Indian Journal of Agricultural Economics 80: 3 (2025):1032-1049
DOI:10.63040/25827510.2025.03.025

Assessment of Unrealised Export Potential, Regulatory Barriers and Rejection Patterns in the Indian Dairy Sector

Gunjan Bhandari, Udita Chaudhary, and Subhasis Mandal[1]

ABSTRACT

India, despite being the world's largest milk producer, contributes less than 0.3% to global dairy exports—a contradiction that underscores structural and regulatory challenges. This study examines India's dairy export performance across three dimensions: export potential, non-tariff measures and export rejections. Using data from the International Trade Centre, UNIDO Standards Compliance Analytics and the World Integrated Trade Solution, the study identifies an unrealised export potential of USD 161 million, concentrated in Mexico (USD 32 million), the European Union (USD 28 million) and China (USD 22 million). Skim milk powder, butterfat, and casein together account for 69% of this unrealised potential. However, the prospective markets impose more stringent NTMs—particularly sanitary and phytosanitary measures—with an average prevalence of 512 in potential destinations, compared to 424 in existing ones. A focused assessment of U.S. import refusals reveals that India incurred 77 rejections from 2010 to 2022; 64.8% stemmed from labelling violations, and 13.8% from unauthorised additives. These findings underscore the imperative for stronger regulatory compliance, targeted investment in the cold chain, improvement in testing infrastructure, and proactive market engagement. The study recommends a dual-track strategy that prioritises compliance enhancements in high-barrier markets while simultaneously expanding presence in more accessible regions to unlock India's full dairy export potential.

Keywords: Indian dairy exports, non-tariff measures, export potential, trade barriers, sanitary and phytosanitary regulations

JEL codes: F13, F14, O24, Q17, Q18

I

INTRODUCTION

India's dairy sector represents one of the most notable success stories in modern agriculture, yet it faces a persistent disconnect between its domestic dominance and limited global trade presence. As the world's largest milk producer, India contributed over 25% of global milk output in 2023-24, with production reaching an estimated 239 million metric tons (PIB, 2025). The sector supports the livelihoods of over 80 million farmers and contributes approximately 5% to the national economy (Singh, 2025). A compound annual growth rate (CAGR) of 7.93% between 2014–15 and 2020–21 (IDA, 2024) underscores its robust domestic performance, with projections suggesting output could reach 333 MMT by 2032-33 (NITI Aayog, 2018). Despite this scale, India's share in global dairy exports remains marginal-just 0.25% of world trade in 2023-24, valued at approximately USD 272.64 million from 63,738 metric tons. In contrast, global dairy exports totalled USD 101 billion in 2022–23 (IDA, n.d.). This paradox of high production and low global presence forms the central concern of current research in the Indian dairy trade.

The challenge of expanding India's dairy exports is shaped by three interrelated dimensions: export potential, non-tariff barriers (NTBs) and export

[1]ICAR – National Dairy Research Institute, Karnal, Haryana -

rejections. First, India possesses significant unrealised export potential due to its low-cost milk production and proximity to large, fast-growing markets in Asia and the Middle East. The National Dairy Development Board estimates that India could target 5% of global dairy trade by 2030, equivalent to USD 5.5 billion in export value (Joshi et al., 2018). Second, non-tariff barriers—particularly sanitary and phytosanitary (SPS) measures—act as binding constraints. India remains excluded from several high-value markets, including the European Union, due to concerns such as its status regarding foot-and-mouth disease (FMD) and compliance with stringent quality standards. Ongoing disputes, such as the United States' WTO challenge against India's veterinary certification regime, illustrate how NTBs can escalate into trade frictions. Third, export rejections represent the practical manifestation of these barriers, where Indian consignments fail to meet regulatory standards, resulting in financial losses and reputational damage.

These three dimensions —potential, NTBs, and rejections —are closely intertwined. Export potential identifies markets where India enjoys a competitive advantage, while NTBs outline the regulatory environment that may inhibit access to those markets. Export rejections provide empirical evidence of compliance failures, highlighting the specific areas where Indian exports fail to meet international expectations. A comprehensive understanding of this triad is crucial for developing effective strategies to enhance India's export performance. In this context, the present study adopts an integrated approach to assess the structural constraints and strategic opportunities in Indian dairy exports. Specifically, it addresses the following research questions:

- Which dairy products and destination markets offer the highest unrealised export potential for India?
- How do destination-specific non-tariff measures (NTMs) affect this potential?
- What are the major causes of export rejections for Indian dairy products, particularly in the U.S. market?

By analysing export potential estimates, the prevalence and severity of non-tariff measures and patterns of product rejections using internationally recognised data sources, this study provides evidence-based insights to support policymakers and stakeholders in strengthening India's global dairy competitiveness.

II

DATABASE AND METHODOLOGY

2.1 Data sources

This study draws on multiple authoritative data sources to evaluate the export potential, regulatory barriers and rejection patterns affecting Indian dairy exports. The Export Potential Map of the International Trade Centre (ITC), at the HS-6 digit level, was used to assess both total and unrealised (untapped) export potential for Indian

dairy products. Data on non-tariff measures (NTMs) faced by Indian dairy exports were compiled from the World Integrated Trade Solution (WITS) – NTM database. Detailed country-level information on the number and types of NTMs imposed on Indian dairy products was sourced from the ITC Market Access Map. Additionally, data on export rejections were obtained from the Standards Compliance Analytics database maintained by the United Nations Industrial Development Organisation (UNIDO).

2.2 Product and market selection

For the product selection, the top seven dairy products at the HS-6 digit level, accounting for approximately 93% of India's total unrealised export potential, were included in the analysis. The following products and their corresponding HS codes are: low-fat milk powder (040210), Dairy fats & oils (040590), Casein (350110), Butter (040510), Processed Cheese (040630), Sweetened Milk powder (040229), and Other cheese (040690). To identify target countries, all destinations were ranked based on unrealised export potential. The top 11 countries, collectively accounting for 50% of total unrealised potential, were selected and categorised as the 'Potential' group. These countries include Mexico, China, Egypt, the Philippines, Indonesia, the USA, Algeria, Saudi Arabia, Iraq, South Africa, and Oman. In addition, the European Union (EU) was analysed separately to provide a comparative perspective. A second group, labelled 'Existing', comprised the top 11 countries based on baseline exports, representing India's key current dairy markets. These countries are: UAE, USA, Bangladesh, Saudi Arabia, Bhutan, Singapore, Bahrain, Qatar, Nepal, Malaysia and the Philippines. Notably, the USA, Philippines and Saudi Arabia appear in both the 'Potential' and 'Existing' groups, reflecting their significance in both current exports and unrealised potential. For NTM analysis, Iraq (from the 'Potential' group) and Bhutan (from the 'Existing' group) were excluded due to a lack of data on non-tariff measures.

2.3 Analytical framework and tools

Export potential was assessed using the International Trade Centre's Export Potential Map, which integrates a gravity-model framework with market intelligence to uncover unexploited trade opportunities. For each product-market pair, the model predicts a potential export value, drawing on market size, import growth trends, competitive positioning, and trade facilitation indicators, and compares this to the current export value to produce an untapped potential gap. This approach is particularly well-suited to Indian dairy products, as it accounts for India's pronounced cost advantage in milk production while explicitly recognising the offsetting impact of compliance costs required to meet stringent quality standards in high-value destinations such as the EU and the US.

The Unrealised Potential Index (UPI) was then computed for each destination/product as

$$UPIj = \frac{(Potential\ Exportj - Actual\ Exportj)X\ 100}{Potential\ Exportj}$$

Where a high positive UPI indicates a large latent opportunity, and a negative UPI signal suggests that actual exports already exceed the modelled potential, indicating either market saturation or an underestimation of capacity. By expressing the untapped share of theoretical capacity in percentage terms, the UPI provides a transparent metric for prioritising markets and identifying where policy interventions or market-entry support could yield the greatest dividends.

To capture the incidence and severity of non-tariff measures (NTMs), two complementary indices were constructed. The NTM Prevalence Score measures the average number of distinct NTMs applied to each traded HS-6 product line. Mathematically, for an importer *i*:

$$PSi = \frac{\sum_{j=1}^{J}\sum_{p=1}^{P} NTMijpDijp}{\sum_{j=1}^{J}\sum_{p=1}^{P} Dijp}$$

where NTM_{ijp} is the count of distinct NTMs that importer i applies to product p from India, and D_{ijp} is a dummy equal to 1 if positive trade occurs and 0 otherwise. To reflect differences in restrictiveness, an NTM Severity Index (NTSI) was computed as a weighted sum of NTM incidence:

$$NTSIi = \sum_{j=1}^{m} Wj.Dij$$

Where wj denotes the Cadot et al. (2018) weight for NTM type *j* and D_{ij} indicates its presence. The raw NTSI was then normalised to a 0–1 scale by subtracting the minimum and dividing by the range across all observations. The resulting normalised NTSI captures the relative severity of regulatory barriers faced by Indian dairy exports, enabling direct comparisons across products and destination markets.

Finally, we examined export rejection patterns for the HS04 product group using the UNIDO Standards Compliance Analytics database, which provides consignment-level rejection counts. Because comprehensive data are available only for the United States, we conducted a focused case study of the U.S. market. Export rejection risk was quantified using three complementary metrics—aggregate, unit, and relative rejection rates—adapted from UNIDO's methodology. We then compared India's rejection metrics with those of other major U.S. suppliers (New Zealand, Mexico, Canada and Ireland).

Aggregate Rejection Rate (ARR_{jt}) for the destination market (USA) and year t is the total count of HS04 export consignments from exporting country j that were rejected:

$$ARR_{jt} = \sum Rejections_{jt}$$

A rising ARR_{jt} may reflect higher overall export volumes or deteriorating compliance with importer standards.

To control for export scale, the Unit Rejection Rate (URR_{jt}) measures the number of rejections per USD 1 million of dairy exports. Denoting exporting country j's export value to the USA in year t as X_{jt} (in million USD),

$$URR_{jt} = ARR_{jt} / X_{jt}$$

A high URR_{jt} indicates relatively stringent or poorly met quality and safety requirements in that year, independent of export scale.

To benchmark exporting country j's performance against other suppliers, the Relative Rejection Rate (RRR_{jt}) for importer (USA) in year t is defined as the ratio of j's share of rejections to its share of total dairy imports:

$$RRRjt = \frac{\frac{ARRjt}{\sum_i ARRi,t}}{\frac{Xt}{\sum_i Xi,t}}$$

Here, $\sum_i ARRi,t$ is the total dairy rejections reported by USA from all exporting countries i, and $\sum_i X_{i,t}$ is the total dairy import value into USA. An $RRR_{jt} > 1$ implies India faces proportionally more rejections than its market share of dairy imports, signalling relative underperformance in meeting the market's standards in the USA.

III

RESULTS AND DISCUSSION

3.1 Export potential and baseline exports

The assessment of unrealised export potential reveals a pronounced geographical reorientation away from India's traditional neighbourhood markets toward high-demand economies in North America, East Asia and the European Union (Table 1). Among the top countries/regions with the highest unrealised potential, six—Mexico, the European Union and Western Europe, China, Egypt, the Philippines and Indonesia-collectively account for over 72 per cent of the total untapped potential (USD 184 million). Mexico, with a baseline export of only USD 0.027 million, shows the highest export potential of USD 32 million. Similarly, the EU and Western Europe (USD 28 million), China (USD 22 million) and Egypt (USD 20 million) present significant opportunities for trade expansion. Notably, India's current exports to many of these countries remain negligible, underscoring the presence of substantial market-access constraints, including regulatory barriers, limited cold-chain integration and unfamiliarity with local demand specifications.

In contrast, India's existing dairy exports are highly concentrated in proximate and migrant-driven markets. The United Arab Emirates (USD 53 million),

the United States (USD 46 million), Bangladesh (USD 41 million) and Saudi Arabia (USD 30 million) account for more than 50 per cent of India's total dairy export value. These markets benefit from logistical convenience, historical trade linkages and demand driven by Indian expatriate populations. However, most of these destinations exhibit limited further scope for expansion. Bangladesh, Nepal, Qatar and Bahrain, for instance, show unrealised potentials of less than USD 2 million each. Even in relatively larger markets like Bhutan and Singapore, the headroom remains modest. Only a few countries —the USA (USD 12 million), Saudi Arabia (USD 8.1 million), and Oman (USD 7.3 million) — exhibit moderate unrealised potential, suggesting that export growth in these markets may plateau without diversification or value-added product innovation.

TABLE 1. EXPORT POTENTIAL AND BASELINE PERFORMANCE OF INDIAN DAIRY PRODUCTS

Country	Category	Export Potential (million USD)	Baseline Exports (million USD)	Unrealized Potential (million USD)
Mexico	Potential	32.000	0.027	32.000
European Union	-	35.000	8.100	28.000
China	Potential	22.000	0.198	22.000
Egypt	Potential	25.000	5.200	20.000
Phillipines	Both	19.000	8.800	16.000
Indonesia	Potential	19.000	5.400	14.000
USA	Both	54.000	46.000	12.000
Algeria	Potential	8.600	0.008	8.600
Saudi Arabia	Both	31.000	30.000	8.100
Iraq	Potential	8.100	0.136	7.900
South Africa	Potential	8.000	0.118	7.900
Oman	Potential	14.000	7.800	7.300
Malaysia	Existing	11.000	9.800	5.700
UAE	Existing	34.000	53.000	3.600
Singapore	Existing	11.000	16.000	3.200
Bhutan	Existing	19.000	23.000	2.300
Bahrain	Existing	5.600	16.000	1.800
Qatar	Existing	4.900	14.000	0.450
Bangladesh	Existing	7.200	41.000	0.150
Nepal	Existing	5.600	10.000	0.023

Aggregated data on India's total export potential further reinforces these trends. Of the USD 502 million in estimated export potential for Indian dairy products, only USD 341 million has been realised, leaving an untapped potential of approximately USD 161 million—constituting nearly 32 per cent of the total. This unrealised share points to a strategic imperative for enhanced market development, regulatory alignment and targeted export promotion.

At the product level, unrealised potential is heavily skewed toward a few core commodities (Table 2). Three product categories—skimmed milk powder (HS 040210), butterfat (HS 040590), and casein (HS 350110) — together account for nearly 69 per cent of the total unrealised potential (USD 308 million). Specifically, skim milk powder alone presents an unrealised potential of USD 86 million, followed by butterfat (USD 74 million) and casein (USD 55 million). Other product groups, such as butter (HS 040510), cheese (HS 040630), and milk fats under HS 040690, also offer noteworthy margins, albeit on relatively smaller scales. The current baseline exports exhibit a similar composition, indicating that India's comparative advantages lie in bulk dairy commodities; however, significant headroom remains in premium segments, such as cheese and casein-based derivatives.

TABLE 2. EXPORT POTENTIAL OF KEY INDIAN DAIRY PRODUCTS

(million USD)

	040210	040590	350110	040510	040630	040229	040690
Export Potential	107	134	98	58	27	22	22
Baseline Exports	59	90	51	56	15	8.8	24
Unrealized Potential	86	74	55	30	15	14	12

While India's dairy exports are currently focused on the Gulf and South Asian markets, a strategic expansion into underexploited yet high-potential regions, such as Latin America (Mexico), East Asia (China, Philippines), and parts of Europe and Africa, could significantly bolster the country's global dairy trade. Such efforts would require targeted R&D investments in areas such as quality assurance, trade negotiations, market intelligence, and cold chain infrastructure, as well as addressing product-specific regulatory requirements in these destination markets. Therefore, realising the full export potential of Indian dairy products depends not only on sustaining existing market linkages but also on systematically addressing the constraints that limit access to untapped markets.

3.2 Unrealised Potential Index

The Unrealised Potential Index (UPI) reveals stark contrasts across markets and products. In the "Potential" group, almost every country shows very high UPI values, confirming vast unmet demand for Indian dairy. Mexico (99.92%) and Algeria (99.91%) lead, with virtually all of their dairy import potential untapped, followed by China (99.10%), South Africa (98.53%), and Iraq (98.32%). Even Egypt (79.20%), the EU and Western Europe (76.86%), and Indonesia (71.58%) have yet to absorb the majority of their capacity for Indian dairy, whereas Oman (44.29%) reflects a more advanced penetration of Indian exports. By contrast, the "Existing" group averages a deeply negative UPI (–87.20%), driven by baseline dairy exports from India that exceed modelled potential in Bangladesh (–469.44%), Qatar and

Bahrain (–185.71% each), and Nepal (–78.57%). Such negative values likely stem from geographic proximity, preferential trade agreements or strong diaspora demand that propel Indian dairy shipments beyond the Export Potential Map's estimates. Nonetheless, even among established markets, the USA (14.81%), Saudi Arabia (3.23%), and the Philippines (53.68%) still exhibit positive UPI, indicating room for further growth in their intake of Indian dairy products. Overall, the potential group's average UPI of 69.32 % underscores the significant latent demand for dairy exports from India. In comparison, the existing group's average of -87.20 % highlights how established trading relationships can drive volumes beyond modelled expectations.

TABLE 3. UNREALIZED POTENTIAL INDEX BY COUNTRY AND GROUP

Country	Category	Unrealised Potential Index (%)
Mexico	Potential	99.92
Algeria	Potential	99.91
China	Potential	99.10
South Africa	Potential	98.53
Iraq	Potential	98.32
Egypt	Potential	79.20
EU & Western Europe	-	76.86
Indonesia	Potential	71.58
Philippines	Both	53.68
Oman	Potential	44.29
USA	Both	14.81
Malaysia	Existing	10.91
Saudi Arabia	Both	3.23
Bhutan	Existing	-21.05
Singapore	Existing	-45.45
UAE	Existing	-55.88
Nepal	Existing	-78.57
Qatar	Existing	-185.71
Bahrain	Existing	-185.71
Bangladesh	Existing	-469.44
Existing Group		-87.20
Potential Group		69.32

Disaggregated by product, India's dairy export potential remains unevenly realised (Table 4). Sweetened milk powder (HS 040229) exhibits the highest UPI at 60.00%, followed by casein (HS 350110) at 47.96% and low-fat milk powder (HS 040210) at 44.86%, indicating substantial room for expansion in shipments of these items. Processed cheese (HS 040630) retains 44.44 % of its potential and dairy fats and oils (HS 040590) 32.84 %, while butter (HS 040510) is nearly fully realised at 3.45 %, signifying that current exports closely match modelled capacity. Other cheese (HS 040690) slightly exceeds its potential estimate (–9.09 %). An aggregate UPI of 32.07 % for these seven dairy products demonstrates that although India has

established footholds in several product lines, significant product-specific opportunities remain unexploited.

TABLE 4. UNREALIZED POTENTIAL INDEX OF INDIAN DAIRY PRODUCTS

HS Code	Product Description	Unrealised Potential Index
040229	Sweetened Milk powder	60.00
350110	Casein	47.96
040210	Low-fat milk powder	44.86
040630	Processed Cheese	44.44
040590	Dairy fats & oils	32.84
040510	Butter	3.45
040690	Other cheese	-9.09
Total		32.07

3.3 NTM prevalence and severity

The non-tariff measures (NTMs) confronting Indian dairy exports (Table 5) are dominated by sanitary and phytosanitary (SPS) regulations, which account for 1,558 out of 3,090 recorded measures (50.4 %), followed by technical barriers to trade (TBTs) at 729 instances (23.6 %) and export-related measures at 660 instances (21.4 %). All other categories together represent less than 5 % of the total. This distribution underscores the primacy of health- and safety-oriented controls in shaping India's dairy export environment and points to the critical importance of harmonising Indian production and certification systems with international SPS and

TABLE 5. NON-TARIFF MEASURES AFFECTING INDIAN DAIRY EXPORTS

NTM type	Description	Number	% to total NTM
A	Sanitary and Phytosanitary measures	1558	50.42
B	Technical Barriers to Trade	729	23.59
C	Pre-shipment Inspection and other formalities	32	1.04
E	Non-automatic import licensing, quotas, prohibitions, quantity-control measures and other restrictions other than SPS or TBT measures	47	1.52
F	Price control measures, including additional taxes and charges	64	2.07
P	Export-related measures	660	21.36
	Total	3090	100.00

TBT regimes. Comparing the prevalence of NTMs in existing versus potential markets reveals heightened regulatory intensity in prospective destinations (Table 6). The aggregate prevalence score increases from 424.5 in current markets to 512.2 in potential ones, primarily driven by rises in SPS measures (from 305.7 to 335.5) and TBTs (from 77.7 to 123.7). Lesser but meaningful increases occur in broad import restrictions (category E) and new measures (categories L and M, which emerge only in potential destinations). These patterns indicate that even as India seeks to diversify into high-value markets such as the EU, North America and East Asia, exporters will confront a denser thicket of regulatory hurdles.

TABLE 6. PREVALENCE SCORE OF NON-TARIFF MEASURES IN EXISTING AND POTENTIAL EXPORT DESTINATIONS

Type	Existing Destinations	Potential Destinations
A	305.70	335.50
B	77.70	123.70
C	16.00	13.30
E	18.20	20.40
G	6.10	6.80
H	0.70	0.70
L	0.00	3.30
M	0.00	6.90
O	0.10	1.60
Total	424.50	512.20

The Non-Tariff Severity Index (NTSI), which ranges from 0 (least restrictive) to 1 (most restrictive), provides a quantitative assessment of these trade barriers. Among 17 key destinations, China (1.00) and the United States (≈0.89) represent the most restrictive markets, where stringent SPS rules, residue limits and facility approvals effectively block Indian dairy imports (Fig. 1). A mid-tier group-including Egypt (0.41), Algeria (0.23), Mexico (0.18) and several Gulf states (ranging from 0.17 to 0.30)-presents moderate hurdles, such as import licensing, halal certification, cold-chain compliance and local partnership requirements. By contrast, markets in Southeast Asia and sub-Saharan Africa-including Indonesia (0.16), South Africa (0.09), the Philippines (0.08), Malaysia (0.07), Singapore (0.06), Bangladesh (0.03) and Nepal (≈0.00)-pose minimal non-tariff barriers, making them suitable for short-term trade expansion. A dual strategy is therefore recommended: consolidate and scale up exports to low-barrier markets in the near term while investing in quality assurance to penetrate moderately restrictive destinations.

At the product level, prevalence scores confirm that all major dairy lines face more restrictive regimes in potential markets (Table 6). Cheese (HS 040630) jumps from a score of 81.2 to 92.2, skim-milk powder (HS 040210) from 52.0 to 76.6 and other milk fats (HS 040690) from 76.8 to 86.5. When these prevalence measures are normalised into a severity index (Table 7), cheese emerges as the most severely constrained category, rising from 0.1033 in existing to 0.1393 in potential destinations, followed by other milk fats (from 0.0890 to 0.1204) and skim-milk powder (from 0.0056 to 0.0894). These findings suggest that Indian dairy exports, particularly value-added products such as cheese and butter, face significantly more restrictive conditions in prospective markets. Processed and high-margin dairy lines are subject to greater regulatory scrutiny, especially regarding quality standards, labelling and import certifications.

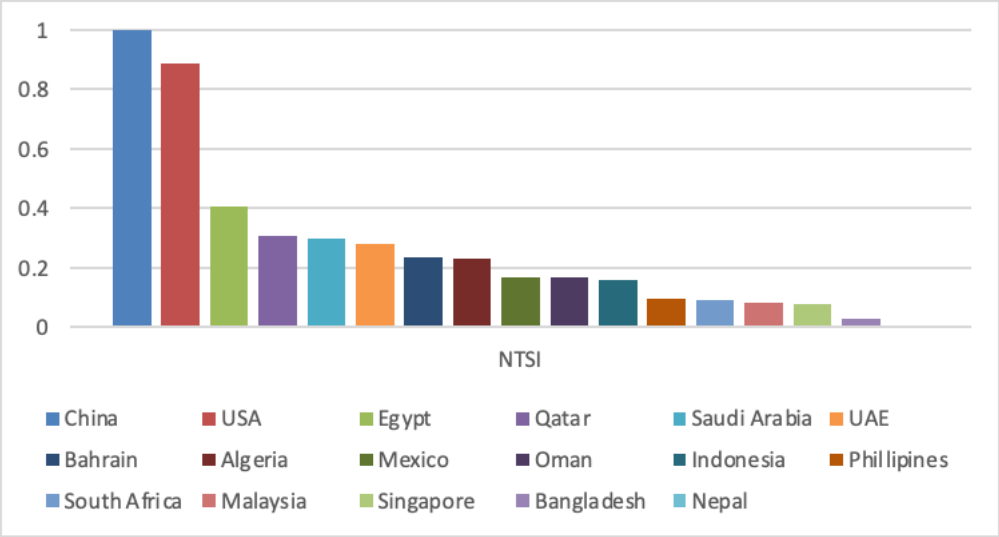

FIGURE 1. NON-TARIFF SEVERITY INDEX (NTSI) ACROSS KEY EXPORT DESTINATIONS FOR INDIAN DAIRY PRODUCTS

To navigate these challenges, Indian exporters must strengthen their compliance with international standards, upgrade their domestic quality infrastructure, and engage in strategic trade negotiations. While current export markets impose moderate NTBs, tapping into more lucrative destinations will require targeted investments and policy coordination to address the higher regulatory barriers that lie ahead.

TABLE 7. PRODUCT-WISE NTM PREVALENCE SCORES AND NON-TARIFF SEVERITY INDEX (NTSI) IN EXISTING AND POTENTIAL EXPORT MARKETS

Products	040210	040590	350110	040510	040630	040229	040690
				NTM Prevalence Score			
Existing	52.00	55.80	51.30	55.40	81.20	43.89	76.80
Potential	76.60	64.00	53.10	64.00	92.20	75.80	86.50
				Non-Tariff Severity Index (NTSI)			
Existing	0.0056	0.0144	0.0273	0.0135	0.1033	0.000	0.0890
Potential	0.0894	0.0455	0.0573	0.0459	0.1393	0.0870	0.1204

3.4 Relationship between export potential, baseline exports and NTM severity

The correlation analysis uncovers a nuanced relationship between the Non-Tariff Measures Severity Index (NTSI), India's export potential and current baseline dairy exports (Table 8). A strong positive correlation between NTSI and export potential (r = 0.6050) suggests that markets imposing more severe non-tariff measures on Indian dairy products often represent the greatest latent demand. This counterintuitive finding suggests that destinations with stringent regulatory barriers

may offer substantial market opportunities once these barriers are successfully navigated, potentially reflecting premium market positioning, higher value-added product demand or strategic importance despite regulatory complexity. By contrast, the association between NTSI and baseline exports is weak (r = 0.1501), indicating that India's existing export performance is only marginally linked to regulatory severity. Instead, historical trade ties, bilateral agreements, cultural affinity for Indian dairy and established distribution networks appear to drive actual export volumes more decisively than barrier stringency.

TABLE 8. CORRELATION MATRIX OF KEY INDICATORS

	NTSI	Export Potential	Unrealized Potential	Baseline Exports
NTSI	1.0000			
Export Potential	0.6050	1.0000		
Unrealized Potential	0.3893	0.5057	1.0000	
Baseline Exports	0.1501	0.4689	-0.4208	1.0000

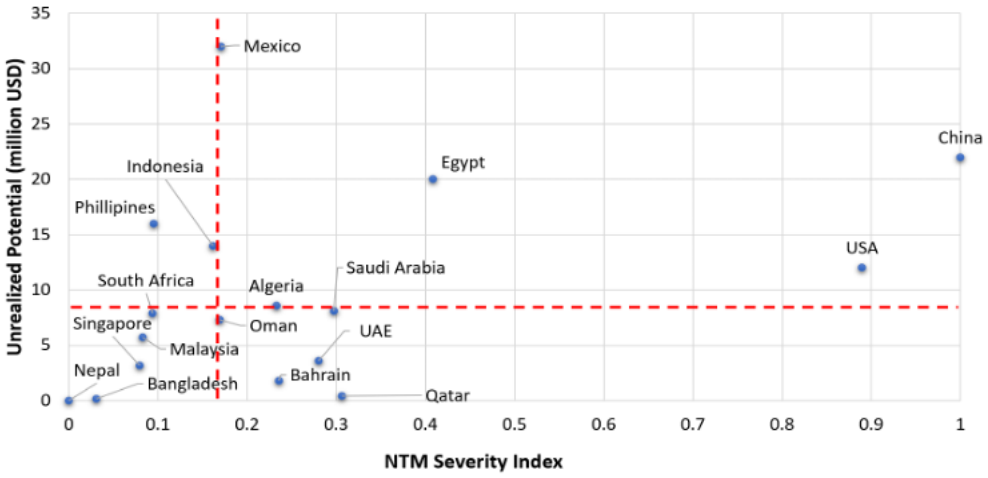

FIGURE 2. SEVERITY OF NON-TARIFF MEASURES AND UNREALIZED EXPORT POTENTIAL OF INDIAN DAIRY PRODUCTS ACROSS DESTINATION MARKETS

A moderate positive correlation between NTSI and unrealised potential (r = 0.3893) further underscores the untapped opportunity in high-barrier markets. Quadrant analysis-using the median NTSI (0.1704) and median unrealised potential (USD 7.9 million)-categorises destination markets into four categories (Fig. 2). Quadrant I (High NTSI / High Potential) includes China, USA, Egypt, Algeria and Mexico, revealing that the strictest regulatory regimes coincide with the largest untapped market opportunities for Indian dairy exports. Quadrant II (Low NTSI / High Potential) comprises Indonesia and the Philippines, indicating that low-barrier Southeast Asian markets nevertheless offer above-median growth prospects driven by

rising consumption. Quadrant III (Low NTSI / Low Potential) groups South Africa, Malaysia, Singapore, Bangladesh and Nepal, reflecting a smaller market size and limited premium segments. Quadrant IV (High NTSI / Low Potential) comprises Qatar, Bahrain, the UAE, and Oman, indicating that high compliance costs in these modest markets necessitate specialised, high-value product strategies.

The negative correlation between unrealised potential and baseline exports (r = –0.4208) confirms that markets with large existing exports have less residual capacity, while low-volume destinations offer the greatest opportunities. The moderate positive correlation between India's export potential and its baseline exports (r = 0.4689) suggests that, in general, markets with greater theoretical capacity for dairy imports do indeed receive more Indian product today—but not to the fullest extent possible. Exporting to high-potential markets may stem from regulatory compliance costs, certification requirements, logistical challenges, or limited market penetration strategies.

3.5 Export rejection analysis

Between 2010 and 2022, India experienced a total of 77 rejections of HS04 (dairy) exports to the United States, ranking it in the mid-range among major suppliers (Table 9). Mexico experienced the highest number of rejections (299), followed by Canada (147), while New Zealand and Ireland reported 44 and 4 rejections, respectively. India’s annual rejection counts fluctuated moderately, ranging from a low of 1 in 2022 to peaks of 9 in 2013, 2015 and 2017. By comparison, Mexico consistently exhibited elevated rejections, with counts ranging from 14 to 45 per year. Canada demonstrated a sharp decline in rejections, dropping from 97 in 2010 to near zero by 2019. New Zealand reported no rejections through 2016, with isolated increases in 2017 (4) and 2018 (37), whereas Ireland maintained near-perfect compliance throughout the period. These trends suggest that, although India is not among the most problematic exporters, it still encounters more compliance issues than low-risk countries such as New Zealand and Ireland.

When assessed in terms of the unit rejection rate, defined as the number of rejections per million USD of exports, India demonstrates clear progress (Fig. 3). Beginning at 0.10 in 2010, India’s unit rate remained between 0.07 and 0.10 until 2016 before declining steadily to just 0.004 by 2022. This downward trajectory suggests that, despite occasional rejections, the compliance rate relative to export volume has improved significantly. In contrast, Mexico’s unit rejection rate remained consistently high, ranging from 0.2 to 0.6, indicating persistent risk per export dollar. Canada began with a unit rate of 0.70 in 2010 but achieved a reduction to zero by 2019. New Zealand and Ireland maintained near-zero unit rejection rates, underscoring their strong alignment with U.S. import regulations.

The relative rejection rate, measuring each country's share of rejections relative to its share of U.S. dairy imports, further contextualises these findings (Fig.

4). India's relative rate generally ranged from 0.6 to 1.4 during most years, indicating that it was mostly in line with or slightly above the lowest-risk benchmark. An exception occurred in 2016, when the rate spiked to 3.1, driven by a drop in export value combined with moderate rejection counts. This was, however, a temporary deviation with the relative rate declining thereafter. Mexico consistently recorded the highest relative rejection rates, often exceeding 3.0 and peaking at 5.2 in 2011, indicating systemic non-compliance challenges. Canada's relative rate fell from 4.0 in 2010 to effectively zero by 2019, reflecting a successful alignment with U.S. standards. New Zealand showed a temporary peak in 2018 (3.0), whereas Ireland consistently maintained the lowest risk profile.

TABLE 9. AGGREGATE REJECTION RATE OF HS04 EXPORTS TO THE U.S. MARKET FROM MAJOR EXPORTING COUNTRIES

Year	India	New Zealand	Mexico	Canada	Ireland
2010	7	0	45	97	0
2011	4	0	37	11	0
2012	5	0	35	5	0
2013	9	0	14	7	0
2014	8	0	9	5	0
2015	9	0	19	4	0
2016	6	0	15	5	0
2017	9	4	9	1	0
2018	4	37	20	2	0
2019	7	0	22	0	0
2020	4	0	24	0	0
2021	4	3	28	3	4
2022	1	0	22	7	0
Total	77	44	299	147	4

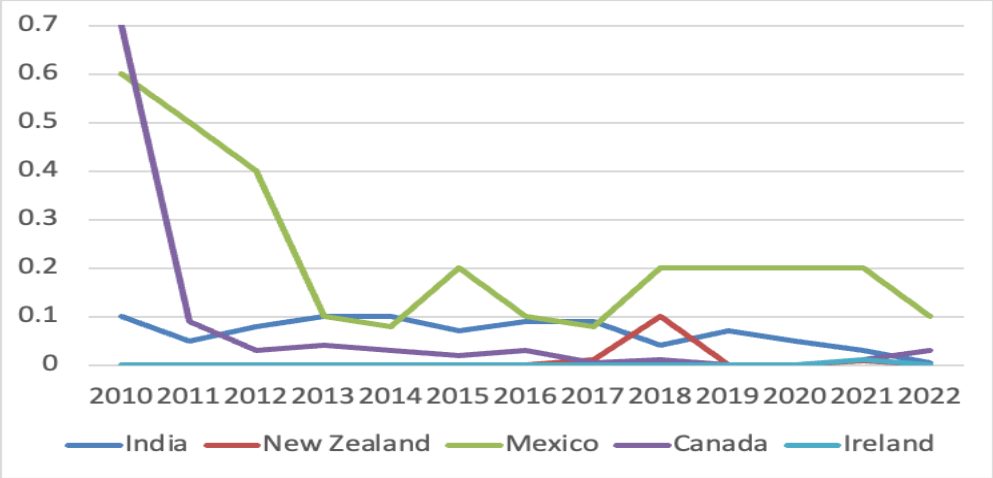

FIGURE 3. UNIT REJECTION RATE OF HS04 EXPORTS IN THE U.S. MARKET

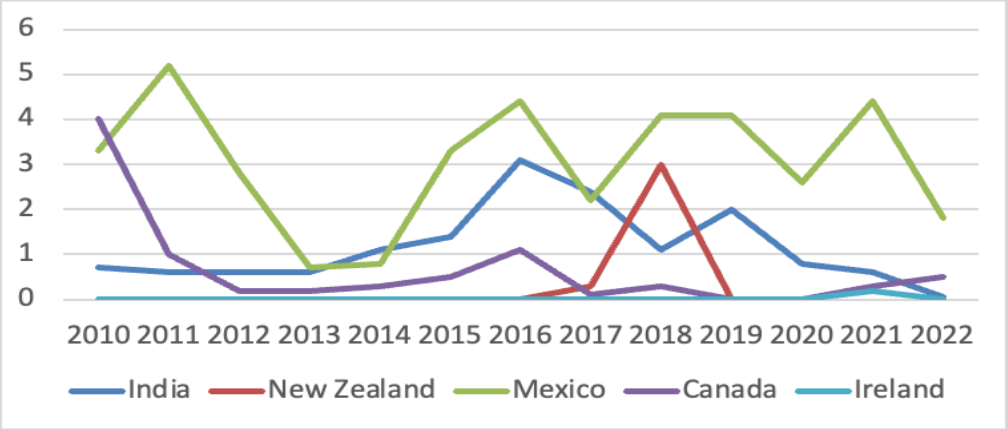

FIGURE 4. RELATIVE REJECTION RATE OF HS04 EXPORTS IN THE U.S. MARKET

Collectively, these metrics indicate that while India is not the most problematic supplier of dairy products to the U.S., it faces more rejections than consistently low-risk exporters such as Ireland and New Zealand. However, the steady decline in India's unit rejection rate highlights notable progress in export quality and compliance. To maintain and build on this trajectory, India must continue to invest in pre-export testing, strengthen cold-chain infrastructure, and improve exporter adherence to U.S. Food and Drug Administration (FDA) and Department of Agriculture (USDA) standards. Benchmarking against countries like Canada and Ireland could offer valuable insights into best practices for regulatory compliance and export performance.

3.6 Reasons behind export rejections

An analysis of U.S. import refusal data for the HS04 product group reveals that India's pattern of non-compliance differs significantly from that of other major exporters (Fig. 5). While many countries face rejections primarily due to microbiological contamination and hygiene-related issues, India's rejections are more often tied to technical regulatory infractions, particularly labelling and additive violations. This suggests that India's dairy exports generally meet basic food safety standards but fall short in terms of documentation and product conformity requirements. Labelling violations constitute the most common reason for India's dairy export rejections, accounting for approximately 64.8% of refusals, compared to 35.6% for other suppliers. These violations often pertain to non-compliance with FDA regulations on nutritional labelling, allergen disclosures, language specifications and permitted terminology. Many small and medium-sized Indian exporters lack dedicated regulatory compliance teams, which hampers their ability to meet these stringent requirements. In contrast, exporters from the European Union and New Zealand are more accustomed to the U.S. regulatory environment and typically meet labelling standards with greater consistency.

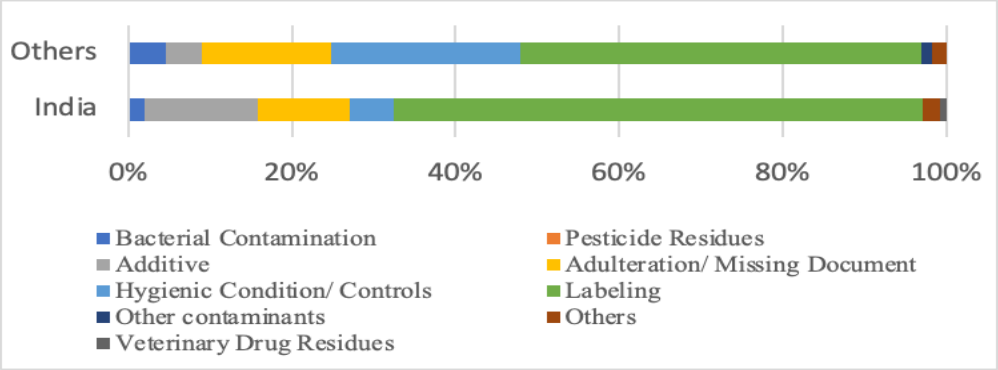

FIGURE 5. REASONS FOR HS04 EXPORT REFUSALS FROM INDIA AND OTHER LEADING SUPPLIERS IN THE U.S. MARKET

Issues related to additive usage are also notably higher for India. Rejections based on unauthorised or excessive use of preservatives, colourants, or processing aids constitute 13.8% of India's total, significantly above the 1.9% average among other exporters. In contrast, fundamental food-safety violations are relatively rare in India's case. Only 2.0% of Indian rejections were due to bacterial contamination, compared to 26.8% for other suppliers. Similarly, hygiene-related deficiencies accounted for just 5.3% of Indian refusals, compared to 10.0% among others. This can be attributed to the nature of Indian dairy exports to the U.S., which often consist of high-value, niche products, such as whey proteins and fortified milk powders, manufactured in certified facilities under strict sanitary controls. Other exporters frequently ship a broader range of products, including perishable items such as raw milk and soft cheeses, which carry higher contamination risks. For issues such as adulteration or missing documentation, India's refusal rate stands at 11.3%, which is roughly half the 23.7% average seen among other exporters. However, a small but non-zero proportion of India's rejections (0.8%) were due to veterinary drug residues, whereas most other countries maintained near-zero levels. This suggests occasional lapses in compliance with drug withdrawal times or testing protocols. Notably, pesticide residues and other chemical contaminants were negligible in India's case. Overall, India's rejections in the U.S. dairy market stem more from technical regulatory non-compliance, particularly labelling and additives, than from food safety concerns. Addressing these challenges will require strengthened regulatory training, better in-house compliance capacities among exporters and closer alignment between Indian standards and U.S. requirements. Continued attention to veterinary drug controls and robust sanitary practices will further enhance India's credibility and competitiveness in global dairy trade.

IV

CONCLUSIONS AND POLICY IMPLICATIONS

India's dairy export performance improved substantially between 2010 and 2022 as exporters aligned more closely with international standards and upgraded compliance infrastructure. An analysis using the ITC Export Potential Map reveals USD 161 millions of untapped export potential, concentrated in skim milk powder, butterfat, and casein, and in three markets: Mexico, the European Union, and China, which together account for more than half of that gap. This latent potential contrasts sharply with the regulatory barriers India faces. Non-tariff measures are more prevalent in prospective markets, with an average score of 512 compared to 424 in existing destinations. Sanitary and phytosanitary controls account for over half of all NTMs, followed by technical barriers to trade and export-related formalities. Products such as cheese and skim milk powder face normalised NTM severity indices of up to 0.14, indicating that quality and safety requirements, rather than logistical constraints, pose the greatest obstacle to deeper market penetration.

A focused examination of U.S. import refusals for HS04 products between 2010 and 2022 provides further clarification of India's compliance trajectory. India incurred 77 rejections, placing it in the mid-range among major suppliers; yet, its unit rejection rate dropped sharply from 0.10 per million USD of exports in 2010 to 0.004 in 2022. Relative rejection rates declined from as much as 1.4 times the lowest-risk benchmark in the early 2010s to just 0.07 by 2022. Most rejections were due to technical regulatory infractions, with 64.8 per cent attributed to labelling violations and 13.8 per cent to unauthorised additives, whereas fundamental food safety failures, such as bacterial contamination and hygiene deficiencies, accounted for only 2.0 per cent and 5.3 per cent of refusals. These patterns underscore that India's principal compliance gaps lie in regulatory conformity rather than in core sanitary controls.

Together, these findings highlight the need for a strategy that combines targeted compliance enhancements with proactive market engagement. In high-barrier markets, such as Mexico, the EU, and China, efforts should focus on harmonising national standards with Codex Alimentarius, FDA, and EU SPS and TBT requirements, alongside bilateral dialogues to secure mutual recognition agreements. Establishing centralised regulatory affairs units for training on labelling, additive compliance, and veterinary certification will reduce administrative and technical refusals. For more accessible markets with moderate NTMs—such as the United Arab Emirates, Saudi Arabia and the Philippines—India should intensify promotional campaigns, diversify its product portfolio and develop value-added offerings.

Effective institutional coordination is critical to sustaining these efforts. A dedicated Dairy Export Facilitation Cell under the Ministry of Fisheries, Animal

Husbandry and Dairying would centralise export intelligence, regulatory updates and market research. Leveraging real-time trade data and analytics to monitor emerging NTMs and rejection trends will enable proactive compliance adjustments and rapid response to regulatory changes. By systematically addressing regulatory barriers, strengthening compliance infrastructure and pursuing a balanced market engagement strategy, India can transform its dairy sector's global standing. Realising its full export potential in the dairy sector will unlock significant economic value, advance rural livelihoods, drive technological adoption across the value chain and secure India's position as a leading player in the international agrifood trade.

REFERENCES

Cadot, O., Gourdon, J., & van Tongeren, F. (2018). *Estimating ad valorem equivalents of non-tariff measures: Combining price-based and quantity-based approaches* (OECD Trade Policy Papers No. 215). OECD Publishing. https://doi.org/10.1787/f3cd5bdc-en

Indian Dairy Association (IDA). (2024, March). *Focus: India's dairy production model—National Digital Livestock Mission, e-Gopala, Rashtriya Gokul Mission and more* (Vol. 76, No. 3). *The Indian Dairyman*. https://indiandairyassociation.org/uploads/publications/id/ID_V76_No3_Focus.pdf

Indian Dairy Association. (n.d.). *Dairy dynamics: Opportunities and challenges* [President's Desk]. Retrieved July 31, 2025, from https://indiandairyassociation.org/Presidents-Desk.aspx?PRID=NDE%3D

Joshi, R. M., Symss, J., & Rana, A. (2018). *Roadmap and strategies to promote export of dairy products for the organized dairy sector*. Indian Institute of Foreign Trade. https://www.nddb.coop/sites/default/files/pdfs/baseline/16_Roadmap_&_strategies_to_promote_dairy_products.pdf

NITI Aayog. (2018). *Demand and supply projections towards 2033: Crops, livestock, fisheries and agricultural inputs* (Working Group Report, Final, July 30, 2021). National Institution for Transforming India. https://www.niti.gov.in/sites/default/files/2023-02/Working-Group-Report-Demand-Supply-30-07-21.pdf

Press Information Bureau. (2025, March 25). *Global dairy industry*. Ministry of Fisheries, Animal Husbandry & Dairying. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2114715

Singh, A. K. (2025, July 28). India's livestock future is not just about big hooves but also about small hooves and beaks. *Down To Earth.* https://www.downtoearth.org.in/agriculture/indias-livestock-future-is-not-just-about-big-hooves-but-also-about-small-hooves-and-beaks