Analysis of Agricultural Exports from Indian States: Impact of Covid-19 and the Significance of Infrastructure Facilities

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Abstract

The present study investigates agricultural exports across Indian states, focusing on COVID-19's effects and infrastructure significance. Utilizing statistical and econometric techniques, it examines monthly data from April 2017 to March 2022 and annual data from 2010-11 to 2021-22. Despite pandemic disruptions, agricultural exports displayed positive trends in earnings and quantities. However, average export prices declined, highlighting potential global market challenges. Agricultural exports outpaced overall exports in growth, varying among Indian states. Export volatility diminished over time, notably in Bihar, Rajasthan, West Bengal, Andhra Pradesh, and Uttar Pradesh. Gujarat emerged as a dominant contributor, accounting for 25% of total agricultural exports, followed by Maharashtra, Uttar Pradesh, Haryana, Tamil Nadu, Andhra Pradesh, West Bengal, and others. The research emphasized diversified exports in terms of products and destinations. Vital infrastructure like food processing units, cold storage, and packaging significantly impacted exports, as confirmed by regression analysis. The study recommends policy measures, emphasizing infrastructure improvement, reduced volatility, and diversification strategies for bolstering agricultural exports.

Keywords: *Agricultural exports, Indian states, COVID-19, Infrastructure facilities, Growth rate, Instability.*
JEL Classifications*: F14, R11, I18, O18, O40, F40*

1. Introduction

Agricultural exports play a crucial role in India's economic growth and development, contributing significantly to foreign earnings and employment generation. The sector has witnessed various challenges and opportunities, including the recent impact of the COVID-19 pandemic. Understanding the dynamics of agricultural exports, especially in the context of COVID-19, and identifying the key determinants of export performance are essential for formulating effective policies and strategies. The aim of this paper is to analyze the agricultural exports from Indian states, with a specific focus on the impact of COVID-19 and the significance of infrastructure facilities. By examining the trends, patterns, and determinants of agricultural exports, policymakers can gain insights into the sector's performance and identify areas for improvement. The paper utilizes a combination of quantitative analysis and econometric techniques to assess the impact of COVID-19 on

agricultural exports. It examines the changes in export earnings, quantity, and average prices of agricultural products during the pre- and post-COVID periods. Additionally, the paper investigates the role of infrastructure facilities such as processing industries, cold storage facilities, and packaging houses in promoting agricultural exports. To achieve these objectives, the paper draws on secondary data from various sources, including the Directorate General of Commercial Intelligence and Services (DGCIS), APEDA websites, and government reports. The data cover a significant time period, allowing for a comprehensive analysis of agricultural export dynamics. The findings of the paper contribute to the existing literature on agricultural exports and provide valuable insights for policymakers and stakeholders in the agricultural sector. By understanding the impact of COVID-19 on agricultural exports and the significance of infrastructure facilities, policymakers can formulate effective strategies to enhance export performance, reduce volatility, and promote diversification. The subsequent sections of the paper include a review of relevant literature, an analysis of the impact of COVID-19 on agricultural exports, an assessment of the growth and instability of agricultural exports from Indian states, an examination of the concentration and diversification of agricultural exports, and a discussion on the role of infrastructure facilities. The paper concludes with a set of policy recommendations aimed at improving the export performance of the agricultural sector and ensuring its long-term sustainability in the face of future challenges.

2. Review of literature and Research Gaps

India has established itself as a significant exporter of various agricultural commodities to both developed and developing countries (Kumareswaram et al., 2018). The country's agricultural export performance has shown notable improvement, with food-based agro-products and allied products contributing significantly to its GDP (Paramasivan and Pasupathi, 2017). However, the agricultural export sector faces challenges such as frequent crop failures, inadequate export infrastructure, and the impact of global events like the COVID-19 pandemic. Research studies have provided valuable insights into the pandemic's impact on agricultural exports in different contexts.

For instance, Ben-xiLIN and Yu YvetteZHANG (2020) conducted a study in China, revealing varied impacts on different agricultural products, with an overall decline in exports. However, certain products, particularly grain and oil, exhibited resilience and even increased exports during the pandemic. The World Trade Organization (WTO) study (2020) highlights agriculture's resilience during the COVID-19 pandemic compared to other sectors, with staple foods and processed fruits and vegetables seeing increased demand. The study underscores the importance of transparency and open trade for global food security.

Lebastard et al. (2023) investigated the impact of COVID-19 on exporters in global value chains (GVCs) using data on French firms. They found that participation in GVCs increased firms' vulnerability to the pandemic, particularly due to supply bottlenecks. Exporters located downstream in the value chain were more severely affected, experiencing significant export losses and higher probabilities of discontinuity in export relations. However, firms that diversified their sourcing networks for core inputs showed greater resilience, supporting the hypothesis that diversification in global value chains can mitigate the impact of supply disruptions.

In the Indian context, the National Bank for Agriculture and Rural Development (NABARD) conducted a study in 2020 to assess the pandemic's impact on Indian agriculture and the rural

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economy. The findings indicated that while agricultural production in terms of crops was not significantly affected at the national level, allied sectors such as poultry, fisheries, and dairy experienced significant declines due to reduced demand and supply disruptions. Farm gate prices remained relatively stable for crops but declined in the allied sectors. Availability and prices of agricultural inputs were also affected, with reduced accessibility and increased prices due to supply chain disruptions. The study underscores the need for policy measures to support the agriculture and rural sectors in mitigating the adverse effects of the pandemic.

Dr. Vinod Kumar's study (2021) examines India's agricultural trade trends, indicating a significant increase in exports despite the COVID-19 pandemic. The study emphasizes the importance of efficient value chains, contract farming, diversification, and adherence to international standards for sustained growth in agricultural exports. Another study by Divya Reddy Bakka and Supriya Bathini (2022) highlights that staple food exports remained strong, while less essential sectors experienced a decline in demand.

A working paper by NIAP (2020) on "Covid-19 Lockdown and Indian Agriculture: Options to Reduce the Impact" provides an optimistic view of the pandemic's impact, emphasizing resilience and positive growth but lacking a comprehensive analysis of potential long-term effects and challenges faced by vulnerable workers and sectors outside of agriculture. Meenu (2021) examines the impact of the lockdown on agricultural exports in Punjab, noting a rebound in exports post-lockdown but lacking a critical evaluation of the factors contributing to the fluctuations.

Cariappa et al. (2021) analyzed the COVID-19 pandemic's disruption of the Indian agricultural system, identifying issues such as labor and logistical constraints, negative income shocks, and increased food prices. They proposed a 10-point strategy for post-pandemic recovery, including social safety nets, family farming, and monetizing buffer stocks. Dilnashin et al. (2021) discussed the economic shock of COVID-19 on India's agri-sector, highlighting severe disruptions and the need for policy responses to build resilience.

Vyas et al. (2021) utilized news mining and content analysis to assess early impacts on the Indian food supply chain, finding widespread disruptions and high negative sentiment. They emphasized the need for resilient food systems and targeted policy responses. The Ministry of Commerce & Industry (2021) reported significant merchandise exports and introduced measures to support exporters, particularly MSMEs, and enhance trade resilience.

Sridhar et al. (2022) reviewed the global impact of COVID-19 on agriculture, advocating for sustainable practices and digital tools to enhance resilience. They emphasized the importance of innovations and policy measures for building a resilient food system.

Jaacks et al. (2022) evaluate the impact of COVID-19 on Indian agriculture through a nationally representative survey. They found that most farmers continued to cultivate the same crops during the pandemic, with a notable interest in adopting sustainable farming practices driven by government schemes and peer influence. However, disruptions due to the pandemic affected productivity, and farmers reported barriers such as lack of knowledge and access to inputs, which hindered changes in cropping patterns. The study suggests that enhancing support systems and providing better access to knowledge and resources are crucial for fostering resilient agri-food systems in India.

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Saxena et al. (2023) investigated the structure, performance, and competitiveness of Indian agricultural exports, identifying significant changes in trends, composition, and diversification since 2001. They emphasized the need for stable trade policies, strict adherence to sanitary and phytosanitary measures, and efficient management of export-oriented supply chains.

Goel et al. (2023) conducted a comprehensive review of the impact of the COVID-19 lockdown on Indian agriculture, emphasizing the severe economic repercussions for farmers and laborers. The lockdown led to significant disruptions in labor availability and the supply chain, affecting production, storage, and marketing of agricultural products. The authors highlighted the substantial direct and indirect losses in the sector and stressed the need for smart investments and improved technologies to mitigate these impacts. The study also noted the rise in unemployment and the importance of adaptive planning and resource management to build resilience in the agricultural sector.

The study by Hussain & Guha (2023) examines farm infrastructure's role in agribusiness during crises in rural Assam, India, amid the pandemic-induced lockdown. Using the Instrumental Variable Two Stages Least Square method, it finds that inadequate village-level storage and processing facilities led to crop wastage and income loss. The study recommends policies to develop rural marketing infrastructures, such as storage and processing units, and improve access to Agricultural Produce Market Committee (APMC) yards to help farmers sustain income during emergencies.

Ravi Kumar, Naidu, and Shafiwu (2024) examine the drivers of Indian agricultural exports using a dynamic panel data approach. They identify risks associated with India's reliance on commodities like basmati rice, buffalo meat, and spices. Using system GMM estimation on data from 40 export items over 11 years, they find that past export performance, agricultural output, value-added activities, GDP, trade openness, FDI, water use efficiency, and exchange rates positively influence exports, while higher consumer prices have a negative impact. The study suggests diversification, improved productivity, and sustainable practices to mitigate risks and promote long-term growth in India's agricultural export sector.

Kumar et al. (2024) analyzed determinants and opportunities for Indian rice trade using a dynamic panel gravity model, highlighting India's competitive advantage due to diverse agro-climatic conditions and supportive policies. They emphasized evidence-based policy decisions to bolster trade relationships and enhance rice exports.

Research Gaps: Despite the valuable contributions of existing studies, several research gaps remain in understanding the impact of COVID-19 on Indian agricultural exports. Many studies provide descriptive analyses without rigorous quantitative evaluations, highlighting the need for in-depth quantitative analysis to identify precise impacts, determine causal relationships, and formulate effective policies. There is limited focus on infrastructure, with a lack of studies examining the role of infrastructure facilities in promoting agricultural exports from Indian states. Future research should explore the impact of infrastructure development, such as processing industries, storage facilities, and packaging houses, on agricultural exports and identify measures to enhance infrastructure availability.

Additionally, comprehensive analysis encompassing long-term effects, including changes in export patterns, market dynamics, and overall competitiveness of Indian agricultural products, is crucial for devising effective strategies for sustainable export growth. Evaluating the

effectiveness of policy measures in supporting agricultural exports and assessing potential gaps or constraints is also an important research gap. Commodity-specific analysis focusing on vulnerabilities, market dynamics, and export performance of individual agricultural commodities would provide valuable insights for targeted interventions and strategies to enhance competitiveness.

Significance of the Present Study: The present study is significant as it aims to address these research gaps by providing a comprehensive analysis of infrastructure facilities and their role in promoting agricultural exports from Indian states. By employing rigorous quantitative methods and analyzing monthly data from April 2017 to March 2022 and annual data from 2010-11 to 2021-22, the study will identify precise impacts and determine causal relationships. This approach will help develop targeted and effective strategies to support agricultural exports during and after global disruptions like the COVID-19 pandemic.

The study also aims to offer a comprehensive examination of long-term effects on export patterns, market dynamics, and the competitiveness of Indian agricultural products. Understanding these long-term impacts is crucial for formulating sustainable export growth strategies that can withstand future global shocks. Additionally, the study will evaluate the effectiveness of policy measures implemented during the pandemic to support agricultural exports, identifying gaps and constraints and providing recommendations for enhancing policy effectiveness.

Furthermore, the study will conduct commodity-specific analyses, focusing on the vulnerabilities, market dynamics, and export performance of individual agricultural commodities. This detailed approach allows for targeted interventions and strategies to enhance the competitiveness of specific agricultural products in global markets. By addressing critical research gaps and providing actionable insights, the study aims to inform policy measures, enhance infrastructure development, and promote the resilience and competitiveness of the Indian agricultural export sector in the face of global disruptions.

3. Database and Methodology

The study focuses on Indian states as the study area, including Tamil Nadu, Haryana, Andhra Pradesh, West Bengal, Kerala, Punjab, Karnataka, Delhi, Bihar, Rajasthan, Telangana, Madhya Pradesh, Odisha, Chhattisgarh, Goa, Uttarakhand, and Assam. Secondary data from various sources is used for analysis. The period of study is from 2010-11 to 2021-22. The major agriculture trade data is extracted from the Directorate General of Commercial Intelligence and Services (DGCIS) and APEDA websites, Government of India. Monthly export data on APEDA products from April 2017 to March 2022 is collected from the website: https://agriexchange.apeda.gov.in/indexp/reportlist.aspx for the analysis of the impact of Covid-19. The various issues of Horticulture Statistics at a Glance, GOI are another important source of collected secondary data. Different statistical and econometric methods are used, such as tables, graphs, trends, growth rates, coefficient of variation (CV), dummy variable regression analysis including ARCH Model, and multiple regression analysis to analyze the data and infer the results of the study.

Calculation of Growth and instability: Growth rate is calculated as the annual average compound growth rate (%). Coefficient of Variation (CV) as a measure of instability is calculated as (Standard deviation/Mean) * 100. Percentage (%) change is estimated in the mean export during the last 5 years (2016-17 to 2020-21) over the first 5 years (2011-12 to 2015-16)

to examine point to point change in exports by eliminating year-wise fluctuations in trade data. The annual average compound growth rate of export of agricultural products from India is calculated using a semi-logarithmic stochastic regression equation:

Log(y_t) = a + bt + u. Then, the growth rate (r) is estimated as r = (e^{b*} - 1) * 100, where b* is the least-square estimate of b.

Concentration and Diversification Index: The normalized Herfindahl-Hirschman formula is used to calculate the concentration index (CI) and define the Diversification Index (DI) of trade (geographical as well as commodity).The product concentration index of exports for country j (CI*j*) is calculated as √(∑(Xij/Xj)^2) - √(1/N) / (1 - √(1/N)), where Xij is the value of exports of product i by country j, Xj is the total value of exports of country j, and N is the number of products exported. Then, the Diversification Index is defined as: DIj= 1- CI*j* and it ranges from one (indicating highly diversified exports) to zero (no diversification).

ARCH Model and Dummy Variable Regression: The Autoregressive Conditional Heteroscedasticity (ARCH) model is used to analyze volatility clustering in agricultural trade data. The model estimates future volatility as a function of prior volatility using conditional maximum likelihood. The STATA software is used to estimate the ARCH model on monthly data of agricultural exports from India from April 2017 to March 2022. We have considered Augmented Dickey-Fuller unit-root test for checking stationary of the time series data under study.

Suppose, Y_t = agricultural export (quantity, value, price) from India.
y_t= log of Y_t
dy_t= y_t- y_{t-1}= relative change in the exports.
u_t= dy_t – mean of dy_t

Now, u_t is the mean adjusted relative change in exports. We can now use u_t^2 as a measure of volatility and the following model ($u_t^2 = \beta_0 + \beta_1 u^2_{t-1} + \varepsilon_t$) postulates that the volatility in the current period is related to its value in the previous period plus a white noise error term. If β_1 is significantly positive, it suggests that if volatility was high in the previous period then it will continue to be high in the current period, indicating volatility clustering. If β_1 is zero, then there is no volatility clustering.

We have tested the ARCH effect (LM test) with the help of STATA software. As per the STATA software, the basic model ARCH is

$y_t = x_t\beta + \varepsilon_t$
$Var(\varepsilon_t) = \sigma_t^2 = \gamma_0 + A(\sigma, \varepsilon) + B(\sigma, \varepsilon)^2$
The y_t equation may optionally include ARCH-in-mean and ARMA terms:
$y_t = x_t\beta + \sum\psi_i g(\sigma_{t-i}^2) + ARMA(p, q) + \varepsilon_t$

If no options are specified, A() = B() = 0, and the model collapses to linear regression.

ARCH-in-mean is the most commonly used model in evaluating financial time series data. It specifies that the contemporaneous expected conditional variance be included in the mean equation:

$y_t = \beta_0 + \beta_1 x_t + \psi\sigma_t^2 + \varepsilon_t$
$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon^2_{t-1}$
That is, the variance of ε_t follows an ARCH (1) process.
In our regression model, we have considered two explanatory variables as follows:

The dummy variable (covidapril20) is defined as covidapril20 = 0 for the monthly export data period from April 2017 to March 2020 (Lockdown was started on 24 March 2020 in India) and covidapril20 = 1 for the export data on COVID-19 and post- Covid periods (i.e., the rest of the period from April 2020 to March 2022. The monthly coding variable (monthc=

1 for January, 2 for February, …. and 12 for December) is considered another explanatory variable to eliminate the seasonal (monthly) effect on export data.

Justification of ARCH model: The ARCH model is ideal for analyzing volatility in agricultural exports from India during the COVID-19 pandemic for several reasons: (i) This model captures the dynamic nature of volatility, essential for understanding fluctuations in export quantities, values, or prices amidst pandemic disruptions. This is crucial for policymakers to comprehend how export volatility has evolved, (ii) The ARCH model estimates future volatility based on past data, identifying volatility clustering where high volatility periods follow each other. This can indicate persistent disruptions in supply chains or demand changes during the pandemic, (iii) Model flexibility is another characteristic of the ARCH model. It accommodates various volatility patterns, identifies clustering, capturing complex dynamics like sudden spikes or prolonged volatility due to the multifaceted pandemic impact, and (iv) the ARCH model provides statistical tests, such as the Lagrange Multiplier test, to assess the presence of ARCH effects, ensuring robustness and reliability of findings.

Multiple regression analysis: To assess the role of infrastructure facilities (Food Processing industries, cold storage facilities, and packaging systems) in agricultural exports from Indian states, a multiple regression model is used.

$$Meanex = \alpha + \beta_1 fpino + \beta_2 coldcapmt + \beta_3 ofpackh + v$$

The model includes variables such as the number of food processing industries (fpino), capacity of cold storages (coldcapmt) in MT, and number of on-farm pack houses (ofpackh).The dependent variable is average agricultural export (Meanex) in Rs. Crore from Indian states. The model also includes a stochastic disturbance term (v).

Thus, the study employs various statistical and econometric techniques to analyze the data, including growth rates, concentration, and diversification indices, ARCH modeling, and multiple regression analysis. The methodology allows for the assessment of trends, volatility clustering, and the role of infrastructure facilities in agricultural exports from Indian states.

4. Results & Discussions

The present section consists of four sub-sections. Section 4.1 analyses the trend in agricultural exports vis-à-vis total exports from India during 2010-11 to 2020-21. Section 4.2 examines the impact of COVID-19 on the export of agricultural products. Section 4.3 discusses the growth and instability in agricultural export from Indian states during two sub-periods of 2010-11 to 2014-15 and 2015-16 to 2020-21. The role of processing industries, storage facilities, and packaging in the export of agricultural products from Indian states is examined in section 4.4.

4.1 Growth and fluctuations in agri-exports from India: Analysis of annual data

Table 4.1.1 illustrates the trends in India's agricultural exports in relation to its total exports of goods and services from 2010-11 to 2020-21. The analysis focuses on the Covid-19 period, which spans from April 2020 to March 2021. The data reveals a significant increase in the export of agricultural products from India, with the value rising from Rs. 42,437.2 crores in 2010-11 to Rs. 1,52,730.7crores in 2020-21, representing an average compound growth rate of 7.49 percent per year. In terms of quantity, agricultural exports grew from 11,568 thousand metric tonnes in 2010-11 to 32,036 thousand metric tonnes in 2020-21. Meanwhile, India's total exports of goods and services increased from Rs. 17,10,193crores to Rs. 36,85,170 crores during the same period, with a growth rate of 7.19 percent per year. Notably, the growth rate of agricultural exports exceeded that of total exports. However, it is worth noting that agricultural exports exhibited higher year-wise fluctuations (CV=26.17) compared to total

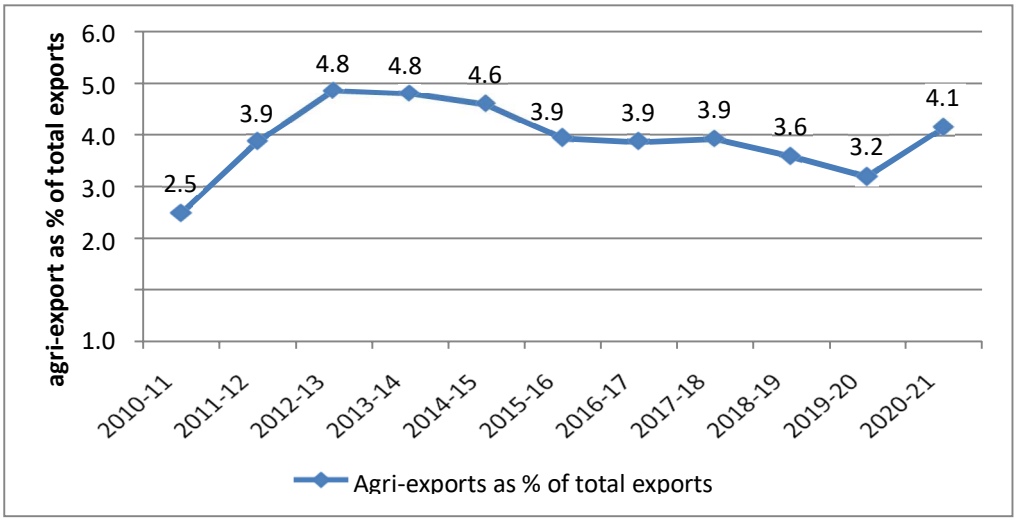
exports (CV=22.77) in India throughout the study period. Examining the contribution of agricultural exports to India's total exports, Table 4.1.1 presents the percentage share of agro-exports. The share increased from 2.5% in 2010-11 to a peak of 4.8% in 2012-13 before declining to 3.2% in 2019-20. However, during the Covid-19 period of 2020-21, the share of agricultural exports in total exports rose to 4.1% (Figure 4.1.1), indicating the sector's resilience during the pandemic.

Table 4.1.1India's total exports and agricultural exports during 2010-11 to 2020-21

	Total export of goods and services		Total export of agricultural products			% Share of agro-export in total exports
Year	Value (in Rs.Crore)	Index	Quantity (inM.T.)	Value (in Rs.Crore)	Index	
2010-11	1710193	100.0	11567531	42437.2	100.0	**2.5**
2011-12	2143931	125.4	19664571	82940.2	195.4	**3.9**
2012-13	2439707	142.7	30172964	118251.0	278.6	**4.8**
2013-14	2856781	167.0	30001797	136922.6	322.6	**4.8**
2014-15	2863636	167.4	27134311	131343.0	309.5	**4.6**
2015-16	2728647	159.6	20474814	107482.9	253.3	**3.9**
2016-17	2948772	172.4	21385986	113853.8	268.3	**3.9**
2017-18	3211521	187.8	22404037	125852.7	296.6	**3.9**
2018-19	3766294	220.2	23180550	135101.4	318.4	**3.6**
2019-20	3750567	219.3	18269308	119390.8	281.3	**3.2**
2020-21	3685170	215.5	32035992	152730.7	359.9	**4.1**
Growth rate(%)	**7.19**		**2.94**	**7.49**		**0.28**
CV	**22.77**		**26.17**	**26.17**		**17.72**

Note: Growth rate (%) = annual average compound growth rate.
CV= coefficient of variation (%). Sources: 1. DGCIS. 2. Reserve Bank of India, GOI.

Figure 4.1.1 India's Agricultural exports as percentage of total exports



Source: Author's calculation.

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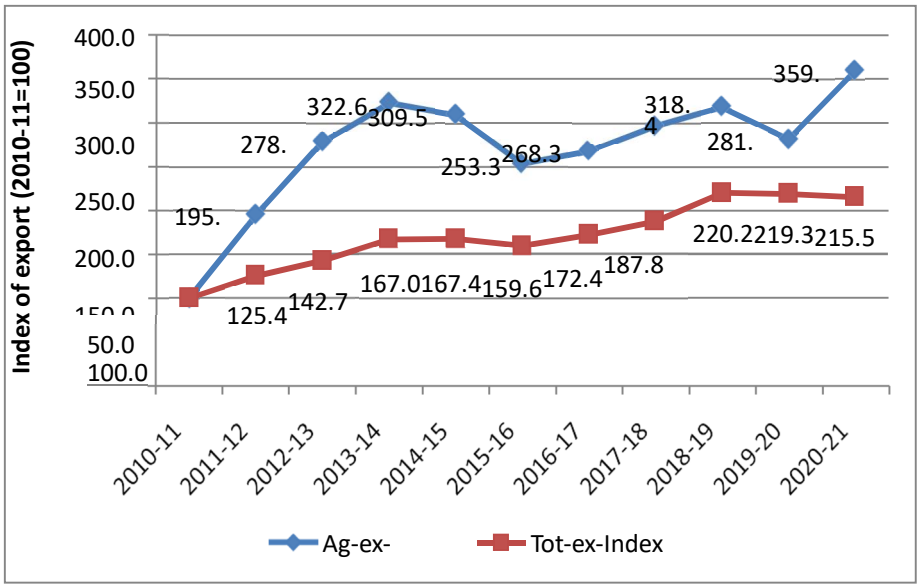
Figure 4.1.2 provides a comparative analysis of the growth and variability in India's agricultural exports and total exports using index values. The index of agricultural exports increased from 100 in 2010-11 to a peak of 359.9 in 2020-21, with fluctuations along the way. In contrast, the index of total exports rose from 100 in 2010-11 to a maximum of 220.2 in 2018-19, followed by marginal decreases. Notably, the values of the index of agricultural exports were consistently higher than those of total exports, indicating the relatively stronger performance of the agricultural export sector. The variability in the index values of agricultural exports was also greater. Interestingly, despite the challenges posed by the COVID-19 pandemic, agricultural exports experienced growth from 2019-20 to 2020-21, while total exports decreased during the same period, suggesting a positive impact of the pandemic on agricultural exports.

Figure 4.1.3 depicts the trends in agricultural exports from India in terms of indices of quantity, value, and average export price. On average, there was an increasing trend in agricultural exports for these indices, with significant fluctuations in quantity and value but relatively fewer fluctuations in export prices. The average export price index initially increased from 158.9 in 2018-19 to 178.1 in 2019-20 before decreasing to 130.0 in 2020-21. Conversely, the quantity and value indices exhibited an opposite movement, decreasing from 200.4 (318.4) in 2018-19 to 157.9 (281.3) in 2019-20 and then increasing to 276.9 (359.9) in 2020-21.

Figure 4.1.2 Trend in Index of total exports and Index of agricultural exports of India (Base: Export earnings 2010-11=100)



Source: Author's calculation

Figure 4.1.3 Trend in agricultural exports (quantity, value, Price) from India, 2010-11 to 2020-21(Base: 2010-11=100)

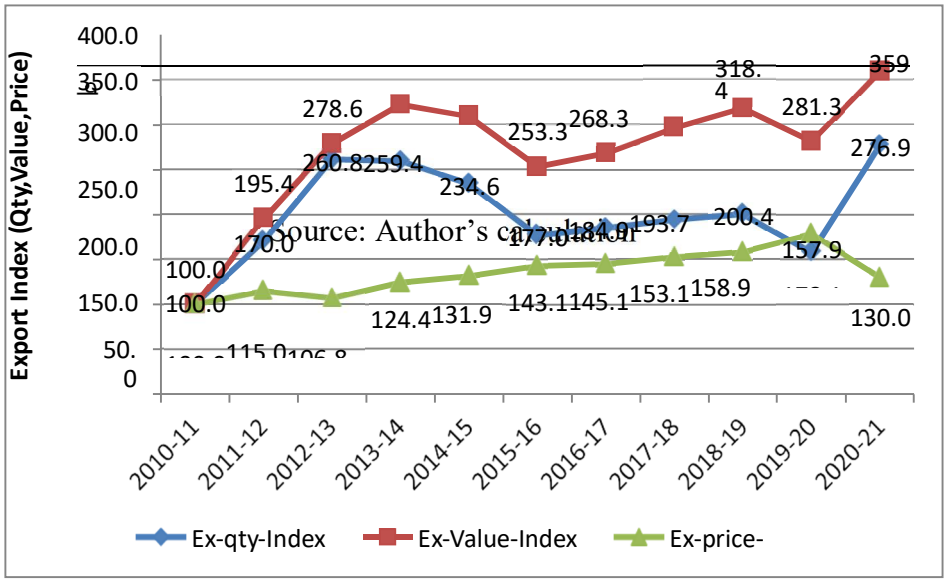
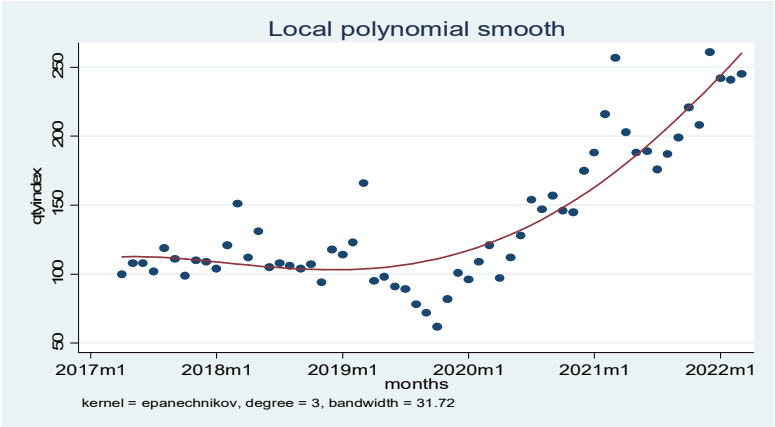


Figure 4.1.4a Local polynomial smoothing curve of agri-export quantity index



A closer examination of the polynomial smoothing curves based on monthly data (Figure 4.1.4a, Figure 4.1.4b, and Figure 4.1.4c) reveals a significantly positive impact of COVID-19 on both the quantity and value indices of India's agricultural exports. However, there was a negative impact on the average export price of agricultural products during the pandemic period. These findings highlight the dynamic changes in the agricultural export sector in response to the pandemic and its effects on quantity, value, and pricing.

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Figure 4.1.4b Local polynomial smoothing curve of agri-export value index

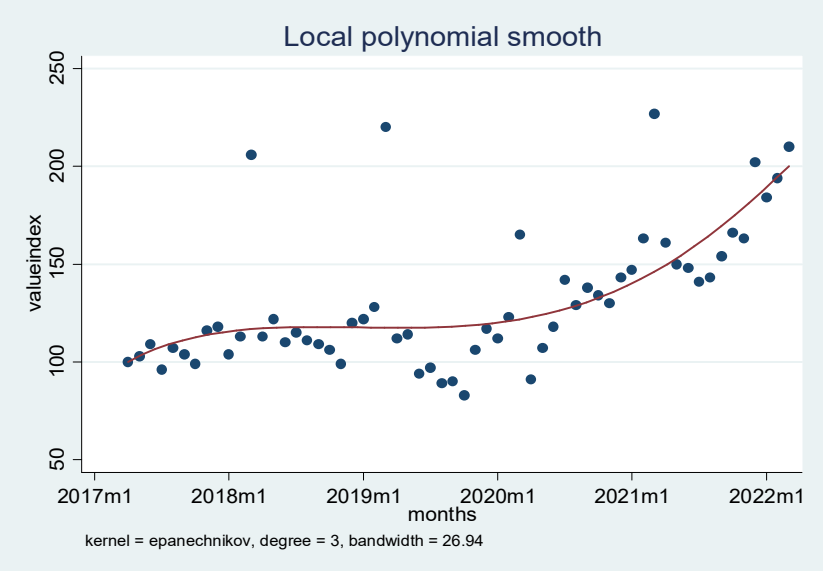
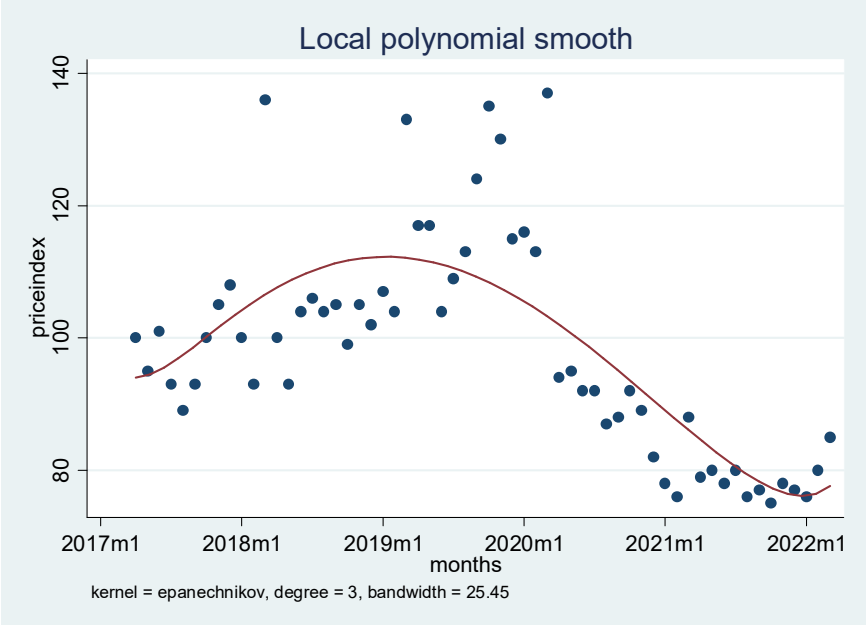


Figure 4.1.4c Local polynomial smoothing curve of average price index of agri-export



4.2 Impact of COVID-19 on the export of agricultural products

In this section, we analyze the impact of COVID-19 on the export of agricultural products using commodity-level data for the last three years of our study period. We consider the year 2018-19 as the pre-COVID period, 2019-20 as the intermediate period, and 2020-21 as the COVID-19 period. We calculate the percentage change in agricultural exports for each commodity and examine the patterns of change during these years. Specifically, we estimate (i) the percentage change in export of agricultural products in 2019-20 compared to 2018-19, (ii) the percentage change in export in 2020-21 compared to 2019-20, and (iii) the percentage change in export in

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2020-21 compared to the pre-COVID year of 2018-19 (indicating the impact of COVID-19). Negative changes in export during the COVID period compared to the pre-COVID period represent the negative impact of COVID-19, while positive changes indicate a positive impact on the export of that commodity.

Table 4.2.1 Impact of Covid-19 on agricultural exports (value): Top-20 products

	2018-19	2019-20	2020-21 (April-March)		% change in 2019-20 Over 2018-19	% change in 2020-21 Over 2019-20	**% change in 2020-21 Over 2018-19**
Product Name	Value (in Rs. Crore)	Value (in Rs. Crore)	Value (in Rs. Crore)	% share			
Non Basmati Rice	21185	14365	35475	23.23	-32.2	147.0	**67.5**
Basmati Rice	32804	31026	29715	19.46	-5.4	-4.2	**-9.4**
Buffalo Meat	25168	22668	23460	15.36	-9.9	3.5	**-6.8**
Miscellaneous Preparations	4073	4148	5858	3.84	1.8	41.2	**43.8**
Groundnuts	3298	5096	5382	3.52	54.5	5.6	**63.2**
Cereal Preparations	3860	3872	4681	3.07	0.3	20.9	**21.3**
Maize	1872	1019	4661	3.05	-45.5	357.3	**149.1**
Wheat	425	439	3987	2.61	3.3	807.9	**838.2**
Processed Vegetables	2474	2761	3717	2.43	11.6	34.7	**50.3**
Processed Fruits, Juices & Nuts	2805	3086	3173	2.08	10.0	2.8	**13.1**
Cashew Kernels	4579	4018	3112	2.04	-12.3	-22.5	**-32.0**
Fresh Onions	3467	2319	2820	1.85	-33.1	21.6	**-18.7**
Jaggery & Confectionery	1606	1633	2657	1.74	1.7	62.7	**65.5**
Alcoholic Beverages	2104	1649	2348	1.54	-21.6	42.4	**11.6**
Fresh Grapes	2335	2177	2298	1.50	-6.8	5.6	**-1.6**
Other Fresh Fruits	1835	2066	2233	1.46	12.6	8.1	**21.7**
Other Fresh Vegetables	2070	2065	2143	1.40	-0.2	3.8	**3.5**
Pulses	1822	1534	2116	1.39	-15.8	38.0	**16.1**
Guargum	4707	3262	1949	1.28	-30.7	-40.2	**-58.6**
Cucumber And Gherkins (Prepd.& Presvd.)	1437	1241	1652	1.08	-13.6	33.1	**14.9**
				(93.92)			
Total	**135101**	**119391**	**152731**	**100.0**	**-11.6**	**27.9**	**13.0**

Source: Author's calculation

Table 4.2.1 summarizes the results for the top 20 agricultural export commodities in India, which account for approximately 94% of total agricultural exports. An analysis of the results in Table 4.2.1 reveals a positive impact of COVID-19 on the export of most agricultural commodities in India. Out of the 20 export commodities, 14 have shown a positive change in export in 2020-21 compared to 2018-19. The highest change is observed in the export of wheat (838.2%) during the COVID period compared to the pre-COVID period, followed by maize (149.1%), non-basmati rice (67%), jaggery and confectionery (65.5%), groundnuts (63.2%), processed vegetables (50.3%), miscellaneous preparations (43.8%), other fresh fruits (21.7%),

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cereal preparations (21.3%), and pulses (16.1%). The total earnings from the export of agricultural commodities increased from Rs. 135,101 crores in 2018-19 (pre-COVID period) to Rs. 152,731 crores in 2020-21 (COVID period) in India.

ARCH Model: Analysis of Monthly data

We have conducted regression analysis using the ARCH model on agricultural exports, specifically focusing on the logarithm of quantity, value, and price. After conducting various statistical and econometric tests (Time series graphs (line, ac, pac), ADF unit-root test, LM test for ARCH effect etc.), the regression results ARCH model are presented in Table 4.2.2a for agricultural export quantity, Table 4.2.2b for export value, and Table 4.2.2c for export price.

The Wald Chi-square test indicates that the overall ARCH models (in respect of agricultural export quantity, value, and price) are statistically significant at the 1% level (p-value = 0.000), meaning that the included variables in each model collectively explain a significant portion of the variability in the changes in the log of the quantity, or value or price of agricultural exports.

Upon analyzing the regression results, we observe a positive impact of the COVID-19 dummy variable (covidapril20) on the quantity of agricultural exports from India and a negative impact on their value and price. However, the coefficient for the COVID-19 dummy is not statistically significant, indicating that the data does not provide strong evidence of COVID-19 significantly affecting monthly changes in agricultural exports from India.

The coefficient for (monthc), seasonal effect on monthly data, is positive and statistically significant at the 1% level in each ARCH model. This suggests that each subsequent month sees an average increase in the first difference of the log of the quantity (0.0189 units), value (0.0333), and price (0.0089) of agricultural exports. This indicates a consistent monthly upward trend in the agricultural exports during the sample period.

The variance equation in the ARCH model estimates the conditional variance of the residuals. The lagged squared residual (ARCH L1) term has a positive coefficient and is statistically significant for the quantity (p-value = 0.064) and price (p-value = 0.004) of agricultural exports from India. This suggests some evidence of volatility clustering in these datasets, meaning periods of high volatility in export quantities and prices are likely to be followed by further periods of high volatility. However, there is no strong evidence of volatility clustering in the value of exports dataset, indicating that periods of high volatility in export values are not necessarily followed by further periods of high volatility.

The constant term in the variance equation is positive and statistically significant at the 1% level. This indicates a baseline level of volatility in the changes in the log of the quantity (or value or price) of agricultural exports.

Policy implications of these regression results are:

1. The significant positive monthly trend highlights the importance of sustaining growth in agricultural exports from India through consistent policies and support.
2. The lack of significant impact from COVID-19 suggests that agricultural export quantities may have been resilient or adaptive during the pandemic.
3. The presence of some volatility clustering indicates a need for policies that can manage and stabilize fluctuations in agricultural exports from India.

Additionally, the regression results suggest the need to explore other potential variables that could impact agricultural exports from India. Further investigation into the factors contributing

to volatility clustering could help in developing strategies to stabilize agricultural exports.

Table 4.2.2a Estimated ARCH model on monthly agri-export quantity (in MT)
(Dependent variable= D.lqtymt = First difference of log of quantity)

ARCH family regression

Sample: 2017m5 - 2022m3 Number of obs = 59
Distribution: Gaussian Wald chi2(2) = 17.61
Log likelihood = 39.41534 Prob > chi2 = 0.0002

D.lqtymt	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
lqtymt						
monthc	.0188546	.0044936	4.20	0.000	.0100473	.0276619
covidapril20	.0249576	.031334	0.80	0.426	-.036456	.0863711
_cons	-.1234567	.0359667	-3.43	0.001	-.1939502	-.0529633
ARCH						
arch						
L1.	.52468	.2834838	1.85	0.064	-.0309382	1.080298
_cons	.0089658	.0034334	2.61	0.009	.0022365	.0156952

Table 4.2.2b Estimated ARCH model on monthly agri-export value (in Rs. Crore)
(Dependent variable= D.lrscrore = First difference of log of export value)

ARCH family regression

Sample: 2017m5 - 2022m3 Number of obs = 59
Distribution: Gaussian Wald chi2(2) = 22.31
Log likelihood = 25.02789 Prob > chi2 = 0.0000

D.lrscrore	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
lrscrore						
monthc	.0333124	.0075402	4.42	0.000	.0185339	.048091
covidapril20	-.0282073	.0472751	-0.60	0.551	-.1208649	.0644502
_cons	-.1943837	.0708419	-2.74	0.006	-.3332313	-.0555362
ARCH						
arch						
L1.	.4672264	.3533609	1.32	0.186	-.2253483	1.159801
_cons	.0159267	.0056135	2.84	0.005	.0049244	.0269289

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Table 4.2.2c Estimated ARCH model on agricultural export price
(Dependent variable= D.lprice = First difference of log of average price of exports)

ARCH family regression

Sample: 2017m5 - 2022m3 Number of obs = 59
Distribution: Gaussian Wald chi2(2) = 15.44
Log likelihood = 63.13824 Prob > chi2 = 0.0004

D.lprice	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
lprice						
monthc	.0084641	.0021609	3.92	0.000	.0042288	.0126993
covidapril20	-.0185922	.0240378	-0.77	0.439	-.0657055	.028521
_cons	-.0391589	.018538	-2.11	0.035	-.0754926	-.0028251
ARCH						
arch						
L1.	.8975668	.3127129	2.87	0.004	.2846608	1.510473
_cons	.0029902	.0011361	2.63	0.008	.0007635	.0052169

Table 4.2.3 Linear regression results on agricultural exports (Dep. Var= log of y_t)

Dep. Variable (Yt)	Coeff. of explanatory variables						
	monthc	covidapril20	lag of Yt	_cons	R^2	dw	obs
log of export quantity	0.024	0.187	0.697	4.205	0.890	2.28	59
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)			
log of export value	0.036	0.161	0.446	4.890	0.694	2.17	59
(p-value)	(0.000)	(0.001)	(0.000)	(0.000)			
log of export price	0.010	-0.134	0.546	0.744	0.769	2.12	59
(p-value)	(0.003)	(0.000)	(0.000)	(0.000)			

Note: monthc= monthly code (defined in methodology section), Covidapril20=dummy variable. Source: Author's calculation.

Diversification of agricultural exports from India

In terms of agricultural export diversification from India, non-basmati rice holds the highest share of 23.23% in total agricultural exports in 2020-21, followed by basmati rice (19.46%), buffalo meat (15.36%), Miscellaneous Preparations (3.84%), Groundnuts (3.52%), Cereal Preparations (3.07%), Maize (3.05%), wheat (2.61%), and processed vegetables (2.43%). The trend of agricultural export diversification in India has increased during the COVID-19 and post-COVID periods, with the rate of diversification being greater compared to the pre-COVID period, as shown in Figure 4.2.1a.The value of the commodity diversification index (DI) for India's agricultural exports has risen from 0.759 in 2017-18 to 0765 in 2018-19 and from 0.769 in 2020-21 to 0.785 in 2021-22, indicating a broader range of agricultural commodities being exported. Analyzing specific commodities, there was a negative percentage change of -32.2% in the export of non-basmati rice in 2019-20 compared to 2018-19. However, there was a significant positive percentage change of 147.0% in the export of non-basmati rice in 2020-21 compared to 2019-20. Basmati rice and buffalo meat, on the other hand, experienced a negative impact of COVID-19 on their exports. Negative impacts of COVID-19 were also observed for cashew kernels, fresh onions, fresh grapes, and guargum. However, there was a positive change

in the export of fresh onions, fresh grapes, and buffalo meat in 2020-21 compared to 2019-20. Bangladesh, UAE, USA, Vietnam, Saudi Arabia, and Nepal are identified as the most important export markets for India's agricultural exports, as shown in Table 4.2.4. India has around 200 agricultural export partners (countries). The value of the geographical diversification index (Geo-DI) for India's agricultural exports increased from 0.845 in 2017-18 to 0.879 in 2020-21 and slightly decreased to 0.863 in 2021-22, as depicted in Figure 4.2.1b.

Figure 4.2.1a Commodity diversification index (DI) of agri-exports from India

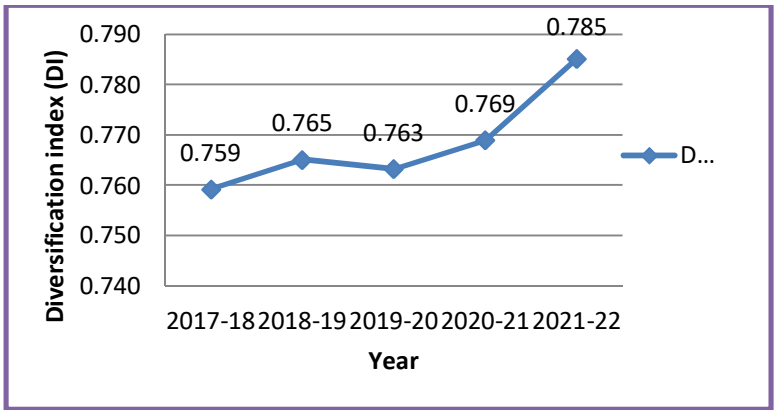

Figure 4.2.1b Geographical diversification index (Geo-DI) of India's agri-exports

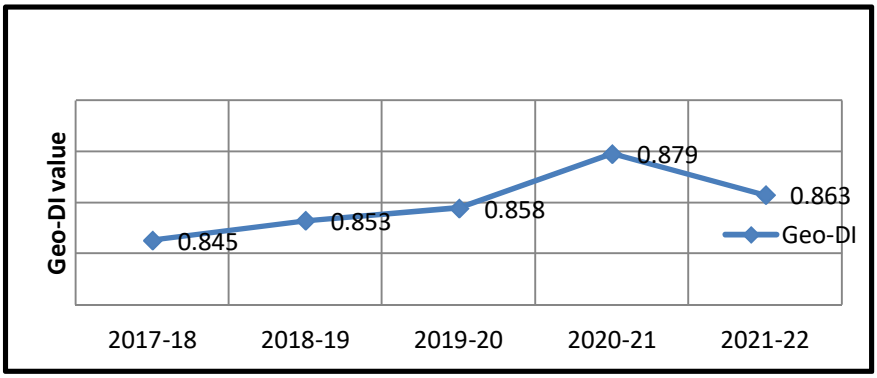

Table 4.2.4 Top ten destinations of India's agricultural exports

Top 10 Export destinations	%share of exports in 2021-22	%share of exports in 2017-18
Bangladesh Pr	11.45	5.19
U Arab Emts	6.48	7.83
U S A	5.05	6.58
Vietnam Soc Rep	5.01	12.60
Saudi Arab	4.54	6.87
Nepal	4.44	3.43
Malaysia	4.26	3.33
Indonesia	4.02	2.12
Iran	3.88	5.19
Egypt A Rp	3.30	1.62

Source: Author's calculation

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4.3 Growth and instability in agricultural exports from Indian states

Table 4.3.1 presents the growth rate and instability (measured by the coefficient of variation, CV) in agricultural exports from Indian states during the periods 2010-11 to 2014-15 (the first 5-year period) and 2015-16 to 2019-20 (the second 5-year period). The mean exports and percentage changes in exports across states are analyzed. In the first 5-year period, Gujarat holds the highest position in mean exports among the states, followed by Maharashtra and Uttar Pradesh. Andhra Pradesh, Tamil Nadu, Rajasthan, Haryana, West Bengal, Punjab, Delhi, Kerala, and Karnataka secure subsequent positions. Other states like Bihar, Telangana, Madhya Pradesh, Chhattisgarh, Goa, Odisha, Uttarakhand, and Assam have relatively low levels of exports. The average export of agricultural products per year for India as a whole during this period is found to be Rs. 102,378.8 crore. In the second 5-year period, Gujarat maintains its highest position with an average export of Rs. 30,607.6 crore per year, followed by Maharashtra (Rs. 26,036.0 crore) and Uttar Pradesh (Rs. 17,025.9 crore). Tamil Nadu, Haryana, Andhra Pradesh, West Bengal, Kerala, Punjab, and Karnataka secure the next positions. The average export of agricultural products from India per year during this period is Rs. 120,336.3 crore. Analyzing the percentage change in mean exports from the first 5-year period to the second 5-year period, positive changes are observed in most states except for Rajasthan (-73.43%), Punjab (-4.67%), and Andhra Pradesh (-1.94%). Odisha shows the highest positive change in export, followed by Assam, Uttarakhand, Kerala, Karnataka, and Bihar. The annual average compound growth rate of agricultural exports varies greatly across states, with positive growth in all states except Rajasthan and Chhattisgarh during the period of 2010-11 to 2019-20. Regarding instability in agricultural exports, the coefficient of variation (CV) is calculated for each sub-period. The CV value shows high instability in exports during the first 5-year period (38.63%) compared to the second 5-year period (8.88%) in India. This decreasing degree of instability indicates more stable agricultural exports from India. Figure 4.3.1 demonstrates the changes in instability (CV) in agricultural exports between the two sub-periods across major states in India. The value of CV decreases in each state from the first sub-period (2010-11 to 2014-15) to the second sub-period (2015-16 to 2019-20). Bihar, Rajasthan, West Bengal, Andhra Pradesh, and Uttar Pradesh have reduced their high export variability during the first 5 years to the second 5 years of the study. Chhattisgarh has the highest CV value in exports (106.64%) during 2010-11 to 2014-15, while Tamil Nadu exhibits the lowest CV value (24.12%). In the second sub-period (2015-16 to 2019-20), Chhattisgarh still has the highest CV value (78.33%), while Tamil Nadu maintains the lowest CV value (3.34%). For India as a whole, the CV in agricultural exports is 8.88% during 2015-16 to 2019-20, which is lower than the CV in exports during 2010-11 to 2014-15 (Table 4.3.1).

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Table 4.3.1 Growth and Instability in export of agricultural products from Indian states, 2010-11 to 2019-20

State	5-Year Average agril. exports (Rs.crore)			Growth rate of agril. exports(%)	Coefficient of variation (CV) in agril. exports (%)		States' (%) share in India's agril. exports
	2010-11 to 2014-15	2015-16 to 2019-20	% change	2010-11 to 2019-20	2010-11 to 2014-15	2015-16 to 2019-20	
Gujarat	25098.2	30607.6	21.95	9.01	38.62	18.26	25.44
Maharashtra	22545.5	26036.0	15.48	5.44	32.48	5.13	21.64
UttarPradesh	13611.9	17025.9	25.08	10.40	51.57	7.23	14.15
Haryana	6471.0	8057.0	24.51	10.45	43.72	15.03	6.70
TamilNadu	7058.6	8273.3	17.21	4.86	24.12	3.34	6.88
AndhraPradesh	7177.8	7038.9	-1.94	10.84	56.35	22.39	5.85
WestBengal	4632.3	6113.8	31.98	11.53	58.29	17.53	5.08
Kerala	1017.4	3515.6	245.54	27.07	37.78	30.96	2.92
Punjab	3435.2	3274.7	-4.67	5.18	44.78	6.74	2.72
Karnataka	1002.3	2402.2	139.67	20.29	35.55	24.67	2.00
Bihar	796.3	1763.6	121.48	25.90	65.74	19.12	1.47
Rajasthan	6481.4	1722.0	-73.43	-11.96	61.99	19.27	1.43
Delhi	1736.0	1837.1	5.82	2.85	33.74	14.92	1.53
Telangana	657.6	1245.8	89.44	16.20	42.79	6.89	1.04
MadhyaPradesh	423.0	791.9	87.20	24.26	77.20	21.00	0.66
Odisha	14.6	227.1	1457.88	58.43	49.41	4.87	0.19
Goa	82.6	122.0	47.59	28.73	84.64	17.62	0.10
Uttarakhand	6.6	60.6	820.10	47.46	57.40	48.30	0.05
Chhattisgarh	100.7	170.7	69.49	-13.58	106.64	78.33	0.14
Assam	2.3	26.0	1023.78	60.90	77.07	57.09	0.02
Total-India	102378.8	120336.3	17.54	7.73	38.63	8.88	100.00

Source: Author's calculation based on data from the DGCIS.
Note: Growth rate= Annual average compound growth rate (%) during 2010-11 to 2019-20.
CV= Coefficient of Variation = (Standard deviation/Mean)* 100
% change=Percentage change in average agril. export during 2016-20 over the period 2011-15.

Figure 4.3.1 Change in Instability (in terms of CV) in export between two sub-periods

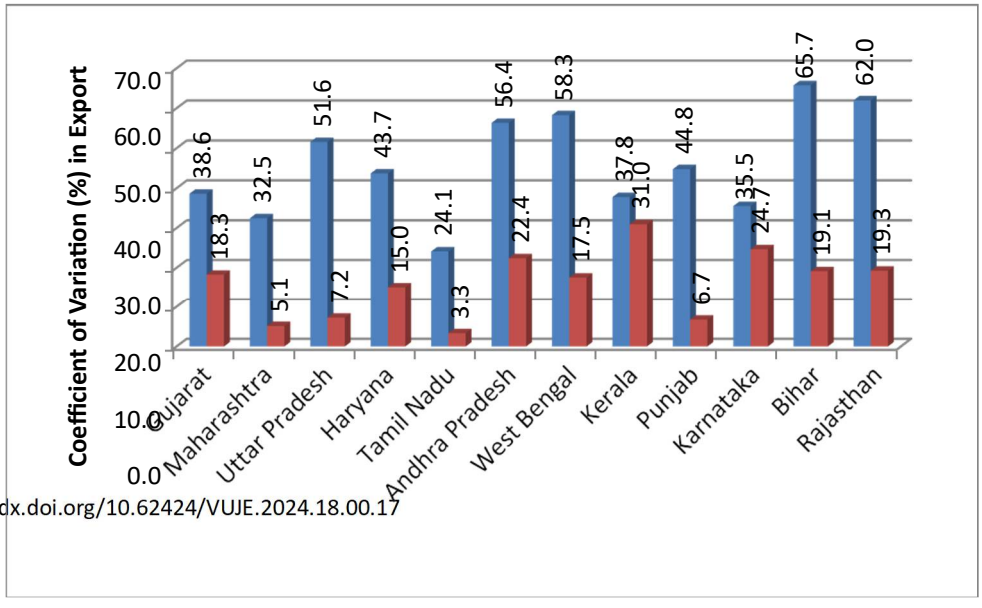

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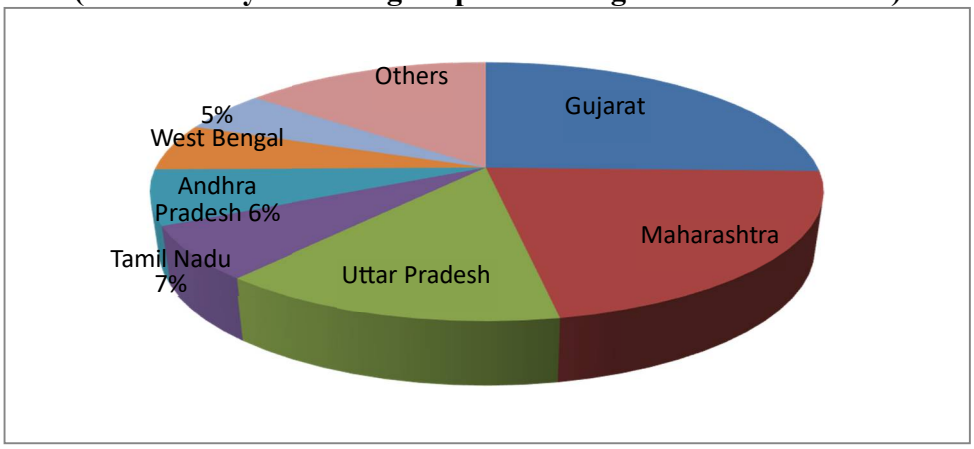
Figure 4.3.2 illustrates the percentage distribution of India's total agricultural exports among states from 2015-16 to 2019-20. Gujarat has the highest share of 25%, followed by Maharashtra (22%), Uttar Pradesh (14%), Haryana (7%), Tamil Nadu (7%), Andhra Pradesh (6%), and West Bengal (5%).

Figure 4.3.2 Distribution of export of agricultural products among the states, (Based on 5-year average exports during 2015-16 to 2019-20)



Source: Author's calculation

Figure 4.3.3 compares the average export positions of states in the two sub-periods. Table 4.3.3 displays the estimated growth rates (%) of exports from different states during 2010-11 to 2019-20. Assam and Odisha exhibit the highest export growth rates (60.90% and 58.43% per year, respectively), while Rajasthan and Chhattisgarh have negative growth rates (-11.96% and -13.58%) and are placed lower than the other states. The growth rate of agricultural exports for India as a whole is estimated at 7.74% during this period.

Figure 4.3.4 presents the annual average growth rates of agricultural product exports across major states in India from 2010-11 to 2019-20. Kerala shows the highest growth rate at 27.1%, followed by Bihar (25.9%), Karnataka (20.3%), and West Bengal (11.5%) among the major states. Gujarat, Maharashtra, and Uttar Pradesh have growth rates of 9%, 5.4%, and 10.4%, respectively, during this period.

Figure 4.3.3 Average export of agricultural products by major states during the two sub-periods from 2010-11 to 2014-15 and from 2015-16 to 2019-20.

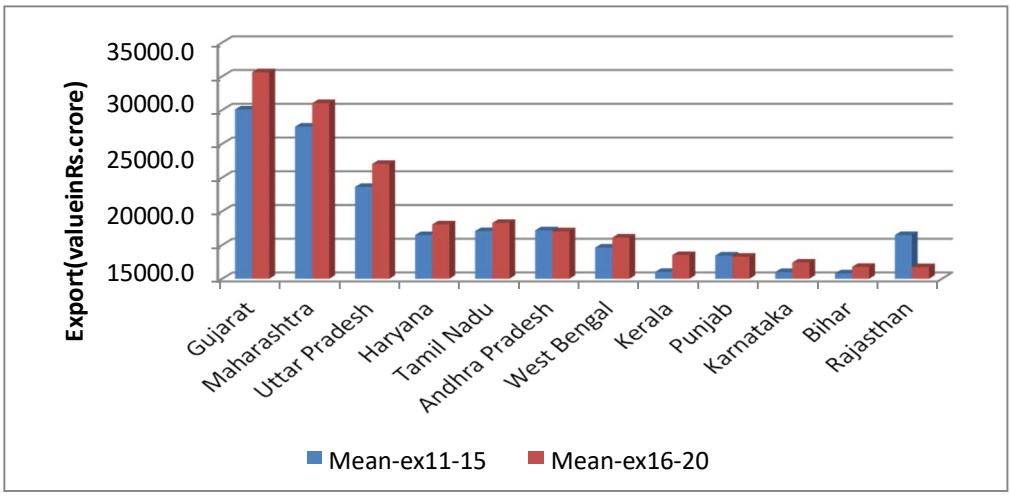


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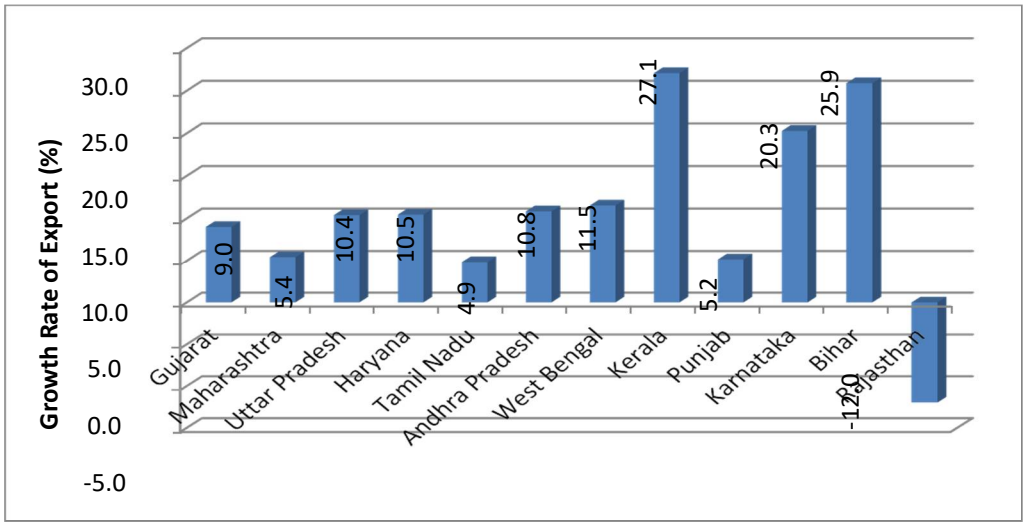
Figure 4.3.4 Growth rate of agricultural export by major states, 2010-11 to 2019-20



Source: Author's calculation

4.4 Determinants of Agricultural exports

In this section, we assess the role of certain factors in increasing agricultural exports from Indian states, specifically focusing on food processing industries (FPI), the number and capacity of cold storages, and the packaging system. These factors play a crucial role in maintaining the standard and quality of agricultural products and enhancing their exports. The regression results on the determinants of agricultural exports are summarized in Table 4.4.1. The regression model indicates that the number of FPI, the capacity of cold storage (in MT), and the number of on-farm pack houses are all significant explanatory variables for agricultural exports from India. The multiple regression model as a whole is statistically significant at the 1% level, with an R-squared value of 0.438. This implies that 43.8% of the variation in agricultural exports across states is explained by the variation in these explanatory variables.

All the coefficients of the explanatory variables have the desired positive sign, indicating their positive impact on agricultural exports. The coefficients for cold storage capacity and packaging are statistically significant at the 1% and 5% levels of significance, respectively. However, the coefficient for FPI, while positive, is not statistically significant in India. It should be noted that the share of processed products, such as processed vegetables and processed fruits, juices, and nuts, is relatively low in total agricultural exports in India.

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Table 4.4.1Determinants of exports of agricultural products from India: Regression

```
regress meanex fpino coldcapmt ofpackh

      Source |       SS       df       MS              Number of obs =      26
-------------+------------------------------           F(  3,    22) =    5.72
       Model |  704810904      3  234936968            Prob > F      =  0.0047
    Residual |  903683220     22   41076510            R-squared     =  0.4382
-------------+------------------------------           Adj R-squared =  0.3616
       Total |  1.6085e+09    25  64339764.9            Root MSE      =  6409.1

------------------------------------------------------------------------------
      meanex |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       fpino |     1.06078   .8751518     1.21   0.238    -.7541739    2.875733
   coldcapmt |    .0012376   .0004418     2.80   0.010     .0003213    .0021538
     ofpackh |    2.391514   1.161483     2.06   0.052    -.0172538    4.800281
       _cons |   -669.1771   1883.502    -0.36   0.726    -4575.322    3236.967
------------------------------------------------------------------------------
```

Results

Note: meanex=agricultural export (in Rs. Crore), fpino = Number of food processing industries, coldcapmt = Capacity of cold storages (in MT), and ofpackh = number of on farm pack house.
Source: Author's Calculation.

As of March 31, 2018, there were 7,016 cold storages in India with a total storage capacity of 36,229,675 metric tons (MT). Additionally, there were 23,604 on-farm pack houses and 38,603 registered food processing industries. Therefore, it is important to focus on expanding and improving infrastructure facilities, such as increasing the number of food processing industries (FPIs), cold storages, and pack houses, in order to promote agricultural exports and generate foreign earnings for India.

5. Summary conclusions and policy prescriptions

The summary conclusions and policy prescriptions of the paper are as follows:

1. The growth rate of agricultural exports from India is higher than the growth rate of total exports during the study period. This indicates the importance of the agricultural sector in contributing to India's export performance.
2. There is a considerable variation in the growth rate of export of agricultural products among different Indian states. This highlights the need for targeted policies to address disparities and promote export growth in states with lower performance.
3. The degree of instability in agricultural exports has been reducing over time, indicating improved stability in the sector. States such as Bihar, Rajasthan, West Bengal, Andhra Pradesh, and Uttar Pradesh have experienced a reduction in the variability of their agricultural export performance.
4. The ARCH models for agricultural export quantity, value, and price are statistically significant, indicating good explanatory power.
5. COVID-19 shows a positive impact on export quantity and a negative impact on value and

price, but these effects are not statistically significant, which indicate that agricultural exports from India may have been resilient or adaptive during the pandemic.
6. There is a consistent monthly upward trend in agricultural export quantity, value, and price.
7. Volatility clustering is observed in export quantities and prices, but not in export values.
8. The concentration of agricultural exports from India is high, with a few states dominating the export share. Gujarat, Maharashtra, Uttar Pradesh, Haryana, Tamil Nadu, Andhra Pradesh, and West Bengal are the major contributors to agricultural exports.
9. Wheat, maize, non-basmati rice, jaggery & confectionery, groundnuts, processed vegetables, and miscellaneous preparations were among the commodities that showed a positive impact of Covid-19. However, there were negative impacts on the export of basmati rice, buffalo meat, cashew kernels, fresh onions, fresh grapes, and guargum.
10. The study finds that states with better processing infrastructure, including processing units and facilities for value addition, tend to have higher agricultural exports.
11. Similarly, the presence of well-developed cold storage facilities for preserving perishable agricultural products plays a crucial role in facilitating export growth.
12. Adequate packaging facilities, including packaging materials and technologies, are also found to be important in maintaining the quality and shelf life of agricultural products during transportation and export.
13. States that invest in improving processing industries, storage facilities, and packaging infrastructure are likely to experience enhanced agricultural export performance.

In conclusion, the study highlights the need to investigate other potential factors, exporter behaviors, and supply chain disruptions that influence agricultural exports during crises. The COVID-19 pandemic significantly impacted these areas, prompting exporters to adopt digital platforms, diversify markets, and focus on high-demand products. Supply chain disruptions led to increased local sourcing, inventory buffers, and stronger supplier relationships. Logistics challenges, regulatory compliance, and workforce management required agility and adaptation. Investments in technology, such as blockchain and AI, improved resilience and transparency. Government support and infrastructure development, including cold storage and transport networks, facilitated export activities. These findings underscore the necessity for flexibility, innovation, and robust policy support to sustain agricultural exports during crises. Understanding these factors can provide deeper insights and help develop more targeted strategies to stabilize and enhance agricultural exports.

Based on these findings, the following policy prescriptions are suggested:

1. Infrastructure facilities such as processing industries, cold storage facilities, and packaging houses should be expanded and improved to promote foreign earnings from agricultural exports.
2. Efforts should be made to reduce volatility in agricultural exports through appropriate policies and measures.
3. State-wise variations in agricultural exports should be addressed by reducing restrictions on the movement of agricultural goods across states and improving cold van facilities.
4. Diversification of agricultural exports by both commodity composition and geographical destinations should be pursued to enhance resilience and explore new market opportunities.

   By implementing these policy recommendations, India can further strengthen its agricultural export sector, ensure stability, and capitalize on the potential of agricultural trade for economic growth and development.

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References

Bakka, D.R. & Bathini, S. (2022). Impact of Covid -19 on Indian Agricultural Exports. Journal of Research in Humanities and Social Science. Volume 10. Issue 10 pp. 358-363.

Ben-xiLIN, & Yu YvetteZHANG. (2020). Impact of COVID-19 on agricultural export companies in China. Journal of Agricultural Economics, 71(2), 345-360.

Cariappa, A. A., Acharya, K. K., Adhav, C. A., Sendhil, R., & Ramasundaram, P. (2021). Impact of COVID-19 on the Indian agricultural system: A 10-point strategy for post-pandemic recovery. Outlook on Agriculture, 50(1), 26-33. https://doi.org/10.1177/0030727021989060

Dilnashin, F., Singh, R. P., & Kumar, A. (2021). Economic shock of COVID-19 on India's agri-sector: Food safety, nutrition, and livelihoods. Journal of Agribusiness in Developing and Emerging Economies, 11(5), 445-458.

Goel, V., Ranjan, R., & Verma, A. (2023). Impact of COVID-19 lockdown on Indian agriculture. Indian Journal of Agricultural Sciences, 93(4), 557-567.

Hussain, M. A., & Guha, P. (2023). Role of farm infrastructure in agribusiness during crises: Evidence from rural Assam, India. Agricultural Economics Research Review, 36(1), 33-47.

Jaacks, L. M., Roy, A., Smith, M. R., & Jain, M. (2022). Impact of COVID-19 on Indian agriculture: Nationally representative survey results. Food Policy, 102, 102118. https://doi.org/10.1016/j.foodpol.2021.102118

Kumar, K. N. R., Reddy, K. G., Shafiwu, A. B., & Reddy, M. J. M. (2024). Trade determinants and opportunities for Indian rice: A dynamic panel gravity model perspective. Cogent Economics & Finance, 12(1), 2312367. https://doi.org/10.1080/23322039.2024.2312367

Kumar, V. (2021). Trends and Performance of India's Agricultural Trade in the Midst of COVID-19 Pandemic. Indian Journal of Agricultural Economics. Volume 76, Number 3, July-September 2021. Mumbai.

Kumareswaram T, Jolia P, Maurya M, Maurya A, Abbasmandri S, and Kamalvanshi V (2018). "Export scenario of Indian agriculture: A review." Journal of Pharmacognosy and Phytochemistry, Vol. 7, Issue 6.

Lebastard, A., Garnero, M., & Leclair, M. (2023). COVID-19 and global value chains: The impact on French exporters. Economic Modelling, 109, 105762. https://doi.org/10.1016/j.econmod.2022.105762

Meenu (2021). State Wise Agricultural Exports of India During Covid 19 with Special Reference to Punjab. International Journal of Advanced Research in Commerce, Management & Social Science (IJARCMSS). Volume 04, No. 03 (II), July-September, 2021, pp.142-150.

Ministry of Commerce & Industry. (2021). Merchandise exports from India: April to November 2021. Government of India Report.

NABARD (2020), Impact Assessment of COVID-19 on Indian Agriculture & Rural Economy, Department of Economic Analysis & Research, National Bank for Agriculture and Rural Development, Mumbai, August 2020.

NIAP (2020), Covid-19 Lockdown and Indian Agriculture: Options to Reduce the Impact, Working Paper, National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi.

Paramasivan, C. and Pasupathi R. (2017). "A study on growth and performance of Indian agro-based exports." International Journal of Humanities and Social Science Research, Vol. 3, Issue 9, pp. 01-05.

Ravi Kumar, K. N., Naidu, G. M., & Shafiwu, A. B. (2024). Drivers of Indian agricultural exports: A dynamic panel data approach. Journal of Agricultural Economics and Development, 8(2), 211-229.

Saxena, R., Singh, R., Agarwal, P., Kumar, R., & Raman, M. S. (2023). Structure, performance and competitiveness in Indian agricultural exports. In S. A. Narula & S. P. Raj (Eds.), Sustainable food value chain development (pp. 233-250). Springer. https://doi.org/10.1007/978-981-19-6454-1_14

Sridhar, G., Banerjee, P., & Rao, V. R. (2022). Global impact of COVID-19 on agriculture: Lessons for building a resilient food system. Agricultural Systems, 191, 103169. https://doi.org/10.1016/j.agsy.2021.103169

Vyas, V., Chaudhary, P., & Singh, A. (2021). Early impacts of COVID-19 on Indian food supply chain: An analysis using news mining. Journal of Agribusiness in Developing and Emerging Economies, 11(5), 595-610. https://doi.org/10.1108/JADEE-07-2020-0158

World Trade Organization (WTO). (2020). The impact of COVID-19 on global trade and supply chains. WTO Study Report, June 2020.

WTO (2020). Covid-19 and Agriculture: A Story of Resilience. Information Note, World Trade organization. August 2020.