesh retains its shares over the study period were 34.39 per cent and 33.19 per cent respectively. UK and other countries retain a share of 15.59 per cent and 25.00 per cent respectively. Saudi Arabia lost its share of 42.68 per cent to UK, 21.66 per cent to Kuwait and 1.27 per cent to other countries while it gained a share of 42.52 per cent from UAE, 6.72 per cent from Kuwait, 6.49 per cent

from UK and 21.43 per cent from other countries. Bangladesh lost its share to UAE (23.24 %), Kuwait (19.09 %), UK (14.52 %) and other countries (9.96 %) and gained from Kuwait (33.58 %), UK (18.18 %) and other countries (10.71 %). UK lost its share of 31.17 per cent to UAE, 18.18 per cent to Bangladesh, 6.49 per cent to Saudi Arabia and a share of 28.57 per cent to other countries and gained its share from UAE (52.76 %), Saudi Arabia (42.68), Bangladesh (14.52 %) and Kuwait (8.21 %).

Shwetha and Naik (2016) Studied export performance of mango fruit in India in Northern parts of Karnataka. The results revealed that, Nepal is unstable importer of Indian mango because it retained only 1.84 per cent of its share from the previous year by losing 98.16 per cent to Bangladesh. Saudi Arabia was the most unstable importers of Indian mango during the study period as the country did not retain any amount of its share from the previous year.

Adhikari *et al.* (2016) identified direction of trade and changing pattern of rice exports from India with special reference to basmati rice during the period 1980-81 to 2012-13. Results showed that, UAE was the most stable market among the major importers of Indian basmati rice, as exhibited by the highest probability of retention at 0.8226 (82 %). Saudi Arabia had the probability of retention 0.7517 (75 %). Similarly, Iran had retained its original export share of 72 per cent. This implies that Saudi Arabia and Iran were also the stable importers of Indian basmati rice. Kuwait, UK and other countries have shown lower probability of retention, viz. 0.3831, 0.4673 and 0.5400, respectively. On the contrary, Iraq has shown 'zero' probability of retention, indicating that Iraq was an unstable importer of Indian Basmati rice. The major gainer among the importers of Indian basmati rice over the study period was Iran followed by Saudi Arabia.

Swamy *et al.* (2017) analyzed the changing structure of Indian cocoa product exports over 16 years (2000-01 to 2016-17) The analysis categorized export markets into stable (USA, China, and others) and unstable (Singapore, Netherlands). From the results

major markets for Indian cocoa are USA (14.9 %), Nepal (11.6 %), China (7.71 %), Netherlands (6.94 %), and Singapore (5.06 %).

Shilpa *et al.* (2017) examined India's natural honey trade patterns from 2007-08 to 2012-13. The results found that 34 per cent of India's honey exports to the USA were retained, while 66 per cent shifted to other markets. Exports to Yemen were 45 per cent retained, with the remaining 55 per cent redirected to the USA. India failed to retain honey imports from China and Australia, with only 7.3 per cent of imports from Malaysia retained, while 85.5 per cent were diverted to China and 7.2 per cent to other countries.

Shilpa *et al.* (2017) analysed the pattern of export, import and balance of trade of Poultry products in India for the period of 6 years and results revealed that India's previous export to the Afghanistan market was retained to the level of 36 per cent and the remaining 64 per cent was diverted to Germany (10 per cent) and other countries (54 per cent) whereas in case of imports, India's previous import from the Brazil market was retained to the level of 46 per cent and the remaining 54 per cent was diverted to Netherland. India could not retain its previous import of poultry products to Netherland, Japan and Australia.

Manjunath *et al.* (2017) studied direction of trade and changing pattern of Indian marine products exports for the period of 10 years. The structural change and direction of trade in marine products was analysed using Markov Chain approach and it is evident that European Union has been the only stable importer of Indian marine products as reflected by the high probability of retention indicated by Transitional Probability value 0.7954. This implied that the share of import by EU was 79 per cent. Besides EU, SEA, and China are the other countries which are importing Indian marine products with a contribution of 78 per cent (0.7812) & 74 per cent (0.7407) respectively. Japan, Middle East and USA have depicted low probability retention of 0.2970, 0.5514 & 0.6284 respectively during study period.

Kshirsagar *et al.* (2018) examined the growth of mango exports from India during 2006-07 to 2014-15. The study revealed that, the Mango contributed substantially

to the total horticultural export during study period. The higher growth observed in the value of mango export (8.77 %) than the quantity of export (-6.54 %). The growth of unit value of mango export is higher (16.39 %). The instability index has been found higher for unit value (21.38 %) than the quantity of export (15.94 %) and value of export (10.16 %).

Singh *et al.* (2018) analyzed global mango trade from 2006-07 to 2015-16 using Markov chain analysis. The study found that Bangladesh was the most stable market for Indian mangoes, with an (82.32 %) retention probability, followed by the UAE (63.45 %) and the Netherlands (14.46 %) in terms of quantity. For value, the UAE was the most stable with a (75 %) retention probability, followed by Bangladesh (36.2 %). The UK and Saudi Arabia were identified as the most unstable markets for both quantity and value, with Kuwait also being unstable in terms of value.

Singh *et al.* (2018) carried a study to estimate growth of area, production and productivity of fresh mango in India for period of 10 years from 2006-07 to 2015-16. The growth in area, production and productivity was estimated through the compound annual growth rate function. Result reveals that the compound growth rate is positive and non-significant (0.47 %) for area and positive and significant (4.70 %) for production at 1 per cent level of probability. Also the compound growth rate for productivity's positive and significant at 1 per cent level of probability and values 14.83 per cent per annum.

Charwakaet *al.* (2019) analyzed the trade direction of Indian unmanufactured tobacco from 2009-10 to 2017-18. The study revealed that South and Southeast Asia were the most stable markets, retaining about 46.81 per cent of their previous share, although they lost 52.79 per cent to Western Europe. Western Europe retained 42.34 per cent of its previous share but lost 29.69 per cent to Africa and 10.56 per cent to Eastern Europe. The Middle East retained 36.08 per cent of its previous share, while Eastern Europe retained 33.75 per cent. North and South America and Australia were less stable, retaining 24.28 per cent and 1.82 per cent of their shares, respectively. Africa was identified as a disloyal market for Indian unmanufactured tobacco.

Bagalkotiet *al.* (2019) studied structural change in trade direction of cardamom export from India for the period of 1980-81 to 2014-15. The structural change in export of cardamom from India was examined by using the Markov chain approach. The five major importing countries selected were Saudi Arabia, Japan, Kuwait, UAE, USA and remaining countries were considered under other countries. It is evident from results that Kuwait (75.10 %) was the most stable market followed by Saudi Arabia (66.53 %), USA (46.42%), UAE (30.28 %) and Japan (13.65 %).

Gade *et al.* (2020) examined the growth and instability in the area, production, and productivity of chilies in India from 1995-96 to 2017-18 using the Compound Annual Growth Rate (CAGR) and Cuddy-Della Valle Instability Index (CDI). The CAGR for area was -0.774, while production and yield grew at 3.647 per cent and 4.262 per cent per annum, respectively, with all growth rates statistically significant at the 1 per cent. The Coefficient of Variation (CV) for chili area was 0.09 per cent, and the CDI was 0.07 per cent. For production and yield, the CV was 0.26 per cent and 0.30 per cent, respectively, while the CDI was 0.13 per cent for production and 0.12 per cent for yield.

Priya and Singh (2020) studied the instability in mango area, production, and productivity over 25 years (1991-92 to 2015-16), divided into three sub-periods: Period I (1991-92 to 2000-01), Period II (2001-02 to 2010-11), and Period III (2011-12 to 2015-16). Coefficient of Variation (CV) was used to measure instability. Results showed that the CV for area was highest for the entire study period (26 %), with Period I (11 %) and Period III (5.9 %) showing lower variability, and Period II having the lowest (1.3 %). For production, the whole study period had the highest CV (24.55 %), followed by Period III (9.5 %) and Period II (1.24 %), with the lowest in Period I (0.68 %). For productivity, the CV for the entire study period was 13%, with Period III (11.09 %) and Period I (9.71 %) showing higher variability compared to Period II (9.52 %).

Islam (2020) examined trends in the quantity and value of mango export from India. Compound growth rate (CGR) was worked out, to examine the tendency of the variable to increase, decrease or stagnant over a period of time of 6 years from 2012-13 to 2017-18. Result depicts that, the quantity of mango exported

to U.A.E and U.K. decreased and displayed negative compound annual growth rate of 8.94 and 4.31 per cent respectfully. While the quantity of mango exported to Saudi Arabia, Qatar, Kuwait, Nepal and other countries has increased and pronounced compound annual growth rate of 9.84 percent, 8.83 percent, 9.39 per cent, 28.60 percent and 1.80 per cent, respectfully. The highest increase in value of mango export is witnessed by U.K. and recorded outstanding compound annual growth rate of 43.96 per cent. Nepal holds the second rank in terms of increase in value of mango exported from India and witnessed compound annual growth rate of 19.91 per cent followed by Qatar (17.43%), Kuwait (14.19 %), Saudi Arabia (12.88%) and U.A.E. (2.53%).

Myneni *et al.* (2020) examined the trade direction of cotton export. The markov chain analysis was attempted through linear programming method to assess the transition probabilities for major cotton markets for 12 years i.e. 2004-05 to 2015-16. The major Indian cotton export markets were categorized as stable markets (China, Bangladesh) and unstable markets (Italy, Thailand, Indonesia) based on the magnitude of transition probabilities. The major export markets for Indian cotton are China (79 % and 77 %) and Bangladesh (66 % and 78 %) respectively in terms of quantity and value.

Mehazabeen and Srinivasan (2020) studied the direction of trade of Indian banana to different importing countries by estimating the transitional probability matrix and steady state probability matrix using the Markov chain analysis for the period of 10 years from 2007-08 to 2016-17. The identified major banana destinations were UAE, Saudi Arabia, Iraq and Nepal. It is evident that UAE had one of the most stable markets among the major importers of Indian banana as reflected by higher probability of retention. UAE retains its exports share over the study period was 54 per cent. Saudi Arabia retains its export share of 4.80 per cent. The countries such as Oman, Iran and Nepal had the retention of 4.44 per cent, 1.18 per cent and 2.82 per cent respectively. The other importing countries had retention of share of 54.67 per cent.

Kumar and Devaraj (2020) studied direction of trade and changing export pattern of fresh grapes in India during pre-WTO and post-WTO period from 2001-02 to 2016-17. The results of the Transitional Probability Matrix of fresh grapes export from India

showed that The Netherlands was one of the stable markets of Indian fresh grapes as reflected by the probability of retention. It might be due to increasing demand for fresh grapes in that country and as a crop it was not cultivated extensively in the Netherlands. However, Germany did not continue as a loyal importer of India's fresh grapes. It might be due to rigid competition by other countries such as the Netherlands.

Gade *et al.*(2020) studied the direction of trade and changing export pattern of chilli. Results concluded that, Indonesia, Thailand and Vietnam found most unstable importers of the chilli in period-I and Bangladesh, Malaysia, Sri Lanka and USA found most stable importers. Bangladesh, Pakistan and UAE are found most unstable importers in period-II and Malaysia, Sri Lanka, Thailand and Vietnam found most stable importers. In overall trade direction, Malaysia and Sri Lanka found the most stable market, followed by Vietnam and USA and UAE found most unstable country in importers of Indian Chilli.

Paulmurugan (2021) studied growth and instability in area, production and productivity of mango in India for a period of 10 years from 2008-09 to 2017-18. Results analyzed with the help of various statistical tools like descriptive and time series analysis. Results revealed that the area grows with negative compound growth rate of 0.59 per cent and production grows with positive growth rate 5.04 per cent at 1 per cent level of probability. It also reveals that the productivity of mango grows with significant compound growth rate of 5.68 per cent at 1 per cent level of probability.

2.3 Examine the composition of India's fresh mango export

Pillania (2008) highlights the growth trajectory of the Indian economy and foreign trade. Since gaining independence in 1947, India's merchandise exports have surged from \$1.3 billion in 1950-51 to \$63.8 billion in 2003-04, reflecting a compound annual growth rate of 7.6 per cent. Post-liberalization in 1991, trade growth accelerated, with manufactured goods and services now dominating India's trade composition. India's service exports hold a share in global exports more than double that of manufacturing exports. East Asian countries, especially China, have become significant trading partners. There remains substantial untapped potential for India's foreign trade in the future.

Bhat (2011) reported that the post reform period in India has witnessed significant changes in the trend, pattern and structure of external trade. The share of manufacturing sector has marginally fallen in the GDP and significantly declined in the share of export. The growth of services was more pronounced in GDP growth and is reflected in the increasing share of services in exports. The share of primary products has fallen in export and that of petroleum products showed an increase. The author hence reported that in near future India may emerge as an 'Asian Petroleum Hub. Study further remarked that India has not taken the advantage of international segmentation of production process and the export is still heavily dominated by labour intensive products characterized by a slow growing international demand and protected markets.

Thomas *et al.* (2011) analyzed the composition of agricultural exports from 1991 to 1999 and 2000 to 2009. The commodities selected were Cereals and cereal preparation, Fresh and processed vegetables, Fresh and processed Fruits, Pulses, Floriculture products, Tea and coffee, Spices, Tobacco, Cotton, Marine products, Meat and meat preparations, Poultry & dairy products, Oil cakes, oil and oilseeds, and Sugar and molasses. The Study found tea and coffee, cereals and cereals preparations, marine products, oilcake, oil, and oilseeds, and earned a large chunk of the total agricultural export until 1999. However, it can be observed that the relative importance of tea and coffee has marginally declined. From the year 1991 to 2009, the share of cereals export has increased from 12.4 per cent to 17.2 per cent. Tea and coffee, the primary export earners in the earlier decade, declined to 6.3 per cent of the total agricultural export value in 2009 from 21.8 per cent in 1991.

Zhang, Y., (2012) studies structural decomposition analysis to evaluate the scale, composition and technique effects of trade-related carbon emissions in China (mainland) from 1987 to 2007. The initial findings indicate that the increasing magnitude of China's trade, both in terms of the carbon emissions embodied in exports and the carbon emissions avoided via imports, had large-scale effects during the whole period. The technique effect caused by changes in input mix, sector energy intensity, fuel mix and carbon coefficients effectively offset part of the scale effect during the entire period but failed to do so during some sub-periods. Changes in trade composition caused a relative

small increase in the carbon emissions created by exports but a relative small decrease in the carbon emissions avoided via imports during the whole period.

Adhikary (2013) examined India's trade direction for agricultural commodities from 1990-91 to 2007-08. The study revealed that in 2008-09, developing countries and OECD countries were the primary markets for India's agricultural exports, holding 37.6 per cent and 37.4 per cent shares, respectively. OPEC was another significant contributor, with a 21.2 per cent share. The UAE emerged as the largest destination for Indian exports in 2008-09, accounting for 13.1 per cent of the total, surpassing the U.S., which had been the top market for several years. The U.S. followed with an 11.4 per cent share, and other notable markets included China (5.1 %), Singapore (4.5 %), Hong Kong (3.6 %), and the UK (3.6 %).

Sahni (2014) found changing structure of India's exports throws some interesting light on both the demand pattern and supply factors that are increasingly influencing India's exports and the manner in which its production structures, institutions, and policies are responding to it. Regarding changes in the composition of exports since 1980s, it may be observed that the share of agriculture and allied products has been declining while that of ores and minerals has remained more or less steady. Share of manufactured goods has increased generally. Although the opening up of the Indian economy since the early 1990s provided impetus for higher growth for most of the commodities, some products gained more than the others. India's merchandise exports are predominated by the manufacturing sector which accounted for more than three fourth of its total exports during post-reform period.

Mathor and Sagar (2015) states that the exports are increasing at a decreasing rate but the imports are increasing at an increasing rate. Trade deficit increased very sharply from 2004- 05 to 2009- 10. The composition of India's foreign trade has undergone substantial changes, particularly, after the liberalization and globalization. Major exports includes manufacturing goods such as engineering goods, petroleum products, chemicals and allied products, gems and jewellerys, textiles, electronic goods, etc. India's Exports of Services Important: Since data below is for latest time period hence data above too

should be of same period so as to maintain consistency. It is a remarkable achievement that we have transformed ourselves from a predominantly primary goods exporting country into a non-primary goods (manufactured goods) exporting country. By exploiting the benefit of GATS now India is becoming the largest exporter of services.

Gebeltova *et al.* (2020) studied agricultural trends in Czechia using the Herfindahl–Hirschman Index, which revealed a decrease in crop diversity across all regions. The analysis identified wheat, barley, rapeseed, and fodder crops as predominant. The dominance of wheat, barley, and rapeseed, coupled with intensive farming and poor crop rotation, poses a threat to soil fertility. The study recommends focusing on proven agricultural practices, including crop rotation and increased production of fodder crops. Additionally, it suggests adjusting "single area payment subsidies" to address the negative impact of the main crops on soil fertility and declining livestock production.

Carrasco *et al.* (2021) investigate the trade-economic growth nexus in developing countries considering the structure of the external sector. The economic literature has examined the effects on growth of export composition, export diversification and import composition, individually. We add to this discussion by jointly evaluating the role of these three factors in the trade-economic growth nexus. The assessment of the structure of the external sector allows identifying the features that improve the trade-economic growth nexus with relevant economic policy implications for developing countries. Using a sample of 19 developing countries and dynamic panel data models, we found that export composition and export diversification are insignificant. By contrast, the domestic content of exports, the share of high-tech imports and capital goods imports are positively associated with economic growth. Consequently, developing countries growth benefits from high-tech and capital goods imports, and potentially, from the development of an industrial policy able to boost the domestic production of inputs for the exporting sector.

2.4 Measure the competitiveness of India's fresh mango export

Dastagiri *et al.* (2013) examined the marketing efficiency and export competitiveness of Indian vegetables the study was conducted in India as whole for

production and export competitiveness and for marketing efficiency in the 8 states of India covering 20 crops. The study showed that area under total vegetables cultivation is grown at the rate of 4.12 per cent and production growth rates was 6.48 per cent. The results showed that Indian vegetables have huge potential for exports. The results show that for all vegetables the nominal protection coefficient is less than one indicates competitive in the international markets.

Bustanul (2013) in his study examined the competitiveness and sustainability of key agricultural commodities in Indonesia, crops namely: coffee, cocoa, tea, cashew and mango. Study recommends policy options to improve the performance of these value chains in the future, both in terms of the competitiveness and sustainability. The study applied the revealed comparative advantage (RCA), complemented by in-depth interviews and discussions with competent resource persons and development partners.

Pal *et al.* (2015) in their study on competitiveness in export of vegetable crops used nominal protection co-efficient. The export of vegetables cabbage, potato, tomato and onion was found competitive and cabbage was found to be the highest export competitiveness. Singapore, Indonesia, Qatar and Russia were found to be highest export competitiveness for cabbage, onion, tomato, and potato respectively

Kuthe and More (2015) studied export performance of other processed fruits and vegetables from India. The author observed that the average exports of other processed fruits and vegetable were estimated for last twenty five years. It was seen that, United State of America, Saudi Arab, United Kingdom, Netherland, and UAE were the top five export destination from India. The average quantity of processed fruits and vegetables exported to these countries were 16857.50, 11939.12, 9777.27, 8963.45 and 7052.52 MT, respectively during the study period. Similar trend was observed in respect of value realization.

Rizwanulhassan and Shafiqurrehman (2015) analyzed the global competitiveness of Pakistan's mango exports against leading exporter of the world. The study reveals that the comparative advantages of Pakistan in global market for mango exports is declining

during the period of study as well as India and Brazil are also on losing side but the other players like Mexico, Peru, Thailand and Philippines are gaining comparative advantage posing competition for Pakistani exports in world market.

Dhekaleet *al.*(2016) studied the export competitiveness of Indian Tea. Markov chain analysis based on transition probabilities was used to study structural changes in tea export of India. Russia Federation, United States of America and other countries are observed as more stable countries while United Arab Emirates is one of the most unstable country for Indian tea export. Future projections of India tea export has observed declining share in United Kingdom and Kazaikhstan while increasing share in Russian Federation, United Arab Emirates and other countries. In case of value of export, Russian Federation and United Kingdom would decline in percentage share in future while United Arab Emirates would increase percentage share of total export value of India.

Gautam and Alpesh (2016) studied the export competitiveness and marketing channel for fresh grapes of Maharashtra. The study showed that the export of grapes during the year 2008-09 was about 118133 Mt, fetching export earnings of Rs.367.06 crore. The primary data was collected from grapes growing farmers through interview and questionnaire. Grape export has a significant growth rate in India. India has a great scope to export grape in large quantity to such a country having export competitiveness and less distance to transport from India to Saudi Arabia, United Arab Emirates and Belgium to earn more profit

Makamaet *al.* (2016) analysed the export competitiveness of Indian Rice. data indicates that the world output has witnessed that some decline for the recent past production of milled Rice in the world out of total 409.2 million tonnes in 1999 but declined to 384.4 million tonnes in 2002. In India, rice production and its export witnessed fluctuations as it declined during 2009-10 but however went high in 2011-12. All the indicators (NPC,EPC,DRC) were less than unity thus it revealed that the domestic price of Rice in the country is lower than the world market price hence competitive worldwide.

Ranjini *et al.*(2017) studied the competitiveness and potential of agricultural trade between India and ASEAN members for the period 1996-2015. They revealed that Indian wheat has a higher RCA value of 12.23, compared to its competitors, viz., Malaysia (8.81) and

Nagpure *et al.* (2019) studied the export competitiveness of banana in India for period from 1994-95 to 2014-15 using nominal protection coefficient (NPC). The results showed that since 1995, international price of banana is higher than domestic price. Indian banana experienced export advantage of more than 88.79 per cent during the year 2011. The level of domestic price related to international price was much lesser, which facilitated export advantages with 15.57 per cent in the year of 2001-02. It was also revealed that banana experienced a massive export advantages during the year 2002-03 to 2008-09. Nominal protection coefficient was found highest in the year 2014 at 0.17 levels i.e. international price of banana was much greater than domestic price and there is increasing trend of NPC from 2012-13 which was facilitate for export of banana in a massive quantity. It is concluded from the NPC analysis that, the export competitiveness of banana has been increasing over the years i.e. there is an export advantage.

Ahmad *et al.*(2021) analysed the export competitiveness of major fruits and vegetables of Pakistan for the period 2001-2018 using revealed comparative advantage (RCA). Results indicated that mangoes, citrus and dates had revealed comparative advantage. The estimated results of various RCA indices for onions and potatoes showed both revealed comparative advantage as well as disadvantage. The existence of comparative advantage highlights a considerable export potential of fruits and vegetables of Pakistan. Tapping this potential can significantly contribute in enhancing exports and foreign exchange earnings, generating employment opportunities and reducing trade deficit of the country. To increase export competitiveness of fruits and vegetables, the study suggests investment in research and development for finding out new ways for improvements in yield, quality and management of post-harvest losses. Value chain and infrastructural development is also needed to increase the export competitiveness of fruits and vegetables of Pakistan.

III METHODOLOGY

This chapter deals with the description of the study area, the nature and sources of data, sampling procedure followed for selection of the respondents and various analytical tools employed to achieve the objectives. At the end of the chapter a few key concepts used in the study are explained to facilitate clear understanding of the issues with which the present study is concerned. The methodology is presented under the following heads.

3.1 Nature and source of data

3.2 Analytical tools and techniques

3.3 Terms and concepts used in the study

3.1 Nature and source of data

In order to examine and document the specific objectives of investigation, required data for the study was collected from both primary and secondary data

Primary Data: To analyze the value chain of fresh mango exports, primary data was collected from a range of sources. This included five registered fresh mango exporters listed with APEDA, five APEDA-certified farmers, five vendors and one facilitator (packhouse). The data was obtained through a well-structured and pre-tested interview schedule, ensuring its comprehensiveness and relevance.

Secondary Data: For the analysis of growth, trends, direction, and competitiveness in the export of fresh mangoes, secondary data was gathered from several sources. This data included export quantities and values from the top 10 importing countries, covering the years 2004 to 2023, sourced from the Agricultural Processed Food Products Export Development Authority (APEDA) and the National Mango Database. Additionally, varietal composition data was collected from APEDA, while other mango export data was retrieved from the ITC Trade Map. This comprehensive approach combined both primary and secondary data to provide a detailed understanding of the mango export value chain and market dynamics.

Table 1: HS code for different fresh mango varieties

Sl. No.	Varieties	HS CODE
1.	Mangoes	08045002
2.	Fresh/Dried mangoes	08045020
3.	Alphonso (Hapus)	08045021
4.	Banganapalli	08045022
5.	Chausa	08045023
6.	Dasheri	08045024
7.	Langda	08045025
8.	Kesar	08045026
9.	Totapuri	08045027
10.	Mallika	08045028
11.	Other Mangoes	08045029

Source: ITC trade map

Table 2: Top ten importing countries of fresh mangoes by quantity and value (2023)

Sl. No.	Importing countries	Quantity imported (MT)	Value imported (Rs. crores)
1.	Unites Arab Emeritus (UAE)	15336	189
2.	United Kingdom	4706	93
3.	United States of America (USA)	2113	82
4.	Kuwait	963	24
5.	Quatar	1304	18
6.	Canada	699	16
7.	Oman	959	14
8.	Nepal	3106	9
9.	Singapore	376	8
10.	Baharain	473	6
11.	Other countries	2064	35
	Grand total	32104	495
	Share of top 10 countries	93.57	93.13

Source: https://agriexchange.apeda.gov.in/index/genReport_combined.aspx

3.2 Analytical tools and techniques

Analysis is a process of detailed examination of data with the objective of getting useful and supporting information for data interpretation and drawing suitable policy decisions. Pertinent statistical tools and suitable economic techniques were used for assessing the objectives of the study and the details are summarized below.

3.2.1 Descriptive statistics

Descriptive statistics, such as mean and percentages, were used to analyze the data on the growth and export share of mangoes from India to the global market for this study.

3.2.2 Compound Annual Growth Rate (CAGR)

The exponential compound annual growth rates were estimated by using log-linear function on the time series data. That is, the growth rate is estimated by using the semi-log functional form

$$\text{Log} Y_t = a + bt \quad \dots\dots\dots(a)$$

This equation (a) can be elaborated in detail as:

$$Y_t = Y_0 (1+r)^t \quad \dots\dots\dots (i)$$

Taking log on both sides, we get $\text{Log } Y_t = \text{Log } Y_0 + t \text{ Log } (1+r) \dots\dots\dots(ii)$

Equation (ii) can be rewritten as

$$Y_t = a + bt \quad \dots\dots\dots(iii)$$

Where $Y = \text{Log } Y_t$; $a = \text{Log } Y_0$; $b = \text{Log } (1+r)$, In equation (iii)

Y_t = time series variables

a = constant

t = Time variable in year (1,2,3.....n)

b = Regression coefficient that shows the rate of change or growth rates in a series

The annual compound growth rate (r) can be worked out by using;

$$\text{Antilog (b)} = \text{Antilog (log (1+r))}$$

$$\text{Antilog (b)} = 1+r \text{ and } r = \text{Antilog b}-1$$

When multiplied by 100, it gives the percentage growth rate of that time series variables. That is, Compound Annual Growth Rate (CAGR)

$$r = ((\text{Antilog B})-1) \times 100$$

3.2.3 Cuddy Della Valle's Instability Indices (C.I.I.)

It was used to measure instability in production and international trade of Mango which is close to approximation of the average year to year per cent variation adjusted for trend (Cuddy et al., 1978). The algebraic form of it is:

$$\text{Instability Index} = CV\sqrt{(1 - R^2)}$$

Where,

CV = Simple estimates of coefficient of variation in per cent

R^2 = Coefficient of determination from a time trend regression adjusted by the number of degrees of freedom.

3.2.4 Markov Chain analysis

Export data from last decade period were utilized to examine the trade direction and the changing patterns of Indian fresh mango exports. The direction of trade for commodity exports was analyzed using the first-order Markov chain approach. A key component of Markov chain analysis is the estimation of the transitional probability matrix, denoted as P. The elements P_{ij} within matrix P represent the probability that exports will shift from country i to country j over time. The diagonal elements of this matrix measure the likelihood that a country will retain its export share, providing insight into an importing country's loyalty to a specific exporter. In this analysis, structural changes were considered a random process involving selected importing countries. The average exports to a particular country were treated as a random variable that depends solely on the historical exports to that country, which can be expressed algebraically as

$$E_{jt} = \sum_{i=1}^r E_{it-1} * P_{ij} + e_{jt}$$

Where,

E_{jt} = Exports from India to j^{th} country during the year t .

E_{it-1} = Exports to i^{th} country during the period $t-1$

P_{ij} = Probability that the exports will shift from i^{th} country to j^{th} country.

e_{jt} = The error term which is statistically independent of E_{it-1} .

t = Number of years considered for the analysis

r = Number of importing countries

The transitional probabilities P_{ij} which can be arranged in a $(c * r)$ matrix have the following properties.

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

$$\sum_{i=1}^r P_{ij} = 1 \text{ for all } i$$

3.2.5 Revealed Comparative Advantage Index

To compare the competitiveness of each country in the trade of a Mango, the revealed comparative advantage (RCA) index is often computed using the following formula (Balassa, 1965):

$$RCA_{ic} = \frac{x_{ic}/X_{iw}}{X_{cw}/X_w}$$

Where RCA_{ic} is the revealed comparative advantage index of commodity group c for country i , x_{ic} the value of exports of commodity group c by country i , X_{iw} the value of total exports by country i , X_{cw} the value of world exports of commodity group c , and X_w is the value of total world exports.

Country i has comparative advantage in exporting commodity group c when RCA_{ic} has a value greater than unity, that is, when country i 's export share of commodity group c is larger than the world export share of the same commodity group. On the contrary, if RCA_{ic} is less than unity, country i has comparative disadvantage.

3.2.6 Revealed Symmetric Comparative Advantage (RSCA)

To evaluate India's Mango export competitiveness, the Revealed Symmetric Comparative Advantage (RSCA) index can be used (Dalum *et al.*, 1998), calculated as:

$$RSCA_{ic} = \frac{RCA - 1}{RCA + 1}$$

Where:

RSCA is the symmetric revealed comparative advantage of India's Mango exports.

The RSCA index ranges between -1 and +1:

A positive value ($RSCA > 0$) indicates that India has a comparative advantage in Mango exports, meaning its share of global Mango exports is greater than expected relative to its overall export share.

A negative value ($RSCA < 0$) indicates a comparative disadvantage, implying India's Mango export share is smaller than its total export share.

This symmetric approach provides a balanced measure of India's Mango export competitiveness in the global market.

3.2.7 Herfindahl-Hirschman Index of Concentration

Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each commodity exported from India and then summing the resulting number. The HHI is expressed as:

$$HHI = \sum_{(i=1)}^N S_i^2$$

Where, S_i is the market share of country i in the market, and N is the number of countries. The result is a weighted average of market shares, with values ranging from 0 to 1, where 0 indicates no concentration and 1 full concentration in the market (this would be the case of a monopoly). The UK's Competition and Markets Authority (CMA) defines a market as 'concentrated' (CMA, 2010) if the HHI is higher than 0.1 (or 10%) and as 'highly concentrated' if the HHI is higher than 0.2. The US Federal Trade

Commission (US FTC) defines a slightly different threshold with HHI values above 0.18 as a ‘highly concentrated market’, and above 0.1 as ‘moderately concentrated’ (FTC, 2015). A market with a HHI below 0.1 is usually considered as ‘non-concentrated’.

3.2 Terms and concepts

- **Export Volume:** Refers to the total quantity of mangoes exported, usually measured in metric tons or kilograms.
- **Export Value:** The total monetary worth of mangoes exported, typically expressed in U.S. dollars or local currency.
- **Export Growth Rate:** The percentage change in the volume or value of mango exports over a specific period, indicating the rate of increase or decrease in exports.
- **Market Share:** The percentage of a country's total mango exports relative to the global mango trade. It reflects the country's competitiveness in the global market.
- **Varietal Composition:** The distribution of different mango varieties within the export market, indicating which varieties are most commonly exported.
- **Value Chain Analysis:** A detailed assessment of all activities involved in the production, processing and distribution of mangoes from farm to final export, identifying key players such as farmers, packhouses, vendors, and exporters.
- **Competitiveness Index:** A measure used to evaluate a country's ability to compete in the global mango market, often considering factors such as cost efficiency, quality standards and market access.
- **Export Competitiveness:** The relative performance of a country's mango exports in comparison to other countries, often assessed using indicators like export prices and trade balances.
- **Direction of Trade:** The flow of mango exports to different importing countries, which helps identify major trading partners and emerging markets.
- **Trade Barriers:** Any restrictions or tariffs imposed by importing countries that could affect mango exports. These include phytosanitary standards, import quotas, or taxes.

- **HS Code (Harmonized System Code):** A standardized numerical method used to classify goods in international trade. Mangoes typically fall under a specific HS code for fresh fruit exports.
- **Free Trade Agreements (FTAs):** Agreements between countries that reduce or eliminate trade barriers for mango exports, improving market access.
- **Competitor Analysis:** An assessment of other mango-exporting countries, evaluating their strengths, export volumes, and market presence in key importing countries.
- **Seasonality:** The specific time periods during which mangoes are harvested and exported, which can affect pricing and export volumes.
- **Logistics and Supply Chain:** The infrastructure and processes involved in transporting mangoes from the farm to international markets, including storage, handling, packaging, and shipping.
- **Export Pricing:** The price at which mangoes are sold in international markets, influenced by production costs, quality, supply and demand and trade regulations.
- **Import Duty:** Taxes imposed by importing countries on mangoes, which can affect the competitiveness of exports.
- **Quality Standards and Certifications:** Requirements for mangoes to meet specific quality and safety standards (e.g., APEDA certification), ensuring compliance with international market regulations.
- **Trade Deficit/Surplus:** A country's trade balance related to mango exports, with a surplus indicating more exports than imports and a deficit showing the opposite.
- **Export Destinations:** The countries to which mangoes are exported, often categorized by regions or individual countries for analysis.

IV RESULTS AND DISCUSSION

The results obtained from the study are presented under the following headings.

4.1 Export value chain mapping of fresh mango exports from India

4.2 Growth and direction of fresh mango exports from India

4.3 Composition of India's fresh mango exports

4.3 India's Export Competitiveness for fresh mangoes in the Global Market

4.1 Export value chain mapping of fresh mango exports from India

Fig.1 indicates the value chain mapping, which focuses on the value captured from farmers till the exporter, reflects the flow of value at each stage of the export value chain. Based on the needs of the research, In Channel I, mangoes were collected from farmers by a local vendor. The vendor was responsible for field-level grading, packing and transportation to the facilitation center. At the facilitation center, activities such as unloading, primary grading, hot water treatment, ripening, secondary grading, weighing, packing, marking, gamma treatment, quality checking and loading were carried out. Mangoes were then transported to the nearest airport for export. In Channel II, the exporter directly procured mangoes from the farmers and sent them to the facilitation center. After all the processes at the facilitation center were completed, the exporter handled the transportation to the airport, from where the mangoes were exported. In Channel III, the farmer acted as the exporter. The farmer harvested the mangoes, sent them to the facilitation center for processing and then transported them to the airport for export.

4.1.1 Value addition at each stage of different fresh mango export channels

The table 4.1 provides a comparison of value contribution and the compounded value chain across three different channels in the mango export process, involving key stakeholders such as farmers, vendors, facilitators, and exporters. In Channel I, farmers sell mangoes at Rs. 82.00, earning a margin of Rs. 60.00, which contributes 5.31 per cent to the value chain. The vendor, responsible for operational costs and logistics, contributes 0.81 per cent to the value chain with a margin of Rs. 8.20.

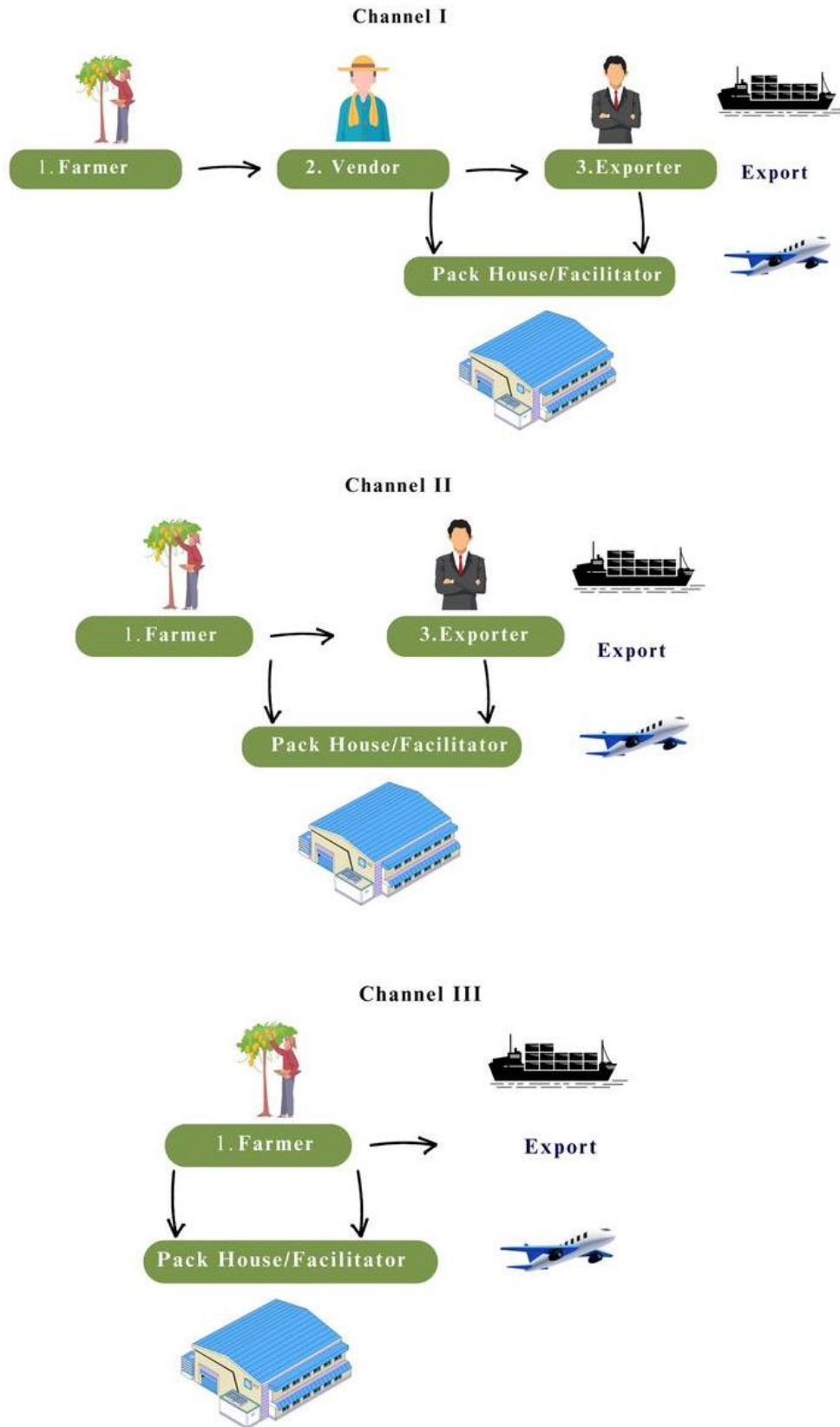


Fig. 1: Export value chain mapping of fresh mango exports from India

The facilitator incurs an operational cost of Rs. 31.32 and contributes 3.50 per cent to the total value chain, earning a margin of Rs. 22.68. Exporters in this channel bear the highest operational costs (Rs. 500.70) and contribute a substantial 90.39 per cent, earning a margin of Rs. 895.85. The total exported price in this channel is Rs. 1545.01 with the compounded value contribution reaching 100 per cent.

In Channel II, the vendor is absent, and the exporter directly procures from the farmer. The farmer's contribution slightly increases to 5.32 per cent, with a margin of Rs.60.00. The facilitator's role and contribution remain similar to Channel I, contributing 3.50 per cent to the value chain. The exporter takes on a larger share of the value chain, contributing 91.18 per cent with an operational cost of Rs. 505.90 and a margin of Rs.899.94. The exported price in Channel II is marginally lower at Rs. 1541.84, with the compounded value chain contribution also at 100 per cent.

In Channel III, where the farmer assumes the role of the exporter, the farmer's direct contribution as a seller is lower (Rs. 26.80), with minimal margin from sales (1.74%). However, by acting as the exporter, the farmer captures a larger share of the total value chain, contributing 94.76 per cent, with a margin of Rs. 959.48. The facilitator's role remains unchanged, contributing 3.50 per cent to the value chain. The absence of intermediaries like vendors makes this channel more efficient for the farmer, and the exported price is Rs. 1540.98.

Based on the research need to assess the value captured from farmers till the exporter, it is evident that the share of value varies significantly between channels. In Channel I, while farmers capture a decent margin, the highest value is ultimately captured by the exporter (90.39%). In Channel II, the absence of a vendor slightly increases the farmer's share, but again, the exporter retains the majority (91.18%). Channel III, however, demonstrates a model where the farmer, acting as the exporter, captures the majority of the value (94.76%). This model of integration provides the greatest value retention for farmers by eliminating the need for intermediaries and allowing farmers to control the export process, thus increasing their overall earnings. This insight is critical for understanding how farmers can capture more value through vertical integration within the export value chain.

Table 4.1: Channel wise value addition in fresh mango exports

Stake holders	Particulars	Channel 1	Value contribution at eachstage	Compounded Value Chain	Channel II	Value contribution at eachstage	Compounded Value Chain	Channel III	Value contribution at eachstage	Compounded Value Chain
Farmers (05)	Selling price	82.00	5.31	5.31	82.00	5.32	5.37	26.80	1.74	1.26
	Cost of Production	22.00			22.00			22.00		
	Marketingcost	0.00			0.00			4.80		
	Margin	60.00			60.00			-		
Vendor (05)	Purchaseprice	82.00	0.81	6.11	-	-	-	-	-	-
	Operationalcost	4.26			-			-		
	Margin	8.20			-			-		
Facilitator (01)	Purchaseprice	94.46	3.50	9.61	82.00	3.50	8.90	26.80	3.50	4.81
	Operationalcost	31.32			31.32			31.32		
	Margin	22.68			22.68			22.68		
Exporter/ Farmer as Exporter (05)	Purchase price	148.46	90.39	100.00	136.00	91.18	100.00	80.80	94.76	100.00
	Operational cost	500.70			505.90			500.70		
	Margin	895.85			899.94			959.48		
Exported Price		1545.01	100.00		1541.84	100.00		1540.98	100.00	

*Costs per Kg of Mango Exports

4.1.2 The cost break-up for value added at Facilitators level

Table 4.2 illustrates the cost break-up for value added at facilitators level for mangoes as follows, unloading costs were Rs. 1 per kilogram, primary grading costs were Rs.3 per kilogram, hot water treatments incurred Rs. 6 per kilogram and ripening costs amounted to Rs. 3 per kilogram. Secondary grading, weighing, marking, and related tasks were priced at Rs. 4 per kilogram, while the gamma treatment represented the highest cost, at Rs. 35 per kilogram. Finally, loading charges were Rs. 2 per kilogram, bringing the total operational cost at the facilitation center to Rs. 54 per kilogram.

In terms of value distribution, gamma treatment, which is a compulsory SPSS (Sanitary and Phyto sanitary) requirement for USA, one of India's major trade partners, accounted for the largest share of the costs. This highlights the critical importance of adhering to international phytosanitary standards, especially for the U.S. market. The costs associated with hot water treatments and secondary grading further underscore the emphasis on quality assurance and preparation for export, ensuring the mangoes meet both regulatory and market expectations. Meanwhile, the relatively lower costs for unloading, loading and primary grading reflect the basic logistical operations within the facilitation center. Overall, the most significant investments are in post-harvest treatments essential for international trade, with gamma treatment playing a pivotal role in compliance and market access.

Table 4.2: The cost break-up for value added at Facilitators level

Sl.No.	Operations	Costs (Rs./ Kg)
1	Unloading charge	1
2	Primary grading	3
3	Hot water treatments	6
4	Ripening	3
5	Secondary grading, weighing, marking and etc	4
6	Gamma treatment	35
7	Loading charge	2
	Total operation costs (Rs./Kg)	54

4.1.3 The cost break-up for value added at exporter level

Table 4.3 represents cost break-ups at exporter level in export value chain of fresh mangoes, results found that, in Channel I and III, the costs outlined were Rs. 20.00 for packing material, Rs. 5.00 for the Customs House Agent (CHA) and quality check, Rs. 3.20 for insurance, Rs. 467.50 for freight, and Rs. 5.00 for miscellaneous expenses, totalling Rs. 500.70 per kilogram. In Channel II, an additional Rs. 5.20 per kilogram is incurred for transportation from the farm to the facilitative center, bringing the total cost to Rs. 505.90 per kilogram.

The packing material of a 4 kg box costing Rs.80 per box, which is ideal measure for exports. The licenced Customs House Agent (CHA) services are predominantly for the U.S exports. Insurance and freight costs are averaged for air transport. Miscellaneous charges cover legal expenses, transportation to the airport and airport handling fees. In Channel II, the transportation from the farmer to the facilitative center is also included as part of the overall cost structure. These findings were similar with the results of (Mehdi *et al.*, 2016).

Table 4.3: The cost break-up for value added at exporter level

Sl. No.	Operations	Cost (Rs. /Kg)
1	Packing material (Rs 80/ 4 Kg Box)	20.00
2	CHA/ Quality checking	5.00
3	Insurance	3.20
4	Freight	467.50
5	Miscellaneous	5.00
Channel I & III	Total cost	500.70
	Transportation	5.20
Channel II	Total cost	505.90

4.2 Growth and direction of fresh mango export from India

4.2.1 Trends in fresh mango exports from India

Table 4.4 indicates the trends in fresh mango exports from India (2004-2023) illustrates the performance of India's mango export industry over two decades, covering the export quantity (in metric tonnes or MT) and value (in crore rupees) from the fiscal year 2004-05 to 2023-24. The quantity of fresh mangoes exported fluctuated, while the monetary value associated with these exports experienced more consistent growth over the period (fig.2).

The table reveals significant fluctuations in the quantity of mangoes exported. The period began with a relatively modest 53,480 MT in 2004-05, followed by a steep rise to 83,703 MT in 2008-09, indicating strong export performance in the early years. The quantity declined to 58,863 MT in 2010-11, but climbed again to a high of 79,060 MT in 2006-07.

These fluctuations suggest external factors such as changing market demand, climatic conditions, or production capacity may have influenced exports. A significant drop was observed during the 2020-21 period (21,033.56 MT), likely due to the impact of the COVID-19 pandemic, which disrupted global supply chains and affected the production and transportation of agricultural goods. However, the export volume showed some recovery in subsequent years, reaching 32,104 MT in 2023-24.

Despite the fluctuating export quantities, the value of mango exports has shown a generally upward trend. Starting from Rs. 89.61 crore in 2004-05, the value of mango exports increased to Rs. 495.46 crore by 2023-24, showing a substantial rise in the value of mangoes exported even when the volume didn't always follow the same upward pattern.

There is a marked increase in export value after 2010, which accelerated further from 2013-14 onwards. For instance, in 2013-14, the value was Rs. 285.43 crore and by 2016-17, it surged to Rs. 443.66 crore. Even during periods when export quantities dropped, such as 2020-21, the value of exports remained relatively high (Rs. 271.88

crore) due to likely higher market prices or shifts in demand for Indian mangoes in premium markets. By 2022-23, the value had reached Rs. 378.49 crore, reflecting a sharp post-pandemic recovery, despite a smaller quantity exported compared to pre-pandemic years. This suggests that higher prices per unit of export might have compensated for the lower volumes.

Table 4.4: Trends in fresh mango exports from India

Sl. No.	Year	Quantity (MT)	Value (Rs. Crore)
1.	2004-05	53480.02	89.61
2.	2005-06	69606.6	128.11
3.	2006-07	79060.88	141.94
4.	2007-08	54350.8	127.42
5.	2008-09	83703.18	170.71
6.	2009-10	74460.61	200.54
7.	2010-11	58863.41	164.84
8.	2011-12	63441.29	209.74
9.	2012-13	55584.99	264.72
10.	2013-14	41279.97	285.43
11.	2014-15	42998.33	302.54
12.	2015-16	36779.26	320.64
13.	2016-17	52761.00	443.66
14.	2017-18	49180.48	382.34
15.	2018-19	46510.22	406.5
16.	2019-20	49658.68	400.21
17.	2020-21	21033.56	271.88
18.	2021-22	27872.77	327.45
19.	2022-23	22963.76	378.49
20.	2023-24	32104.09	495.46
	CAGR	-5.12**	7.75**

Note: ** indicates significant at 5 per cent

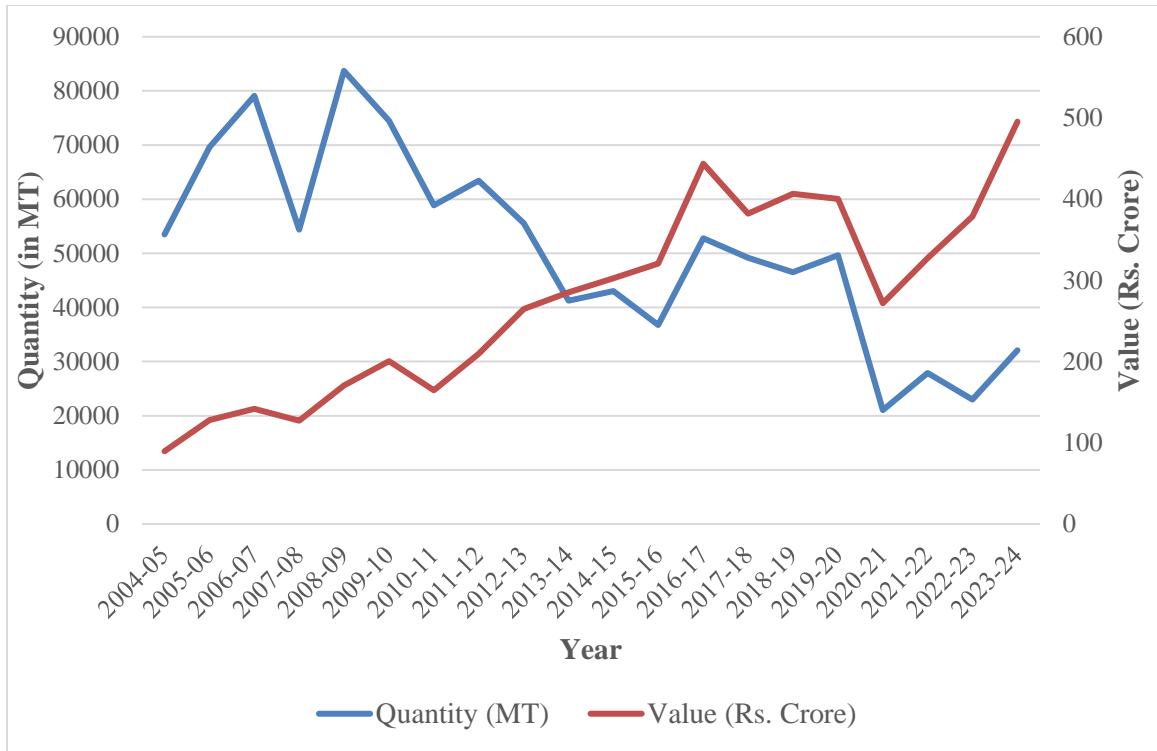


Fig. 2: Trends in fresh Mango exports from India

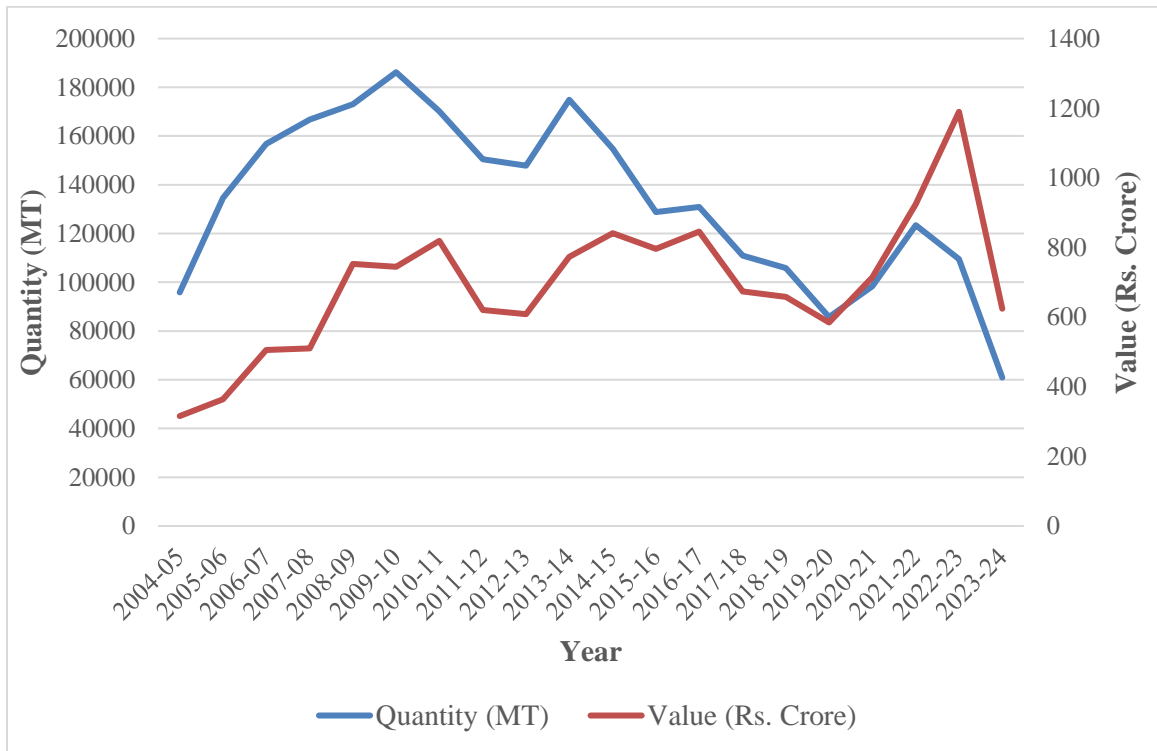


Fig. 3: Trends in Mango pulp exports from India

While export quantity experienced dramatic ups and downs, the value consistently grew. For instance, from 2011-12 to 2012-13, the quantity decreased from 63,441 MT to 55,584 MT, but the value rose from Rs. 209.74 crore to Rs. 264.72 crore. This suggests that Indian mangoes commanded a higher price in international markets due to either higher demand or quality, making export value resilient even when volumes shrank. In 2019-20, the export volume was higher (49,658 MT) compared to 2020-21 (21,033 MT), but the export value for the two periods (Rs. 400.21 crore in 2019-20 and Rs. 271.88 crore in 2020-21) did not decrease proportionally, further supporting the idea of price increases and changing global market dynamics. From 2015-16 onwards, there has been a strong upward trajectory in the export value despite fluctuating export volumes. In particular, 2016-17 saw a notable increase in value to Rs. 443.66 crore despite exporting a relatively moderate quantity (52,761 MT). This could indicate successful export strategies targeting higher-value markets, improvement in mango quality, or favourable trade agreements. In 2023-24, the export quantity (32,104 MT) is far below peak years, but the export value of Rs. 495.46 crore is the highest on record. This is a key sign of the increasing premium associated with Indian mangoes.

The trends in mango exports from India demonstrate a dynamic relationship between export quantity and value. While the volume of mango exports has been inconsistent over the years due to various internal and external factors, the export value has shown robust growth. The sharp divergence between quantity and value, especially in recent years, suggests that Indian mangoes are fetching higher prices in global markets, possibly due to strong international demand and market diversification.

4.2.2 Trends in Mango pulp exports from India

The Table 4.5 indicates the trends in India's mango pulp exports over a period of two decades, from 2004-05 to 2023-24. The quantity of mango pulp exported (in Metric tons) and the total export value (in crores of rupees). A compound annual growth rate of -2.93 for quantity and 3.34 for value indicates contrasting trends over the years. From 2004-05 to 2023-24, the quantity of mango pulp exports fluctuated but overall showed a declining trend, decreasing from 95,857 MT in 2004-05 to 60,900 MT in 2023-24.

However, during the same period, the export value increased steadily, with some fluctuations, from Rs. 315.72 crores to a high of Rs. 1189.66 crores in 2022-23, before falling slightly to Rs. 624.29 crores in 2023-24. This indicates that although the volume of exports is shrinking, the value per unit of export is increasing, likely due to higher prices and the appreciation of mango pulp in international markets.

The period from 2004-05 to 2009-10 saw a consistent increase in the quantity of exports, peaking at 186,197 MT in 2009-10. After 2010-11, the trend began to reverse, with the quantity of exports gradually declining. By 2019-20, the quantity dropped to its lowest point during the period (85,725 MT). In the years 2020-21 and 2021-22, export quantities recovered slightly but then dropped again to 109,501 MT in 2022-23, and reached a significant low of 60,900 MT in 2023-24.

Despite fluctuations in quantity, the value of exports grew steadily, particularly after 2008-09, when the value reached Rs. 752.99 crores. The value continued to increase, reaching its peak at Rs. 1189.66 crores in 2022-23. This growth in value, despite decreasing quantities, can be attributed to factors such as: Higher global demand for Indian mango pulp in premium markets. Improved quality and the possible shift to more value-added mango pulp products. Price inflation for agricultural products and favourable currency exchange rates, which boosted the value of exports in rupee terms. The data also suggests that external factors such as global economic conditions, market disruptions and possibly the COVID-19 pandemic impacted the export volumes.

The overall trends indicate that India's mango pulp export market is transitioning from a volume-driven to a value-driven export model. While the quantity of exports has been on a downward trajectory (CAGR of -2.93), the value of these exports has increased at a steady rate (CAGR of 3.34), reflecting a rise in global demand for Indian mango pulp or higher prices in international markets. This could be due to improvements in product quality, price increases, or favourable currency exchange rates. Moving forward, India may focus on strengthening its market position by continuing to export higher-quality or value-added products, which fetch higher prices. However, the significant drop in export quantity in 2023-24 due to SPSS, more pest residue content in mangoes, production

challenges and export supply chain disruption. These findings were aligned with the results of (Shwetha and Naik 2016).

Table 4.5: Trends in Mango pulp exports from India

Sl. No.	Year	Quantity (MT)	Value (Rs. Crore)
1.	2004-05	95857.00	315.72
2.	2005-06	134613.20	364.24
3.	2006-07	156835.51	505.83
4.	2007-08	166752.17	509.69
5.	2008-09	173013.60	752.99
6.	2009-10	186197.85	744.61
7.	2010-11	170219.72	818.93
8.	2011-12	150499.06	620.83
9.	2012-13	147815.69	608.56
10.	2013-14	174860.33	772.95
11.	2014-15	154820.66	841.39
12.	2015-16	128866.01	796.18
13.	2016-17	130886.07	846.02
14.	2017-18	110923.73	673.92
15.	2018-19	105873.22	657.67
16.	2019-20	85725.57	584.32
17.	2020-21	98369.75	714.41
18.	2021-22	123476.71	924.54
19.	2022-23	109501.38	1189.66
20.	2023-24	60900.21	624.29
	CAGR	-2.93**	3.34**

Note: ** indicates significant at 5 per cent

4.2.3 Compound annual growth rate and Instability of fresh mango and mango pulp export from India

The Table 4.6 provides insights into the compound annual growth rate (CAGR) and the instability of India's fresh mango and mango pulp exports, using several statistical measures: mean, standard deviation (SD), coefficient of variation (CV%), and Cuddy Della Vella Instability Index (CDVI). These metrics help to assess both the growth and the volatility of export quantities and values over time.

The CAGR for fresh mango exports shows a decline of -5.12 per cent in quantity, while the value of exports grew by 7.75 per cent. This indicated that while fewer fresh mangoes are being exported, the revenue from these exports has increased significantly, likely due to higher per-unit prices or better access to premium markets. For mango pulp, the quantity exported declined at a lower rate of -2.93 per cent, while its export value grew at a moderate rate of 3.34 per cent. This reflects a similar pattern, where export volumes are declining but revenue is rising, though at a slower pace than for fresh mangoes.

The mean export quantity for fresh mangoes is 50,784.70 MT with an average value of Rs. 275.61 crores, whereas the mean export quantity for mango pulp is much higher, at 133,300.37 MT, with an average value of Rs. 693.34 crores. This suggests that India exports a significantly larger volume of mango pulp compared to fresh mangoes and the value of mango pulp exports is also substantially higher. The SD for fresh mango exports in terms of quantity is 17,729.93 MT, with a value of Rs. 118.39 crores, indicating a relatively high level of fluctuation from the mean. For mango pulp, the SD is higher for quantity (34,165.59 MT) but moderate for value (Rs. 196.67 crores). This reflects more significant fluctuations in the volume of mango pulp exports compared to fresh mangoes, while the fluctuations in value are somewhat comparable.

The CV measures the relative variability of the exported quantity and value. Fresh mango exports show higher volatility in value (42.96 %) than in quantity (34.91 %), indicating that the value of fresh mango exports is more unstable over time. For mango

pulp, the CV for both quantity (25.63 %) and value (28.37 %) is lower, indicating relatively more stability compared to fresh mangoes.

The CDVI measures the instability of exported quantity and value from India. Fresh mango exports both quantity and value exhibited medium level of instability 20.85 and 17.83, respectively. While mango pulp exports show same pattern, both quantity and value showed medium level of instability 20.19 and 21.95, respectively. These values indicate that while both product categories face moderate instability, the fluctuations in mango pulp exports are marginally higher in terms of value.

Both fresh mango and mango pulp exports from India have experienced declining quantities, with fresh mango exports declining at a faster rate than mango pulp. However, export values have increased, particularly for fresh mangoes (7.75 % CAGR), indicating that even with reduced export volumes, revenue from these exports has grown due to higher pricing or value-added products. Mango pulp exports, while more stable than fresh mangoes, still show moderate volatility, especially in terms of quantity. Given that mango pulp exports have a higher mean value and quantity, they contribute more significantly to India's overall mango export revenue. By the above results the study rejects the null hypothesis and therefore there is negative growth of fresh mango exports from India.

Table 4.6: Compound annual growth rate and Instability of fresh mango and mango pulp export from India

Particulars	Fresh Mangoes		Mango pulp	
	Quantity (MT)	Value (Rs. Crore)	Quantity (MT)	Value (Rs. Crore)
CAGR	-5.12	7.75	-2.93	3.34
Mean	50784.70	275.61	133300.37	693.34
SD	17729.93	118.39	34165.59	196.67
CV (%)	34.91	42.96	25.63	28.37
CDVI	20.85	17.83	20.19	21.95

4.2.4 Direction of trade of Indian fresh mango export

The table 4.7 represents transitional probability matrix of fresh mangoes volume exports from India to world from 2014 to 2023. The elements in the columns of the Transitional Probability Matrix (TPM) represent the extent to which a country gains trade from its competitors, while the values in the row indicates loss of trade to the its competitors and the diagonal elements indicate the likelihood that a country retains its trade volume from the previous year.

The transitional Probability matrix of India's fresh mangoes export has been presented in the table. The mangoes, were being exported to around 50 different countries from India. Among them, key destinations for export are the UAE, UK, USA, Kuwait, Qatar, Canada, and Oman which together held the share of around 81.25 per cent of total fresh mangoes exported from India in 2023. The remaining importers are grouped into a category named "Others".

It is observed that, Oman is the most stable importer of the mangoes as the probability that Oman retained its original share from previous year was 83.44 per cent. They lost their share of about 16.56 per cent to Qatar and gained from other countries group 2.26 per cent. UAE was another stable importer of fresh mangoes as it retained 44.56 per cent of its share from previous year by losing 35.47 per cent to other countries, Qatar (10.35 %) and UK (9.62 %). Even though it gained considerable share from Other countries (88.49 %), Qatar (78.50 %), UK (38.40 %), Canada (35.14 %) and USA (35.04 %).

The most unstable markets among the importing countries were Kuwait, Canada and other countries with the zero per cent retention and UK (39.72 %), and USA (0.08 %) retention of total exports from India. Considering the results of the Transitional probability matrix of fresh mangoes, Oman regarded as the most reliable market destination for the export of India's fresh mangoes, followed by UAE, UK and USA.

The findings are consistent with those of Sharma and Shilpa (2021), Kusuma and Basavaraja (2014) and Kumar *et al.* (2007). However, Kumaresh and Sekar (2013)

reported contrasting results, identifying six major countries—UAE, Saudi Arabia, Bangladesh, UK, Bahrain, and Nepal as key importers of mangoes. Bangladesh, in particular, was found to be a stable importer of Indian fresh mangoes, maintaining its original market share of approximately 39 per cent during the period from 2000 to 2012.

Table 4.7: Transitional Probability matrix of fresh mango exports in terms of volume from India to world (2014-2023)

Importers	UAE	U K	U S A	Kuwait	Qatar	Canada	Oman	Others
UAE	0.4456	0.0962	0.0000	0.0000	0.1035	0.0000	0.0000	0.3547
U K	0.3840	0.3972	0.0000	0.2188	0.0000	0.0000	0.0000	0.0000
U S A	0.3504	0.6488	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000
Kuwait	0.0000	0.4094	0.1545	0.0000	0.0000	0.4361	0.0000	0.0000
Qatar	0.7850	0.0000	0.2150	0.0000	0.0000	0.0000	0.0000	0.0000
Canada	0.3514	0.0000	0.4744	0.1742	0.0000	0.0000	0.0000	0.0000
Oman	0.0000	0.0000	0.0000	0.0000	0.1656	0.0000	0.8344	0.0000
Others	0.8849	0.0674	0.0000	0.0091	0.0161	0.0000	0.0226	0.0000

4.2.5 Direction of trade of Indian fresh mango export in terms of value

The pattern of fresh mango exports from India to various global markets was examined using a Markov-chain analysis by constructing a transition probability matrix based on six years of export value data. This matrix, presented in Table 4.8 provides insights into the dynamics of India's fresh mango exports between 2018 and 2023.

The analysis revealed that the USA was the most consistent and stable importer of Indian fresh mangoes. The probability of the USA maintaining its market share from the previous year was 67.66 per cent. However, the USA experienced a shift in its market composition, losing 32.34 per cent of its share to the UK, while gaining significant shares from Canada (100 %) and Kuwait (80.63 %). This stability and market retention indicate the strong demand for Indian mangoes in the US market, bolstered by favourable

economic factors, such as the relative appreciation of the US dollar against other currencies.

Similarly, Oman emerged as another stable market, retaining 54.40 per cent of its mango import share from the previous year, though it lost 45.60 per cent of its share to the UK. Oman managed to increase its imports by gaining 7.60 per cent from other countries and 3.29 per cent from its internal market dynamics, reinforcing its position as a key importer. In contrast, the most volatile and unstable markets for Indian mango exports were the UK, Kuwait, Qatar, Canada, and several other smaller markets, all of which showed zero retention of their previous year's market share. The UAE retained 41.24 per cent of its share, making it a moderately stable destination.

Table 4.8: Transitional probability matrix of fresh mangoes export (Value) from India (2014-2023)

Importers	UAE	U K	U S A	Kuwait	Qatar	Canada	Oman	Others
UAE	0.4124	0.2819	0.0000	0.0210	0.0502	0.0000	0.0329	0.2016
U K	0.6848	0.0000	0.0000	0.1257	0.1895	0.0000	0.0000	0.0000
U S A	0.0000	0.3234	0.6766	0.0000	0.0000	0.0000	0.0000	0.0000
Kuwait	0.0000	0.0000	0.8063	0.0000	0.0000	0.1937	0.0000	0.0000
Qatar	0.2880	0.0000	0.0000	0.2515	0.0000	0.1376	0.0000	0.3229
Canada	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Oman	0.0000	0.4560	0.0000	0.0000	0.0000	0.0000	0.5440	0.0000
Others	0.7758	0.0529	0.0000	0.0000	0.0954	0.0000	0.0760	0.0000

The findings from the transition probability matrix, when considering export value in USD, highlight the USA as the most reliable market for Indian mango exports. This reliability can be attributed to both market demand and the strengthening of the US dollar, which enhances the value of exports in USD. Oman and the UAE also stand out as important and stable markets, although with relatively lower retention compared to the

USA. The findings are consistent with those of Sharma and Shilpa (2021), Kusuma and Basavaraja (2014). By this the study rejects the null hypothesis and there by accept alternate hypothesis.

4.3 Composition of India's fresh mango exports

India, as the largest global producer and exporter of mangoes, offers a wide array of varieties that are distinct in flavor, texture, and aroma. Over the years, a few select varieties have dominated the export market due to their high demand internationally. This section analyzes the varietal composition of India's fresh mango exports from 2019-20 to 2022-23, based on data availability and provided only for four years by the Agricultural and Processed Food Products Export Development Authority (APEDA).

4.3.1 Trade Composition growth rates of fresh mango varieties in volume from India

The table 4.9 provides highlights the export quantities of various mango varieties from India over four fiscal years, 2020-21 to 2023-24, along with their Compound Annual Growth Rate (CAGR). The total export quantity of fresh mangoes has generally increased, growing from 21,033.56 MT in 2020-21 to 32,104.1 MT in 2023-24, reflecting a CAGR of 6.11.

Among individual varieties, Kesar mangoes showed a strong growth trend, with exports rising sharply from 983.73 metric tons in 2020-21 to 3,787.01 metric tons in 2023-24, achieving a CAGR of 18.80. In contrast, Alphonso (Hapus) mangoes, despite being a premium variety, saw a slight decline in exports, with a CAGR of -2.75, decreasing from 3,195.85 metric tons in 2020-21 to 2,673.39 metric tons in 2023-24. Other varieties such as Banganapalli experienced modest growth with a CAGR of 2.74, while Totapuri showed significant growth (CAGR 15.08) but with smaller absolute volumes. The Chausa variety had an impressive CAGR of 25.71, surging from 40.98 metric tons in 2020-21 to 488.26 metric tons in 2023-24. Other Mangoes, a category likely including less specific varieties, dominated in terms of export quantity, contributing significantly to the overall mango exports with a CAGR of 6.47. This was

illustrated the growth trends across different mango varieties and highlights the growing demand for certain varieties like Kesar and Chausa, while others like Alphonso are facing challenges. By the following results the study rejects the null hypothesis.

Table 4.9: Trade Composition growth rates of fresh mango varieties in volume from India

(Value in MT)

Sl. No	HS Code	Product	2020-21	2021-22	2022-23	2023-24	CAGR
1	08045021	Kesar	983.73 (4.67)	2319.08 (8.32)	1749.96 (7.62)	3787.01 (11.79)	18.80
2	08045026	Alphonso (Hapus)	3195.85 (15.19)	5994.86 (21.50)	2829.76 (12.32)	2673.39 (8.32)	-2.75
3	08045022	Banganapalli	830.55 (3.94)	1674.03 (6.00)	856.91 (3.73)	1081.68 (3.36)	2.74
4	08045023	Totapuri	47.47 (0.22)	151.01 (0.54)	116.6 (0.50)	91.95 (0.28)	15.08
5	08045027	Mallika	41.40 (0.19)	61.16 (0.21)	28.81 (0.12)	38.17 (0.11)	0.03
6	08045025	Dasheri	49.50 (0.23)	75.92 (0.27)	34.70 (0.15)	75.54 (0.23)	-2.05
7	08045024	Chausa	40.98 (0.19)	25.64 (0.09)	19.72 (0.08)	488.26 (1.52)	25.71
8	08045028	Langda	48.99 (0.23)	122.16 (0.23)	70.02 (0.30)	81.9 (0.25)	6.40
9	08045029	Other Mangoes	15795.09 (75.09)	17448.90 (62.60)	17257.30 (75.15)	23786.20 (74.09)	6.47
		Total	21033.56 (100)	27872.76 (100)	22963.80 (100)	32104.10 (100)	6.11

Note: Figures in the parenthesis indicates percentage to the total

4.3.2 Trade composition of fresh mango varieties export from India: average volume from 2020-21 to 2023-24

The Table 4.10 and fig. 4 depicted that the average composition of fresh mango varieties exported from India from 2020-21 to 2023-24, showing both quantities (in metric tons) and their percentage shares. The most significant portion of mango exports falls under Other Mangoes (HS code 8045029), which accounted for a substantial 71.45 per cent of total exports, with an average quantity of 18,571.87 metric tonnes. Among the named varieties, Alphonso (Hapus) leads the exports, contributing 14.13 per cent (3,673.47 metric tons). Kesar follows at 8.50 per cent (2,209.95 metric tons) and Banganapalli makes up 4.27 per cent (1,110.79 metric tons). Lesser-exported varieties include Totapuri (0.39 %), Chausa (0.55%) and Langda (0.31%), while Mallika and Dasherri have minimal export shares of 0.16 per cent and 0.23 per cent, respectively. This composition reflects the dominance of other miscellaneous mango varieties in India's fresh mango exports, with Alphonso and Kesar being the most prominent named varieties in international markets.

Table 4.10: Trade composition of fresh mango varieties export from India: average volume from 2020-21 to 2023-24 (Value in MT)

Sl. No.	HS Code	Product	Average quantity	Per cent
1	08045021	Alphonso (Hapus)	3673.47	14.13
2	08045026	Kesar	2209.95	8.50
3	08045022	Banganapalli	1110.79	4.27
4	08045023	Chausa	143.65	0.55
5	08045027	Totapuri	101.76	0.39
6	08045025	Langda	80.78	0.31
7	08045024	Dasherri	58.92	0.23
8	08045028	Mallika	42.39	0.16
9	08045029	Other Mangoes	18571.87	71.45
		Total	25993.56	100.00

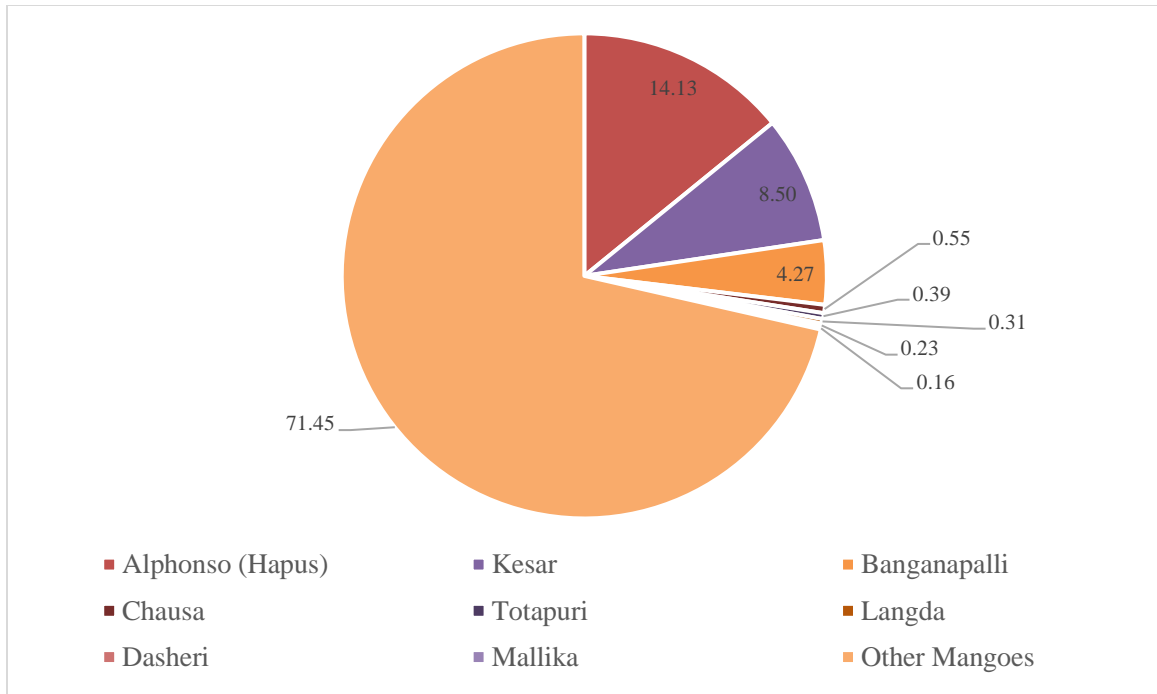


Fig. 4: Per centage share of composition of different varieties of fresh mango export from India (Quantity) 2020

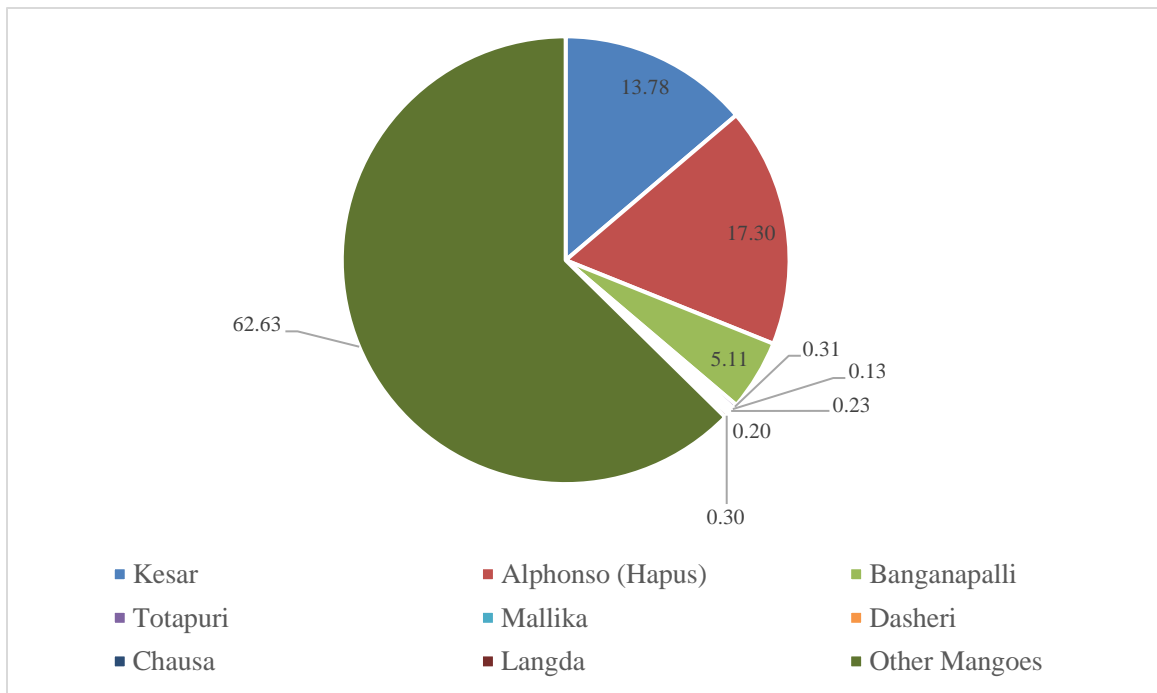


Fig. 5: Per centage share of composition of different varieties of fresh mango export from India (Value)

4.3.3 Trade Composition growth rates of fresh mango varieties in value from India

Table 4.11 indicates the export values of various fresh mango varieties from India over the period 2020-21 to 2023-24, showing an overall compound annual growth rate (CAGR) of 7.02 per cent per annum. The Kesar variety demonstrated significant growth with a remarkable CAGR of 18.25, as its export value rose from Rs. 2,923.28 crore in 2020-21 to Rs. 11,251.50 crore in 2023-24. In contrast, the prestigious Alphonso (Hapus) variety experienced a decline, with a negative CAGR of -2.82 per cent, ending at Rs. 8,680.16 crore in 2023-24 despite fluctuations in its export value. This highlights the rising global demand for Kesar mangoes, while Alphonso, traditionally a premium variety, faced challenges in maintaining its export performance. Other varieties also had mixed performances. Banganapalli grew at a modest CAGR of 3.90 per cent, while Totapuri and Mallika had slow but steady growth of 6.78 per cent and 3.00 per cent, respectively. Dasherri and Langda grew at a similar pace, with respective CAGRs of 3.66 per cent and 5.01 per cent. Interestingly, Chausa experienced a massive growth spike, with a CAGR of 44.19, surging from Rs.51.02 Crores in 2020-21 to Rs. 244.58 Crores in 2023-24.

Table 4.11: Trade Composition growth rates of fresh mango varieties in value from India (2020-21 to 2023-24) (Value in INR Crores)

Sl.No.	HS Code	Product	2020-21	2021-22	2022-23	2023-24	CAGR
1	8045026	Kesar	2923.28	6905.31	4967.37	11251.5	18.25
2	8045021	Alphonso (Hapus)	6084.17	10091.4	7836.41	8680.16	-2.82
3	8045022	Banganapalli	1459.37	3006.94	2002.47	3195.78	3.90
4	8045027	Totapuri	65.27	167.52	196.97	158.73	6.78
5	8045028	Mallika	34.98	88.4	57.78	72.73	3.00
6	8045024	Dasherri	94.27	111.35	55.34	167.02	3.66
7	8045023	Chausa	51.02	49.36	34.83	244.58	44.19
8	8045025	Langda	84.46	163.56	122.89	191.4	5.01
9	8045029	Other Mangoes	25422.1	23483.9	33260	36178.7	7.50
		Total	36219	44067.7	48534	60140.6	7.02

The category of Other Mangoes saw consistent growth with a CAGR of 7.50 per cent, making it a significant contributor to overall export performance. This was indicated varied demand for different mango varieties, with some experiencing significant export growth, while others, like Alphonso, face challenges.

4.3.4 Trade composition of fresh mango varieties export from India: average value from 2020-21 to 2023-24

The table 4.12 and fig. 05 revealed that, the average composition of fresh mango varieties exported from India between 2020-21 to 2023-24, measured in values and percentages. Among the different varieties, Alphonso (Hapus) leads with an average export of Rs. 8,173.04 Crores., constituting 17.3 per cent of the total exports. Kesar follows closely, with Rs. 6,511.87 Crores., making up 13.78 per cent. Other popular varieties like Banganapalli and Totapuri contribute 5.11 per cent and 0.31 per cent, respectively. Interestingly, a large proportion of exports, 62.63 per cent, is made up of unspecified or other mango varieties, totalling Rs. 29,586.18 Crores.. Lesser-known varieties like Mallika, Dasherri, Chausa, and Langda represent only minor shares, each accounting for less than 0.5 per cent. The export value highlights the dominance of Alphonso, Kesar, and unspecified mangoes in India's mango export market. These findings were aligned with results of (Thomas *et al.*, 2011).

Table 4.12: Trade composition of fresh mango varieties export from India: average value from 2020-21 to 2023-24 (Value in INR Crores)

Sl. No.	HS Code	Product	Average	Per cent
1	08045021	Kesar	6511.87	13.78
2	08045026	Alphonso (Hapus)	8173.04	17.30
3	08045022	Banganapalli	2416.14	5.11
4	08045023	Totapuri	147.12	0.31
5	08045027	Mallika	63.47	0.13
6	08045025	Dasherri	107.00	0.23
7	08045024	Chausa	94.95	0.20
8	08045028	Langda	140.58	0.30
9	08045029	Other Mangoes	29586.18	62.63
		Total	47240.33	100.00

4.4 India's Export Competitiveness for fresh mangoes in the Global Market

India, as one of the world's largest producers of mangoes, holds a prominent position in global mango trade. An analysis of trade competitiveness for India's fresh mangoes is crucial to understanding its current performance and future potential in international markets.

4.4.1 Export Competitiveness for India's fresh mangoes in the global market

The table 4.13 presents the competitiveness of India's fresh mango exports from 2012 to 2023, measured using the Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) indices.

Table 4.13: Export Competitiveness for India's fresh mangoes in the Global Market

Sl. No	Year	RCA	RSCA
1.	2012	1.70	0.26
2.	2013	1.45	0.18
3.	2014	1.34	0.15
4.	2015	1.36	0.15
5.	2016	1.51	0.20
6.	2017	1.28	0.12
7.	2018	1.10	0.05
8.	2019	1.00	0.00
9.	2020	0.52	-0.32
10.	2021	0.68	-0.19
11.	2022	0.71	-0.17
12.	2023	0.82	-0.10

Source: ITC trade map,

Note: data pertaining from January to December of the year in ITC trade map

The RCA values above 1 from 2012 to 2019 indicate that India had a comparative advantage in mango exports during these years, although this advantage showed a declining trend, dropping from 1.70 in 2012 to 1.00 in 2019. The RSCA values, which range from -1 to 1, reinforce this observation, with positive values up to 2019, indicating competitiveness, though decreasing from 0.26 in 2012 to 0.00 in 2019. Post-2019, both indices show that India's comparative advantage in fresh mango exports diminished, with RCA values falling below 1, indicating a comparative disadvantage in exporting fresh mangoes. The RSCA values turn negative from 2020 onwards, highlighting a comparative disadvantage, though there is a slight improvement from -0.32 in 2020 to -0.10 in 2023. Overall, the data reflects a significant decline in the competitiveness of India's fresh mango exports over the given period. These results were aligned with the results of (Dastagiri *et al.*, 2013).

4.4.2 Market share of major importers of Indian Fresh Mangoes

The table 4.14 indicated that the market shares of major importers of Indian Fresh Mangoes in the world from 2014 to 2023, the United Arab Emirates (UAE) dominated the market for Indian fresh mangoes, accounting for nearly half of both the quantity and value of imports. On average, the UAE imported 18,735 metric tons (MT) annually, representing 49.06 per cent of the total imports and contributing 48.72 per cent to the total value, equivalent to \$25.9 million. The United Kingdom followed, though with a much smaller share: it imported 3,028 MT (7.93 %) but contributed a higher proportion to the value (14.15%) due to higher price points, amounting to \$7.5 million. Other significant importers include Qatar (5.09 % of the quantity, 5.43 % of the value), the United States (2.45 % of the quantity, 4.38 % of the value), and Oman (4.37 % of the quantity, 4.27 % of the value). Notably, Other Countries collectively made up 28.09 per cent of the total imports and 15.84 per cent of the value, suggesting a diversified but lower-value import market for Indian mangoes across various regions. Overall, the world imported an average of 38,186 MT of Indian mangoes annually, worth \$53.2 million.

Table 4.14: Market share of major importers of Indian Fresh Mangoes in the world (2014 to 2023)

Sl. No.	Imports	Average quantity (MT)	Percentage Contribution (%)	Average value (USD)	Percentage Contribution (%)
1.	United Arab Emirates	18735	49.06	25919544	48.72
2.	United Kingdom	3028	7.93	7525359	14.15
3.	Nepal	695	1.82	2972824	5.59
4.	United States of America	935	2.45	2332408	4.38
5.	Qatar	1942	5.09	2887555	5.43
6.	Kuwait	459	1.20	856684	1.61
7.	Oman	1667	4.37	2272802	4.27
8.	Other Countries	10726	28.09	8428834	15.84
	World	38186	100.00	53196013	100.00

Source: ITC Trade map

4.4.3 Market concentration of fresh mango trade

In the study Herfindahl-Hirschman Index (HHI) is used to measure the concentration of fresh mango export origin and import destinations. The table 4.15 analyzes the export concentration of Indian fresh mangoes from 2014 to 2023. It compares the concentration levels based on the thresholds set by two regulatory authorities: The United Kingdom Competition and Market Authority (UK CMA) and the United States Federal Trade Commission (US FTC).

According to the HHI values provided, both in terms of quantity (0.331) and value (0.293) of fresh mango exports, the market shows a high concentration. This is because these values exceed the high concentration thresholds set by both the UK CMA (HHI \geq 0.2) and US FTC (HHI \geq 0.18). A high concentration indicates that Indian fresh

mango exports are dominated by a few key markets or players, potentially suggesting limited competition and a lack of market diversity for this product during the analyzed period. The table thus highlights that Indian fresh mango exports are not diversified, with a significant reliance on a small number of buyers or export destinations, which can pose risks to market stability and competitiveness.

Table 4.15: Export concentration of Indian Fresh Mangoes (2014 to 2023)

Particulars	HHI Thresholds		HHI of Fresh Mango Exports	
	UK CMA	US FTC	Quantity (MT)	Value (USD)
No concentration	≤ 0.1	≤ 0.1		
Moderate concentration	$0.1 > \text{HHI} < 0.2$	$0.1 > \text{HHI} < 0.18$		
High concentration	≥ 0.2	≥ 0.18	0.331	0.293

Note: UK CMA: United Kingdom Competition and Market Authority US FTC: United States of America Federal Trade commission

4.4.4 Constraints faced by fresh mango exporters in India

The table 4.16 revealed that the constraints faced by fresh mango exporters, ranked by their problems. The most significant constraint was Sanitary and Phytosanitary (SPS) measures, with a Garrets Mean Score of 77.18, indicating that exporters find regulatory compliance particularly demanding. High international freight charges follow, with a score of 67.162, reflecting the financial burden of shipping. Difficulties in obtaining necessary certifications rank third, suggesting issues with regulatory processes. Custom clearance challenges are also notable, ranked fourth. The availability of quality mangoes in sufficient quantities is a concern but less critical, ranked fifth. Local transportation costs, institutional support deficits, poor infrastructure, lack of standardization in post-harvest handling, and price fluctuations are progressively less impactful, with the lowest-ranked issues being price fluctuations and post-harvest standardization. This ranking highlights the primary areas where exporters face the most significant difficulties, from regulatory hurdles to logistical and infrastructural problems.

Table 4.16: Constraints faced by fresh mango exporters in India (n=5)

Sl. No.	Particulars	Garrets Mean Score	Rank
1	Sanitary and Phytosanitary (SPS)measures	77.18	I
2	High international freight charges	67.162	II
3	Difficulties in certification	65.522	III
4	Difficulties in custom clearance	59.878	IV
5	Unavailability of quality mangoes insufficient quantity	51.998	V
6	High local transportation charges	41.032	VI
7	Lack of institutional support with respectto credit	38.234	VII
8	Poor infrastructure facilities like coldstorage	35.226	VIII
9	Lack of standardization on post-harvesthandling	33.882	XI
10	Price fluctuation of the commoditysupply at home country	29.726	XI

4.5 Policy suggestions

4.5.1 Following are the policy suggestion from the study findings:

- Support programs like that enable farmers to directly engage in the export process, thereby increasing their share of the value chain and reducing dependency on intermediaries.
- Simplify and harmonize Sanitary and Phytosanitary (SPS) regulations to reduce the regulatory burden on exporters and facilitate easier compliance with international standards.
- Implement strategies to reduce reliance on a few key export destinations by exploring and developing new international markets for Indian mangoes.
- Address high market concentration by encouraging competition and market entry for more players, which can mitigate risks and improve market stability for Indian mango exports.

V SUMMARY

Mangoes, known as *Mangifera indica*, are cultivated extensively in tropical and subtropical regions. India leads global production, accounting for (40%) of the total, with key states including Uttar Pradesh, Andhra Pradesh and Karnataka. Despite this dominance, India's export share is limited due to high domestic demand. India exported approximately 32,104 MT of fresh mangoes in FY 2023-24, marking a (19%) increase from the previous year. Major markets include the UAE, UK, and USA. However, exporters face challenges such as meeting international standards, insufficient cold storage, and competition from other countries. Opportunities exist in expanding global demand, particularly for processed mango products like pulp and juice. Emphasizing sustainable farming practices could enhance market appeal and cater to evolving consumer preferences. Addressing these challenges and leveraging opportunities can strengthen India's position in the global mango trade.

India's mango production, encompassing a diverse range of varieties, plays a crucial role in both domestic and international markets. The country's strategic location and favorable climate contribute to its leading position in global mango production. Despite significant production volumes, India's export growth is hampered by challenges such as adherence to international quality standards, inadequate infrastructure and fierce competition from other mango-producing nations like Mexico and Thailand. To overcome these challenges, India could focus on improving cold storage and transport facilities, which are critical for maintaining mango quality during export. Additionally, tapping into the rising global demand for exotic fruits and value-added mango products, such as pulp and dried mangoes, presents promising opportunities.

With the intention of analysing and enhancing the performance of India's fresh mango export, the current study, "A study on export competitiveness of Indian fresh mangoes" was developed with the following specific objectives

5.1 Major finding of the study

- In channel-I, exporters capture the largest share of the value chain (90.39%), with the farmer's contribution being relatively modest at 5.31 per cent. The vendor and facilitator each contribute minor portions to the total value chain.
- In channel-II, with the vendor removed from the process, the farmer's contribution slightly increases to 5.32 per cent, but the exporter still retains the majority of the value (91.18%).
- In channel-III, when farmers act as exporters, they capture the largest portion of the value chain (94.76%), demonstrating the benefits of vertical integration for farmers by eliminating intermediaries and maximizing their earnings.
- Fresh mango exports experienced a decline in quantity with a Compound Annual Growth Rate (CAGR) of -5.12 per cent, but the export value increased by 7.75 per cent. Similarly, mango pulp exports saw a decrease in quantity by -2.93 per cent, while the value grew at 3.34 per cent. This suggests that despite reduced export volumes, higher prices or value-added products have led to increased revenue.
- Both fresh mangoes and mango pulp exports show moderate levels of instability in quantity and value as measured by the Cuddy Della Vella Instability Index (CDVI). Fresh mangoes have CDVI values of 20.85 for quantity and 17.83 for value, while mango pulp shows slightly higher instability with CDVI values of 20.19 for quantity and 21.95 for value. This reflects a consistent level of fluctuation in both categories, with mango pulp experiencing marginally higher value instability.
- Oman emerged as the most stable importer of Indian fresh mangoes, with a high retention probability of 83.44 per cent from the previous year. UAE also demonstrated stability, retaining 44.56 per cent of its share. Both markets show significant reliability in their import patterns, indicating strong and consistent demand for Indian mangoes.
- The USA proved to be the most stable market in terms of export value, with a retention probability of 67.66 per cent. It also gained shares from other countries such as Canada and Kuwait, reflecting a strong and growing demand in the US market.

Oman and UAE were also significant, though with slightly lower retention rates compared to the USA.

- Alphonso (Hapus) mangoes faced a notable decline, with a negative CAGR of -2.75 per cent. Exports decreased from 3,195.85 metric tons in 2020-21 to 2,673.39 metric tons in 2023-24. Despite being a premium variety, Alphonso is experiencing challenges in maintaining its export performance, contrasting with the growth trends seen in other varieties like Kesar and Chausa.
- Kesar mangoes exhibited remarkable growth with a CAGR of 18.80 per cent, increasing their export quantity from 983.73 metric tons in 2020-21 to 3,787.01 metric tons in 2023-24. Similarly, Chausa mangoes saw an impressive CAGR of 25.71 per cent, surging from 40.98 metric tons to 488.26 metric tons over the same period. These varieties are experiencing significant growth in both quantity and value, highlighting a rising global demand.
- Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) indices have shown a significant decline in India's competitiveness in fresh mango exports. RCA values dropped from 1.70 in 2012 to 0.82 in 2023, and RSCA values turned negative from 2020 onwards, reflecting a diminishing comparative advantage in the global market.
- The Herfindahl-Hirschman Index (HHI) indicates a high concentration in the export market of Indian fresh mangoes, with HHI values of 0.331 (quantity) and 0.293 (value) exceeding high concentration thresholds. This suggests that the market is dominated by a few key destinations or buyers, which may limit competition and pose risks to market stability.
- The most significant constraint faced by fresh mango exporters in India is Sanitary and Phytosanitary (SPS) measures, with a Garrets Mean Score of 77.18. This indicates that regulatory compliance for meeting international standards is a major challenge for exporters.

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