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Standardization Barriers in China–Kazakhstan Border-Port Logistics: Evidence from Border-Crossing Time and Cost

[1*]Cheng Yulong

Doctoral Student, Al-Farabi Kazakh National University, Almaty, Kazakhstan

https://orcid.org/0009-0008-6952-4431

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Abstract

Purpose: This study identifies the barriers to logistics standardization at China–Kazakhstan border ports, examines how they are reflected in border-crossing time and cost, and derives policy measures.

Methodology: Drawing on transaction cost economics, institutional theory and the trade facilitation literature, the study develops a four-dimensional framework (technical, institutional, informational and organizational) with one proposition per dimension and uses border-crossing time and cost as proxies for transaction costs. It compares the Alashankou–Dostyk and Horgos–Nur Zholy/Altynkol border-crossing point (BCP) pairs in the China-to-Kazakhstan direction, using BCP-level means, medians and sample sizes for 2019–2024 from the Corridor Performance Measurement and Monitoring (CPMM) mechanism of the Central Asia Regional Economic Cooperation (CAREC) Program.

Findings: At the rail gauge interface, transloading took about three hours, whereas waiting for wagons, where it occurred, lasted 52–94 hours; similar means and medians at the Kazakh receiving stations indicate that long crossings affect most shipments. Road crossing time and cost were higher on the Chinese side, where regulation requires cargo to change carriers. In both modes, delay concentrated where cargo passes from one national system to the other. The informational and organizational dimensions could be assessed only qualitatively.

Unique contribution to theory, practice and policy: The study provides paired-BCP evidence on where standardization-related frictions arise on a major Eurasian corridor and separates fixed gauge infrastructure from the procedural standards that can be harmonized. It orders policy measures by the strength of evidence and their feasibility under Eurasian Economic Union (EAEU) rules, placing the coordination of capacity and wagon supply at paired rail stations first, followed by carrier access and transfer procedures at road crossings.

Keywords: *China–Kazakhstan Border Ports, Logistics Standardization, Transaction Costs, Trade Facilitation, Border-Crossing Time*

JEL Codes: *F13, F15, L92, R41*

1. INTRODUCTION

Kazakhstan is China's largest trading partner in Central Asia and a key transit country on the Silk Road Economic Belt. Bilateral merchandise trade reached USD 43.8 billion in 2024 according to China's General Administration of Customs (The Astana Times, 2025), and rail freight between the two countries reached a record 32 million tonnes (CAREC Institute, 2026, p. 31).[1] As volumes grow, the efficiency of border ports increasingly determines the performance of the corridor as a whole.

Border ports are where the technical norms, regulatory rules and information systems of two countries meet. In this study, border-port logistics refers to inspection, transloading, customs clearance, temporary storage and document processing at border-crossing points (BCPs), and logistics standardization denotes unified technical specifications and administrative requirements for these operations (Jiao, 2020, p. 164). Where national rules diverge, the divergence materializes as repeated inspections, longer dwell times and additional charges (Wu & Lao, 2020, p. 34), and the international literature shows that such delays are costly for trade (Djankov et al., 2010; Hummels & Schaur, 2013).

Research on China–Kazakhstan logistics is largely descriptive and published in Chinese (Cang, 2019; Jiao, 2020; Wu & Lao, 2020). It lacks a framework that links divergent standards to the transaction costs they generate, and it rarely uses systematic border-crossing monitoring data, so the magnitude of standardization-related frictions, and the side of the border on which they arise, remain unclear.

This study therefore asks: (RQ1) What barriers impede the standardization of China–Kazakhstan border-port logistics? (RQ2) How are these barriers reflected in border-crossing time and cost? (RQ3) Which policy measures can reduce them, and in what order of priority? RQ2 is answered empirically for the technical and institutional dimensions and qualitatively for the informational and organizational dimensions, for which no quantitative indicators are available.

The study makes two contributions. Conceptually, it combines transaction cost economics, institutional theory and the trade facilitation literature in a four-dimensional framework with propositions, and it separates fixed gauge infrastructure from procedural standards. Empirically, it uses monitoring data from the Corridor Performance Measurement and Monitoring (CPMM) mechanism of the Central Asia Regional Economic Cooperation (CAREC) Program for two paired BCPs over 2019–2024, which allows the two sides of each crossing, rather than only the two countries, to be compared. Section 2 reviews the literature and develops the framework, Section 3 describes the research design, data and context, Section 4 presents the results, Section 5 discusses them, Section 6 sets out policy implications, and Section 7 concludes.

[1]The CPMM 2024 report gives a lower figure of USD 30.1 billion without stating a source (CAREC Institute, 2026, p. 31); differences between partner-country trade records are common.

2. LITERATURE REVIEW AND ANALYTICAL FRAMEWORK

2.1 Theoretical Perspectives

Transaction cost economics holds that the cost of an exchange depends on asset specificity, uncertainty and frequency, and comprises the costs of search, negotiation, monitoring and enforcement (Williamson, 1985). Each attribute has a counterpart at China–Kazakhstan border ports. Rolling stock and transloading equipment are tied to one gauge and one side of the border; inspections and the availability of wagons on the receiving side are uncertain; and because the same corridors carry recurrent shipments, standing institutional arrangements are more economical than case-by-case negotiation. Institutional theory regards standards, regulations and certification procedures as formal institutions that define the rules of exchange (North, 1990). Differences between national institutional environments constitute institutional distance, which mutual recognition narrows by allowing one country's certification and inspection results to be accepted by the other. The trade facilitation approach links trade performance to port efficiency, the customs and regulatory environment and information infrastructure (Wilson et al., 2003).

2.2 Border Delays, Trade Facilitation and Standards

Time and cost at the border are established measures of trade frictions. Djankov et al. (2010) show that each additional day of delay before shipment reduces trade, and Hummels and Schaur (2013) estimate that each day in transit is worth 0.6–2.1% of the value of goods. Portugal-Perez and Wilson (2012) find that both hard infrastructure, such as transport networks, and soft infrastructure, such as border efficiency and the business environment, affect export performance. Reviews of the literature on standards find that shared international standards generally facilitate trade, whereas divergent national standards can act as barriers (Swann, 2010). For the Eurasian land bridge, Pomfret (2019a, 2019b) shows that the growth of China–Europe rail services has depended on improvements in logistics services and border procedures as well as on physical links. This literature justifies crossing time and cost as proxies for transaction costs, since both directly express the search, monitoring and enforcement activities that take place at the border, and it suggests distinguishing the hard element of the gauge interface from the soft, procedural elements that standardization can address.

2.3 Standardization at China–Kazakhstan Border Ports

Studies of China–Kazakhstan logistics consistently identify standardization as a constraint. Cang (2019) and Li (2023) examine Xinjiang border ports and cross-border transport facilitation, pointing to unaligned transloading and vehicle standards and a shortage of qualified personnel. Shen and Starshova (2020) highlight differences in information systems and data interfaces. Wu and Lao (2020) use system dynamics simulation to show that cross-border collaboration, including informatization and mutual recognition, affects logistics performance. Xing (2022) stresses the reliance on ad hoc negotiation rather than regular coordination mechanisms, and Jiao (2020)

discusses efficiency at the logistics transit base in Lianyungang. These studies describe individual barriers but neither relate them to a common mechanism nor examine them with monitoring data.

2.4 Analytical Framework and Propositions

The study distinguishes four dimensions of border-port logistics standardization: (1) technical and operational standards at the gauge interface, such as transloading procedures, loading and securing rules, equipment specifications and capacity planning; (2) institutional and regulatory standards, such as certification, sanitary and phytosanitary (SPS) inspection, rules on carrier access and the mutual recognition of controls and documents; (3) document and information standards, such as document formats, data interfaces and transmission protocols; and (4) organizational and human-resource conditions, such as enterprise participation and the supply of qualified specialists. The 85 mm difference in rail gauge is treated not as a standard to be harmonized but as fixed infrastructure that creates the need for an interface operation; standardization concerns how that operation is organized. One proposition is formulated for each dimension:

P1 (technical): At the rail gauge interface, the duration of crossing depends more on the coordination of capacity and wagon supply between paired stations than on the transloading operation itself.

P2 (institutional): Regulatory requirements that force cargo to change carriers or to be inspected again at the border increase crossing time and cost on the side where they apply, even when infrastructure remains unchanged.

P3 (informational): Inconsistent document and data standards generate additional documentation costs, such as duplicate filing and error correction.

P4 (organizational): Limited enterprise participation and a shortage of qualified specialists impede the implementation of common standards.

3. RESEARCH DESIGN, DATA AND CONTEXT

3.1 Case Selection

The study adopts a comparative case design of two purposively selected BCP pairs in the China-to-Kazakhstan direction: Alashankou–Dostyk on CAREC Corridor 1a, and Horgos–Nur Zholy/Altynkol on Corridor 1b, where Nur Zholy is the Kazakh road crossing and Altynkol the Kazakh rail crossing. Alashankou and Horgos are China's principal land ports towards Central Asia and Europe, serve as exit points for westbound China–Europe trains (Li, 2023, p. 88) and are continuously covered by CPMM monitoring. The results therefore describe two pairs in one direction and may not generalize to the Kazakhstan-to-China direction or to other corridors.

3.2 Context

Rail dominates bilateral freight. Because China uses the 1,435 mm standard gauge and Kazakhstan the 1,520 mm broad gauge (Wu & Lao, 2020, p. 36), every cross-border rail shipment must change

gauge. This can technically be done by transloading cargo or containers, exchanging bogies or using variable-gauge wheelsets; at the BCPs examined here, shipments are transferred to Kazakh trains (CAREC Institute, 2026, p. 14). Traffic is growing: transit through Kazakhstan rose by 19% to 15.3 million tonnes in 2024, and rail throughput at Alashankou rose from 14.3 million tonnes in 2020 to 16.6 million tonnes (CAREC Institute, 2026, pp. 31–33). The alignment of the Belt and Road Initiative with Kazakhstan's Nurly Zhol policy and the China–Kazakhstan Cooperation Committee provide a policy basis for cooperation (Li, 2023, p. 87; Xing, 2022, p. 29). However, as a member of the EAEU, Kazakhstan applies customs rules and many technical regulations set at the Union level (Eurasian Economic Union, 2014), which limits the scope of bilateral agreements. Paper documents remain in use alongside electronic ones, the sharing of logistics data is at an early stage, and specialists familiar with both countries' systems are scarce (Cang, 2019, p. 14; Li, 2023, p. 90; Wu & Lao, 2020, p. 37; Xing, 2022, p. 27). At the country level, the World Bank Logistics Performance Index (LPI) placed China 19th (score 3.7) and Kazakhstan 79th (2.7) in 2023, with gaps in customs (3.3 vs. 2.6), infrastructure (4.0 vs. 2.5) and tracking and tracing (3.8 vs. 2.8) (World Bank, 2023). Because the LPI is perception-based and its methodology has changed between editions (Arvis et al., 2023), it is used here only as context.

3.3 Data and Measures

The CPMM mechanism compiles the time and cost of actual commercial shipments reported by partner freight-forwarding and carrier associations (Asian Development Bank, 2020, 2021; CAREC Secretariat, 2022, 2023; CAREC Institute, 2025, 2026). Border-crossing time (TFI1) runs from a shipment's arrival at the BCP, including queuing, to its authorization to leave, and covers inspection, loading and unloading and, for rail, the change of gauge; border-crossing cost (TFI2) includes official and unofficial payments (CAREC Institute, 2026). At the Chinese BCPs the indicators record the outbound process and at the Kazakh BCPs the inbound process. The two sides of a pair thus measure different stages of one crossing, and they are compared to locate where delay arises, not to rank the efficiency of national agencies. Because only the inbound rail process includes the change of gauge, longer times on the Kazakh side are partly a consequence of this design; the more informative evidence lies in the dispersion of crossing times and in the composition of the time spent at the interface.

The study uses the BCP-level means, medians and sample sizes published in the CPMM annual reports for 2019–2024, not individual shipment records. Sample sizes range from 6 to 133 shipments at the road BCPs and from 132 to 253 at the rail BCPs (Appendix Table A1). The rail counts on the two sides of each pair are identical in 2023–2024 and nearly identical in 2022, which suggests that largely the same consignments were recorded on both sides. The 2024 road values for Alashankou and Dostyk rest on six shipments each and are interpreted with caution. Because Kazakhstan had no CPMM partner association in 2024, its performance in that year was measured from shipments carried by partners in other countries, and the outbound value for Nur Zholy, based on two shipments, is not used (CAREC Institute, 2026, pp. 10, 15).

3.4 Analytical Procedure

Crossing time and cost are compared between the two sides of each pair and across years. Because shipment-level records are unavailable, dispersion is assessed by comparing means with medians, and no statistical tests are performed. Rail activity records for 2023 and 2024 are then examined to locate the sources of delay, and the results are assessed against propositions P1–P4. The analysis is descriptive and does not attempt causal inference.

4. RESULTS

4.1 Rail Crossings

Tables 1 and 2 report mean and median crossing time and cost for 2019–2024.

Table 1: Border-Crossing Time at Paired China–Kazakhstan BCPs, China-to-Kazakhstan Direction, 2019–2024 (Hours, Mean and Median)

Mode	BCP	2019	2020	2021	2022	2023	2024
Road	Alashankou (PRC)	–	18.6 (8.3)	61.7 (46.0)	81.3 (68.4)	37.2 (27.8)	19.4 (20.0)
	Dostyk (KAZ)	–	17.0 (6.7)	46.8 (41.4)	20.7 (15.9)	22.2 (12.8)	11.9 (12.2)
	Horgos (PRC)	11.0 (6.9)	16.4 (12.4)	77.5 (72.4)	23.5 (10.7)	51.4 (31.7)	44.8 (35.0)
	Nur Zholy (KAZ)	3.5 (3.3)	5.1 (5.1)	19.6 (6.9)	10.7 (5.7)	16.5 (15.9)	22.0 (16.4)
Rail	Alashankou (PRC)	17.3 (16.8)	26.9 (22.3)	80.2 (42.4)	30.5 (23.4)	17.5 (19.5)	19.2 (7.7)
	Dostyk (KAZ)	48.2 (47.6)	72.7 (54.8)	70.0 (66.0)	76.1 (70.4)	74.3 (73.1)	61.0 (60.6)
	Horgos (PRC)	7.6 (1.3)	12.7 (1.2)	58.7 (43.0)	34.8 (21.9)	12.5 (6.5)	22.6 (13.7)
	Altynkol (KAZ)	44.7 (48.9)	51.4 (49.2)	65.9 (61.8)	82.6 (73.5)	76.9 (66.0)	59.9 (63.7)

Note: Mean (median). Chinese BCPs, outbound; Kazakh BCPs, inbound. Alashankou–Dostyk lies on CAREC Corridor 1a and Horgos–Nur Zholy/Altynkol on Corridor 1b. Horgos is the spelling used in CPMM data (also Khorgos). – = not reported. Sample sizes in Appendix Table A1. Source: Compiled by the author based on Asian Development Bank (2020, pp. 86–95; 2021, pp. 80–89), CAREC Secretariat (2022, pp. 75–82; 2023, pp. 63–70) and CAREC Institute (2025, pp. 74–80; 2026, pp. 66–72).

Table 2: Border-Crossing Cost at Paired China–Kazakhstan BCPs, China-to-Kazakhstan Direction, 2019–2024 (USD, Mean and Median)

Mode	BCP	2019	2020	2021	2022	2023	2024
Road	Alashankou (PRC)	–	590 (583)	610 (642)	638 (653)	821 (837)	678 (831)
	Dostyk (KAZ)	–	602 (600)	4,840 (612)	4,499 (2,537)	601 (600)	633 (650)
	Horgos (PRC)	450 (457)	1,658 (700)	5,809 (6,134)	1,861 (1,141)	723 (722)	712 (720)
	Nur Zholy (KAZ)	277 (310)	315 (290)	3,918 (280)	1,326 (336)	319 (320)	411 (330)
Rail	Alashankou (PRC)	2 (–)	–	8 (0)	0 (0)	0 (0)	0 (0)
	Dostyk (KAZ)	534 (425)	524 (425)	398 (425)	361 (425)	378 (425)	357 (300)
	Horgos (PRC)	14 (–)	–	15 (19)	2 (0)	0 (0)	0 (0)
	Altynkol (KAZ)	252 (114)	271 (114)	276 (425)	260 (320)	285 (425)	393 (425)

Note: Mean (median), including official and unofficial payments. – = not reported. The 2023 medians for the Chinese road BCPs are taken from Appendix 9 of the 2023 report, because the median column of its Table 4.3 repeats the means. Source: As for Table 1.

On the basis of medians, crossing time at the Kazakh receiving station exceeded that at the Chinese station in every year at both pairs; in 2024 the medians were 60.6 vs. 7.7 hours at Alashankou–Dostyk and 63.7 vs. 13.7 hours at Horgos–Altynkol. As noted in Section 3.3, this difference partly reflects the fact that only the inbound process includes the change of gauge. Mean time at Dostyk and Altynkol was 2.8 and 5.9 times that on the Chinese side in 2019, and 3.2 and 2.7 times in 2024 (Figure 1). The two sides also differ in dispersion. At the Kazakh stations means and medians are close (for example, 61.0 and 60.6 hours at Dostyk in 2024), indicating that long crossing times affect most shipments; at the Chinese stations the mean usually exceeds the median by a wide margin (19.2 vs. 7.7 hours at Alashankou in 2024), indicating a minority of long delays. Part of this tail appears to originate on the Kazakh side, as trains are held at Horgos after completing Chinese formalities until Altynkol has completed controls and the change of gauge for preceding trains (CAREC Institute, 2026, p. 36). The CPMM reports attribute the longer Kazakh times to gauge-change operations, stricter customs control and mismatched throughput between paired stations (CAREC Institute, 2025, p. 13; 2026, p. 34); the data are consistent with this attribution but do not test it.

Rail costs follow the same pattern. Outbound costs at Alashankou and Horgos never exceeded USD 15, whereas inbound costs at Dostyk and Altynkol ranged from USD 252 to USD 534 (Table 2), associated mainly with gauge change and border fees (CAREC Institute, 2025, p. 19; 2026, p.

14). The recurrence of a USD 425 median at Dostyk in five of six years suggests a standard charge per consignment.

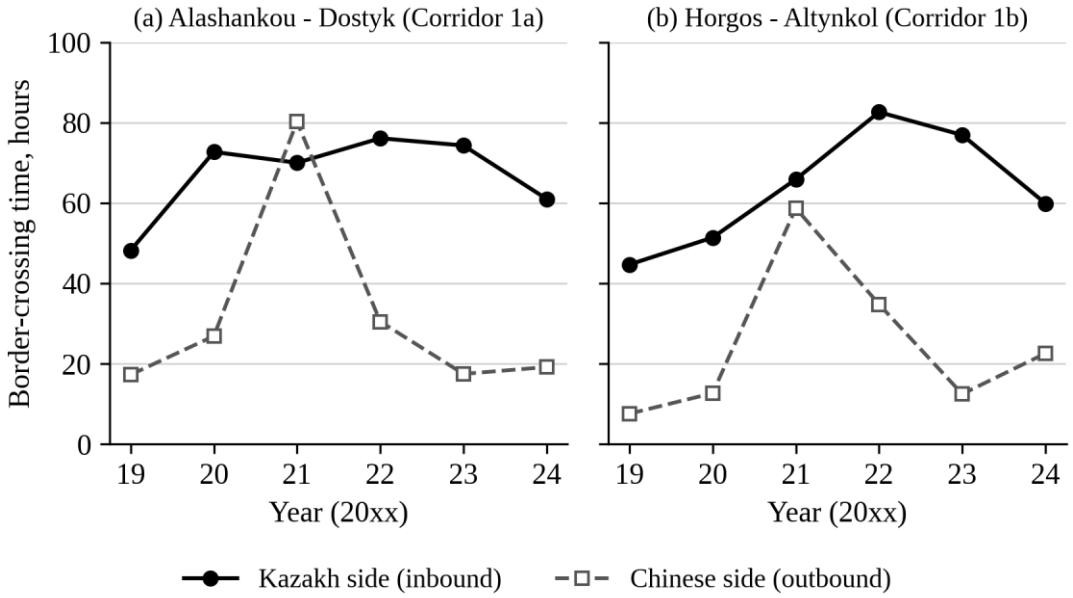

Figure 1: Rail Border-Crossing Time on Both Sides of the Alashankou–Dostyk and Horgos–Altynkol BCP Pairs, 2019–2024 (Hours, Mean)

Source: Table 1.

4.2 Road Crossings

In road transport the pattern is reversed. In every year for which both sides are reported, crossing time was longer on the Chinese side at both pairs (for example, 77.5 vs. 19.6 hours at Horgos–Nur Zholy in 2021, and 44.8 vs. 22.0 hours in 2024), and costs were higher on the Chinese side in most years (USD 712 vs. 411 at Horgos–Nur Zholy in 2024). Although the 2024 values for Alashankou and Dostyk rest on six shipments each, the ordering is the same in 2020–2023, when samples were larger (24–41 shipments). The likely mechanism is regulatory. Chinese trucks are generally not permitted to operate in Central Asia, so goods are unloaded into temporary warehouses in the bonded zone on the Chinese side to await Kazakh carriers, which the CPMM identifies as the main reason for delay at Horgos (CAREC Institute, 2025, p. 12; 2026, p. 11); only a few, costly bonded Chinese carriers may deliver directly to Kazakhstan (CAREC Institute, 2026, p. 35). High volumes and queuing add to the delay (CAREC Institute, 2026, pp. 10, 17).

Road results are, however, confounded by COVID-19-era controls and traffic growth. The average outbound road crossing cost in China rose from USD 181 in 2019 to USD 1,413 in 2021 before falling to USD 442 in 2024 (Asian Development Bank, 2020, p. 34; CAREC Secretariat, 2022, p. 31; CAREC Institute, 2026, p. 22), and Alashankou's road time peaked at 81.3 hours in 2022. In 2021 the median cost at Horgos (USD 6,134) was as high as the mean, indicating that the increase

affected the typical shipment, whereas the high means at Dostyk and Nur Zholy (USD 4,840 and USD 3,918) were driven by a minority of shipments, the medians remaining at USD 612 and USD 280.

4.3 Rail Crossing Activities

The CPMM activity records locate the delay at the Kazakh rail stations. In 2023, transloading took on average 2.3 hours at Altynkol and 3.5 hours at Dostyk, whereas waiting for unavailable wagons averaged 94.2 and 66.0 hours; in 2024 the corresponding values were 3.3 and 3.4 hours for transloading and 60.9 and 52.4 hours for waiting (CAREC Institute, 2025, pp. 79–80; 2026, pp. 71–72). Transloading accounted for USD 207–300 of the crossing cost and customs inspection for USD 82–141. These activity values are averages over the shipments that recorded each activity: the average wait at Altynkol in 2023 (94.2 hours) exceeds the overall mean (76.9 hours), so at most about 82% of shipments there can have recorded waiting. Because the share of shipments affected is not published, the data show that waiting, where it occurs, far exceeds transloading, but not that it is the main source of delay for all shipments. This reading is consistent with the CPMM case study, which reports that both BCPs at Alashankou–Dostyk operate near design capacity and that Dostyk and Altynkol need to be expanded to match the Chinese side (CAREC Institute, 2026, pp. 37–38).

5. DISCUSSION

5.1 Assessment of the Propositions

P1 is supported by the rail evidence. The concentration of time and cost at the Kazakh stations partly follows from the measurement design, but the composition of crossing time does not: transloading itself takes about three hours, whereas waiting for wagons, where it occurs, takes 52–94 hours, and the similar means and medians at the Kazakh stations show that long crossings affect most shipments. The duration of the interface thus depends chiefly on the coordination of wagon supply and handling capacity between paired stations (CAREC Institute, 2026, pp. 36–38), alongside transloading, loading and securing rules and vehicle standards that have not been systematically aligned (Cang, 2019, p. 14; Xing, 2022, p. 28).

P2 is partly supported by the road evidence. The longer times and higher costs on the Chinese side accompany a regulatory requirement rather than any infrastructure difference: because Chinese trucks are generally not permitted to operate in Central Asia, cargo must change carriers in the bonded zone. Road costs also rose sharply under pandemic controls while infrastructure was unchanged. Cooperation relies on ad hoc negotiation (Xing, 2022, p. 28), mutual recognition of certification and inspection results remains insufficient (Wu & Lao, 2020, p. 38), and Horgos lacks synchronized inspection systems (CAREC Institute, 2025, p. 7). Because pandemic controls and volume growth are confounded with the regulatory regime, however, the data cannot isolate the effect of regulation.

P3 and P4 cannot be tested with the available indicators. The literature and reports are consistent with them: enterprises file repetitive forms with several agencies (Xing, 2022, p. 28), document corrections at Dostyk are costly (CAREC Institute, 2025, p. 19), information systems differ in data formats and interfaces (Shen & Starshova, 2020, p. 118), electronic data systems are unevenly adopted on China–Europe routes (CAREC Institute, 2025, p. 48), and enterprise participation and qualified specialists are limited (Cang, 2019, p. 14; Li, 2023, p. 90). Table 3 summarizes the assessment.

Table 3: Standardization Gaps and Evidence by Dimension

Dimension	Main gap	Evidence on time and cost	Policy measure
Technical and operational (P1)	Gauge interface is fixed infrastructure; wagon supply and capacity of paired stations not coordinated; transloading, loading-securing and vehicle standards not aligned	Measured (rail): waiting for wagons far exceeds transloading; Kazakh means ≈ medians	Coordinate capacity and wagon supply; align interface procedures (6.1)
Institutional and regulatory (P2)	Carrier-access rules force cargo to change carriers in the bonded zone; no regular mutual recognition of controls; no synchronized inspection at Horgos; customs rules set at EAEU level	Measured but confounded (road): time and cost higher on the Chinese side, where cargo changes carriers; pandemic-era cost peak	Wider bonded-carrier access and simpler transfer; mutual recognition pilots (6.2)
Document and information (P3)	Paper and electronic documents in parallel; repetitive forms; differing data formats and interfaces	Not measured; reported error-correction costs at Dostyk	Common electronic documents and data exchange (6.3)
Organizational and human resources (P4)	Limited enterprise participation; shortage of qualified specialists	Not measured	Public–private consultation and joint training (6.4)

Source: Compiled by the author based on Sections 3–5.

5.2 International Evidence and Theoretical Implications

Taken together, the rail and road evidence shows a common pattern: in both modes, delay concentrates where cargo passes from one national system to the other, through the gauge interface for rail and through the change of carriers for road. The magnitudes are economically relevant. In 2024, the Kazakh side added about 42 hours at Alashankou–Dostyk and 37 hours at Horgos–Altynkol, or roughly 1.5–1.7 days. Applied to the estimate of Hummels and Schaur (2013), this corresponds to an ad valorem equivalent of roughly 1–4%, a figure that is only illustrative because

their estimates derive from other modes and markets. The concentration of delay at the interface between two systems is consistent with the emphasis of Portugal-Perez and Wilson (2012) and Pomfret (2019a) on soft infrastructure and border procedures. The results are also compatible with transaction cost reasoning: gauge-specific assets and uncertain wagon availability raise monitoring and coordination costs at the receiving station, and recurrent flows would justify standing arrangements such as joint capacity planning in place of case-by-case negotiation. Testing these mechanisms formally would require shipment-level data.

6. POLICY IMPLICATIONS

The measures below are ordered by the strength of the supporting evidence and their feasibility under EAEU rules (Table 4).

6.1 Coordinating Capacity and Wagon Supply at Paired Rail Stations

The strongest evidence concerns the rail interface. China State Railway Group and Kazakhstan Temir Zholy, together with the border station administrations, should jointly plan wagon supply and handling capacity at Alashankou–Dostyk and Horgos–Altynkol and align transloading procedures, loading and securing rules and equipment specifications (Wu & Lao, 2020, p. 39). Because waiting for wagons was the longest recorded activity where it occurred, and the CPMM itself recommends expanding capacity at Dostyk and Altynkol (CAREC Institute, 2026, p. 38), capacity coordination should accompany procedural harmonization rather than follow it. These measures fall largely within the competence of the two railway operators and are feasible in the short term without changes to EAEU law.

6.2 Carrier Access and Mutual Recognition at Road Crossings

The road evidence points first to the rules that force cargo to change carriers. The transport ministries and customs authorities of the two countries, including China's General Administration of Customs and Kazakhstan's State Revenue Committee, could widen access for bonded carriers and simplify the transfer procedure in the bonded zone at Horgos–Nur Zholy, where only a few, costly bonded carriers currently operate (CAREC Institute, 2026, p. 35). Mutual recognition of selected controls and joint inspection could be piloted alongside, using the Kazakhstan–China Khorgos BCP Joint Border Commission as the coordinating body (CAREC Institute, 2025, p. 42) and the experience of the Khorgos International Border Cooperation Center (Li, 2023, p. 89), and the risk management and non-intrusive inspection already applied at Alashankou–Dostyk could be extended (CAREC Institute, 2025, p. 42). Because carrier access depends on bilateral road transport arrangements and Kazakh customs procedures are governed by EAEU rules (Eurasian Economic Union, 2014), these are medium-term measures.

6.3 Common Electronic Documents and Data Exchange

Customs, railway and quarantine agencies should coordinate document formats and data criteria (Xing, 2022, p. 29) and develop data exchange on cargo status and clearance progress (Shen &

Starshova, 2020, p. 118; Wu & Lao, 2020, p. 39), including harmonized documentation, pre-arrival processing and rail cargo tracking for China–Europe trains (CAREC Institute, 2025, p. 49). Because the evidence is qualitative and Kazakh systems must remain compatible with EAEU systems, this is a medium- to long-term measure.

6.4 Enterprise Participation and Specialist Training

Logistics enterprises should be involved in designing and testing interface procedures through regular public–private consultation linked to the joint border commission, with procedural changes and expected processing times published in advance (CAREC Institute, 2025, p. 42), and universities and industry associations in both countries should jointly train specialists (Li, 2023, p. 90). These measures support the others but rest on the weakest evidence.

Table 4: Ordering of Policy Measures

Order	Measure	Responsible bodies	Time frame	Feasibility and constraints
1	Joint planning of wagon supply and capacity; aligned interface procedures at paired rail stations	China State Railway Group; Kazakhstan Temir Zholy; border station administrations	Short term	Operational; largely bilateral; strongest evidence
2	Wider bonded-carrier access and simpler transfer at Horgos–Nur Zholy; mutual recognition pilots and joint inspection	Transport ministries; GACC; State Revenue Committee of Kazakhstan; Joint Border Commission	Medium term	Depends on bilateral road transport arrangements and EAEU customs rules; evidence confounded by pandemic and volume
3	Common electronic documents, data exchange and cargo tracking	Customs, railway and quarantine agencies	Medium to long term	Requires compatibility with EAEU systems; qualitative evidence
4	Public–private consultation and joint training of specialists	Joint Border Commission; universities; industry associations	Long term	Supporting measure; weakest evidence

Source: Compiled by the author.

7. CONCLUSION

Using CPMM data for 2019–2024, this study examined standardization barriers at two China–Kazakhstan BCP pairs. Within the limits of these data, three findings emerge. First, at the rail gauge interface, transloading itself takes about three hours, whereas waiting for wagons, where it

occurs, lasts far longer, and similar means and medians at the Kazakh stations show that long crossings affect most shipments; coordinating wagon supply and capacity at paired stations therefore matters as much as harmonizing procedures. Second, road crossing time and cost concentrate on the Chinese side, where regulation requires cargo to change carriers. Third, in both modes delay arises where cargo passes from one national system to the other. The evidence thus suggests that the main frictions extend beyond standardization in the narrow sense to capacity coordination and carrier access.

The study has several limitations. It relies on published BCP-level means and medians, some based on small samples, and cannot perform statistical tests or separate the effect of standards from those of pandemic controls and traffic growth. It covers two BCP pairs in one direction; the outbound and inbound indicators measure different stages of a crossing, so that the longer inbound rail times partly reflect the measurement design; the activity data cover two years and do not report the share of shipments affected; and the informational and organizational dimensions are assessed only from the literature. Future research could use shipment-level CPMM records to model the determinants of crossing time, apply a gravity model to quantify the effect of standardization on trade costs (Wilson et al., 2003), and extend the analysis to the Kazakhstan-to-China direction and other CAREC corridors.

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APPENDIX

Table A1: Number of Shipment Samples by BCP, China-to-Kazakhstan Direction, 2019–2024

Mode	BCP	2019	2020	2021	2022	2023	2024
Road	Alashankou (PRC)	–	26	41	36	36	6
	Dostyk (KAZ)	–	24	41	36	37	6
	Horgos (PRC)	54	133	76	72	72	72
	Nur Zholy (KAZ)	18	133	76	72	72	76
Rail	Alashankou (PRC)	133	143	212	238	253	210
	Dostyk (KAZ)	145	143	132	238	253	210
	Horgos (PRC)	167	161	189	217	147	150
	Altynkol (KAZ)	167	157	171	218	147	150

Note: – = not reported. In the 2019 report the Kazakh road BCP opposite Horgos appears both as Nur Zholy and as Khorgos (KAZ); the Nur Zholy values are used for consistency with later years. Source: Compiled by the author based on Asian Development Bank (2020, pp. 86–95; 2021, pp. 80–89), CAREC Secretariat (2022, pp. 75–82; 2023, pp. 63–70) and CAREC Institute (2025, pp. 74–80; 2026, pp. 66–72).

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