A Comprehensive Analysis of Export Performance and Trade Competitiveness of Millets from India

Abstract

The present study examines the trade performance, competitiveness and trade directions of millets. Indian milletmarket shedding light on their role in fostering a resilient and sustainable food system, aligning with global agendas for a healthier and more sustainable future.The secondary data collected from the ITC Trade Map, focusing on global and Indian millet exports and imports performance, the dataspanning from 2013 to 2021. The analytical tools like Revealed Comparative Advantage (RCA), Markov Chain analysis, and Herfindahl-Hirschman Index (HHI) are employed. Ukraine, India, and Russia are major millet exporters, while Indonesia, Belgium, and Germany are significant importers in the world. The UAE, Nepal and Saudi Arabia are prominent destinations for Indian millet exports. The RCA index analysis revealed that Ukraine has the highest average RCAindex value for millet exports, followed by India. The trade direction stability, with Nepal being the most stable importer.The HHI for global millet exports is 0.141, indicating moderate concentration while global millet imports, the HHI is 0.277, signifying high concentration. In the case of Indian millet exports, the HHI is 0.17, representing moderate concentration. Efforts should be made to boost the exports of millets from India, tapping into the potential of diverse markets and reducing dependence on a limited number of countries.

Keywords: Millets, Trade Dynamics, Comparative advantage,Export & Import, Economic growth, and Foreign exchange.

1. Introduction

Millets, often referred to as "nutri-cereals" encompass a group of small-seeded grains that have been integral to Indian agriculture for centuries. In recent years, the global demand for millets has witnessed a notable upswing owing to their nutritional benefits, climate resilience, and diverse applications (Dayakar *et. al*., 2022; Madhu *et al*., 2023a; Kadam, *et al*., 2023).The cultivation and consumption of millets are diminishing in numerous countries, and their potential to address food and nutritional security remains underutilized. With an increasing emphasis on the consumption of nutritious food and sustainable production, urgent efforts are required to raise awareness about the nutritional and ecological benefits of millets among consumers, producers, and decision-makers (Amrutha, 2018; Eduru, *et al*., 2021). Millets have been demonstrated to outperform major cereals across several key metrics. Millets exhibit superior water use efficiency compared to major cereals (Sathish, 2018). Additionally, (Nagaraj *et al*., 2013) found that millets demonstrate higher nutrient use efficiency. Millets' resilience to both biotic and abiotic stresses (Kumar *et al*., 2018; Singh *et al.,* 2022).

The climate resilience of millets (Kumar*et al*., 2018; Kumar, 2021). Millets are significantly more nutritionally dense compared to major cereals (Jenkins *et al*., 2008 and Shobana *et al*.,2009).

In 2013, India's National Food Security Act incorporated millets, initially defined as coarse cereals. By 2018, millets were officially integrated into the National Food Security Mission. Additionally, the Government of India declared 2018 as the National Year of Millets (Madhu *et al*., 2023b; Anonymous, 2022).In the wake of the International Year of Millets in 2023, a pivotal moment for the global recognition of the nutritional and ecological benefits of millets. Millets, characterized by their resilience in diverse agro-climatic conditions and rich nutritional profiles, have been integral to the Indian agricultural landscape for centuries (Poshadri *et al*., 2023). As the world acknowledges the significance of millets in addressing contemporary challenges such as food security, malnutrition, and sustainable agriculture, understanding the trade trends and competitiveness of millets in India becomes paramount(Soumya and Yeledhalli, 2020)The International Year of Millets serves as a catalyst for our exploration, underscoring the global significance of millets in achieving sustainable development goals. The International Year of Millets provides a unique opportunity for India to help create greater awareness of millet production, contribute to food and nutritional security, ensure sustainable livelihoods and incomes of farmers – particularly in regions that are drought-prone or threatened by climate change (Anonymous, 2022; Madhu *et al*., 2023b).

In 2021, Asia dominated global millet production, representing 37.69% of the total millet-growing area (116.61 lakh ha) and 56.49% of the overall production (169.98 lakh tonnes) followed by Africa with millet production 121.05 lakh tonnes (40.23%) and contributing 60.11% of the millet-growing area (185.95 lakh ha). Europe had a smaller share, accounting for 1.19% of the millet-growing area (3.68 lakh ha) and 1.97% of the production (5.92 lakh tonnes). The Americas and Australia/New Zealand had even smaller proportions, each representing less than 1% of both the millet-growing area and productionOverall, the total global millet-growing area in 2021 was 318.35 lakh ha, and the total production was 327.90 lakh tonnes (FAOSTAT, 2021).

Millets are mainly grown in poor agro-climatic regions, particularly rainfed areas of the country.India emerged as the top producer of millets, accounting for 40.29% of the global production, with a productivity of 1.35 tonnes per hectare on 9764.82 hectares of land. Following India, Niger, Sudan, Mali, and Nigeria were the other major millets producers, with productivity levels ranging from 0.35 to 0.96 tonnes per hectare (FAOSTAT, 2021). In the 2020-21 period, Rajasthan emerged as the leading millet producer in India, yielding 5.15 million metric tons (MT), which accounted for 28.61% of the national production. Following closely, Karnataka secured the second position with a production of 2.56 million MT, contributing 14.26% to the overall national output. Other notable millet-producing states encompassed Maharashtra (2.51 million MT or 13.95%), Uttar Pradesh (2.29 million MT or 12.75%), Haryana (1.36 million MT or 7.58%), and Gujarat (1.09 million MT or 6.06%). Collectively, these top six states played a pivotal role, contributing over 80% to India's millet production in the specified period (Indiastat 2021; Directorate of Economics and Statistics (DES), 2021; Anonymous, 2022).

Millets offer a unique potential to enhance India's agricultural exports, concurrently advancing India's contribution to global nutritional security. By leveraging the increasing global awareness of

health, India has the opportunity to make substantial investments in marketing, establishing a robust brand presence. Such efforts can contribute to positioning value-added millets as a premium product, serving the dual purpose of mitigating climate change at the agricultural level and offering nutritious food options to consumers worldwide, including in India (Bhatia *et al*., 2021;Singh, *et al.,* 2023). Export potentials of millets from India, anticipating a surplus of 0.56 million metric tons of millets by 2030, India is poised to explore the export market for millet and millet-derived value-added products, with an estimated value of USD 2 billion (Anonymous, 2022). Unlocking Opportunities for Indian Millet marketing and exports were **v**alue-added food, spanning categories like flour, cookies, cakes, Tetrapak drinks, alternative protein beverages, and snacks, is a dynamic sub-segment experiencing growth in both domestic and export markets. Beverages, particularly millets malt, present opportunities in non-alcoholic drinks and the burgeoning craft beer sector. The Animal Feed Segment is witnessing a surge, with India leading in cara beef and aquaculture exports, driving demand for compound feed, supplements, and green fodder. Millets' versatility extends to bird feed, offering export potential with high-quality, traceable millets. Millets' starch content, ranging from 51 to 79%, positions them as strategic substitutes for corn and rice in global trade. Lastly, India's seed sector holds immense potential for millet seed exports, benefiting from competitive production costs and a favourable climate.

An overview of millet export performance and trade competitiveness in India is crucial for several reasons. It provides insights into the economic viability of millet cultivation, aiding policymakers in formulating effective agricultural and trade strategies (Paramasivan and Pasupathi, 2017; Nirmal Ravi Kumar, 2020; Prasad, 2023). The trade dynamics helps identify market trends, enabling farmers and businesses to make informed decisions. Additionally, it contributes to global food security efforts, as millets are valuable crops with nutritional benefits. Moreover, assessing competitiveness fosters sustainable agricultural practices, supporting India's position in the international market. With this background the study is undertaken to analyse the export performance, comparative advantage, trade direction and market concentration of millets export and import from India. It is instrumental in promoting economic growth, ensuring food sustainability, and guiding strategic decisions in the agricultural and trade sectors.

2. Methodology

2.1 Data collection

Secondary data is collected from trade map, global and Indian exports and imports of millets has been gathered from the most recent year, 2021. This data is utilized to calculate the percentage share of imports and exports of millets on both the global and national scales. Additionally, data spanning from 2013 to 2021 is considered for the Revealed Comparative Advantage (RCA) and Transitional Probability Matrix related to millets exports. For the calculation of market concentration using the Herfindahl-Hirschman Index (HHI), data on global millets exports and imports from 2012 to 2021, as well as Indian millets exports from 2013 to 2021, is sourced from the trade map.

HS code: 100829 Millet (excluding grain sorghum, and seed for sowing) and HS code: 100821 Millet seed for sowing (excluding grain sorghum) is merged together and calculated RCA and Transitional Probability Matrix.

2.2 Descriptive statistics

For the study, descriptive statistics such as mean and percentages were used for the analysing the data pertaining to the export and import of millets at global and National scenario.

2.3Revealed Comparative Advantage Index

To assess the competitiveness of different countries in the millets trade, analysts frequently calculate the Revealed Comparative Advantage (RCA) index. This index is typically derived using the following formula:

$$RCA\ ic\ = \frac{xic/Xiw}{xcw/Xw}$$

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

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

$\mathbf{X_{iw}}$ = The value of total exports by country **i,**

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

$\mathbf{X_w}$ =Is the value of total world exports.

A country possesses a comparative advantage in exporting a specific commodity group (denoted as 'c') when the Relative Comparative Advantage (RCA) index for that country and commodity group (RCAic) exceeds one. This signifies that the country's share of exports in commodity group 'c' is greater than the global export share for the same commodity group. Conversely, when RCAic falls below one, it indicates that the country experiences a comparative disadvantage in exporting that particular commodity group.

The RCA is a measure that determines whether a country has a comparative advantage in a particular product based on its share of global exports and the product's share of total exports. An RCA greater than 1 indicates that a country has a comparative advantage in that product.

2.4 Markov Chain analysis

Exports data for the period 2013 to 2021 were used to analyse the export trade direction of millets. The major millets importing countries namely UAE, Saudi Arabia, Yemen, Oman, Libya, Tunisia, Morocco, UK, Nepal, Japan and others. The trade directions of commodities exports were analysed using the first order Markov chain approach. Central to Markov chain analysis is the estimation of the transitional probability matrix P. The elements P_{ij} of the matrix P indicates the probability that export will switch from country i to country j with the passage of time. The diagonal elements of the matrix measure the probability that the export share of a country will be retained. Hence, an examination of the diagonal elements indicates the loyalty of an importing country to a particular country's exports. In the context of the current application, structural changes were treated as a random process with selected importing countries. The average exports to a particular country were considered to be a random variable which depends only on the past exports to that country, which can be denoted algebraically as

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

Where,

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

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

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

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

t = Number of years considered for the analysis

r = Number of importing countries

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

$$O \leq P_{ij} \leq 1 = 1 \text{ for all } i$$

Thus, the expected export shares of each country during period 't' were obtained by multiplying the export to these countries in the previous period (t-1) with the transitional probability matrix. To estimate the transitional probabilities of the Markov chain model Minimum Absolute Deviations (MAD) estimation procedure was employed, which minimizes the sum of absolute deviations. The conventional linear programming technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear programming formulation is stated as

$$\text{Min, } OP^* + Ie$$

$$\text{Subject to, } XP^* + V = Y$$

$$zGP^* = 1$$

$$P^* > 1$$

Where,

O- is the vector of zeroes.

P*- is the vector in which probability Pij are arranged.

I- is an apparently dimensioned vector of area.

E- is a vector of absolute error (1 U 1).

Y- is the vector of export to each country.

X- is the block diagonal matrix of lagged values of Y.

V- is the vector of errors.

G- is the grouping matrix to add the row elements of P arranged in P* to unity.

The values in the transitional probability matrix will have different interpretations. The value of diagonal elements indicates the probability of retention of the previous year values, while values in columns reveals probability of gain of a particular country from other countries, values in rows reveals probability that a country might lose to their countries in respect of a specific commodity exports.

2.5. Herfindahl-Hirschman Index of Concentration

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

$$HHI = \sum_{i=1}^{N} Si^2$$

where Si = Is the market share of country i in the market, and

N = Is the number of countries.

The result is a weighted average of market shares, with values ranging from 0 to 1, where 0 indicates no concentration and 1 full concentration in the market (this would be the case of a monopoly).

The UK's Competition and Markets Authority (CMA) defines a market as 'concentrated' (CMA, 2010) if the HHI is higher than 0.1 (or 10%) and as 'highly concentrated' if the HHI is higher than 0.2. The US Federal Trade Commission (US FTC) defines a slightly different threshold with HHI values above 0.18 as a 'highly concentrated market', and above 0.1 as 'moderately concentrated' (FTC, 2015). A market with a HHI below 0.1 is usually considered as 'non-concentrated'.

3. Results and Discussion

3.1. Global Millet Exports

The global millets export scenario reveals that the Ukraine is the largest exporter of millet in 2021, accounting for 31.89 per cent of the total exports, followed by India with 17.33 per cent and Russia with 12.04 per cent. The United States and France account for 8.03 per cent and 6.15 per cent, respectively, while Canada and Austria have contributed 3.26 per cent and 1.55 per cent of the exports. Tanzania, Netherlands, and China have contributed 1.20 per cent, 1.04 per cent, and 0.94 per cent respectively. The total global millet exports in 2021 were 52,6,807 metric tons (Table 1 and Fig. 1).

Table 1: Major exporters of millets in the world (2021)

Exporters	Quantity in Tonnes	Percent
Ukraine	167976	31.89
India	91288	17.33
Russia	63426	12.04
USA	42277	8.03
France	32419	6.15
Canada	17150	3.26
Austria	8176	1.55
Tanzania	6303	1.20
Netherlands	5484	1.04
China	4955	0.94
Others	87353	16.58
World	**526807**	**100.00**

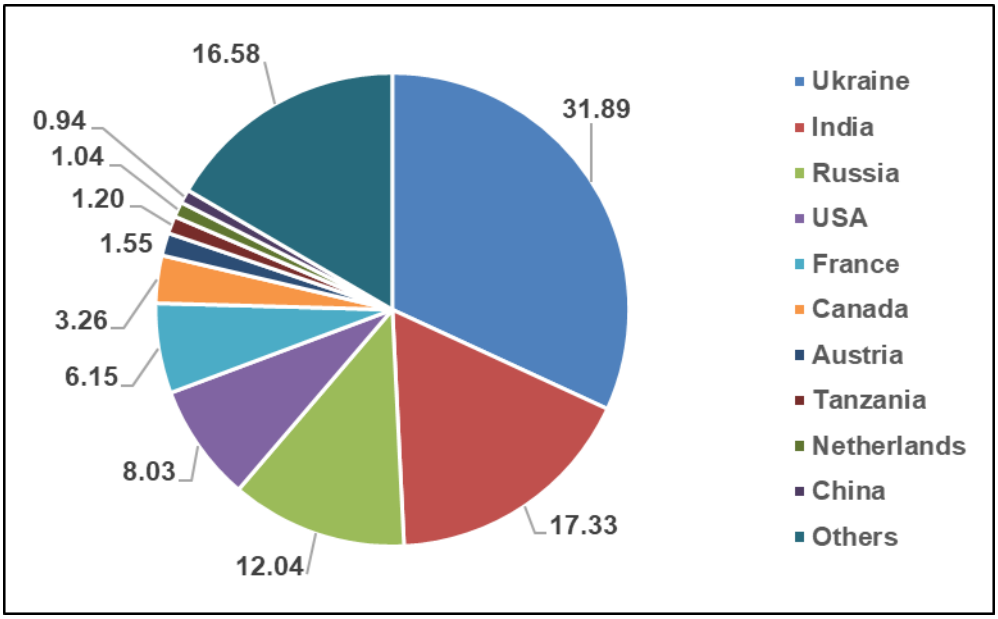

Fig.1: Percent share of major exporters of millets in the world (2021)

3.2. Global Millet Imports

The global millets import scenario reveals that the Indonesia is the largest importer of millet, accounting for 15.85 per cent of the total imports, followed by Belgium with 5.56 per cent and Germany with 5.51 per cent. Turkey and the United Arab Emirates account for 5.28 per cent and 4.41 per cent, respectively, while Nepal and Canada have contributed 4.35 per cent and 4.32 per cent of the imports. Kenya, Niger, and Iraq have contributed 4.21 per cent, 3.89 per cent, and 3.03 per cent, respectively. The remaining 43.59 per cent of millet imports come from other countries not listed in the table. The total global millet imports in the year were 4,91,267 metric tons (Table 2 and Fig. 2).

Table 2: Major importers of millets in the world (2021)

Importers	Quantity in Tonnes	Percent
Indonesia	77874	15.85
Belgium	27295	5.56
Germany	27080	5.51
Turkey	25953	5.28
UAE	21676	4.41
Nepal	21367	4.35
Canada	21226	4.32
Kenya	20671	4.21
Niger	19102	3.89
Iraq	14903	3.03
Others	214120	43.59

World	**491267**	**100.00**

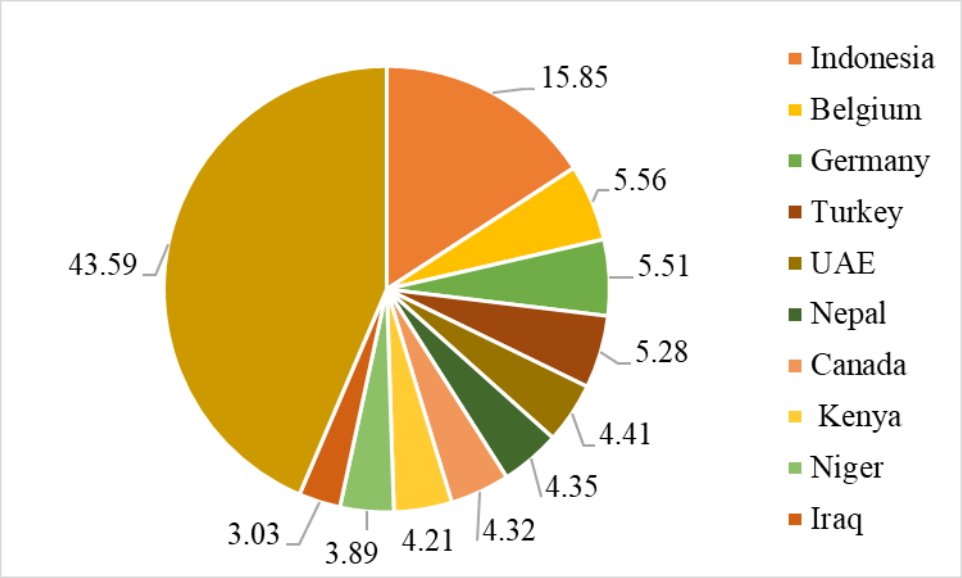

Fig. 2: Percent share of major importers of millets in the world (2021)

3.3. Export Destinations for Millets

The major importing markets for millet exported by India during the year 2021, with a total exported quantity of 91,288 tonnes. The table 3 and Fig. 3, displays the top 10 importing markets for millet exported by India, along with the quantity of millet exported to each market and the percentage of the total exported quantity that each market represents.

The data shows that the United Arab Emirates was the largest importing market for millet exported by India, with an exported quantity of 24,273 tonnes, representing 26.59 per cent of the total exported quantity. Nepal was the second-largest importing market, with an exported quantity of 22,073 tonnes, representing 24.18 per cent of the total exported quantity.The "others" category represents a group of importing markets other than the top 10, and it imported 14,318 tonnes, representing 15.68 per cent of the total exported quantity. The fourth-largest importing market was Saudi Arabia, with an exported quantity of 11,464 tonnes, representing 12.56 per cent of the total exported quantity. The data also shows that other importing markets, such as Oman, Yemen, Libya, Tunisia, Morocco, the United Kingdom, and Japan, imported quantities ranging from 783 to 4,445 tonnes, representing between 0.86 per cent and 4.87 per cent of the total exported quantity.

Table 3: Major export destinations for millets from India (2021)

Importers	Exported quantity in tonnes	Percentage
United Arab Emirates	24273	26.59
Nepal	22073	24.18
Saudi Arabia	11464	12.56
Oman	4445	4.87

Yemen	4195	4.60
Libya	3522	3.86
Tunisia	2917	3.20
Morocco	1676	1.84
United Kingdom	1622	1.78
Japan	783	0.86
others	14318	15.68
World	**91288**	**100.00**

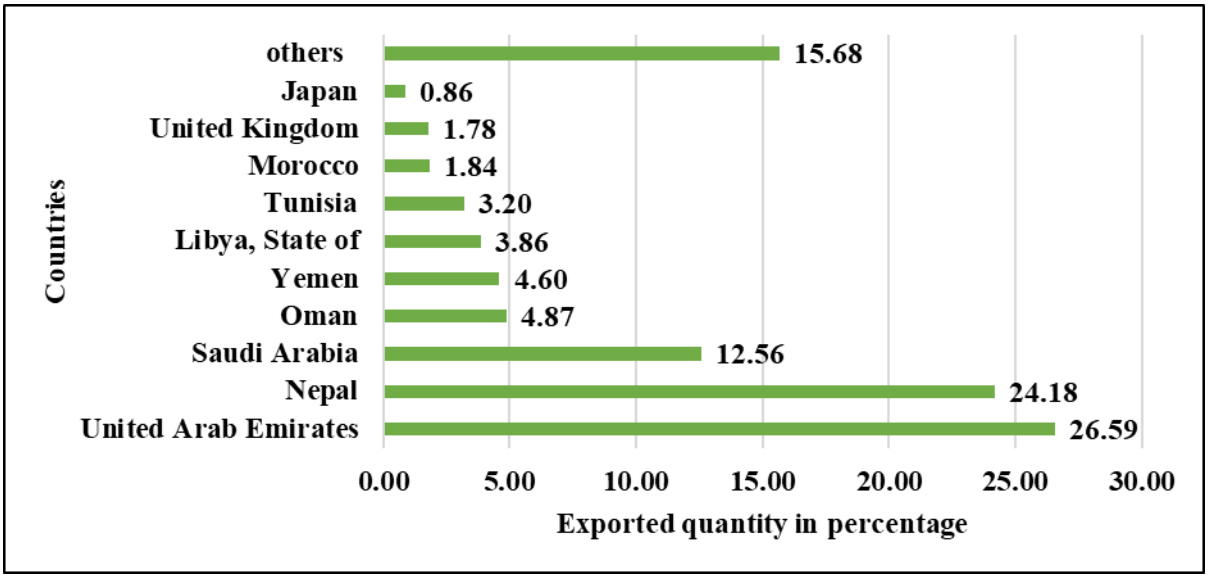

Fig. 3: Percentage share of major exporting destination for millets from India

3.4. Revealed Comparative Advantage (RCA)of Millets

The concept of Revealed Comparative Advantage (RCA) is grounded in the Ricardian comparative advantage theory and serves as an index to assess the relative trade performance of specific countries in a given commodity. This index operates under the assumption that the trade patterns of commodities reflect both inter-country variations in relative costs and non-price factors. Consequently, the RCA is utilized to unveil the comparative advantage held by countries engaged in trade (Sing *et al.,* 2023).

Revealed Comparative Advantage of Millets exports for major millets exporting countries in world. RCA has been estimated for top 10 millet exporting countries in globe. The major exporting

countries *viz.,* Ukraine, USA, Russian, India, France and so on for the period 2013to 2021 (Table 4). It can be observed that Ukraine has the highest average RCA of 40.75 for millets exports to the world over the years 2013 to 2021, followed by India with an average RCA of 10.62. The Austria, Russian Federation, France and USA also have a comparative advantage in millet exports, with average RCAs of 4.17, 3.81, 2.68 and 2.55 respectively. China, Canada, Netherlands and Other countries also export millets, but their RCAs are less than unity which means they are comparative disadvantage in millet exports. It is worth noting that some countries have a fluctuating RCA trend over the years. It's interesting to note that Turkey had a comparative advantage in millets export in 2013 and 2014 but lost it in the following years, and regained it in 2020 and 2021. Additionally, the "Others" category, which represents countries other than the top 10 exporters, has a relatively low RCA for millets export, with an average value of 0.28.

The Relative Comparative Advantage (RCA) of India with respect to various countries has exhibited diverse patterns over the years, influenced by variations in millet exports and the overall global millet export performance of each respective country. The factors affecting to changes in the RCA includes structural and economic changes, Improved trade specializations and increase in the consumption of millets in the world. The similar finding was observed in the Goverdan, 2014;Jagdambe, 2015; Singh *et al.,*2023.

Table 4: Revealed Comparative Advantage of Millets export in the world

Country	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Ukraine	0.00	24.81	42.02	64.19	44.46	26.03	31.52	55.36	78.38	**40.75**
USA	1.39	2.28	2.56	2.01	2.55	3.66	3.66	3.02	1.82	2.55
Russian	2.75	4.63	4.62	4.87	4.21	3.23	2.83	3.05	4.07	3.81
India	**9.93**	10.24	13.68	13.19	11.70	11.56	9.03	8.44	7.84	**10.62**
France	3.59	2.97	2.68	2.00	1.97	3.32	2.34	2.22	3.01	2.68
China	0.69	0.41	0.36	0.39	0.32	0.23	0.21	0.23	0.23	0.34
Turkey	6.12	7.34	0.00	0.10	0.00	0.03	1.08	2.34	3.20	2.25
Canada	1.36	0.53	0.68	0.41	0.56	0.58	0.98	0.70	1.65	0.83
Austria	**6.82**	4.68	4.57	4.31	4.03	3.90	2.88	3.37	3.00	4.17
Netherlands	1.03	0.64	0.86	1.14	0.79	0.86	1.17	1.17	0.84	0.95
Others	0.41	0.25	0.22	0.27	0.33	0.23	0.29	0.32	0.25	0.28

3.5. Direction of Trade of Millets Export from India

The analysis of changes in trade direction from 2013 to 2021 employs Markov chain analysis. During this period, the Transitional Probability Matrix (TPM) is utilized to examine trade direction. The TPM estimation facilitates the study of various aspects of trade dynamics. Specifically, diagonal elements in the transitional probability matrix offer insights into an importing country's commitment to our exports, representing the probability of maintaining trade ties. Meanwhile, the row elements indicate the likelihood of a country losing its export market share to competing nations, and the column elements reveal the probability of gaining export market share over those same competitors (Kumar, 2023; Prasad, 2023). Through a thorough examination of the TPM (Table 5), the trajectory of our exports and develop an appropriate policy framework. This strategic approach aims to support exporters by minimizing uncertainties in the export process.

The top 10 major countries which imported millets from India were: UAE, Saudi Arabia, Yemen, Oman, Libya, Tunisia, Morocco, UK, Nepal, and Japan. The export to remaining countries was pooled under the category of 'other countries'. It is evident from the table 5 that, Nepal is the most stable importer of the Indian Millets as the probability that Nepal retained its original share from previous year was 81.63 percent. They lost theirshare of about 14.83 per cent to Saudi Arabia, 1.97 per cent to Oman and 1.56 per cent to UK even though the Nepal gained considerable amount from Libya (30.66%) and Tunisia (27.34%). Other countries are another stable importer of Indian millets as it retained 51.20 percent of its share from previous year by losing 27.21 per cent to Saudi Arabia, UAE (7.66%), Morocco (5.40%), Yemen (3.84%), Libya (2.75%), UK (1.45%), Japan (0.41%), Oman (0.08%), even though it gained considerable share from Japan (100 %), Yemen (55.21%), and UAE (49.20%). The most unstable markets among the importing countries were UAE, Oman, Libya, Morocco, United Kingdom and Japan with the zero per cent retention and Saudi Arabia (12.06%), Yemen (10.91%) and Tunisia (7.52%) retention of total exports from India(Table 5).

The findings indicate that Nepal, Saudi Arabia, and Yemen are consistently reliable markets for millet exports from India. These nations consistently import millets, establishing them as dependable potential markets for India in the future. It is advisable to focus on countries currently importing millets in limited quantities and at sporadic intervals, as efforts directed towards them could potentially enhance exports (Kumar, 2020; Kumar *et al.,* 2023; Prasad, 2023). The top 10 countries importing millets include UAE, Saudi Arabia, Yemen, Oman, Libya, Tunisia, Morocco, UK, Nepal, and Japan. However, beyond these countries, there are numerous unexplored markets that present significant opportunities for export expansion.

Table 5: Transitional Probability matrix of millets export from India to world (2013-2021)

Importers	UAE	Saudi Arabia	Yemen	Oman	Libya	Tunisia	Morocco	UK	Nepal	Japan	Others
UAE	**0.0000**	0.0000	0.3386	0.0000	0.0746	0.0515	0.0000	0.0110	0.0000	0.0324	0.4920
Saudi Arabia	0.7470	**0.1206**	0.0000	0.0292	0.0000	0.0862	0.0000	0.0000	0.0000	0.0170	0.0000
Yemen	0.0000	0.0000	**0.1091**	0.0000	0.0000	0.3388	0.0000	0.0000	0.0000	0.0000	0.5521
Oman	0.0000	0.0000	0.0000	**0.0000**	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Libya	0.0372	0.0000	0.0000	0.1695	**0.0000**	0.3786	0.0000	0.1002	0.3066	0.0080	0.0000
Tunisia	0.0000	0.2215	0.0000	0.0111	0.1810	**0.0752**	0.1992	0.0386	0.2734	0.0000	0.0000
Morocco	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000
UK	0.9726	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0274	0.0000
Nepal	0.0000	0.1483	0.0000	0.0197	0.0000	0.0000	0.0000	0.0156	**0.8163**	0.0000	0.0000
Japan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	1.0000
Others	0.0766	0.2721	0.0384	0.0008	0.0275	0.0000	0.0540	0.0145	0.0000	0.0041	**0.5120**

3.6. Herfindahl-Hirschman Index of Concentration (HHI)

The plans for export should be oriented towards the country and also plans should be formulated for stabilizing the export to other countries. The reasons may be that there is a major shift in the consumption and thereby composition of demand for millets in the developed (importing) countries which has had unfavourable effects on aggregate export earnings from millets.United Kingdom's competition regulator the Competition and Market Authority (UK CMA) defines market is not concentrated if the estimated HHI value less than or equal to 0.1, moderately concentrated if the estimated HHI value is greater than 0.1 and highly concentrated if estimated HHI value is greater than 0.2. However, Federal Trade Commission of United States of America (US FTC) defines slightly different threshold levels, market is not concentrated if the estimated HHI value is less than 0.1, market is moderately concentrated if the estimated HHI value is greater than 0.1 and less than 0.18 and market is highly concentrated if the estimated HHI value is greater than or equal to 0.18.

3.6.1. HHI of concentration of Millets exports

Herfindahl-Hirschman Index (HHI) is used to measure the concentration of Millets exports. The HHI is used to estimate the concentration of global Millets exports using the market share of more than 90 exporting countries and the estimates HHI values for millets is 0.141 (Table 6). Thus, the estimated HHI value from the analysis above indicates that the Millets exports market is moderately concentrated. The estimated HHI value also reveals that the level of concentration of export origin has increased in the recent years. From top 10 Millets producing countries only India and China are contributing to the world top 10 exporting countries with percentage share of 17.33 and 0.94, respectively (Table 1).

Table 6: HHI reference thresholds and HHI of concentration of Millets exports

Market characterization	HHI Thresholds		HHI of Global Millets Exports
	UK CMA	US FTC	2012-2021
No concentration	<= 0.1	<= 0.1	
Moderate concentration	0.1> HHI <0.2	0.1> HHI <0.18	0.141
High concentration	>= 0.2	>= 0.18	

3.6.2. HHI of concentration of Millets Imports

With respect to global Millet imports, the estimated HHI value was 0.277 for the period 2012 to 2021, which falls under 'High Concentration' according to the UK's CMA and USA's FTC (Table 7). However, concentration of Millets import origins is more compared to Millets export destinations. The number of countries that imported 90 per cent of the Millets trade during 2012 to 2021 were 48 (Table 2). The high concentration may result from strong competitive advantages, economies of scale, or limited diversification, influencing trade dynamics and potentially impacting market competition and pricing.

Table 7: HHI reference thresholds and HHI of concentration of Millets Imports

Market characterization	HHI Thresholds		HHI of Global Millets Imports
	UK CMA	US FTC	2012-2021
No concentration	<= 0.1	<= 0.1	
Moderate concentration	0.1> HHI <0.2	0.1> HHI <0.18	
High concentration	>= 0.2	>= 0.18	**0.277**

3.6.3. HHI of concentration of Millets Exports from India

The millet exports from India, the estimated HHI value was 0.17 for the period 2013 to 2021, which falls under 'Moderate Concentration' according to the UK's CMA and USA's FTC (Table 8). The export origin has increased in the recent years. there are some firms with significant market power, but there is also a reasonable level of competition among them. Firms in a moderately concentrated market may have some degree of pricing power, but they must still compete with other firms for customers. The top 10 millet export destination that are imported 75% of the millets during 2013 to 2021 those countries are UAE, Saudi Arabia, Yemen, Oman, Libya, Tunisia, Morocco, United Kingdom, Nepal, and Japan. (Table 5)

Table 8: HHI reference thresholds and concentration of Millets Exports from India

Market characterization	HHI Thresholds		HHI of Indian millet Exports
	UK CMA	US FTC	2013-2021
No concentration	<= 0.1	<= 0.1	
Moderate concentration	0.1> HHI <0.2	0.1> HHI <0.18	**0.17**
High concentration	>= 0.2	>= 0.18	

4. Conclusion

The analysis of millet trade dynamics provides valuable insights into the patterns of millet exports and imports, as well as the competitiveness of major players in the market. Ukraine as the leading millet exporter in 2021, contributing significantly to the global market with a share of 31.89%, followed by India and Russia. On the import side, Indonesia emerges as the largest importer, accounting for 15.85% of total global millet imports. India's role in millet exports reveals that the United Arab Emirates is the primary market, absorbing 26.59% of India's millet exports in 2021, followed by Nepal and Saudi Arabia. This indicates the importance of strategic trade partnerships and the need for targeted export strategies to meet the varying demands of different importing nations.The Revealed Comparative Advantage analysis sheds light on the competitive advantages of major millet-exporting countries. Ukraine stands out with the highest average RCA, indicating a strong comparative advantage in millet exports. India follows closely, showcasing its significance in the global millet market.The direction of millet exports from India highlights the stability of Nepal as a major importer, retaining a significant share over the years. However, certain markets, such as the UAE, Oman, Libya, Morocco, the United Kingdom, and Japan, exhibit greater volatility in their millet imports from India, emphasizing the need for adaptive trade strategies.The Herfindahl-Hirschman

Index analysis reveals that the global millet exports market is moderately concentrated. Similarly, the HHI for millet imports indicates a high concentration, suggesting that a limited number of countries dominate the import landscape.Understanding these dynamics is crucial for policymakers, traders, and stakeholders to formulate effective strategies that promote competitiveness and sustainability in the evolving millet market.

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