



Growth, instability and export performance of horticultural crops from India: An economic analysis

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Abstract

Horticulture has emerged as one of the potential agriculture enterprises that will accelerate the growth of the Indian Economy. The present paper analyse the growth, instability and export performance of horticultural crops from India: An economic analysis with the objectives to examine growth, instability and export performance of horticultural crops from India and to identify the major destination of India for exporting horticultural crops from India. For the analysis, secondary data from 2010-11 to 2023-24 has been utilized, employing statistical tools such as Compound Annual Growth Rates (CAGR), Standard Deviation (SD), Coefficient of Variation (CV) and Cuddy Della Valle's Instability Index (CDVI). The study revealed that during the period the export quantity of certain commodities, such as walnuts and fresh mangoes experienced negative growth. In terms of export value, walnuts also showed a decline during this period. The export growth rates of fruits such as fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables are positive in terms of quantity. The quantity of export of processed fruits & vegetables such as Processed Fruits, processed vegetables has shown positive growth rate while cucumber and gherkins (Prepared & Preserved) have shown a negative growth rate. In the case of processed fruits & vegetables overall growth rate in the value term is positive and high except for mango pulp. Walnut has shown the highest instability index value indicating the highest instability and variability among others in both cases quantity and value term. In term of value, Mango pulp has shown the medium level of instability index value indicating the highest instability and variability among others. India's key markets for fresh fruit and vegetables are United Arab Emirates, Iran, Netherland, and Bangladesh while processed fruit and vegetables are mainly exported to the USA and Saudi Arabia.

Keywords: Horticulture, fruit, vegetables, export, growth, instability

Introduction

India is a significant player in the global horticultural market, known for its diverse range of crops that cater to the demands of both domestic and international markets. The export of horticultural crops from India has shown a steady increase over the years, contributing significantly to the country's economy. This performance is driven by the growth in production of key horticultural products such as fruits, vegetables, spices and flowers along with an expanding global market that values quality and variety. India's horticultural sector benefits from a favorable climate conditions, and a rich tradition of agriculture making it one of the largest producers of horticultural products in the world. Key exports include fresh fruits like mangoes, bananas and grapes and vegetables such as onion, potatoes and tomatoes as well as spices and floriculture products all of which enjoy high demand in various countries.

Horticulture has emerged as one of the potential agriculture enterprises that will accelerate the growth of the Indian Economy. India is the second largest producer of horticulture crops globally, accounting for more than 10% of the world's production of fruits and vegetables. During the year 2019-20, the country recorded its highest ever horticulture production of 320.77 million tonnes from an area of 25.66 million hectares. Various central and state-led initiatives have had a positive impact on the horticulture sector in terms of increase in production, productivity and value realization of the produce. However, India's share of horticulture export in global trade stands at 1.7% and 0.5% for vegetables and fruits respectively, which is significantly lower than other producer countries (APEDA). The government initiatives such as the National Horticultural

Mission and the Agricultural and Processed food products Export Development Authority (APEDA) have played a crucial role in boosting exports. These initiatives focus on improving production techniques, enhancing quality standards and ensuring better market access through trade agreements and infrastructural support.

Review of Literature

Jha *et al* (2019) ^[6] identified key challenges in the horticulture sector, highlighting the need to boost productivity through research and development, increase the share of value-added products, diversify export destinations, and improve infrastructure such as cold storage and rural roads. The authors stressed the importance of strengthening public sector research while addressing the limitations faced by smallholder farmers, who make up a substantial portion of the producers. Ramesh *et al* (2017) ^[7] in their study, it was observed that the quantity of horticultural produce imported in to India increased significantly during the post-National Horticulture mission (NHM) period, rising from 0.67% to 4.23%. However, in terms of value imports experienced a decline, dropping from 0.51% to -3.34%. Despite being a major producer of horticultural crops, the growth in import volumes did not correspond with an increase in value, indicating a contrasting trend. This rise in imports can be attributed to the growing population and heightened awareness of the nutritional benefits associated with these crops. Rabha and Sarma (2021) ^[8] although India is the world's largest producer of fruits and vegetables, its export performance has been inconsistent, with export volumes fluctuating over the years. From 2009-10 to 2018-19, certain commodities, such as walnuts, fresh mangoes,

cucumbers, gherkins (prepared and preserved), and mango pulp experienced negative growth rates, largely due to strong domestic demand. The authors pointed out various challenges, including quality issues, insufficient infrastructure (such as cold storage, markets, roads and transportation), and significant post-harvest losses all of which contribute to lower productivity per unit area. (Shanthanagaraju and Shanmugam (2023) [9] in their study it was observed that there were positive growth trends in horticulture export with significant potential for further sectoral expansion. The authors stressed that the key role of the government in developing infrastructure, promoting research, and incentivizing farmers to capitalize on this potential for sustained growth in horticultural exports.

Objectives of the study

1. To examine growth, instability and export performance of horticultural crops from India.
2. To identify the major destination of India for exporting horticultural crops from India.

Data Resources and Methodology

The study is based on secondary data and the required data is collected from Agricultural and Processed Food Products Export Development Authority APEDA. Data collected to analyzing export potential based on their contribution to the total agricultural export. The study used time series data on the quantity and value of exports of horticultural crops from India, for a period of 2010-11 to 2023-24. In order to achieve the objectives of the study, following statistical measures such as percentages, compound growth rates (CAGR), standard deviation (SD), coefficient of variation (CV) and Cuddy Della Valle's Instability Index (CDVI) has been applied to show the trends and instability and variability in export of horticultural crops from India.

1. Compound Annual Growth Rate

The compound growth rate has been carried out to identify the growth rate in the export of horticultural crops of India during the period 2010-11 to 2023-24. The compound annual growth rates (CAGR) has been computed by using the formula;

$$Y = AB^t$$

Where Y = dependent variable, t = time

By taking logarithms of both sides of the equations it takes the form: $\text{Log } Y = \text{Log } A + t \text{Log } B$.

If we put $\text{Log } A = a$ and $\text{Log } B = b$, then equation becomes $\text{Log } Y = a + bt$, which is linear function with independent variable t and dependent variable Log Y. The compound growth rate calculates as $(\text{antilog } b - 1) \times 100$ and represent uniform rate of change from year to year.

2. Instability Analysis

Instability in export of horticultural commodity from India has been estimated by using Coefficient of Variation and Cuddy-Della Valle Index. Although Coefficient of Variation (C.V) is the simplest measure of instability, its over-estimates the level of instability in time series data which are characterized by long-term trends. CV is calculated as follows:

$$CV = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

Cuddy-Della Valle Index (%) with an objective to know that, up to what extent risk is occurred in the selected variables. The Cuddy Della Valle Index de-trends shows the exact direction of the instability. Therefore, it is a better measure to capture instability in export of horticultural commodity from India. The Cuddy-Della Valle Index is calculated as follows:

$$\text{Cuddy-Della Valle Index} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100 \times \sqrt{1 - R^2}$$

Where, C.V. was the Coefficient of Variation in per cent, and R^2 was the coefficient of determination from a time trend regression adjusted for its degrees of freedom.

A low value of this index indicates low instability in the selected variables. The ranges of CDVI are given as follows;

- Low instability = 0 to 15 (%)
- Medium instability = 15 to 30 (%)
- High instability = 30 and above (%)

Results and Discussion

1. Growth trends and instability in the export of fresh fruits & vegetables from India in terms of quantity and value

The growth trends and instability in export of fresh fruit and vegetables in terms of quantity has been presented in Table 1. The export growth rates of fruits such as fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables are positive with a value of 9.80%, 10.75%, 2.75%, and 2.19%, respectively. However, the export growth is not uniform and is fluctuating over the years. For example, walnuts and fresh mangoes show a negative growth rate with -15.18% and -6.10%, respectively. The quantity exported of walnuts and fresh mango during the year 2010-11 was 5.75 and 58.86 thousand tonnes which decreased to 0.64 and 32.10 thousand tonnes in 2023-24 respectively, while quantity exported of fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables during the year 2010-11 was 92.44, 250.69, 1182.32 and 452.68 thousand tonnes which increased to 343.98, 887.42, 1717.44 and 918.11 thousand tonnes in 2023-24. The coefficient of variation of walnuts, fresh mangoes, fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables in terms of quantity is 64.94%, 30.92%, 40.14%, 48.69%, 26.82%, and 16.87%, respectively. Walnut has shown the highest CV value indicating the highest variability among others. The value of instability index of walnuts, fresh mangoes, fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables in terms of quantity is 29.20%, 20.98%, 16.68%, 17.20%, 24.88%, and 15.30%, respectively. Walnut has shown the highest instability index value indicating the highest instability and variability among others while other fresh vegetables shown the lowest instability value indicating low level of instability and variability among others.

Table 1: Growth trends and instability in export of fresh fruits and vegetables from India in terms of quantity (in'000'MT)

| Years | Walnuts | Fresh Mangoes | Fresh Grapes | Other Fresh Fruits | Fresh Onions | Other Fresh Vegetables |
|---------|---------|---------------|--------------|--------------------|--------------|------------------------|
| 2010-11 | 5.75 | 58.86 | 92.44 | 250.69 | 1182.32 | 452.68 |
| 2011-12 | 5.83 | 63.44 | 94.86 | 262.48 | 1309.92 | 665.42 |
| 2012-13 | 5.30 | 55.58 | 140.97 | 256.25 | 1666.87 | 724.23 |
| 2013-14 | 6.72 | 41.28 | 160.26 | 232.11 | 1482.50 | 881.60 |
| 2014-15 | 2.66 | 43.00 | 94.38 | 261.21 | 1238.10 | 798.60 |
| 2015-16 | 3.29 | 36.78 | 132.65 | 362.95 | 1382.96 | 712.56 |
| 2016-17 | 2.19 | 52.76 | 198.47 | 394.32 | 2415.74 | 993.12 |
| 2017-18 | 3.60 | 49.18 | 188.22 | 321.16 | 1588.99 | 739.06 |
| 2018-19 | 1.87 | 46.51 | 246.13 | 372.21 | 2183.77 | 735.74 |
| 2019-20 | 1.65 | 49.66 | 193.69 | 496.58 | 1149.90 | 754.01 |
| 2020-21 | 1.07 | 21.03 | 246.11 | 609.61 | 1578.02 | 682.09 |
| 2021-22 | 2.48 | 27.87 | 263.08 | 761.03 | 1537.50 | 770.23 |
| 2022-23 | 0.72 | 22.96 | 267.95 | 674.29 | 2525.26 | 827.29 |
| 2023-24 | 0.64 | 32.10 | 343.98 | 887.42 | 1717.44 | 918.11 |
| Average | 3.13 | 42.93 | 190.23 | 438.74 | 1639.95 | 761.05 |
| SD % | 2.03 | 13.28 | 76.36 | 213.60 | 439.91 | 128.39 |
| CV % | 64.94 | 30.92 | 40.14 | 48.69 | 26.82 | 16.87 |
| CDVI % | 29.20 | 20.98 | 16.68 | 17.20 | 24.88 | 15.30 |
| CAGR % | -15.18 | -6.10 | 9.80 | 10.75 | 2.75 | 2.19 |

Source: APEDA, <https://agriexchange.apeda.gov.in>

Note: SD=Standard Deviation, CV=Coefficient of Variation, CDVI= Cuddy-Della Valle Index, CAGR=Compound Annual Growth Rate

Growth trend and instability in export of fresh fruits and vegetables in term of value shown in Table 2, the growth rate of export in terms of the value of fresh mangoes, fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables are positive with values 5.49%, 14.73%, 14.99%, 5.76%, and 6.59%, respectively. However, it has been showing a negative growth rate with a value -16.65% in case of walnut. Here coefficient of variation for walnuts, fresh mangoes, fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables are 76.73%, 27.46%, 48.98%, 54.96%, 28.10% and 28.48%, respectively. Overall, the growth rate in the export of fresh fruits & vegetables by value term is higher than the growth rate in quantity. Among the fresh fruit & vegetables, other fresh fruits and fresh grapes have earned maximum foreign exchange value. The export value of walnuts during the year 2010-11 was Rs.

166.1 crore which decreased to Rs 20.02 crore in 2023-24 while the export value of Fresh mango, fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables during the year 2010-11 was Rs. 164.84, 391.01, 486.1, 1779.29 and 804.38 crore, which increased to Rs. 495.46, 3460.7, 3759, 3922.78 and 2938.27 crore in 2023-24 respectively. The value of instability index of walnuts, fresh mangoes, fresh grapes, other fresh fruits, fresh onions, and other fresh vegetables in terms of value is 36.67%, 18.96%, 20.05%, 11.67%, 17.58%, and 18.75%, respectively. In term of value walnut has shown the highest instability index value indicating the highest instability and variability among others while other fresh fruits shown the lowest instability value indicating low level of instability and inconsistency of export of fresh fruits and vegetables among others.

Table 2: Growth trends and instability in export of fresh fruits and vegetables from India in terms of value (Rs. in crore)

| Years | Walnuts | Fresh Mangoes | Fresh Grapes | Other Fresh Fruits | Fresh Onions | Other Fresh Vegetables |
|---------|---------|---------------|--------------|--------------------|--------------|------------------------|
| 2010-11 | 166.1 | 164.84 | 391.01 | 486.1 | 1779.29 | 804.38 |
| 2011-12 | 230.99 | 209.74 | 516.76 | 716.31 | 1723 | 1152.98 |
| 2012-13 | 199.82 | 264.72 | 982.04 | 726.88 | 1966.63 | 1368.51 |
| 2013-14 | 324.42 | 285.43 | 1437.07 | 924.37 | 3169.61 | 2027.99 |
| 2014-15 | 136.39 | 302.54 | 972.77 | 1084.06 | 2300.54 | 2158.67 |
| 2015-16 | 117.89 | 320.64 | 1362.26 | 1567.29 | 3097.21 | 2059.42 |
| 2016-17 | 55.18 | 443.66 | 1781.71 | 1629.64 | 3106.06 | 2698.16 |
| 2017-18 | 127.21 | 382.34 | 1899.95 | 1443.76 | 3088.82 | 1882.32 |
| 2018-19 | 66.77 | 406.5 | 2335.25 | 1834.57 | 3468.87 | 2069.66 |
| 2019-20 | 52.78 | 400.21 | 2176.87 | 2065.82 | 2320.7 | 2064.77 |
| 2020-21 | 29.79 | 271.88 | 2298.45 | 2233.31 | 2826.53 | 2143.2 |
| 2021-22 | 73.98 | 327.45 | 2302.16 | 2900.7 | 3432.16 | 2160.74 |
| 2022-23 | 25.83 | 378.49 | 2543.42 | 2736.99 | 4522.79 | 2443.04 |
| 2023-24 | 20.02 | 495.46 | 3460.7 | 3759 | 3922.78 | 2938.27 |
| Average | 116.23 | 332.42 | 1747.17 | 1722.06 | 2908.93 | 1998.01 |
| SD % | 89.19 | 91.27 | 855.73 | 946.39 | 817.49 | 568.97 |
| CV % | 76.73 | 27.46 | 48.98 | 54.96 | 28.10 | 28.48 |
| CDVI % | 36.67 | 18.96 | 20.05 | 11.67 | 17.58 | 18.75 |
| CAGR % | -16.65 | 5.49 | 14.73 | 14.99 | 5.76 | 6.59 |

Source: APEDA, <https://agriexchange.apeda.gov.in>

Note: SD=Standard Deviation, CV=Coefficient of Variation, CDVI= Cuddy-Della Valle Index, CAGR=Compound Annual Growth Rate

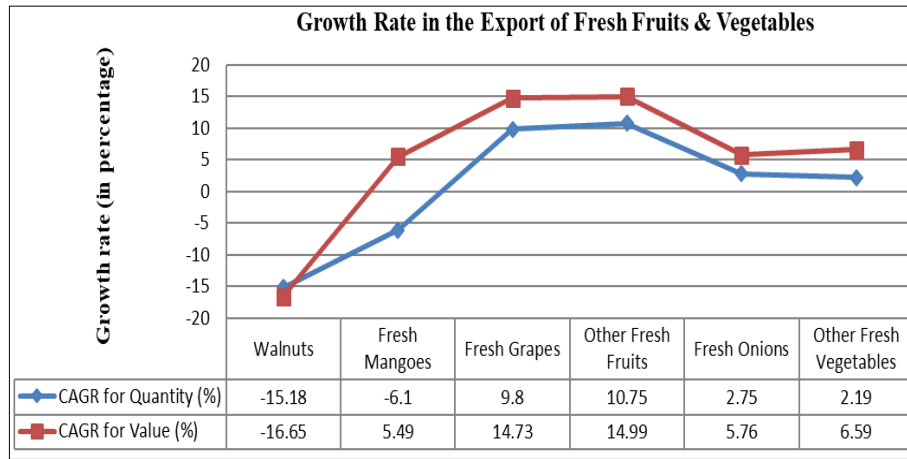


Fig 1: Growth rate in the export of fresh fruits & vegetables from India in terms of quantity and value

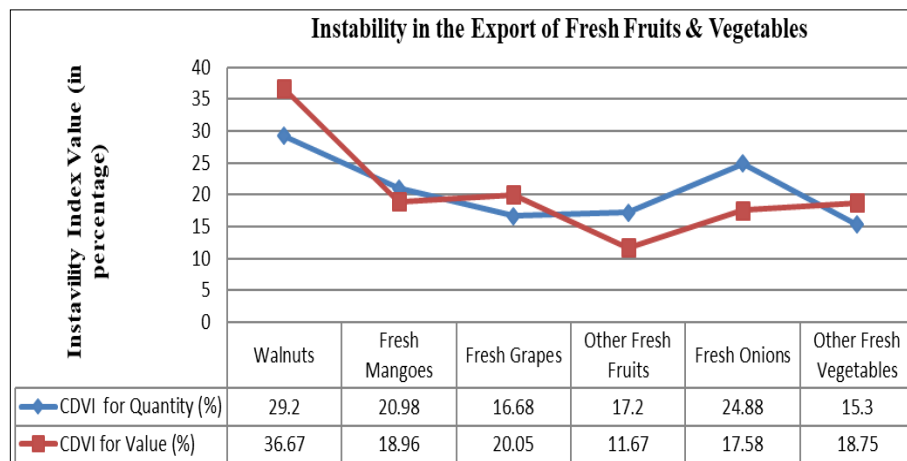


Fig 2: Instability in the export of fresh fruits & vegetables from India in terms of quantity and value

2. Growth trend and instability in exports of processed fruits & vegetables from India in terms of quantity and value

Table 3 indicates that the quantity of export of processed fruits & vegetables such as processed fruits, juice & nuts and processed vegetables has shown positive growth rate with 9.03% and 6.97% respectively. However, Cucumber and gherkins (Prepared & Preserved) have shown a negative growth rate of -0.25% and mango pulp is -5.60%. The quantity exported of mango pulp during the year 2010-11 was 170.22 thousand tonnes which decreased to 60.90 thousand tonnes in 2023-24 while quantity exported of cucumber and gherkins (Prepared & Preserved), processed fruits, juices & nuts and processed vegetables during the year 2010-11 was 209.23, 123.21 and 179.07 thousand tonnes which increased to 244.24, 537.56 and 489.22

thousand tonnes in 2023-24. The value for the coefficient of variation of cucumber and gherkins (Prepared & Preserved), processed fruits, juices & nuts, mango pulp and processed vegetables are 10.10%, 34.69%, 26.03% and 36.25%, respectively. The value of instability index of cucumber and gherkins (Prepared & Preserved), processed fruits, juices & nuts, mango pulp and processed vegetables in terms of quantity is 10.46%, 10.89%, 14.85% and 18.10%, respectively. Processed vegetables have shown the high level of instability index value indicating the highest instability and variability among others while cucumber and gherkins (Prepared & Preserved) shown the lowest instability value indicating low level of instability and inconsistency of export of processed fresh fruits and vegetables among others.

Table 3: Growth trends and instability in export of processed fruits and vegetables from India in terms of quantity (in'000'MT)

| Years | Cucumber and Gherkins (Prepd. & Presvd) | Processed Fruits, Juices & Nuts | Mango Pulp | Processed Vegetables |
|---------|---|---------------------------------|------------|----------------------|
| 2010-11 | 209.23 | 123.21 | 170.22 | 179.07 |
| 2011-12 | 258.60 | 203.03 | 150.50 | 224.51 |
| 2012-13 | 238.62 | 223.07 | 147.82 | 193.10 |
| 2013-14 | 218.75 | 246.13 | 174.86 | 204.66 |
| 2014-15 | 251.18 | 253.35 | 154.82 | 180.39 |
| 2015-16 | 202.95 | 275.58 | 128.87 | 177.33 |
| 2016-17 | 179.66 | 300.01 | 130.89 | 210.58 |
| 2017-18 | 220.94 | 317.35 | 110.92 | 226.48 |
| 2018-19 | 212.82 | 339.61 | 105.87 | 248.12 |
| 2019-20 | 189.34 | 360.49 | 85.73 | 253.28 |
| 2020-21 | 223.52 | 403.36 | 98.37 | 306.99 |

| | | | | |
|---------|--------|--------|--------|--------|
| 2021-22 | 217.52 | 460.62 | 123.48 | 374.26 |
| 2022-23 | 227.70 | 410.42 | 109.50 | 388.21 |
| 2023-24 | 244.24 | 537.56 | 60.90 | 489.22 |
| Average | 221.08 | 318.13 | 125.20 | 261.16 |
| SD % | 22.34 | 110.34 | 32.59 | 94.66 |
| CV % | 10.10 | 34.69 | 26.03 | 36.25 |
| CDVI % | 10.46 | 10.89 | 14.85 | 18.10 |
| CAGR % | -0.25 | 9.03 | -5.60 | 6.97 |

Source: APEDA, <https://agriexchange.apeda.gov.in>

Note: SD=Standard Deviation, CV=Coefficient of Variation, CDVI= Cuddy-Della Valle Index, CAGR=Compound Annual Growth Rate

Growth trend and instability in export of processed fruits & vegetables in term of value shown in table shown in Table 4, in the case of processed fruits & vegetables, the export value of cucumber and gherkins (Prepd. & Presvrd) is 8.77%, processed fruits, juices & nuts (15.31%), and mango pulp (0.93%) and Processed Vegetables (12.51%). Therefore, overall growth rate in the value term found to be positive for processed fruits and vegetables. Therefore, processed fruits, juices & nuts have earned maximum foreign exchange value from among the category of export of processed fruits & vegetables. The exported value of mango pulp during the year 2010-11 was Rs. 818.93 crore which decreased to Rs. 624.29 crore in 2023-24 while quantity exported of cucumber and gherkins (Prepared &

Preserved), processed fruits, juices & nuts and processed vegetables during the year 2010-11 was Rs. 515.26, 591.76 and 941.23 crore which increased to Rs. 2127.07, 6523.47 and 5659.47 crore in 2023-24. The value of instability index of cucumber and gherkins (Prepared & Presvrd), processed fruits, juices & nuts, mango pulp and processed vegetables in terms of value is 13.19%, 16.44%, 21.71% and 10.26%, respectively. Mango pulp has shown the high level of instability index value indicating the highest instability and variability among others. Processed vegetables have shown the low level of instability index value indicating the lowest instability among other processed fruits and vegetables.

Table 4: Growth trends and instability in export of processed fruits and vegetables from India in terms of value (Rs. in crore)

| Years | Cucumber and Gherkins (Prepd. & Presvd) | Processed Fruits, Juices & Nuts | Mango Pulp | Processed Vegetables |
|---------|---|---------------------------------|------------|----------------------|
| 2010-11 | 515.26 | 591.76 | 818.93 | 941.23 |
| 2011-12 | 745.03 | 1116.16 | 620.83 | 1249.98 |
| 2012-13 | 856.59 | 1452.59 | 608.56 | 1357.58 |
| 2013-14 | 955.2 | 1823.52 | 772.95 | 1707.39 |
| 2014-15 | 1202.42 | 1899.75 | 841.39 | 1913.4 |
| 2015-16 | 999.17 | 2297.3 | 796.18 | 1994.56 |
| 2016-17 | 936.19 | 2492.7 | 846.02 | 2280.04 |
| 2017-18 | 1285.22 | 2647.84 | 673.92 | 2211.59 |
| 2018-19 | 1437.13 | 2804.97 | 657.67 | 2474 |
| 2019-20 | 1241.21 | 3086.44 | 584.32 | 2760.53 |
| 2020-21 | 1651.82 | 3718.63 | 714.41 | 3173.42 |
| 2021-22 | 1487.3 | 3986.45 | 924.54 | 3626.08 |
| 2022-23 | 1761.1 | 4987.36 | 1189.66 | 4754.83 |
| 2023-24 | 2127.07 | 6523.47 | 624.29 | 5659.47 |
| Average | 1228.62 | 2816.35 | 762.41 | 2578.86 |
| SD % | 436.63 | 1584.54 | 162.22 | 1342.40 |
| CV % | 35.54 | 56.26 | 21.28 | 52.05 |
| CDVI % | 13.19 | 16.44 | 21.71 | 10.26 |
| CAGR % | 8.77 | 15.31 | 0.93 | 12.51 |

Source: APEDA, <https://agriexchange.apeda.gov.in>

Note: SD=Standard Deviation, CV=Coefficient of Variation, CDVI= Cuddy-Della Valle Index, CAGR=Compound Annual Growth Rate

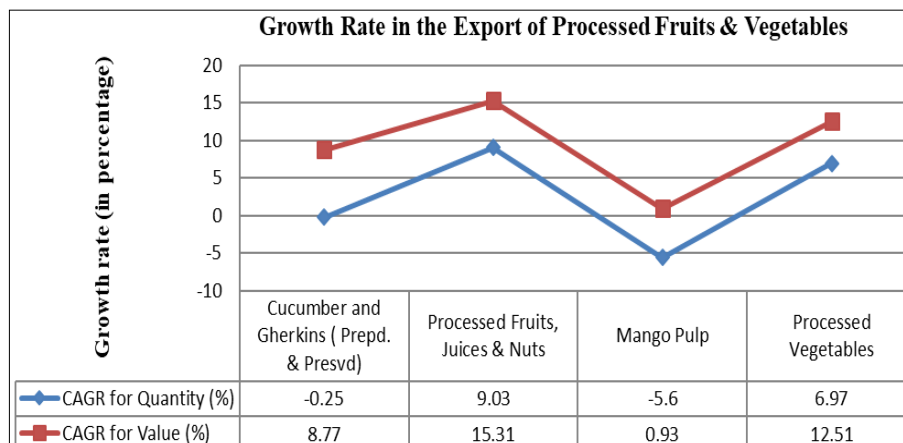


Fig 3: Growth rate in the export of processed fruits & vegetables from India in terms of quantity and value

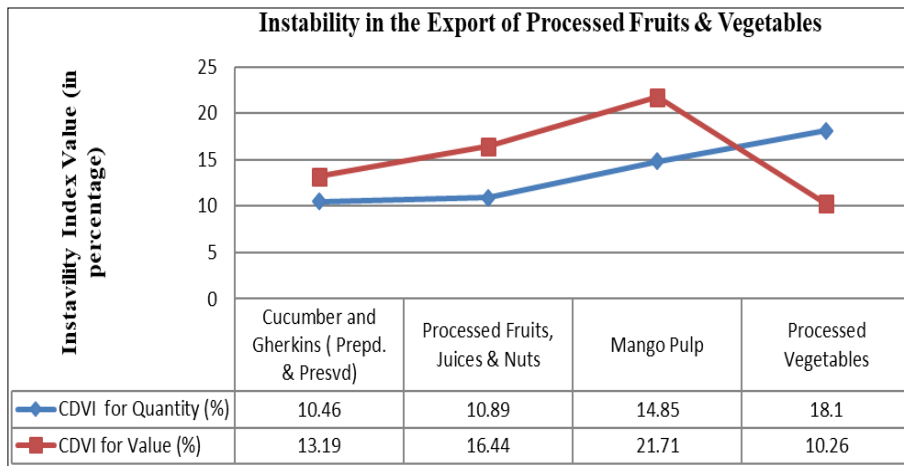


Fig 4: Instability in the export of processed fruits & vegetables from India in terms of quantity and value

3. Major countries and share percentage of exports of fresh as well as processed fruits and vegetables from India, 2023-24

The Major countries where India exported maximum fresh and processed fruits and vegetables are presented in Table 5. One of the major trading partners for exports of fresh fruits and vegetables is United Arab Emirates. The maximum share of exports of fresh mangoes, other fresh fruits, and Other Fresh vegetables go to the United Arab Emirates.

However, walnut, fresh grapes, and fresh onions have found their market in Iran, the Netherlands, and Bangladesh in the year of 2023-2024. In the case of processed fruits & vegetables, as shown in table 6, the maximum share of cucumber and gherkins (Prepared & Preserved), processed fruits, juices & nuts and processed vegetables go to the USA. While India exports its mango pulp to the Saudi Arabia.

Table 5: Major countries and share (%) of exports of fresh fruits and vegetables from India, 2023-24

| Countries | Country 1 | Country 2 | Country 3 | Country 4 | Country 5 |
|------------------------|------------------------|------------------------|------------------------|----------------|-----------------------|
| Walnuts | Iran (50.65%) | UAE (40.46%) | Germany (2.45%) | Chile (2.00%) | Singapore (0.85%) |
| Fresh Mangoes | UAE (38.16%) | UK (18.90%) | USA (16.62%) | Kuwait (4.84%) | Qatar (3.59%) |
| Fresh Grapes | Netherland (48.57%) | UK (7.86%) | UAE (7.27%) | Russia (7.21%) | Bangladesh Pr (5.95%) |
| Other Fresh Fruits | UAE (20.99%) | Iraq (18.90%) | Iran (14.43%) | Nepal (7.55%) | Bangladesh Pr (7.17%) |
| Fresh Onions | Bangladesh Pr (39.66%) | Malaysia (13.94%) | Sri Lanka Dsr (10.55%) | UAE (9.22%) | Nepal (3.85%) |
| Other Fresh Vegetables | UAE (19.79%) | Bangladesh Pr (13.92%) | Nepal (11.71%) | UK (7.97%) | Oman (5.22%) |

Source: APEDA, <https://agriexchange.apeda.gov.in>

Table 6: Major countries and share (%) of exports of processed fruits and vegetables from India, 2023-24

| Countries | Country 1 | Country 2 | Country 3 | Country 4 | Country 5 |
|---|--------------------|---------------------|--------------------|------------------|----------------|
| Cucumber and Gherkins (Prepd. & Presvd) | USA (22.90%) | Germany (9.20%) | France (8.32%) | Spain (7.70%) | Russia (7.04%) |
| Processed Fruits, Juices & Nuts | USA (10.54%) | Netherland (9.98%) | Saudi Arab (9.63%) | UAE (9.09%) | Russia (4.50%) |
| Mango Pulp | Saudi Arab (17.90) | USA (10.99%) | UK (8.86%) | Germany (7.58%) | Canada (7.42%) |
| Processed Vegetables | USA (14.05%) | Philippines (9.40%) | UK (8.35%) | Thailand (6.11%) | UAE (5.05%) |

Source: APEDA, <https://agriexchange.apeda.gov.in>

Conclusions

However, India is world’s largest producer of fruits and vegetables but the export volumes instead shown fluctuating trend over the years. During the period 2010-11 to 2023-24 the export of some commodities in terms of quantity like walnuts and fresh mangoes show a negative growth rate and in terms of value walnuts also showed negative growth. During the study period the quantity of export of processed fruits & vegetables such as processed fruits, processed vegetables has shown positive growth rate while cucumber and gherkins (Prepared & Preserved) have shown a negative growth rate. In the case of processed fruits & vegetables overall growth rate in the value term is positive and high except for mango pulp. The value of instability index for all fresh fruits and vegetables shows medium level of instability and inconsistency in the export of fresh fruits and vegetables in terms of quantity. Walnut has shown the highest instability index value indicating the highest

instability and variability among others in both cases quantity and value term. The value of instability index for fresh mango, fresh grapes, fresh onion and other fresh vegetables shows higher as compare to the export of these fresh fruits and vegetables in terms of value while for other fresh fruits the value of instability index shown low level of instability in the export value. Mango pulp has shown the medium level of instability index value indicating the highest instability and variability among others. However, India’s key markets for fresh fruit and vegetables are United Arab Emirates, Iran, Netherland, and Bangladesh while processed fruit and vegetables are mainly exported to the USA and Saudi Arabia. However, notable annual fluctuations indicate instability due to climatic variations, pests, market volatility, and policy changes.

Policy recommendations emphasize enhancing stability and sustaining growth of export through the cultivation of high-value horticultural crops, collaboration among various

stakeholders, pest management and better infrastructure. Emphasis should be placed on improving pre and post harvest handling and storage. Addressing these instabilities is crucial for long term sustainability and resilience, providing valuable insights for policymakers and stockholders to foster a more stable and productive horticulture sector. In a nutshell it can be suggested that to improve growth and stability in export of horticultural crops, governments should invest in R&D for high-yield, climate-resilient varieties and promote sustainable farming practices. Modernizing irrigation, storage, and transportation infrastructure is crucial. Expanding farmer education on best practices and ensuring access to affordable credit and insurance will empower farmers. Additionally, enhancing market access and supporting agro-processing industries can boost profitability. Policies should be integrated with environment and economic strategies, involve stakeholder input, and include regular monitoring. These steps will create a more sustainable horticultural sector.

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