



Trends and volatility in agricultural trade between India and Nepal

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Abstract

Bilateral trade between India and Nepal has evolved significantly over the years, influenced by changing economic policies, trade agreements, market conditions, and external shocks. Despite their close economic relationship, persistent trade asymmetry and Nepal's growing trade deficit raise concerns regarding the stability and vulnerability of bilateral trade. This study examines the trends, composition, and volatility of major agricultural commodities traded between India and Nepal during 2009–2025. The study particularly assesses fluctuations in agricultural trade and the effects of major external shocks, including the COVID-19 pandemic and recent economic and policy changes. The study uses descriptive statistics, the Herfindahl–Hirschman Index (HHI), the Trade Resilience Index (TRI), and structural break analysis to evaluate trade concentration, stability, resilience, and the impact of major economic shocks. The findings indicate that while some agricultural commodities exhibit relatively stable trade patterns, others experience considerable volatility due to changes in trade agreements, price fluctuations, market conditions, and global disruptions. The study highlights the varying resilience and vulnerability of Indo-Nepal agricultural trade and suggests that trade diversification, improved supply-chain infrastructure, effective policy coordination, and appropriate risk-management strategies can enhance trade stability and contribute to a more sustainable and resilient bilateral trade relationship.

Keywords: *Agricultural Products, Bilateral trade, Indo-Nepal trade, Sustainability, Trade agreements, JEL Code: Q17 F14, Q5*

Introduction

The bilateral trade relations between India and Nepal hold strategic and economic significance due to geographical proximity, historical importance, and longstanding treaties. India, being significantly larger than Nepal in terms of GDP, per capita, and population, has consistently been Nepal's largest trading partner, accounting for most of imports and exports. India constitutes 64.1% of the total trade of Nepal, comprising about USD 8.85 billion [1]. Despite having a close trade relationship, trade imbalance and structural asymmetry persist, raising questions about Nepal's growing trade deficit and its implications for economic vulnerability.

Over the decades, while Nepal's trade with India has expanded in volume, its export capacity has not kept pace with the growing imports. Studies of Nepal's heavy reliance on Indian imports, coupled with poor industrial infrastructure, limited export diversification, and the absence of standard quality products, has aggravated the trade deficit [2]. This imbalance has significantly affected Nepal's foreign exchange reserves and overall economic stability. Stated though Nepal has made some progress in trade harmonization, the productivity gains from trade openness have been disproportionately accrued by its trading partners [3]. During global disruptions such as the COVID-19 pandemic, India maintained a net surplus in the agriculture sector due to effective policy execution, diversification, and robust infrastructure [4], [5]. The structural features of Indo-Nepal trade and concluded that Nepalese exports concentrate on a few commodities, whereas Indian exports are diversified; as a result, India has a trade advantage over Nepal [6].

Agricultural trade, in particular, has shown high complementarity, yet Nepal's performance in this sector has remained constrained due to production inefficiencies and infrastructure bottlenecks [7], [8], [9], identifies the problems in Nepal's agricultural sector, which is the primary contributor to Nepal's economy. In this context, understanding the dynamics of Indo-Nepal trade is critical for formulating effective policy interventions [10]. The open border policy and multiple trade agreements between India and Nepal have laid an institutional foundation for the uninterrupted flow of agricultural produce, supported by tariff concessions, preferential access, and non-discriminatory treatment. However, despite these favourable trade agreements, agricultural trade between India and Nepal is frequently subject to volatility that has led to instability and unpredictability in trade flows [11].

Given the challenges and opportunities in Indo-Nepal agricultural trade, this study explores three key questions: What are the main agricultural commodities traded between India and Nepal, and how have trade patterns evolved? How stable or volatile is Indo-Nepal trade, and what factors influence this volatility? What policy measures can improve the sustainability of Indo-Nepal trade, reduce the trade deficit, and promote long-term cooperation? By analysing the agricultural trade between India and Nepal, the study aims to identify trends and the composition of key commodities, evaluate the stability and volatility of bilateral trade flows, and offer policy recommendations to enhance sustainability, address the trade deficit, and strengthen long-term trade relations.

Review of Literature

Previous studies have examined Indo-Nepal trade mainly in terms of trade deficits, agricultural trade patterns, and economic dependence. Agriculture contributes about one-third to the Gross Domestic Product and is the major source of employment in Nepal [12]. The emphasize Nepal's persistent trade deficit and recommend export diversification, improved product quality, and wider market access [2], [13]. Kafle, Khanal & Khanal identify political instability, geographical constraints, and low-quality products as major constraints to Nepal's exports [14], [5]. Kumar & Sharma et al. highlight the importance of infrastructure, skilled human resources, and competitiveness in agricultural trade [4], [9]. Upadhyay Kaur examines changes in agricultural commodity trade and identify India and Nepal as important trading partners [6], while Pandey et al. report comparative advantages for India in jute and spices and Nepal in pulses and tea [8]. Adhikari & Ghimire emphasize Nepal's dependence on India and recommend trade diversification and strengthening domestic industries [11].

However, most existing studies are descriptive or macro-level in nature, with limited focus on trade volatility, resilience, sustainability, and structural changes caused by external shocks. This study addresses these gaps by analyzing the volatility, stability, resilience, and structural changes in Indo-Nepal agricultural trade during 2009–2023.

Methodology

The study adopts both descriptive and inferential statistical methods to examine the trends, composition, stability, and volatility of Indo-Nepal agricultural trade from 2009-2025. The year 2009 is chosen as the base year due to the revision of the Indo-Nepal Trade Treaty, which serves as a key policy framework for the study. Data on exports and imports were collected from World Integrated Trade Statistics (WITS), the Directorate General of Foreign Trade (DGFT), and other relevant reports. Agricultural commodities are classified using the Harmonised System (HS) code at the two-digit level, with the appropriate range for agricultural products spanning from 01 to 24.

To analyse trade trends, the study employs a graphical presentation. The study uses the Rank Dominance method to list the top ten agricultural exports and imports between India and Nepal. The Rank has been assigned to each product (1 to 10) based on the product share held by each product every year. After assigning the rank, a rank score has been given to each product (For Ex, Suppose Product A holds rank 1 its means its score is 10..... Product B holds 10th rank; its score is 01). After assigning rank scores, the total has been derived for each product, and the commodities are listed based on that.

To assess market concentration, the study applies the Herfindahl-Hirschman Index, which helps to determine whether the trade is concentrated only on a few commodities or diversified. HHI is mathematically expressed as:

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

A higher HHI value indicates that trade is concentrated in fewer products, while a lower value suggests greater diversification.

To evaluate stability and volatility, the study will apply the Trade Resilience Index and Structural Break Analysis. TRI is expressed as:

$$TRI = \frac{\text{PostShock} - \text{Shock}}{\text{Pre-Shock} - \text{Shock}}$$

The Trade Resilience Index examines the ability of agricultural trade to withstand and recover from external shocks, and Structural Break Analysis will identify any significant shifts in trade patterns due to policy changes or economic disruptions.

Results and Discussions

Trends and Composition of Agricultural Trade between India and Nepal (2009-2025)

Trade relations between India and Nepal date back to 1950, when the Treaty of Trade and Friendship was signed. The treaty helped foster a strong bond and promoted economic cooperation between the two countries. Figure 1 illustrates the trends in agricultural exports, imports, and trade balance between India and Nepal from 2009-2025.

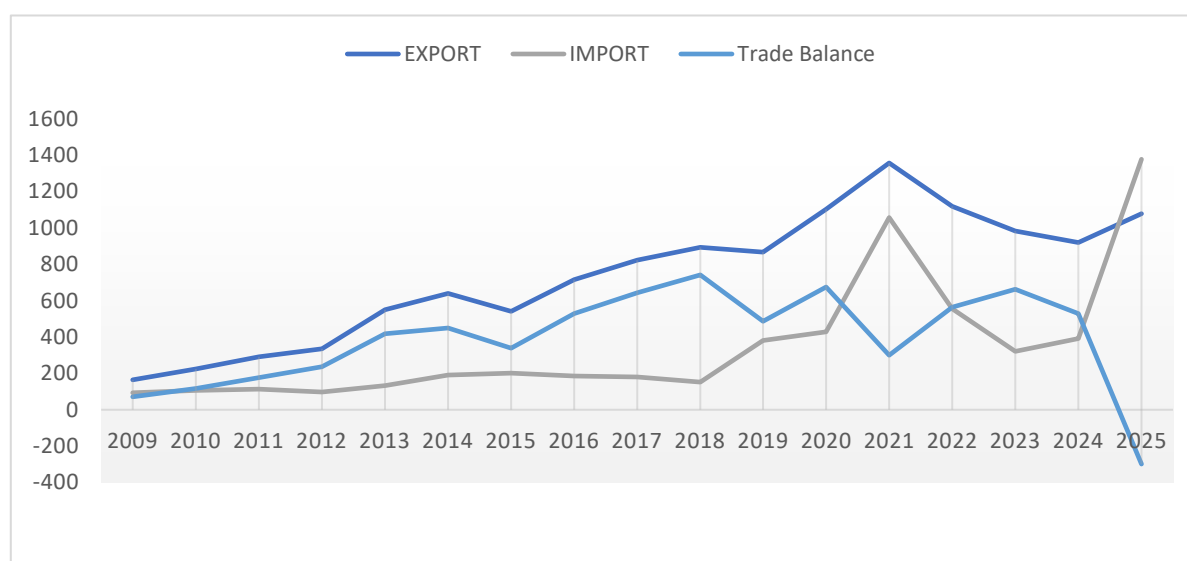


Fig. 1: Agricultural Trends in India-Nepal Trade (2009-2025) in US\$ Million

Source: World Integrated Trade Statistics (WITS)

Exports from India to Nepal show a consistent upward trend from \$ 164.49 million in 2009 to \$ 1,357 million in 2021, before moderately decreasing to \$ 982.91 million in 2023 and again increasing up to \$ 1079 million in 2025. In contrast, imports from Nepal to India have grown in a fluctuating manner. Imports grew steadily from (93.33 \$US million) in 2009, peaking in 2021 (1056.39 \$US million), and again slightly declining in 2023 (321.15 \$US million) and showing an upward trend in 2025 (1377 \$ US million). The trade balance shows that trade remains positive in India's favour. It increased from 71.16 \$US million in 2009 to 741.42 \$US million in 2018 before declining to 299 \$US million in 2025.

The composition of traded commodities reflects the structure and dynamics of Indo-Nepal bilateral relations. In this context, the top ten agricultural commodities exchanged between India and Nepal have been identified from 2009-2025. Since the position of commodities does not remain static through the years, a rank has been assigned to all the commodities. Based on the annual ranks of the commodities, a total score has been

calculated to determine the consistently traded commodities between India and Nepal. Figures 2 and 3 illustrated below show the composition of commodities.

Figure 2 depicts the top ten agricultural produce exported by India to Nepal. Cereals (10) consistently maintained the top rank with a total score of 166. Residues and waste from the food industries (23) secured the 2nd position with a total score of 147, backed by Edible vegetables and certain roots (07) with a total of 137. Other products like Preparations of cereals, flour, milk, and bakery products (19), Coffee, tea, and spices (09), Edible fruits and nuts (08), Oil seeds (12), Tobacco (24), Sugars and confectionery (17), and Miscellaneous edible preparations (21) have been successful in maintaining their position in the top ten priority list.

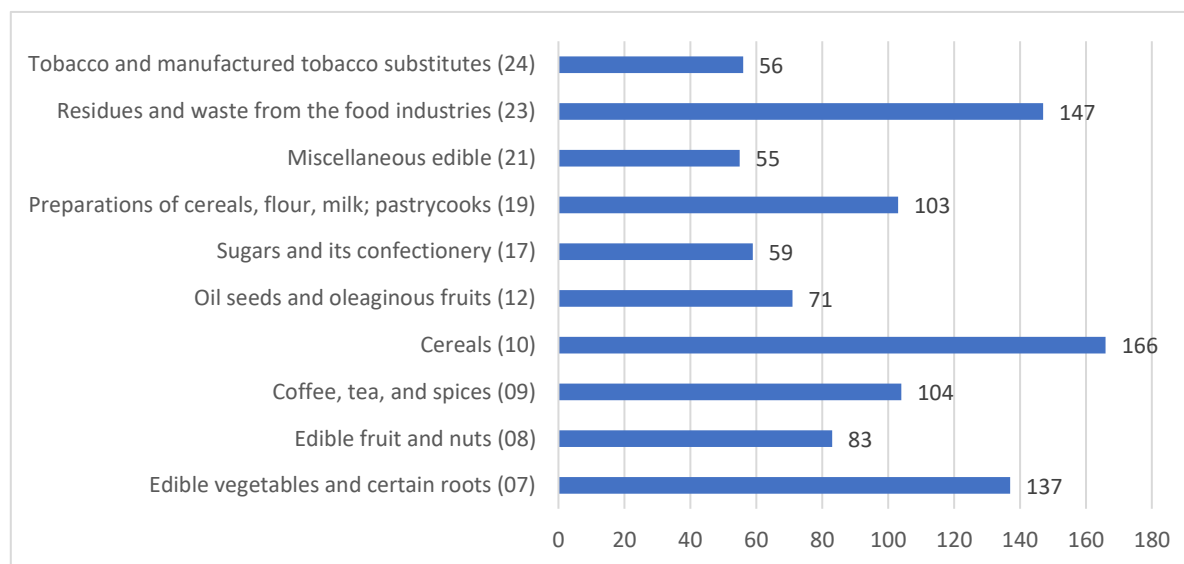


Fig. 2: Top Ten Agricultural exports from India to Nepal (2009-2025)

Source: Author's Calculation

Regarding imports of agricultural products by India from Nepal, it has been seen from Figure 3 that Coffee, Tea, and Spices (09) secured the top rank with a total score of 157, followed by Beverages and vinegar (22) with a score of 153. The 3rd position in the ranking list has been occupied by Residues & waste from food industry with a total score of 123. Other products like Animal, vegetable or microbial fats and oils (15), preparations of cereals, flour, starch or milk (19), vegetable plaiting materials and vegetable products (14), products of milling industry (11), edible fruits and nuts (08), edible vegetables and certain roots and tubers (07) and dairy produce; birds' eggs; honey (04) are the items listed in the top ten imports from Nepal.

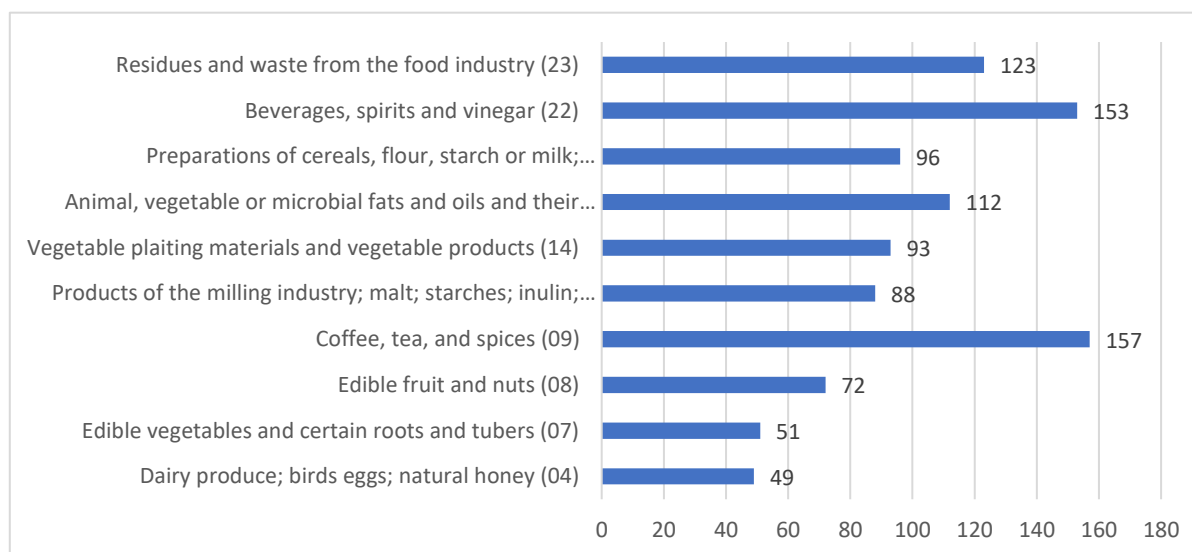


Fig. 3: Top Ten Agricultural Imports from Nepal by India (2009-2025)

Source: Author's Calculation

Stability and Volatility of Indo-Nepal Agricultural Trade (2009-2023)

It is evident from the study that though both India and Nepal produce agricultural products, they are interdependent in this sector. Nepal, being a landlocked country, is particularly reliant on India for transit and supply of its agricultural exports to third countries. This interdependence underscores the importance of stable and healthy bilateral relations. Trade stability is a key indicator of the reliability and resilience of bilateral relations. In the context of Indo-Nepal trade, understanding volatility will help in identifying potential vulnerabilities arising from external shocks, policy changes, and global disruptions. For this purpose, the Herfindahl-Hirschman Index of both exports and imports has been used to examine the trade concentration and the stability of trade. The study also has the mean, standard deviation, and coefficient of variance to measure the volatility of trade, and lastly, the Trade Resilience Index has also been used to study the impact of shocks and global disruptions.

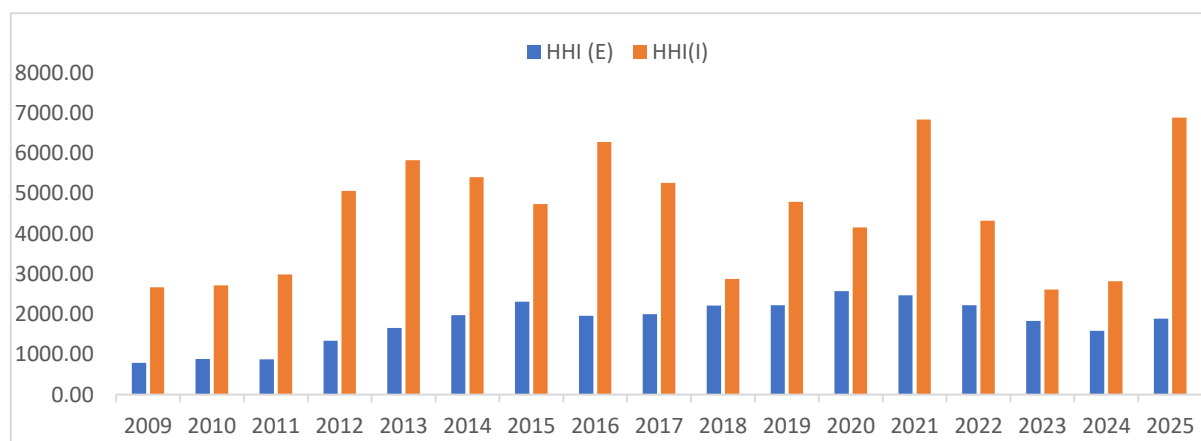


Fig. 4: Herfindahl-Hirschman Index on Exports and Imports (2009-2025)

Source: Author's Calculations

The above chart displays the annual Herfindahl-Hirschman Index (HHI) on agricultural exports and imports between India and Nepal from 2009-2025. The HHI values for India's agricultural exports to Nepal range from 790 to 2573, indicating a relatively diversified and stable export trade structure. This also reflects Nepal's consistent dependence on a broad range of Indian agricultural products. In contrast, HHI values of India's imports from Nepal range from 2667 to 6840, signifying high concentration in imported agricultural commodities. This suggests that India's imports heavily rely on fewer agricultural products, highlighting low diversification on Nepal's part in terms of agricultural exports to India. It is important to note that low concentration indicates high diversification, where trade is spread across many products, and high HHI values indicate low diversification with trade concentrated on a few products.

Test of Volatility: To examine the stability or variability in Indo-Nepal trade over the given period, a test of volatility has been performed. For performing the test, periodic breaks have been included. Table 1 signifies that the volatility test was performed on exports from India to Nepal, imports by Nepal to India, and total trade carried out between India and Nepal.

Table 1: Volatility of Exports, Imports, and Total Trade

Year	Exports			Imports			Total Trade		
	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
2009-2013	312.62	147.65	47.23	108.92	15.55	14.28	421.55	161.20	38.24
2014-2018	722.33	140.57	19.46	182.87	18.64	10.23	904.50	123.56	13.66
2019-2025	1705.77	519.72	30.47	1061.18	161.62	15.23	644.59	408.01	63.30

Source: Author's calculation

It has been observed from the study that exports have grown significantly over the years, with a decreased relative volatility from 47.23% to 30.47%, suggesting a more stable growth in recent years. Imports, on the other hand, exhibit higher volatility, especially during the period 2019-2025, as indicated by a higher Coefficient of Variance, i.e., 15.23%. This might be due to the COVID pandemic or the Russia-Ukraine war,

or changes in domestic demand in Nepal. Total trade between India and Nepal has shown significant growth during the period, but the relative volatility has decreased, suggesting that while the total volume of trade has increased substantially from 421.55 to 644.59, its fluctuation around the mean has become less in the later years.

Trade Resilience Index: Unlike the other bilateral trades in the world, Indo-Nepal trade has also faced economic shocks during different periods. The Trade Resilience Index is an analytical tool that will help us understand how the trade between India and Nepal has recovered from the shocks. Table 2 below signifies the Trade Resilience Index from 2019-2023 for both exports and Imports of the top ten agricultural commodities exchanged between India and Nepal.

Table 2: Trade Resilience Index on Exports and Imports

Trade Resilience Index on Export (2019-2023)					
Code	(Pre-Shock) 2019	(Shock) 2020	(Post-Shock) 2023	TRI	Effect
'07	71.43	101.48	102.61	-0.04	No Resilience
'08	42.35	36.86	54.12	3.14	Highly Resilience
'09	42.36	59.39	50.92	0.50	Partially Resilience
'10	377.46	526.02	361.75	1.11	Full Recovery
'12	35.45	43.23	39.22	0.52	Partially Resilience
'17	17.23	81.24	26.99	0.85	Partially Resilience
'19	49.83	47.30	51.62	1.71	Full Recovery
'21	32.82	30.50	34.61	1.78	Full Recovery
'23	94.49	92.72	148.59	31.55	Highly Resilience
'24	28.48	26.22	26.16	-0.03	No Resilience
Trade Resilience Index on Imports (2019-2023)					
Code	(Pre-Shock) 2019	(Shock) 2020	(Post-Shock) 2023	TRI	Effect
04	0.27	0.02	0.26	0.96	Partially Resilience
07	0.83	0.93	2.78	-18.13	No Resilience
08	0.00	0.09	0.44	-4.02	No Resilience
09	47.74	84.25	103.39	-0.52	No Resilience
11	0.00	0.00	0.02	0.00	No Resilience
14	4.60	14.46	22.95	-0.86	No Resilience
15	251.91	258.94	83.31	24.96	Highly Resilience
19	7.63	8.55	6.94	1.74	Full Recovery
22	40.85	28.29	63.29	2.79	Highly Resilience
23	19.06	18.75	25.75	23.01	Highly Resilience

Source: Author's Compilation

* $TRI \leq 0$ = No resilience, $0 < TRI \leq 1$ = Partially Resilient, $1 < TRI \leq 3$ = Full Recovery, and $TRI > 3$ = Highly Resilient

In the case of exports, agriculture commodities like Edible fruit and nuts (8); peel of citrus fruit or melons, Cereals (10), Preparations of cereals, flour, starch or milk; pastrycooks' products (19), Miscellaneous edible preparations (21), and Residues and waste from the food industries; prepared animal fodder (23) have recovered and surpassed from the external shocks. Products such as Coffee, tea, maté and spices (09), Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal (12), Sugars and sugar confectionery (17) have shown partial recovery and Edible vegetables and certain roots and tubers (07), Tobacco and manufactured tobacco substitutes; products, whether or not containing nicotine (24) are exhibiting negative and unstable trade pattern.

In case of imports, agricultural commodities like Animal, vegetable or microbial fats and oils and their cleavage products; prepared edible fats (15), Preparations of cereals, flour, starch or milk; pastrycooks' products (19), Beverages, spirits and vinegar (22), and Residues and waste from the food industries; prepared

animal fodder (23) have recovered and are considered stable. On the other hand, commodities such as Dairy produce; birds' eggs; natural honey; edible products of animal origin (4), Edible vegetables and certain roots and tubers (07), Edible fruit and nuts; peel of citrus fruit or melons (08), Coffee, tea, maté and spices (09), Products of the milling industry; malt; starches; inulin; wheat gluten (11), and Vegetable plaiting materials; vegetable products not elsewhere specified or included (14) are the commodities fluctuating and unstable.

Recommendations and Suggestions for Strengthening Agricultural Trade Between India and Nepal:

The agricultural trade between India and Nepal plays a significant role in developing the economy of both countries by contributing to food security, rural livelihoods, and economic integration. However, despite immense potential, this sector faces challenges like trade volatility, infrastructure bottlenecks, and inconsistent policy frameworks. To overcome these challenges and foster a more sustainable and resilient trade relationship, several policy recommendations are proposed, which are mentioned below:

- a. *Diversifying Agricultural Trade:* The study suggests that both India and Nepal must encourage the diversification of agricultural commodities to reduce the dependence on a limited number of volatile products. Both countries must explore under-traded but high-potential products to mitigate the risks arising from economic shocks, climatic events, and policy changes.
- b. *Review Bilateral Agreements:* The bilateral agreement between India and Nepal was last revised in the year 2009. The study recommends that trade agreements governing bilateral cooperation must be upgraded regularly to meet evolving market dynamics and agricultural priorities. The study also suggests that focus must be given to certain key areas such as quotas, duty-free access of key commodities, and mechanisms to resolve trade disputes.
- c. *Implementation of Trade Stabilization Tools:* The study seeks to recommend that both countries must cooperate to implement certain trade stabilizing tools such as Minimum Support Price, Pricing of Sensitive products, trade insurance scheme, and joint contingency schemes to mitigate unforeseen shocks like pandemic, earthquake, or global disruptions.
- d. *Upgrade Border Infrastructure:* Since Nepal is a Landlocked country, it has to depend either on India or Nepal for connecting with the other countries of the world. India and Nepal have signed an open border agreement in 1950 to increase trade relations with each other. However, it has been witnessed from the literature that though an agreement has been signed, the infrastructure is still to be developed. Therefore, the study suggests upgrading the border infrastructure to reduce trade costs and delays and improve the shelf life of perishable agricultural commodities.
- e. *Harmonize Standards and Regulations:* Food safety standards, certificate processing, and technical trade barriers often act as a non-tariff barrier that hinders the smooth flow of trade. The study suggests that harmonizing these standards can facilitate more predictable and stable agricultural trade between India and Nepal.
- f. *Encouraging private participation:* The study recommends promoting and encouraging the private sector in agricultural trade. This will boost efficiency, investment, and innovation. In addition, it also creates better supply chains, reduces costs, and ensures timely delivery.

Conclusion

This study examined the trends, composition, stability, and resilience of Indo-Nepal agricultural trade during 2009–2023. The findings indicate that although agricultural trade has increased over time, it remains concentrated in a limited number of commodities, making it vulnerable to policy changes, market fluctuations, and external shocks. The volatility analysis and Trade Resilience Index show that exports are comparatively more stable, while imports are more volatile and less resilient.

Despite strong historical and geographical ties, inadequate trade infrastructure, non-tariff barriers, inconsistent policy measures, and a lack of harmonized standards continue to constrain deeper economic integration. To ensure stable and sustainable agricultural trade, both countries should strengthen trade infrastructure and bilateral cooperation, improve product quality and standards, diversify agricultural commodities, reduce trade barriers, and encourage greater private-sector participation. These measures can

reduce trade disruptions, enhance competitiveness and resilience, and promote mutually beneficial economic growth.

Declaration

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