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Analysis of the Potentialities and Restraining Factors in Agricultural Trade between China and Central Asian Countries

Huijuan Liu, Peng Zhao*
Nanjing Tech University Pujiang Institute, Nanjing 211200, Jiangsu, China

**Author to whom correspondence should be addressed.*

***A*bstract:** In recent years, the Belt and Road Initiative has been deepened and promoted, bringing development opportunities for economic and trade cooperation between China and Central Asian countries. As an important part of bilateral economic and trade relations, agricultural trade has undergone significant dynamic changes in scale and structure. This paper focuses on bilateral agricultural trade, reviews the current situation, and conducts comparative analyses of overall scale, subcategories, and market concentration to reveal the trade landscape. It constructs a core data dimension index system to evaluate trade potential, analyzes potential sub-sectors, and identifies key directions for future trade growth. By examining constraining factors and analyzing trade barriers, logistics costs, and standard differences based on trade condition variations, it estimates breakthrough potential in light of improvement trends and proposes countermeasures and suggestions, providing theoretical and practical references for the sustainable and healthy development of bilateral agricultural trade.

Keywords: China—Central Asia; Agricultural trade; Trade potential; Constraints

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1. Introduction

As important neighbors to China's northwest, the five Central Asian countries have geopolitical, economic cooperation, and agricultural resource complementary advantages. With the Belt and Road Initiative deepening, China-Central Asian agricultural trade has become closer and is an important part of bilateral economic and trade cooperation. However, current agricultural trade faces challenges in scale expansion, category optimization, and market deepening, yet has great development potential. Analyzing the potential and constraints of this trade can help find new growth points for bilateral agricultural cooperation and provide decision-making references for regional economic integration and mutual benefits [1]. The following will conduct comparative analyses in overall trade scale, segmented category structure, and market concentration, systematically assessing trade potential and constraints to support and guide high-quality development of bilateral agricultural trade [2].

2. Current status of agricultural trade between China and central Asian countries

2.1. Comparative analysis of the overall trade scale of agricultural products

The scale of agricultural trade between China and the five Central Asian countries has shown a significant growth trend [3]. In 2018, bilateral trade reached $793 million, with a slight increase in 2019 to $833 million. In 2020, China's imports of agricultural products from the five Central Asian countries amounted to $860 million. In 2021, bilateral trade exceeded $1 billion, reaching $1.073 billion, with China's imports totaling $466 million and exports $507 million. In 2022, trade volume surged to $1.651 billion, and in 2023, it further expanded to $2.875 billion (exports $1.206 billion, imports $1.669 billion). Entering 2024, in just the first five months, China's agricultural imports from the five Central Asian countries reached 4.36 billion yuan, a 26.9% increase compared to the same period last year, continuing the trend of expanding trade scale [4].

2.2. Comparative analysis of sub-category structure

Given the incomplete data for 2024, this study is based on the 2023 data. In China's agricultural exports to Central Asia, dried, fresh, and frozen fruits dominate, with exports reaching $230 million, accounting for 60%. Both the quantity and value have more than doubled year-on-year (quantity increased by 183%, value increased by 116%), indicating a sharp rise in market demand [5].

Cotton textiles ranked second, with exports nearing $100 million, showing a 47% increase in both volume and value [3]. This highlights the Central Asian textile industry's heavy reliance on raw material imports. In the vegetable sector, exports rose 17.9% in quantity but fell 18.4% in value, likely due to lower unit prices. Livestock product exports reached 17,700 tons, with a 215% increase in volume and 132% growth in value. Despite the modest scale, the growth momentum was remarkably strong.

The export value of both vegetable oil and aquatic products was below $20 million. Among them, the quantity of aquatic products increased slightly by 0.06%, while the value decreased by 14%, indicating a relatively sluggish market performance. Overall, China's agricultural exports to Central Asia mainly rely on fruits and cotton textiles, with significant differences in growth rates across categories, reflecting the demand preferences of the Central Asian market.

Table 1. China's 2023 agricultural product export value to Central Asia by category

Product Category	Export Volume	YoY Change	Export Value (10,000 USD)	YoY Change
Grain	0.18 mn tons	4.85%	173.9	123.00%
Vegetable Oil	79.74 tons	–3.35%	27.95	41.35%
Cotton Fabric	12.60k tons	46.93%	9,582.96	47.04%
Vegetables	61.90k tons	17.91%	8,016.22	–18.43%
Dried, Fresh & Frozen Fruit	226.70k tons	183.36%	23,061.29	116.32%
Animal Products	17.70k tons	215.54%	3,523.33	132.21%
Aquatic Products	1,937.63 tons	0.06%	1,871.52	–13.97%

2.3. Comparison of market concentration

In country distribution, Kazakhstan takes the largest share (46.6%) in China's agricultural trade with the five Central Asian countries, being China's most important partner in the region. Kyrgyzstan and Uzbekistan follow with shares of 26.17% and 23.29%, respectively. Tajikistan and Turkmenistan have lower shares of 2.4% and 1.54%. This pattern shows China's agricultural exports to Central Asia are concentrated in three western bordering countries [5]. Geographical proximity, convenient transportation, and well-established cooperation mechanisms drive active trade. As a core market, Kazakhstan has policy and logistics advantages and matches China's export demand, especially in fruits and cotton textiles. Kyrgyzstan

and Uzbekistan, with active border trade and growing consumer markets, are important for China's agricultural products to reach Central Asia's hinterland. In contrast, Tajikistan and Turkmenistan, limited by market size, transportation costs, and customs clearance efficiency, haven't fully realized their trade potential. In the future, with infrastructure projects like the China-Kyrgyzstan-Uzbekistan Railway, regional connectivity may improve, potentially optimizing the trade landscape.

The country-specific data of China's agricultural exports to the five Central Asian countries in 2023 are as follows: exports to Kyrgyzstan amounted to $617 million, to Kazakhstan $323 million, to Uzbekistan $195 million, to Tajikistan $81 million, and to Turkmenistan $55 million. According to the market concentration (CRN) formula CRN=∑(share)×100%, the results are CR3=89.29% and CR4=95.66%. From the CRN index perspective, CR3 approaches 90%, indicating that nearly 90% of China's agricultural exports to Central Asia are concentrated in Kyrgyzstan, Kazakhstan, and Uzbekistan, which are considered the "core markets" for China's agricultural exports to Central Asia. CR4 exceeds 95%, meaning that even if the fourth-largest market, Tajikistan, is included, the top four countries still dominate absolutely, with only about 4.34% of the share distributed to Turkmenistan.

This highly concentrated market structure, on the one hand, reflects the strong demand for China's agricultural products in core markets such as Kyrgyzstan, which may be attributed to factors like geographical proximity, convenient trade routes, and aligned consumption preferences. On the other hand, it also means that China's agricultural exports to Central Asia are highly dependent on the markets of a few countries. Any changes in demand or trade policies in these major markets could significantly impact the overall export situation.

3. Analysis of the development potential of agricultural trade between China and central Asian countries

3.1. Core data dimensions for potential assessment

To scientifically quantify and assess the agricultural trade potential between China and Central Asian countries, a trinity framework integrating trade foundation, structural optimization, and external support is constructed. Four core dimensions are selected: trade scale trends, category optimization space, policy support, and infrastructure improvement. Key data indicators and quantification standards are clearly defined for each dimension to ensure objective and accurate assessment [6].

In terms of trade-volume growth, in 2023, the year-on-year import and export growth rates were 55.67% and 23.07% respectively, with a five-year compound annual growth rate of 38.2%. The proportion of agricultural trade volume was 3.21% and rising, meeting high-potential grade standards, showing a strong and sustainable growth foundation.

Regarding category structure optimization, highly complementary categories now make up 78.5% of total trade volume. Flaxseed imports increased by 202% and honey exports by 1090%. Processed agricultural products account for 16.3% of exports and are on the rise. All indicators reach high-potential levels, indicating significant optimization and upgrading potential in the trade structure.

In terms of policy support, there are 6 bilateral trade agreements, 12 cross-border trade facilitation policies are in place, and the agricultural cooperation special fund is 8 billion yuan. All three indicators are at a high support level, demonstrating strong institutional safeguards and sufficient resource allocation.

For infrastructure development, cross-border road transport accounts for 51.8% of total logistics, and agricultural products at border ports are cleared in an average of 8.5 hours. Cold chain logistics facilities cover 35.2% of the network. The first two indicators reach high-level completion, while cold chain coverage is at a moderate level. This shows solid foundations for efficient logistics and customs clearance, but specialized logistics facilities need further improvement.

A comprehensive evaluation of the four dimensions reveals that China–Central Asia agricultural trade is at the "high potential, high support, and high perfection" level in terms of "potential, policy, and foundation". This conclusion reflects the rationality of potential assessment and confirms the strong growth resilience and development space of current bilateral agricultural trade, laying a foundation for future cooperation.

3.2. Data analysis of potential subsectors

To identify specific product categories with sustained growth momentum, this study analyzed bilateral agricultural trade from 2018 to 2023. Categories with a compound annual growth rate (CAGR) exceeding 15% were selected and cross-validated using the complementarity coefficient (CMCI). This process identified eight core categories with high growth potential.

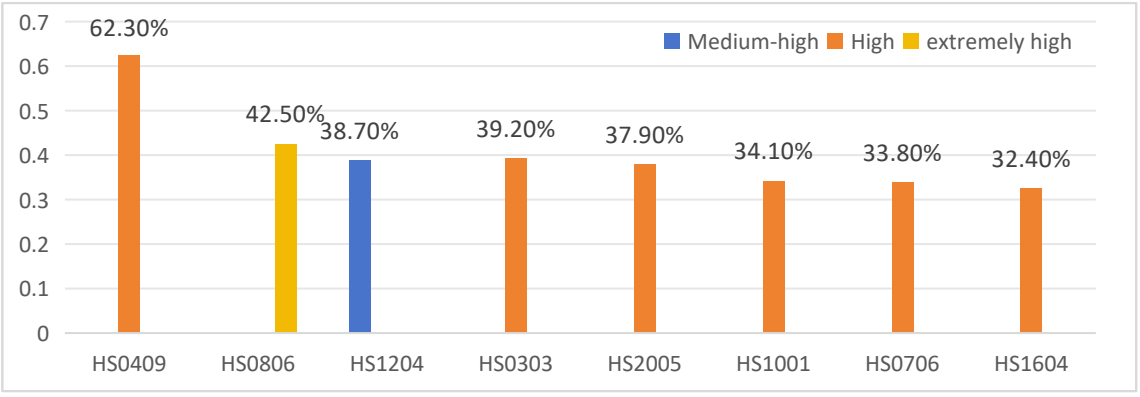

Figure 1. Compound growth rate of high-growth agricultural segments. 1.HS0409 Natural honey; HS0806 Raisins; HS1204 Flaxseed; HS0303 Frozen fish; HS2005 Vegetable products; HS1001 Wheat and wheat blends; HS0706 Edible vegetables; HS1604 Fish and shellfish products. 2.

High-growth potential categories have three prominent features, showing strong development momentum and market prospects. First, the export of Central Asia's distinctive agricultural products drives growth. Natural honey, raisins, and flaxseeds perform well, with year-on-year increases of 62.3%, 41.5%, and 38.7%, respectively. Their CMCI coefficients are no less than 0.44, reflecting strong international competitiveness. Their penetration rate in the Chinese market is below 5%, indicating great growth potential. In the next 3-5 years, with market demand expansion and trade channel optimization, related trade volume may grow 2-3 times.

Secondly, China's export growth rate is remarkable. Vegetable and fish products increased by 37.9% and 32.4% year-on-year, respectively, aligning with Central Asia's food industry upgrading demand, showing complementarity and cooperation potential. Central Asia's import growth rate of China's processed agricultural products exceeded 28%, and its share in China's total agricultural product imports is expected to rise from 16.3% to over 30%, optimizing the bilateral trade structure [2].

Finally, the wheat trade grew steadily. Driven by Kazakhstan's increased production and China's growing demand, wheat imports reached 1.3218 million tons in 2023, showing stable supply-demand alignment. The annual import value is expected to exceed $500 million, highlighting wheat's key role and long-term growth potential. Overall, these features reflect current trade vibrancy and provide a foundation and prospects for future cooperation.

4. Contrast of potential constraints and breakthrough space

4.1. Gap analysis based on terms of trade

Given agricultural trade characteristics, cross-border logistics costs, tariff levels, and inspection and quarantine efficiency are obstacles to bilateral trade. High logistics costs, from relying on land transportation, are troubled by aging infrastructure, insufficient multimodal transport, and weak last-mile delivery, with a 25% loss rate, hindering small and medium-sized traders. Tariffs are restrictive as the actual tax burden differs from policy expectations. Under free trade agreements, some products face compound tax rates and quota restrictions. For example, certain products have a 22% tax burden, and quota management compresses trade profits. Low inspection and quarantine efficiency, along with the lack of mutual recognition of standards, causes frequent repeated inspections, often over 48 hours, making products depreciate

easily and prolonging trade cycles due to non-standardized procedures. Therefore, these four factors are selected to compare China-Central Asia and China-ASEAN trade, quantify gaps, and identify trade development bottlenecks.

Table 2. Analysis of the disparity in trade conditions

Constraining Factor	Measurement Indicator	China—Central Asia terms of trade	China-ASEAN terms of trade
Cross-border Logistics Cost	The proportion of logistics cost in the trade volume of agricultural products	18.7%	8.3%
Tariff Level	average applicable tariff rate on agricultural products	9.6%	3.2%
Inspection & Quarantine Efficiency	Average clearance time (hours)	8.5 hours (standard category) / 22 hours (fresh products)	3.2 hours (standard category) / 8 hours (fresh products)
Trade Facilitation Level	Electronic customs declaration coverage/ document review time	62.3%/2.8 hours	91.5%/0.9 hours

From the perspective of trade condition disparities, China—Central Asia agricultural trade faces significant constraints in multiple key aspects. In terms of logistics costs, they account for as high as 18.7% of the trade volume, far exceeding the 8.3% of China—ASEAN. The excessively long transportation distances and weak cold chain infrastructure result in a high loss rate of fresh agricultural products, reaching 12% (compared to 4% in ASEAN), severely compressing profit margins and suppressing trade in high-value-added categories. Meanwhile, the average applicable tariff rate for agricultural products reaches 9.6%,6.4 percentage points higher than ASEAN, weakening the price competitiveness and market penetration potential of related products.

Furthermore, customs clearance efficiency and trade facilitation levels remain critical bottlenecks. The inspection and quarantine process is inefficient, with average clearance times for ordinary and fresh agricultural products reaching 8.5 hours and 22 hours respectively, 5.3 and 14 hours longer than ASEAN standards. Complicated procedures and insufficient mutual recognition of standards often lead to product spoilage, hindering the development of high-velocity trade. In terms of trade facilitation, the coverage rate of electronic customs declaration stands at only 62.3%, significantly lower than ASEAN's 91.5%. Additionally, document review time is approximately three times longer than ASEAN standards, and inadequate digitalization markedly increases trade time and operational costs, undermining supply chain efficiency. These structural disparities collectively constrain the scaled development of bilateral agricultural trade, particularly for high-potential categories.

4.2. Data-based measurement based on improvement trends

By leveraging the phased implementation of national and local policy incentives alongside comprehensive infrastructure upgrade plans, we have developed a longitudinal comparative analysis framework structured as "current level—target level—improvement magnitude" to systematically identify dynamic trends in key constraining factors. This framework enables the visualization of improvement status across different time points through charts, while quantifying their potential development space and enhancement potential. The resulting data-driven insights provide clear, actionable support for decision-making processes.

Table 3. Quantitative assessment of improvement trends

Constraining Factor	Measurement indicator	2023 level	Target level for 2027	Expected improvement
Cross-border Logistics Cost	Logistics cost ratio	18.7%	11.5%	-7.2 %
Tariff Level	Average applicable tariff rate on agricultural products	9.6%	5.0%	-4.6 %
Inspection & Quarantine Efficiency	Average clearance time (hours)	8.5/22	4.0/10	-4.5 hours/-12 hours
Trade Facilitation Level	Electronic customs declaration coverage/document review time	62.3%/2.8 hours	85.0%/1.2 hours	+22.7 % / -1.6 hours

Based on the quantified targets set forth in **Table 3**, China–Central Asia agricultural trade is projected to undergo systematic improvements in the coming years through coordinated institutional reforms and infrastructure development. These measures are expected to substantially lower cross-border transaction costs and enhance overall trade facilitation.

Specifically, the anticipated completion of the China–Kyrgyzstan–Uzbekistan Railway by 2026, along with the expansion of cross-border cold-chain storage capacity to 30 facilities, is forecast to reduce the share of logistics costs in total trade volume from 18.7% in 2023 to 11.5% by 2027—a decline of 7.2 percentage points—translating to an overall logistics cost reduction of 20–30%. In parallel, ongoing negotiations for a China–Central Asia Free Trade Agreement are expected to extend zero or low-tariff treatment to over 80% of agricultural products, lowering the average applied tariff rate from 9.6% to 5.0%. Furthermore, the mutual recognition of inspection and quarantine standards, the introduction of five additional fast-track clearance channels, and the implementation of "contactless clearance" procedures are projected to shorten average clearance times for general and fresh agricultural products from 8.5 and 22 hours to 4.0 and 10 hours, respectively. Trade facilitation will also be strengthened through the upgraded Cross-Border Trade Single Window, which will integrate customs declaration, quarantine, and settlement processes, raising the electronic declaration rate from 62.3% to 85.0% and cutting document review time from 2.8 to 1.2 hours.

Collectively, these developments are poised to systematically lower trade costs, streamline customs procedures, and enhance facilitation, thereby establishing a more efficient, stable, and predictable institutional and logistical framework to support the sustained expansion of China–Central Asia agricultural trade [7].

5. Conclusion

Through a multidimensional analysis and comparative approach, this study outlines the potential and constraints in agricultural trade between China and Central Asian nations. On one hand, expanding trade volume, optimized product composition, strengthened policies, and improved infrastructure provide a solid foundation for deeper bilateral agricultural cooperation. On the other hand, high cross-border logistics costs, tariff and non-tariff barriers, suboptimal inspection and quarantine procedures, and inadequate trade facilitation restrict the scaled development of high-value-added agricultural trade, especially in fresh produce and processed goods.

The crux of unleashing the potential of China-Asia agricultural trade resides in the enhancement of systematic and institutional cooperation. This encompasses expediting the establishment of cross-border logistics channels, propelling the negotiations of free trade agreements, deepening the mutual recognition of standards, and facilitating reforms. Simultaneously, it is imperative to broaden the scope of diversified trading partners, fortify agricultural technology and capacity cooperation, construct an efficient supply-chain system, foster high-quality development of bilateral trade, and infuse dynamism into the "Belt and Road" agricultural cooperation [3,8]. Subsequent research can probe into the influence of green and digital trade.

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Disclosure statement

The authors declare no conflict of interest.

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