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Export Performance of India's Dairy Products-An Economic Analysis

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Abstract

India is a global leader in milk production, contributing 24.27% of the world's total output. Despite this, agriculture's Gross Value Added (GVA) accounts for about 17% of India's total, with the livestock sector contributing roughly 4%. Notably, the livestock sector experienced significant growth of 17.07% from 2009 to 2019. India's role in dairy exports is modest, ranked 219th with a 0.27% share, but shows diversification in destinations like Turkey, UAE, Egypt, Bangladesh, and Bhutan. This study utilizes secondary data from key Indian dairy bodies such as NDDB, APEDA, and DGCIS from 2009-10 to 2018-19, employing analytical tools like CAGR, Hirschman market concentration index, Export instability index, and Markov-chain models. The objective is to analyze the market performance of Indian dairy products by evaluating growth, market concentration, and export instability and to examine the direction of India's dairy product exports. The results shows that milk production in India registered a CAGR of 5.08%, with per capita availability increasing by 3.81%. Market concentration fluctuated during the study period, with HMCI ranging between 27 and 52. India's dairy exports grew at 6.49% in quantity and 12.53% in value. Export instability was highest in Egypt (1018.31%) and lowest in the UAE (44.01%). Egypt emerged as the most stable importer with a retention probability of 12.2%, followed by the UAE, Bangladesh, Turkey, and Bhutan.

Keywords: CAGR, EII, HMCI, Markov- Chain, Dairy Export

Introduction

Global milk production in 2023 is about 950 million tonnes, with India leading as the top producer, accounting for 24.27 percent of the world's total milk output (FAO, 2023). Nearly 150 million households are engaged in milk production, with the majority of producers being smallholders in developing countries. This sector significantly contributes to food and nutrition security for these producers (Hemme, T., & Otte, J. (2010)). For small-scale farmers, milk provides comparatively quick returns and it is an significant source of financial earnings Kapaj, & Deci (2017).

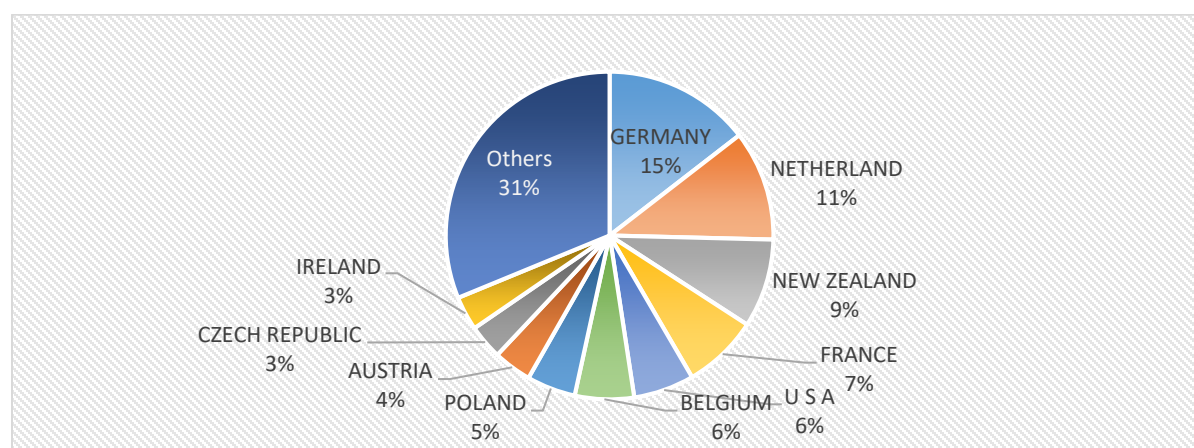
Developing countries have significantly increased their global dairy production share, primarily by expanding their dairy herds. However, challenges such as low-quality feed, diseases, limited market access, and inadequate services hinder productivity growth in many of these regions. The genetic potential of dairy animals in these countries also plays a significant role in

limiting milk production. (Britt et al. 2018). Moreover, the hot and humid climates in these regions are not ideal for efficient dairy farming.

Table 1. The animal population of India and the world

S.No	Item	India (Share in %)	World
Livestock (Million Heads)			
1	Cattle	96.58 (9.81)	984.16
2	Buffaloes	55.89 (51.23)	109.10
3	Sheep	7.43 (5.77)	128.78
4	Gats	14.87 (13.39)	111.13
5	Chicken	8.08 (3.12)	258.56
Livestock Products			
1	Milk Total (million tonnes)	230.58 (24.27)	950
2	Eggs (billion Nos)	138.38 (8.64)	1600
3	Meat (million tonnes)	9.77 (2.67)	365

Figures in the parentheses indicate India's percentage share of the world. Source: FAO, 2023



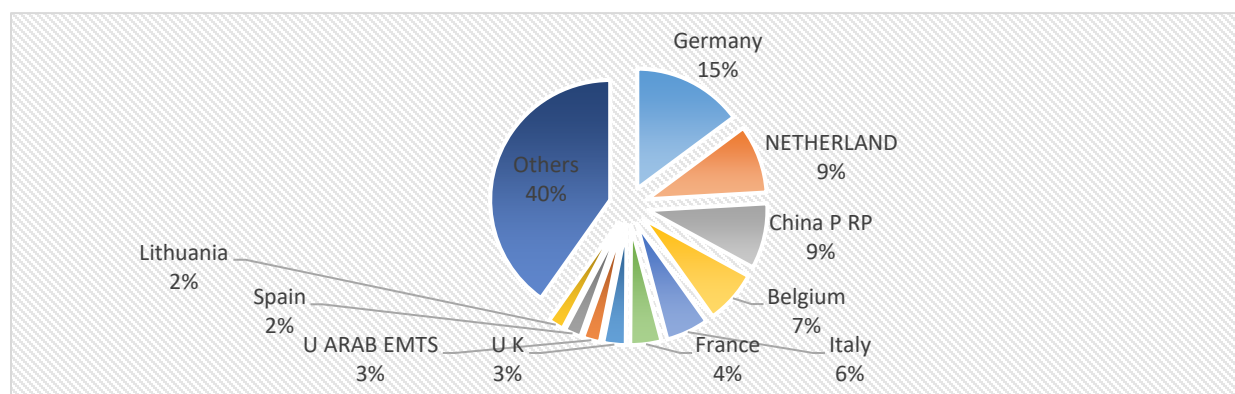
Source: APEDA

Fig. 1. World Top ten Dairy Products Exporting Country and Share(%) in 2022-23

Global Leading Traders

The global dairy trade is dominated by key products such as whole milk powder, butter and skimmed milk powder. Germany leads as the largest exporter with a significant 15% market share,

followed closely by the Netherlands, New Zealand, France, and the USA, among others was shown in figure 1. Similarly, Germany is a major importer of dairy products, sharing a 15% stake in global imports alongside countries like the Netherlands, China, and the United States (figure 2). In contrast, India's involvement in dairy trade remains limited, reflecting its focus on domestic policy priorities.

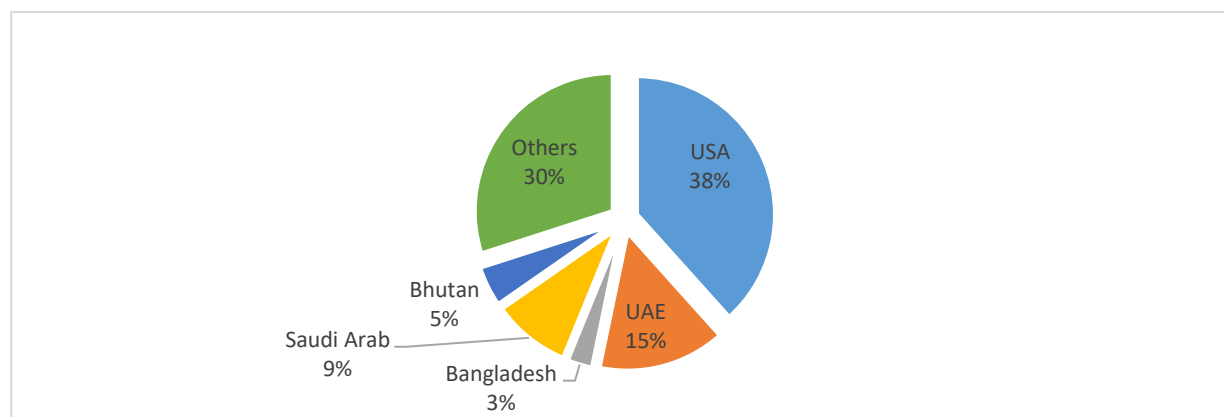


Source: APEDA

Fig. 2. World Top ten Dairy Products Importing Country and Share(%) in 2022

Composition of Indian Dairy Trade

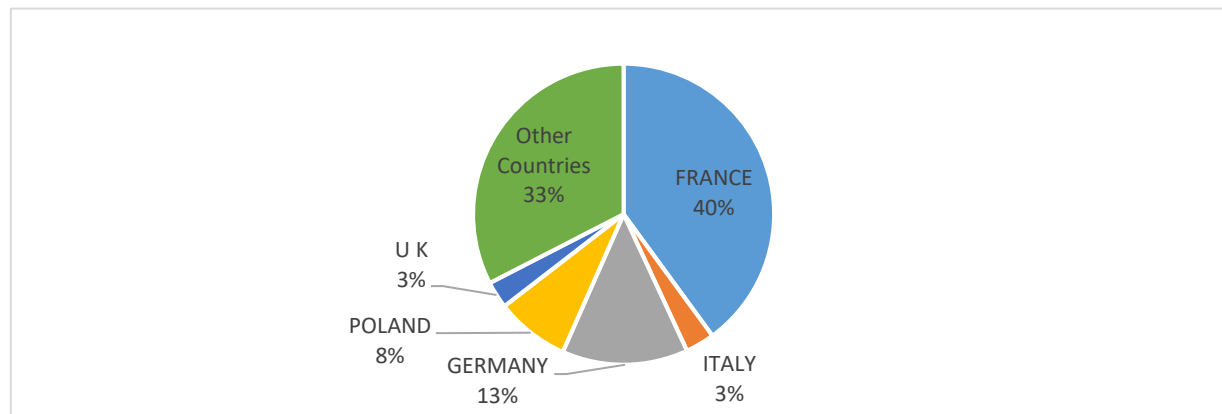
According to APEDA 2023, India exported 63,738.47 metric tonnes of dairy products globally, with a total value of 272.64 million USD in the year 2023-24. The Indian dairy export portfolio has diversified to include fresh butter, buttermilk, butter oil, fresh cheese, cheese, whole milk powder, skimmed milk powder, butter, milk and cream in powder form, infant formula, other fats, skimmed milk powder, various milk powders, whole milk, and ghee.



Source: APEDA

Fig. 3. Top 5 Dairy Products Importing Countries from India and Share (%) in 2022-23

However, the dairy products imported by India include butter oil, whey products, cheese, and milk powders. The major importing countries from India was given in figure 3. The dairy's products exporting from India was shown in figure 4.



Source: APEDA

Fig. 4. Top 5 Dairy Products Exporting Countries to India and Share(%) in 2022-23

The growing domestic production of milk products and the expected strong international demand suggest significant potential for India to expand its exports. This study aimed to explore the export potential of dairy products in India, with two main objectives: first, to analyze the market performance of Indian dairy products by assessing growth, market concentration, and export instability; and second, to examine the direction of India's dairy product exports.

Methodology:

This study relies on secondary data collected from various sources, including the Annual Reports of the National Dairy Development Board of India (NDDB), the Agricultural and Processed Food Products Export Development Authority (APEDA), and the Director General of Commercial Intelligence and Statistics (DGCIS). The analysis covers a period of 19 years, from 2003-04 to 2022-23.

The Compound Growth Rate Analysis

The data was compiled and analyzed using basic statistical tools such as percentage, ranking, and Compound Annual Growth Rate (CAGR). The growth in the value of Indian dairy product exports was estimated by applying the CAGR through an exponential trend distribution. (Aswathy et al., 2006).

$$Y_t = A\beta^t \quad (1)$$

Where Y= Export

A = constant

β = regression coefficient

t= time variable

It is calculated as follows:

$$CAGR = (Anti \log \beta - 1) * 100 \quad (2)$$

Market Concentration

Market concentration refers to the proportion of a specific commodity's total exports that can be attributed to a single country over time (Kandanuri, 2019). In this study, the Hirschman Market Concentration Index (HMCI) was utilized to determine market concentration (Sinha, 2016). The Market Concentration Index (MCI) was calculated for the export value of Indian dairy products, with the HMCI value representing this concentration.

$$HMCI = \sqrt{\sum_{i=1}^n P^2} \quad (3)$$

Where,

HMCI – Hirschman Market Concentration Index

n – Number of importing countries

P – Percentage share of Dairy Products export in terms of quantity or value

Instability Index (II)

The Instability Index (II) is a metric used to assess the stability of exports and to evaluate the risks associated with profitability and export earnings for a particular commodity. It indicates the extent of short-term, year-to-year fluctuations in export earnings (Jeyanthi and Gopal, 2012). In this study, the extent of export instability was calculated using Coppock's Instability Index (EII).

It is calculated as follows:

$$CII = \{(\text{Antilog} \sqrt{\log V}) - 1\} \times 100 \quad (4)$$

$$\log V = \frac{\left[\log \left(\frac{X_{t+1}}{X_t} \right) - M \right]^2}{N-1} \quad (5)$$

Where,

X_t = Indian Dairy Products exports in the year

N = Number of years

M = Arithmetic mean of the difference between the logs of X_{t+1} , X_t , etc.

$\log V$ = Logarithmic variance of the series.

The Direction of the Trade-Markov Chain Model:

This research utilized the Markov chain approach to analyze the structural shifts in India's exports of specific commodities. The focus was on understanding how markets retained or switched their preferences for Indian products over time. (Kumar, 2020). The analysis centered on estimating the Transitional Probability Matrix (TPM, (P)).

$$E_{jt} = \sum_{i=1}^n E_{it-1} * P_{ij} + e_{jt} \quad (6)$$

Where,

E_{jt} = exports from India to the j th country in the year t ,

E_{it-1} = exports of the i^{th} country during the year $t-1$,

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

E_{jt} = the error term, which was statistically independent of E_{it-1} ,

n = the number of importing countries.

The transitional probabilities P_{ji} , which could be arranged in a $(c \times n)$ matrix, have the following properties.

$$\sum_{i=1}^n P_{ij} = 1 \quad (7)$$

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

Results and Discussion:

India's milk production surged significantly from 112.2 million tonnes in 2008-09 to 231 million metric tons in 2022-23, according to a Statista report from 2023. From the table 2, India's dairy Product export in terms of value and quantity was found to positive CAGR of 11.9 per cent and 4.4 cent.

Table 2. CAGR of India's Dairy and Agricultural Sectors (2003-04 to 2022-23)

Particulars	Units	Periods	CAGR
Dairy Product Export	Rs. Crore	2003-04 to 2022-23	11.9***
Dairy Product Export	MillionTonnes	2003-04 to 2022-23	4.4***
Milk Production	MillionTonnes	2013-14 to 2022-23	6.0***
Per Capita Availability of Milk	gms/day	2013-14 to 2022-23	4.7***
GVA[#] of Agriculture	Rs. Crore	2012-13 to 2021-22	10.20***
GVA of Livestock Sector	Rs. Crore	2012-13 to 2021-22	14.4***
Total GVA	Rs. Crore	2012-13 to 2021-22	9.5***

*** -significance at 1 percent level, #Gross value added (GVA)

India's dairy sector revealed robust growth between 2013-14 and 2022-23. Milk production increased at a CAGR of 5.08%, leading to a corresponding rise in per capita availability at a CAGR of 4.7%. This growth positively impacted the agricultural sector, with Gross Value Added (GVA) for agriculture, livestock, and total GVA registering CAGRs of 10.20%, 14.4%, and 9.5%, respectively.

Table 3. Hirschman Market Concentration Index (HMCI) For India's Dairy Products Export

Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
HMCI	27.67	36.41	33.77	33.20	29.37	30.06	32.25	33.48	35.89	34.15

The analysis of market concentration using HMCI (as shown in Table 3) revealed an increasing and fluctuating trend over the ten-year study period. The overall rise in HMCI from 27.67% to 34.15% for quantity value suggests market diversification during this period.

Table 4. Export Instability Index for Top 5 Dairy Products Importing Countries From India - Coppock's Instability Index (CII)

Country	Bangladesh	UAE	Singapore	Egypt	Nepal
INDEX	610.95	46.20	19.81	3924.49	166.57
Rank	2	4	5	1	3

Coppock's Instability Index (CII) for Indian dairy product exports (Table 4) showed that among the countries analyzed, Egypt exhibited the highest instability at 3942.49%, while Singapore had the lowest at 19.81%. Countries were ranked according to their level of instability using the CII method in terms of export value. Egypt and Bangladesh emerged as the top two countries with the highest instability in value.

The direction of Trade:

Table 5. Transitional probability matrix (TPM) of Dairy Product export in India (2012-13 to 2022-23).

Country	Bangladesh	UAE	Singapore	Egypt	Nepal	Others
Bangladesh	0.096	0.026	0.000	0.156	0.128	0.594
UAE	0.669	0.226	0.105	0.000	0.000	0.000
Singapore	0.000	0.000	0.089	0.000	0.000	0.911
Egypt	0.000	0.000	0.000	0.366	0.000	0.634
Nepal	0.166	0.005	0.021	0.248	0.060	0.501
Others	0.092	0.190	0.126	0.000	0.042	0.550

The transition probability matrix in Table 5 shows the shifting trends in India's dairy product exports to key countries. The data reveals that while Bangladesh, UAE, Singapore, Egypt, Nepal, and Other countries were the primary importers, export patterns evolved over the study period. By analyzing the matrix, we can gain insights into the changing direction of India's dairy trade and identify emerging markets.

Egypt stood out as the most reliable market for Indian milk products among major importers during the study period. It exhibited a retention probability of 0.36, indicating a consistent demand and stable trade relationship. This indicates that Egypt maintained its market share 36.66% of the time over the study period. Egypt lose 63.4 percent to Other Countries. Beside Egypt gained considerable save from UAE (66.9 %), Nepal (16.6 %), Bangladesh (9.6 %) and others countries (9.2 %)

The UAE maintained a moderate level of stability as an importer of Indian dairy products. Despite losing market share to Bangladesh (2.6%) and Nepal (5%), the UAE retained its original share of 22.6% over the study period. This suggests a consistent demand for Indian dairy products in the UAE market.

Bangladesh and Singapore were the next stable importers of India's dairy products. They have and 9.6 per cent and 8.9 per cent retention probability. Bangladesh lost its major share (59.4 %) from all other countries, Whereas Nepal lost its significant share to Other Countries (90.1 %).

The country listed in all other categories has a maximum probability of retention (55.0 %) of India's dairy product export. They losses to UAE about 19.0 per cent of their share followed by 12.6 per cent from Singapore and around 9.2 per cent from Bangladesh respectively. Transition probability matrix was given in figure 5.

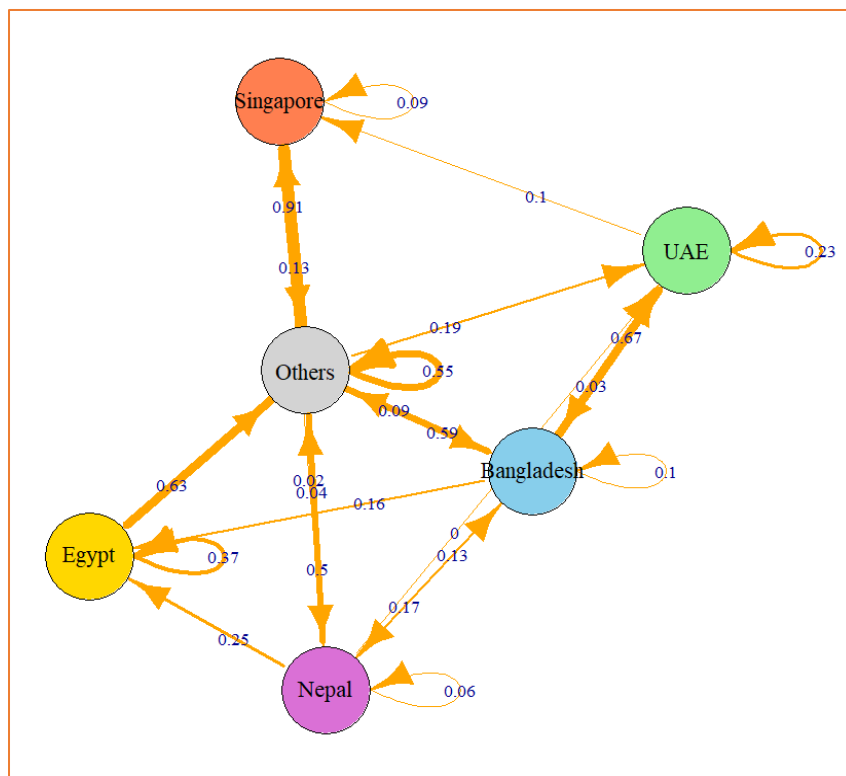


Fig:5 TPM for Dairy Product export in India (2012-13 to 2022-23).

Conclusion:

Despite being a global leader in milk production, India's share of the international dairy export market has remained relatively small, diversified, and subject to fluctuations. This indicates a need for strategies to enhance India's presence in the global dairy trade. Countries like Bangladesh, UAE, Singapore, Egypt, Nepal and Other countries are major stable importers of Indian dairy products, but their retention probability was low. So, to maximize the total global dairy product export share, India needs to concentrate on developing infrastructure facilities in the domain of value addition, supply chain, and logistics, which may also create more employment opportunities.

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