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KAZAKHSTAN – CHINA COOPERATION IN THE DEVELOPMENT OF THE MIDDLE EURASIAN TRANSPORT CORRIDOR

Abstract

The article examines the strategic partnership in the development of the Eurasian transcontinental transport corridor system, as well as in the Republic of Kazakhstan and the People's Republic of China. Special focus has been placed on the Kazakhstani section of the Middle Corridor (Trans-Caspian International Transport Route) – a multilateral, multimodal route connecting Chinese and European marketplaces through Kazakhstan and the Caspian Sea. The aim of the work is to determine how the mechanisms of synergy of infrastructure (infrastructure synergies) and factors defining corridor sustainability are determined using World Bank data (WITS, Logistics Performance Index), analytical material of international organizations, and scientific papers registered in Scopus. The article states that "physical" investments in railway, port, and terminal infrastructure can only yield long-term economic benefits if they are accompanied by trade facilitation, the electronic integration of all procedures, and the formation of institutional corridor governance structures. It has also been demonstrated that the primary restriction in the Middle Corridor is the extreme variability in transit times and costs; this restriction occurs in the majority of cases at intermodal nodes and border crossing points. Therefore, the authors propose a framework for developing corridors based on services, in which priorities are established end-to-end using indicators of logistics service reliability, and transit nodes are converted into logistics and industrial clusters. The practical importance of the research lies in substantiating the direction for Kazakhstan's investment policies and forms of cooperation with China to reduce delays, increase predictability, and increase domestic value-added.

Keywords: investments, transport corridors, dry ports, multimodal logistics, trade facilitation, digitalization, sustainable development.

Introduction

Cooperation between Kazakhstan and China in the development and expansion of infrastructure represents one of the key drivers of contemporary Eurasian connectivity [1]. For China, transport

corridors function as instruments for diversifying foreign trade routes and reducing logistical risks associated with congestion along maritime shipping lanes, freight rate volatility, and the vulnerability of specific nodes within global trade networks [2]. For Kazakhstan, corridor development provides a means to monetize its transit geography and transform cargo flows into a source of long-term economic growth, employment, and technological capabilities [3]. At the current stage, transport infrastructure is no longer perceived merely as a set of physical assets, but rather as an end-to-end service, the quality of which is determined not only by route length but also by the predictability of procedures, tariff transparency, and digital traceability [4].

The growing focus on the Middle Corridor reflects the fact that firms and governments increasingly assess transport routes through the lens of supply chain resilience [5]. The World Bank emphasizes that, when combined with appropriate policy measures, investments can unlock the corridor's potential to increase freight volumes significantly and reduce transit times by 2030 [6]. For Kazakhstan, this implies the need to simultaneously upgrade physical infrastructure – railways, ports, and terminals – and strengthen "soft" connectivity, including customs and control procedures, while deploying digital solutions that reduce uncertainty and transaction costs.

The research problem arises from the gap between the investment and service dimensions of corridor development. The existence of new terminals or expanded rail lines does not, in itself, guarantee route competitiveness if border crossing times remain volatile, ports are not synchronized with railway schedules, and information on cargo status and costs is not accessible in a manner that enables effective planning [7]. Consequently, the central research question is framed in terms of synergy: which combinations of investments and reforms transform infrastructure into a reproducible quality of service, and which leave the effects fragmented and short-lived. By synthesizing international datasets and policy assessments, the article clarifies how infrastructure investments, regulatory reforms, and digital integration interact to shape corridor competitiveness in the context of Kazakhstan–China cooperation, thereby contributing an operational framework that complements existing infrastructure-centered analyses.

Literature Review and Theoretical Framework. In infrastructure economics, transport networks are commonly conceptualized as capital assets that generate externalities for trade and productivity [8]. New economic geography emphasizes that reductions in transport costs and delivery times reshape the spatial organization of economic activity, expand market access, and increase firms' likelihood of integration into value chains [9]. For transit countries, a critical implication is that outcomes depend on nodes and procedures: even where mainline infrastructure exists, high border delays or unstable schedules can effectively negate potential advantages [10].

The literature on the Eurasian Land Bridge and the Belt and Road Initiative demonstrates that the performance of China – Europe routes is shaped not only by physical connectivity but also by service quality, tariff structures, and the institutional environment. Pomfret argues that demand for overland services is formed by comparisons of time and cost with maritime routes. At the same time, the supply of services is constrained not only by infrastructure capacity but also by regulation, the organization of transport operations, and the availability of ancillary services [11]. Focusing on Central Asia, Bitabarova highlights that infrastructure integration offers both diversification opportunities and dependency risks, with outcomes ultimately determined by the host country's ability to embed external investments within its own development strategy [12].

Research on multimodal logistics and dry ports underscores the pivotal role of nodes, where benefits materialize when terminals reduce "friction" at transshipment points and borders, and when a surrounding service ecosystem emerges, including warehousing, consolidation, brokerage services, and digital platforms [13]. In this context, "invisible infrastructure" in the form of electronic data interchange and document standardization becomes essential for reducing uncertainty. Studies on sustainable development and the BRI further identify environmental and social risks associated with infrastructure expansion, emphasizing the need for embedded monitoring mechanisms that increasingly position ESG considerations as a factor in corridor competitiveness [14].

Methodology and Data Sources. The study adopts an applied analytical approach that combines macro-level indicators with a corridor-based end-to-end service framework [4]. At the macro level, World Bank WITS data are used to assess China's position among Kazakhstan's trading partners [15]. At the meso level, the analysis draws on the World Bank's assessment of the Middle

Corridor and its articulated objective of enhancing corridor efficiency by 2030. In addition, the 2023 Logistics Performance Index (LPI) is used to identify weak links in Kazakhstan's logistics system and to determine which types of reforms should accompany infrastructure investments [16].

The core methodological principle is that corridor performance should be evaluated not through individual assets, but through the overall quality of service, where both average indicators and variability are critical [17]. Infrastructure synergy is understood as complementarity, whereby improvements in one element increase the returns of others: upgrading a border node yields maximum impact when internal sections have sufficient capacity and digital data exchange is in place; port development delivers results when fleet regularity and rail schedule synchronization are ensured; and the introduction of electronic procedures is effective only when operators are prepared and standards are harmonized.

Materials and methods

The empirical basis of the study is formed from open statistical and analytical materials from international organizations and sectoral institutions, including data on the structure of trade flows and partnerships, indicators of logistics performance, assessments of bottlenecks along Eurasian routes, and policy documents on corridor development and cross-border "soft" infrastructure. Key sources include the World Bank's WITS database [15], materials from the Logistics Performance Index (LPI) [16], the World Bank's studies on the Middle Corridor [6, 7], documents from the Asian Development Bank (ADB) [17] and CAREC [18] on measuring corridor performance, and reviews by the European Bank for Reconstruction and Development (EBRD) [19, 20] and UNECE [21] / UN ESCAP [22] addressing procedural digitalization, standards harmonization, and risk management.

The study's methodological approach combines systemic and institutional analysis with a comparative evaluation of transport corridors. The analysis compares routes based on key service-related indicators – transit time, cost, reliability, and variability – and examines Kazakhstan's main transit nodes – border crossings, dry ports, and Caspian Sea ports – as interconnected elements of a single end-to-end logistics value chain. This approach enables assessing corridor performance not as a set of individual infrastructure assets, but as an integrated logistics service shaped by the interaction among physical infrastructure, regulatory arrangements, and digital procedures.

The methodology combines systemic and institutional approaches, compares routes through the lenses of transit time, cost, and service reliability, and conducts a qualitative analysis of Kazakhstan's key transit nodes – border crossings, dry ports, and Caspian Sea ports – as interconnected elements within a single value chain.

A limitation of the study lies in the heterogeneity of transit statistics and differences in accounting methodologies among corridor participants. Accordingly, the findings rely on comparable trends, international assessments, and the validation of causal logic linking investments, institutional arrangements, and measurable outcomes.

Results and discussion

Empirical evidence indicates that transport and logistics cooperation between Kazakhstan and China is based not only on transit flows but also on stable bilateral trade relations [23]. According to WITS statistics for 2019, China ranked among Kazakhstan's key partners in both exports and imports, forming a "two-sided" demand base for transport services and related logistics activities, and thereby reducing the vulnerability of corridor investments to fluctuations in pure transit volumes [15]. Within this logic, investments in Eurasian connectivity simultaneously serve external transit routes and the domestic economy, as trade and transit chains rely on similar infrastructure and institutional arrangements. The effects materialize in shorter cargo turnover times, improved delivery predictability, and an expanded range of logistics services [24].

Figure 1 illustrates the configuration of the main Eurasian transport routes, including the Northern, Southern, and Middle Corridors, enabling a visual comparison of their geographic alignment, multimodal structure, and the role of Central Asian countries – above all Kazakhstan – in shaping transcontinental linkages between Chinese and European markets.

Figure 1 – Trade corridors connecting Europe and Asia

Note: World Bank Report [6].

The green "Middle Corridor" line visually assembles a route that combines multiple modes of transport and crosses several sovereign jurisdictions. The route can be described as follows: western China → overland exit through border crossings in eastern Kazakhstan (Khorgos and Dostyk are marked on the map) → rail transit across Kazakhstan to the Caspian ports → maritime leg across the Caspian Sea → renewed rail transport through the South Caucasus and Türkiye → connection to the European transport network. The key analytical value of the figure lies in the fact that, unlike the Northern route (shown in grey-beige), which is dominated by a single, continuous railway backbone, the Middle Corridor is fundamentally composed of a sequence of interfaces – "railway–port–sea–port–railway." Accordingly, the map emphasizes junction points: border crossings, ports, and intermodal terminals.

In figure 1, Kazakhstan lies where routes from China "enter" Eurasia and subsequently diverge into alternative paths. It is precisely at this stage that baseline speed and predictability are formed: congestion at entry points (Khorgos/Dostyk), schedule mismatches, control-related delays, or handling bottlenecks propagate along the entire chain, reaching as far as the Caucasus and European destinations. The map depicts Kazakhstan as the key "long" inland segment of the corridor, where investments in capacity yield results only when combined with investments in service manageability – train processing, stable time windows, digital tracking, and predictable controls. In this sense, Kazakhstan represents the segment where geography can be transformed into a service: a regular corridor product with clearly defined transit time and cost.

The most vulnerable yet strategically critical component of the green route is the Caspian crossing. On the map (figure 1), it appears as a relatively narrow "isthmus" between Kazakhstan and Azerbaijan; analytically, however, it marks the point at which rail-based logic shifts to maritime operations. This is where the most significant variability in transit time arises, driven by fleet constraints, weather conditions, port congestion, schedule mismatches, and the "warehouse effect," in which containers accumulate when maritime and rail operations are not synchronized. Figure 1, therefore, implicitly identifies the locus of infrastructure synergy: port capacity combined with adequate fleet availability, unified voyage planning, and end-to-end digital dispatching. Without this coordination, the green line remains visually coherent on the map but irregular in operational reality.

The Northern route shown in figure 1 extends in broad arcs across northern Eurasia toward Europe. It relies on a continuous land-based backbone, benefiting from the absence of maritime breaks but remaining sensitive to geopolitical and regulatory conditions along the transit path. The Southern route

(orange) stretches through Iran and the Middle East toward Türkiye and Europe, offering directional alternatives but facing its own political and infrastructural constraints. The maritime route (blue) circumvents Eurasia via the Suez Canal and major ports; it is typically cost-efficient for large-volume shipments but disadvantaged in transit time for certain cargoes and exposed to maritime bottlenecks. Against this backdrop, the map highlights the Middle Corridor's niche: it offers shorter transit times than maritime shipping and diversifies land-based transport away from the Northern route, yet requires mature management of interfaces – borders and ports – to prevent the erosion of its time advantage.

Along the green corridor, the principal risk points are clearly identifiable: Khorgos/Dostyk as the entry nodes and technological interfaces; Caspian ports and fleet availability as the primary source of variability; and the Caucasus – Türkiye segment, where railway capacity, terminal infrastructure, and procedural coordination are decisive. Figure 1 thus demonstrates that individual assets do not determine competitiveness, but rather the coherence of the entire chain. Investments limited to Kazakhstan's railway capacity, without addressing Caspian regularity and the digital integration of documents and schedules, are unlikely to stabilize the corridor service.

For Kazakhstan, the Middle Corridor can become a strategic advantage only if investments in "hard" infrastructure – tracks, terminals, and ports – are reinforced by "soft" infrastructure, including procedures, digital data exchange, and unified performance indicators for time and reliability [6].

Thus, the competitiveness of a Eurasian route is determined not so much by the presence of individual infrastructure assets as by the coherence of operations across transport modes and control procedures. In its analytical work on the Middle Trade and Transport Corridor, the World Bank demonstrates that a combination of targeted investments and efficiency-enhancing measures can multiply freight volumes and significantly reduce transit times by 2030; however, this outcome is conditional upon effective coordination, the development of intermodal infrastructure, and the digitalization of processes along the entire route [6]. For corridors that include a maritime leg, interface nodes are particularly critical, as they are the points where the most significant variability in transit times arises from congestion, schedule delays, and disruptions in information exchange. Consequently, "investment synergy" should be understood as the integration of infrastructure projects with operational solutions, ranging from technological regulations to a unified planning and dispatching logic.

Constraints are also reflected in logistics performance indicators. In the World Bank's Connecting to Compete 2023 report, Kazakhstan is classified within the group with an overall LPI score of 2.7 and a "clustered" rank of 79. At the component level, a clear imbalance is evident: customs performance is assessed at a lower level (2.5), infrastructure quality is moderate (2.6), while logistics competence is relatively stronger (2.9), and both tracking and tracing, as well as timeliness, are rated at 2.8 [16]. To place these findings in a corridor-wide context, table 1 presents the Logistics Performance Index (LPI) values for the countries along the Middle Corridor.

Table 1 – Logistics Performance Index (LPI) of the Middle Corridor countries

No.	Country	LPI (2023)
1.	China	3,6
2.	Kazakhstan	2,7
3.	Azerbaijan	2,6
4.	Georgia	2,7
5.	Türkiye	3,4
6.	Romania	3,2
7.	Bulgaria	3,1
Note: Compiled by the authors based on the source [16].		

The data presented in table 1 reflect the heterogeneity of logistics performance among the countries forming the Middle Corridor and confirm its asymmetric character as a transcontinental route. Higher values of the Logistics Performance Index in China and Türkiye indicate a more developed institutional environment, advanced digitalization of procedures, and a stable organization of supply chains. In contrast, the countries of the South Caucasus and Central Asia demonstrate moderate levels of

logistics efficiency. Kazakhstan's position, with a Logistics Performance Index score of 2.7, indicates the presence of basic infrastructure while simultaneously highlighting constraints in the quality of customs administration, the coordination of intermodal operations, and the predictability of delivery times.

This configuration implies that capacity expansion without parallel improvements in procedures and service quality will generate only limited effects: increased throughput does not guarantee shorter transit times if border delays, heterogeneous documentation requirements, and low predictability of control operations persist. The practical implication is the need for simultaneous strengthening of "hard" infrastructure, including terminals, access routes, and transshipment capacities, and "soft" infrastructure, encompassing flow management, data standards, control procedures, and service agreements.

The competitiveness of the Middle Corridor is determined not by average index values, but by bottlenecks along specific segments of the route where logistics efficiency is lower. This reinforces the need to shift from fragmented infrastructure investments to a coordinated, service-oriented model of corridor development, in which procedural harmonization, digital integration, and interstate coordination are decisive.

On the eastern segment, border railway nodes assume particular importance, as they serve as points of standard alignment and concentration of bilateral trade and transit flows. The economic efficiency of developing such nodes depends on the ability to reduce processing times during peak periods and to stabilize operational variability, since for cargo owners, the reproducibility of outcomes is more critical than isolated instances of optimal performance. In this context, the logic of the "node as a source of value added" implies a transition from simple transshipment to a broader range of services, including consolidation, warehousing, electronic commerce support, cargo assembly, and elements of light processing, allowing a portion of the value chain to be retained within the country. However, such a shift is not feasible without institutional and digital support: a service-oriented model requires a unified information environment for cargo and documentation, as well as clear rules of responsibility in the event of disruptions or delays.

The Caspian segment increases the route's dependence on the quality of the intermodal transition "railway–port–sea–port–railway," where a disruption in any single component rapidly translates into a systemic effect, leading to container accumulation and rising storage costs [25]. Consequently, the returns on port investments are determined not only by terminal modernization but also by the regularity of maritime services, schedule management, and data synchronization among operators. From the perspective of transaction costs, the critical factor is not merely the formal reduction of regulatory requirements, but the reduction of uncertainty: when all participants in the chain have access to consistent information on cargo status, expected arrival times, and document completeness, the need for "insurance" time buffers decreases, thereby enhancing the attractiveness of the route for goods that are more sensitive to time and risk.

Figure 2 then presents the projected structure of freight flows along the Middle Corridor across the Caspian Sea by 2030. The visualization is based on World Bank estimates indicating that, conditional on the implementation of a comprehensive package of measures aimed at "unlocking" the route, total volumes across the Caspian could increase to 11 million tonnes, representing more than a threefold rise compared with the baseline level (approximately +209 percent) [6].

Substantively, figure 2 is important because it separates future growth into two segments that differ in their economic nature: intra-regional trade among the Middle Corridor countries and transit freight flows. The first component ("trade") is estimated at 7 million tonnes (+169 percent), with Kazakhstan clearly dominating this segment at 6.2 million tonnes (+186 percent). This effectively positions Kazakhstan as both the key generator of flows and the central node of demand concentration for logistics services. The contributions of Georgia (0.9 million tonnes; approximately +52 percent) and Azerbaijan (0.7 million tonnes; approximately +86 percent) are significantly smaller, indicating an asymmetric distribution of volumes and, consequently, differences in national incentives for investment and reform along the corridor. For Kazakhstan, the economic logic is straightforward: even under conditions of volatile pure transit demand, the corridor remains economically justified because it serves the country's own trade base and generates domestic demand for terminals, warehousing infrastructure, consolidation services, and transport operations.

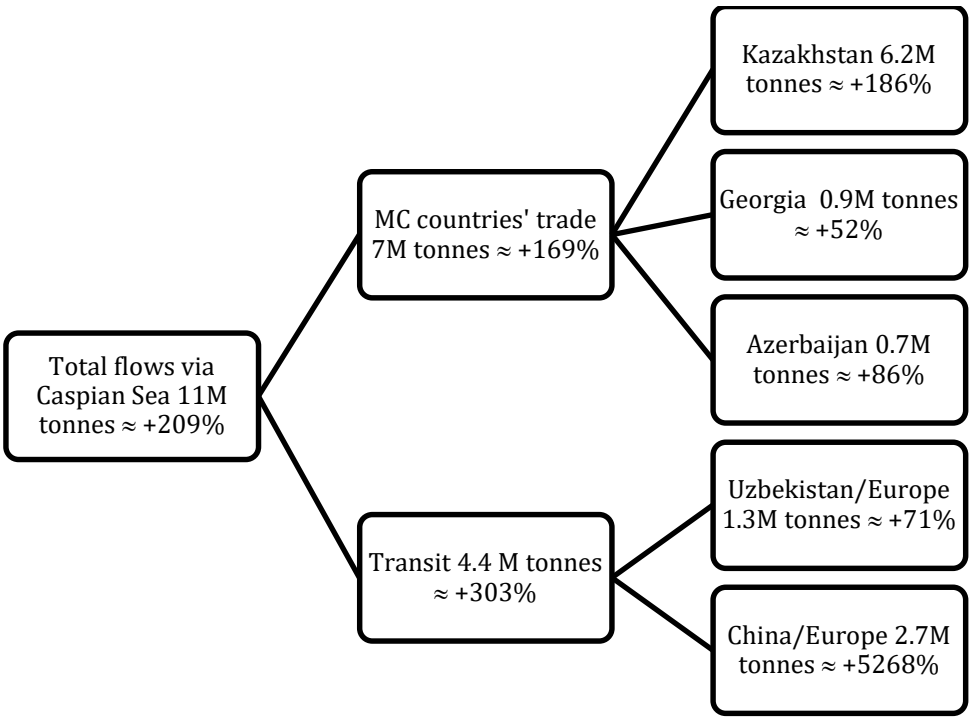

Figure 2 – Traffic along the MC via the Caspian Sea

Note: Projections made by World Bank [6].

The second segment – transit freight (4.4 million tonnes; approximately +303 percent) – is essential not so much for its absolute volume, but for its dynamics and sensitivity to service quality. In figure 2, the China – Europe direction exhibits the most "explosive" growth (2.7 million tonnes; approximately +5,268 percent), which almost always reflects a very low starting base and a high dependence of future volumes on the predictability of node operations, the synchronization of schedules, and the harmonization of procedures. This result can be interpreted as confirmation of the World Bank's thesis that potential demand for the route exists, but its realization requires not isolated investments, but a coordinated package of improvements; otherwise, growth will remain far below the "operationalized corridor" scenario [6]. At the same time, the increase in Uzbekistan – Europe flows to 1.3 million tonnes (approximately +71 percent) indicates that the Middle Corridor is gradually evolving into a regional service for Central Asia, rather than merely an alternative China – European Union route, thereby reinforcing Kazakhstan's role as a transit intermediary between multiple markets.

The World Bank predicts that coordinated investments in rail, port, and Caspian shipping, combined with customs harmonization and digitalization, will lead to a threefold increase in freight traffic by 2030. This increase in traffic will be accompanied by a shift from bulk commodities to high-tech and containerized cargo, thereby transforming the corridor from a purely transit one to an economic and logistics one. The results of data collection and a forecast analysis of structural changes in the flow of goods along the Middle Eurasian Transport Corridor, as well as a quantitative analysis of freight distribution by commodity group, are presented in table 2.

The data in table 2 reflects the overall growth in cargo volumes and the growing diversity of cargo types transported along the Middle Corridor. As shown in table 2, total cargo volume is expected to grow from 3.7 million tons in 2021 to 11.4 million tons in 2030, an increase of approximately 300 percent. Thus, the corridor's transport infrastructure has apparently acquired even greater strategic importance for international trade, and the corridor's role in connecting Eurasia is likely to continue to grow.

Table 2 – Actual and forecast volumes of transportation through the Middle Corridor by commodity groups

Commodity groups	2021 (thousand tonnes)	2030 (thousand tonnes)
Total cargo flows	3,688	11,385
Agricultural products (excluding grains)	166	240
Grains	159	476
Prepared foodstuff	89	135
Minerals	117	184
Ferrous and non-ferrous metal ores	3	6
Coal and coke	615	891
Oil and oil products	1,106	3,553
Fertilizers	50	286
Ferrous metals	372	943
Non-ferrous metals	175	597
Other containerized goods	836	4,074
Note: Compiled by the authors based on the source [16].		

A graphic representation of the changes in cargo composition by commodity group are provided in Figure 3 (cargo by commodity group for 2021 and the 2030 forecast), providing a clearer illustration of the structural transformation of freight flows.

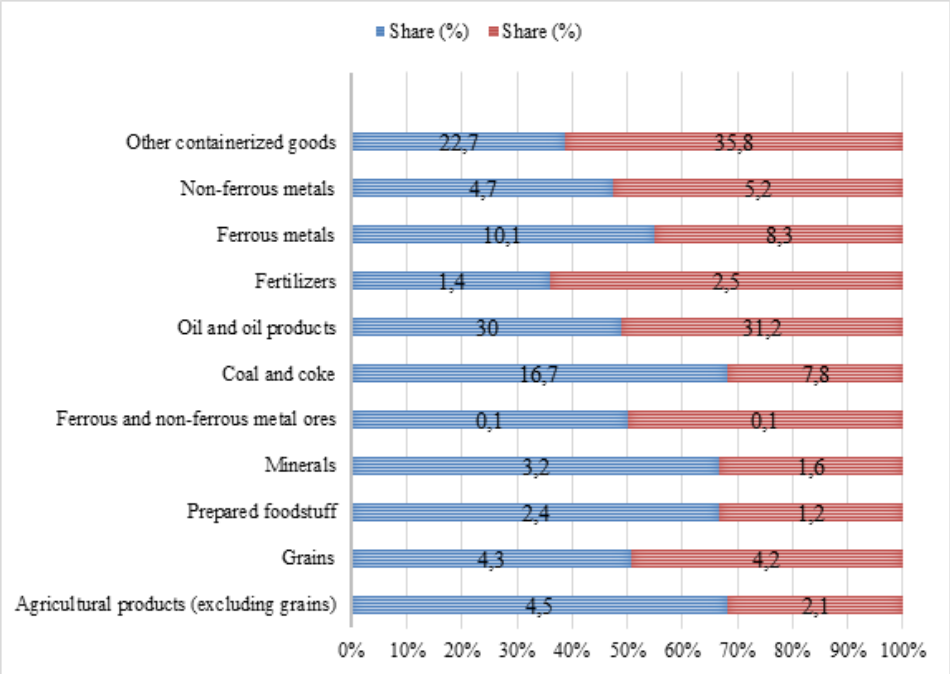

Figure 3 – Change in the composition of transportation through the Middle Corridor by commodity groups

Note: Compiled by the authors based on the source [6].

As shown in figure 3, the Middle Corridor will undergo significant structural modernization. While bulk cargo was the dominant mode of transportation in 2021, the forecast for 2030 indicates a shift toward higher-value containerized cargo. The share of "other containerized cargo" will increase from 22.7% to 35.8%, making it the predominant segment of cargo transported along the corridor. Furthermore, volumes of oil and petroleum products will increase, reflecting Kazakhstan's continued specialization in energy exports. Finally, coal and coke volumes will decline significantly in relative terms, demonstrating a gradual reduction in dependence on low-quality bulk cargo.

Energy goods appear to be the dominant cargo type and, therefore, will continue to dominate freight traffic along the corridor. According to the data, oil and petroleum products are expected to become the largest cargo type, accounting for approximately 31.2% of all cargo transported by the end of 2030. However, the volume of this commodity group is expected to more than triple to just under 10.5 million tonnes. As noted previously, this demonstrates that Kazakhstan continues to strengthen its status as a significant exporter of crude oil and natural gas, while China remains in need of diversified energy sources, and that the corridor provides the means to transport these supplies.

The share of coal and coke transported along the corridor is expected to decline sharply from 16.7% to 7.8% of total cargo volume. While coal and coke volumes may actually increase in the short term due to continued growth in coal and coke export volumes, the share of coal and coke in total cargo volume is expected to decline as other, higher-value cargo categories experience higher growth rates. This trend is consistent with the implementation of global decarbonization policies and ongoing structural changes in energy consumption patterns. Containerized cargo will be the fastest-growing category of cargo transported along the corridor, with an expected growth rate of nearly fivefold and a corresponding increase in market share from 22.7% to 35.8%. This shift from a primary focus on raw materials to a focus on industrial goods, machinery, and consumer goods highlights the corridor's transformation from a simple transit route for raw materials to a multimodal logistics route capable of supporting the movement of high-value industrial goods between China, Central Asia, and Europe. This transition will provide the basis for increased value addition and revenue per tonne of cargo, as well as strengthen the corridor's position in competition with maritime routes.

Finally, agricultural and food product cargo categories are expected to grow in volume but represent a declining share of total cargo volume. Thus, while the corridor is expected to continue serving as a conduit for agricultural exports, this category will remain secondary to the growth of industrial and containerized cargo. Furthermore, metals and fertilizers are expected to demonstrate relatively strong growth in freight volumes and, consequently, play an increasingly important role in the supply of intermediate industrial components to Eurasian markets.

Overall, the results presented in table 2 and figure 3 indicate a qualitative improvement in the freight structure. Specifically, the corridor is expected to transition from its historical reliance on bulk cargo to increased integration into global supply chains, which will increase the economic resilience of corridor users and reduce their exposure to commodity price volatility. Moreover, this transition represents another step toward achieving Kazakhstan's long-term goal of developing the corridor as a regional logistics hub, thereby enabling it to transcend its current status as a resource exporter.

It is crucial to emphasize that the projected growth structure directly links investment priorities to the logistics chain's manageability. If Kazakhstan accounts for the bulk of the "trade" volume and a substantial share of transit flows, its infrastructure and institutions become decisive for the reputation of the entire route. This finding is entirely consistent with the logic of the Logistics Performance Index: overall logistics performance is shaped not only by physical capacity, but also by the quality of procedures, and bottlenecks in customs or infrastructure can effectively neutralize the impact of expanded assets, as delays in a multimodal chain rapidly propagate through cascading idle time [16]. In this interpretation, the figure does not merely depict prospective growth but establishes a criterion for evaluating investment synergy: maximum returns arise where port and fleet modernization on the Caspian Sea, the development of railway junctions, and digital interoperability of documentation are implemented as a single integrated package that reduces delivery time variability and increases shipper confidence. Finally, Kazakhstan's dominance in the "trade" component further confirms that the corridor is anchored in real bilateral trade with China, which remains one of Kazakhstan's largest export and import partners, meaning that the route's sustainability is supported not only by transit market conditions but also by underlying trade fundamentals [15].

Special attention should be paid to digitalization as the corridor's "invisible infrastructure." Where manual operations dominate, and information remains fragmented, the risk of errors increases, compliance controls become more complex, and border crossings become less predictable. By contrast, electronic data exchange, format harmonization, and interoperable digital architecture reduce transaction costs and strengthen trust among supply chain participants, as reflected in international assessments of logistics quality and traceability [16]. It follows that project-based cooperation with Chinese partners should encompass not only financing of physical assets, but also the alignment of

data standards, exchange protocols, and mechanisms for rapid incident resolution; otherwise, the effects of new capacity will be offset by delays and coordination failures in flow management [26].

Finally, the resilience of the Eurasian corridor under external shocks requires a shift toward a corridor governance model in which decisions are based on monitoring measurable service quality indicators – such as node transit times, schedule reliability, the share of electronic procedures, and the reproducibility of outcomes across shipments. In this framework, investment synergy functions as a multiplier: improvements in one segment increase returns in adjacent segments because the chain becomes more coherent, and the final market offering is expressed as a balanced combination of price, transit time, and reliability. In practical terms, this implies that investments in terminals and rail infrastructure must be integrated with through-tariff solutions, digital procedures, and risk allocation embedded in contracts and interagency regulations, so that Kazakhstan's geographic advantage is transformed into a reproducible service quality rather than a fragmented set of infrastructure assets [6, 16].

Conclusion

The strategic investment cooperation between Kazakhstan and China for the development of the Eurasian transport corridor has the potential for sustainable synergy, however this synergy does not arise automatically. The basis of the economic cooperation is provided by China's structural position in Kazakhstan's trade. However, the realization of the Middle Corridor's potential depends on the reduction of the variability of the time and cost of the transit through the removal of bottlenecks at the nodes and borders, development of Caspian intermodal connections, and digitization of procedures. The Logistics Performance Index demonstrates the need for the implementation of a holistic strategy: physical investments should be accompanied by procedural reforms, development of capacities, and transparent tariffs' policy [16, 28].

The Middle Corridor is not merely an alternative route between China and Europe, but also a potential driver of long-term economic growth for Central Asia and the Caucasus. According to World Bank estimates, if a coordinated package of investments and institutional reforms is implemented, the corridor could triple freight volumes and halve travel time by 2030, generating multiplier effects on trade, employment, and entrepreneurial activity across the region [6].

The key constraint to corridor development lies not so much in a shortage of physical capacity per se, but in the fragmentation of infrastructure solutions and weak coordination among segments of the multimodal chain. Bottlenecks – ranging from congested railway sections in Kazakhstan and technically outdated lines in Türkiye to port capacity constraints in the Caspian and Black Seas – create significant variability in delivery times, reducing the corridor's attractiveness for higher-value-added cargo. In this context, the World Bank's identified priority actions illustrate the systemic nature of these challenges, as individual infrastructure failures can propagate into cascading delays along the entire route.

Of particular importance for Kazakhstan is that a significant share of the future growth of the Middle Corridor is driven by regional trade rather than by China – Europe transit alone. This implies that investments in bypassing congested urban nodes, developing new cross-border rail links, and modernizing Caspian Sea ports generate benefits not only for international transit but also for domestic and subregional economic integration [27]. As a result, the corridor increasingly takes on the characteristics of a sustainable logistics service rather than a temporary traffic reallocation route.

The discussion further demonstrates that infrastructure investments alone, without parallel improvements in managerial and digital mechanisms, are insufficient to deliver the anticipated outcomes. Limited digitalization of customs and border procedures, the absence of coordinated schedules and time-definite services, and weak institutional coordination among corridor countries constrain the returns on capital investments. In this sense, the Middle Corridor should be viewed as a "service," whose competitiveness is determined by reliability, predictability, and transparency, rather than by infrastructure capacity alone.

The findings corroborate the World Bank's conclusion that developing the Middle Corridor requires shifting from fragmented national projects to a unified corridor strategy that aligns investments, standards, and governance mechanisms [6]. For Kazakhstan, this creates an opportunity to transform

its geographic position into a reproducible, resilient, competitive advantage that withstands external shocks and fluctuations in transit demand, provided that investment policy is oriented toward synergy among infrastructure, institutions, and digital solutions. The study also demonstrates that a service-based evaluation of corridor development provides a more robust basis for assessing competitiveness than infrastructure expansion alone.

The practical implication is that priorities should be formulated in terms of end-to-end service quality indicators and as a portfolio of interlinked projects, in which "soft reforms and digital solutions complement nodal" investments (borders, ports, terminals). Within such an approach, Khorgos and other key nodes become points of value creation. At the same time, the corridor evolves from a transit trajectory into an infrastructural foundation for economic diversification and sustainable development in Kazakhstan.

The strategic investment cooperation in Kazakhstan and China in the development of the Middle Eurasian transport corridor have resulted in extremely profitable and mutually advantageous relations. Over the last five years, both sides have achieved record-breaking volumes of bilateral trade; many large-scale infrastructural projects have been completed and the Middle Corridor has gone from being an additional option to become a serious alternative to other transportation corridors in Eurasia. In addition to the improvement of connectivity in Kazakhstan through the use of Chinese funds and know-how, China has received a more reliable and diverse western trade route – a classic example of a "win-win" [10]. Moreover, this cooperation is producing positive spillovers for the wider region: Central Asian neighboring states, the South Caucasus, and even European traders will profit from the greater efficiency of a transcontinental corridor [28]. Of course, there are challenges still to overcome before it can be said that the Middle Corridor is fully developed. Kazakhstan needs to take care of the development of its trade with China in order to not be dependent on the Chinese market and to keep sustainable debt levels – a topic frequently mentioned in relation to investments made within the framework of the BRI. Thus far, Kazakhstan appears to be "thinking beyond dependency," using a multi-vector approach and looking for balanced foreign partners [10]. The next major task for Kazakhstan is to increase the capacity and reliability of the Middle Corridor, which requires not only the construction of more hard infrastructure (such as railroads), but also further reforms in trade facilitation, customs cooperation, and public-private partnerships to mobilize investment. A roadmap for implementation was proposed by the World Bank – ten priority measures, including the establishment of a cross-border corridor management agency and the modernization of rail-ferry intermodal terminals – to meet the goals of the 2030 Strategy [28].

Implementation of these measures will be critical to the success of the project. In summary, the strategic partnership between Kazakhstan and China to develop the Middle Eurasian corridor represents the foundation for the integration of Central Asia into the world economy. The statistics confirm the importance of this relationship: billions of dollars in joint investment, the volume of cargo transported via the corridor doubled year-over-year, and the level of trade reached unprecedented levels. Also very important are the qualitative results of the project – improvements in logistics performance, new industrial ventures, and enhanced regional connectivity, contributing to greater economic resilience. As long as both parties give priority to mutually beneficial cooperation, it is reasonable to assume that the success of the Middle Corridor will be enduring, turning Kazakhstan from a land-locked country into a land-linked transit center in the heart of Eurasia [10]. The cooperative model created by China and Kazakhstan may therefore be viewed as a model for infrastructure-based development based on the principles of the Belt and Road Initiative, providing shared prosperity across the region.

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ҚАЗАҚСТАН МЕН ҚЫТАЙДЫҢ ОРТА ЕУРАЗИЯЛЫҚ КӨЛІК ДӘЛІЗІН ДАМЫТУДАҒЫ ЫНТЫМАҚТАСТЫҒЫ

Аңдатпа

Мақалада Еуразиялық трансконтиненталдық көлік дәлізі жүйесін дамытудағы, сондай-ақ Қазақстан Республикасы мен Қытай Халық Республикасындағы стратегиялық серіктестік қарастырылады. Орталық буын – Орта дәліздің (Транскаспий халықаралық көлік бағыты) қазақстандық бөлігі, ол Қытай мен Еуропа нарықтарын Қазақстан мен Каспий теңізі арқылы байланыстыратын мультимодальды бағыт. Зерттеудің мақсаты – Дүниежүзілік банк деректерін (WITS және Логистика өнімділігі индексі), халықаралық ұйымдардың аналитикалық материалдарын және Scopus индекстеген ғылыми басылымдарды талдау негізінде инфрақұрылымдық синергия механизмдерін және дәліздің тұрақтылығын анықтайтын факторларды анықтау. Мақалада «физикалық» инфрақұрылымға – теміржолдарға, порттарға және терминалдарға – инвестициялар тек байланысты өнімдер саудасы, процедуралардың цифрлық интеграциясы және дәліздерді басқару институттары арқылы бір мезгілде дамыған кезде ғана ұзақ мерзімді экономикалық пайда әкелетіні дәлелденген. Орта дәліздің негізгі шектеушісі интермодальды хабтар мен шекарааралық өткелдерде шоғырланған жеткізу мерзімдері мен шығындарының жоғары өзгергіштігі болып қала беретіні көрсетілген. Осыған байланысты дәліздерді дамытудың қызмет көрсету моделі ұсынылады, онда басымдықтар кешенді логистикалық қызметтердің сенімділігіне және транзиттік хабтарды логистикалық-өнеркәсіптік кластерлерге айналдыруға негізделген. Зерттеудің практикалық маңыздылығы кідірістерді азайтуға, жөнелтімдердің болжамдылығын арттыруға және ел ішіндегі қосымша құнды арттыруға бағытталған Қазақстанның инвестициялық саясаты мен Қытаймен ынтымақтастық форматтары бойынша ұсыныстар әзірлеуде жатыр.

Тірек сөздер: инвестиция, көлік дәліздері, құрғақ порттар, мультимодальды логистика, сауданы жеңілдету, цифрландыру, тұрақты даму.

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СОТРУДНИЧЕСТВО КАЗАХСТАНА И КИТАЯ В РАЗВИТИИ СРЕДНЕЕВРАЗИЙСКОГО ТРАНСПОРТНОГО КОРИДОРА

Аннотация

В статье рассматривается стратегическое партнерство в развитии системы евразийских трансконтинентальных транспортных коридоров, а также в Республике Казахстан и Китайской Народной Республике. Центральным звеном является казахстанская часть Среднего коридора (Trans-Caspian International Transport Route), представляющая собой мультимодальный маршрут, который соединит рынки Китая и Европы через территорию Казахстана и Каспийское море. Цель работы заключается в выявлении механизмов инфраструктурной синергии и факторов, определяющих устойчивость коридора, на основе анализа данных Всемирного банка (WITS и Logistics Performance Index), аналитических материалов международных организаций и научных публикаций, индексируемых Scopus. В статье обосновывается, что инвестиции в “физическую” инфраструктуру – железные дороги, порты и терминалы – обеспечивают долгосрочный экономический эффект только при их одновременном развитии торгами сопутствующих продуктов, цифровой интеграции процедур и институтов коридорного управления. Показано, что ключевым ограничением Среднего коридора остается высокая вариабельность сроков и стоимости доставки, сосредоточенная в интермодальных узлах и на трансграничных переходах. В этой связи предложена сервисная модель развития коридора, в которой приоритеты формулируются на основе показателей надежности логистического сервиса “end-to-end” и трансформации транзитных узлов в логистико-индустриальные кластеры. Практическая значимость исследования заключается в формировании рекомендаций по инвестиционной политике Казахстана и форматам кооперации с Китаем, направленных на снижение задержек, повышение предсказуемости перевозок и рост добавленной стоимости внутри страны.

Ключевые слова: инвестиции, транспортные коридоры, сухие порты, мультимодальная логистика, торговое содействие, цифровизация, устойчивое развитие.

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