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IMPROVING THE ECONOMIC MECHANISMS FOR THE DEVELOPMENT OF BORDER TRANSPORT SYSTEMS

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Abstract. Border transport systems constitute a critical link between national economic productivity and regional integration. This article presents a comprehensive analytical framework for improving the economic mechanisms underlying the development of border transport systems, structured around four pillars: (I) public-private partnership (PPP) financing; (II) tariff and pricing reform; (III) logistics cost reduction and multimodal integration; and (IV) regulatory institutions and digitalization. Drawing on contemporary literature from 2020–2025 and empirical evidence from Central Asian transport corridors, particularly Uzbekistan, the article identifies fragmented regulatory regimes, informal fee structures, and underdeveloped multimodal infrastructure as the main barriers to efficient border transport. Evidence-based policy recommendations are proposed to enhance investment attractiveness, reduce transaction costs, and deepen regional economic integration.

Keywords: border transport, economic mechanisms, public-private partnership, logistics, Central Asia, Uzbekistan, multimodal transport, regulatory reform.

Аннотация. Приграничные транспортные системы являются важным связующим звеном между национальной экономической производительностью и региональной интеграцией. В данной статье предлагается комплексная аналитическая основа для совершенствования экономических механизмов развития приграничных транспортных систем, структурированная по четырём ключевым направлениям: (I) финансирование на основе государственно-частного партнёрства (ГЧП); (II) реформа тарифной и ценовой политики; (III) снижение логистических затрат и развитие мультимодальной интеграции; (IV) институциональное регулирование и цифровизация. На основе современной литературы за 2020–2025 годы и эмпирических данных по транспортным коридорам Центральной Азии, прежде всего Узбекистана, выявлены основные барьеры: фрагментированность регуляторных режимов, неформальные платежи и недостаточно развитая мультимодальная инфраструктура. Предложены научно обоснованные рекомендации по повышению инвестиционной привлекательности, снижению транзакционных издержек и углублению региональной экономической интеграции.

Ключевые слова: приграничный транспорт, экономические механизмы, государственно-частное партнёрство, логистика, Центральная Азия, Узбекистан, мультимодальный транспорт, регуляторная реформа.

INTRODUCTION

Border transport systems, comprising roads, railways, border crossings, logistics hubs, and multimodal facilities, occupy a strategic position in contemporary economic geography. For landlocked economies, their efficiency is not merely a logistical concern but a fundamental condition for participation in global value chains. Despite growing scholarly and policy interest, the economic mechanisms governing the development, financing, and regulation of these systems remain insufficiently theorized, particularly in Central Asia.

Uzbekistan clearly illustrates this issue. The country's logistics performance has improved considerably, rising from 129th place in 2014 to 88th place in the World Bank's Logistics Performance Index (LPI) by 2023. Nevertheless, persistent challenges remain in multimodal infrastructure, informal fee structures, and private sector participation (World Bank, 2024; Asian Transport Observatory, 2025). Broader geopolitical shifts, notably the disruption of the northern Eurasian corridor through Russia and the growing importance of the Trans-Caspian International Transport Route (TITR) as a strategic alternative, have simultaneously created a window of opportunity for decisive investment (EBRD, 2024).

This article addresses the following research question: What economic mechanisms most effectively support the development of border transport systems, and how can these mechanisms be improved in emerging landlocked economies? To answer this question, the article proposes a four-pillar analytical framework, reviews supporting evidence, and develops evidence-based policy recommendations.

LITERATURE REVIEW

The fundamental relationship between transport investment and economic development has been extensively studied and empirically validated. Rodrigue (2024) argues that efficient and sustainable transport markets play a key role in regional development, while also noting that large transport projects frequently face inadequate cost control, systematic budget overruns, and political influence, which may reduce their economic returns. Button (2022) emphasizes the role of pricing mechanisms, including user charges, congestion pricing, and toll structures, in allocating transport capacity efficiently and ensuring sustainable reinvestment.

Input-output analysis applied to the value of transport infrastructure (arXiv, 2025) reveals systemic interdependencies between the transport sector and other branches of the economy, reinforcing the need for a holistic approach to infrastructure investment. These studies also highlight the importance of business models that are resilient to contextual changes, including geopolitical, environmental, and technological shifts.

Cross-border transport projects involve two or more sovereign states and therefore require substantial private investment and multi-stakeholder coordination (Eurasian Development Bank, 2023). The Eurasian Development Bank concludes that cross-border public-private partnerships represent effective mechanisms for implementing large-scale infrastructure projects, provided that appropriate legal frameworks, risk allocation structures, and governance arrangements are in place. Bugarčić, Mičić, and Stanišić (2023) demonstrate that improvements in logistics are strongly associated with GDP growth, with this effect being particularly pronounced in border areas.

For Central Asia, the EBRD’s landmark 2023 study on EU–Central Asia connectivity identified five priority reform areas: digitalization of transport documents, improvement of the public-private partnership environment, trade facilitation, market liberalization, and enhanced tariff-setting mechanisms (EBRD, 2024). These findings are supported by the OECD (2025), which identifies informal payments, warehousing bottlenecks, and limited private investment as the main constraints on the competitiveness of the Trans-Caspian International Transport Route (TITR).

RESEARCH METHODOLOGY

This study is based on a qualitative and analytical research approach. The research utilizes scientific literature, reports of international organizations, policy documents, and statistical materials related to border transport systems and regional transport corridors. Comparative analysis, systematic review, and synthesis methods were employed to examine the economic mechanisms influencing the development of border transport infrastructure.

Particular attention was given to recent empirical evidence from Central Asia, especially Uzbekistan, regarding public-private partnership financing, tariff regulation, logistics performance, multimodal transport integration, and digitalization initiatives. The collected data were analyzed within a four-pillar analytical framework to identify key challenges, development trends, and policy directions for improving the efficiency and competitiveness of border transport systems.

ANALYSIS AND RESULTS

Building on the literature reviewed above, this article organizes the economic mechanisms governing the development of border transport systems into a four-pillar framework (Table 1).

Table 1
Four-Pillar Framework for Border Transport Economic Mechanisms¹

Pillar	Core Components	Primary Challenge
I. PPP & Investment	Sovereign loans, IFI financing, cross-border concessions, equity partnerships	Risk allocation; low private-sector confidence
II. Tariff & Pricing	Cost-reflective tolls, user charges, transit fee harmonisation	Informal fees; under-pricing of infrastructure
III. Logistics & Multimodal	Intermodal hubs, container rail, warehousing, freight digitalisation	Fragmented modes; high logistics costs relative to GDP
IV. Regulation & Digital	Customs harmonisation, e-documents, institutional coordination	Regulatory fragmentation; slow border clearance

¹ author’s development

These pillars are analytically distinct but functionally interdependent: weaknesses in any one pillar may constrain the performance of the others.

The financing of border transport systems has historically relied on sovereign public expenditure and official development assistance. However, this model is becoming increasingly insufficient to meet the scale of investment required for modern transport infrastructure. Consequently, diversified financing architectures that combine public investment, international financial institution (IFI) loans, and private capital have become the contemporary standard.

The EBRD's 2024 commitment to invest approximately €1.5 billion in the Trans-Caspian Corridor infrastructure over a two- to three-year period illustrates the scale of financing that can be mobilized when corridor-level economic benefits are clearly articulated and governance risks are effectively mitigated (EBRD, 2024). The accompanying Memorandum of Understanding (MoU) between the EBRD and Kazakhstan outlines a comprehensive reform agenda covering road, rail, port, and logistics infrastructure, with particular emphasis on private-sector participation in freight transportation.

The design of cross-border public-private partnerships (PPPs) requires careful attention to risk allocation mechanisms. Research published in the *Journal of Infrastructure, Policy and Development* (2024) demonstrates that PPP concession agreements should evolve to accommodate technological innovations, including multi-lane free-flow tolling systems and digital enforcement mechanisms, while maintaining an appropriate distribution of risks among stakeholders. Network economics principles further suggest that increased regional connectivity generates positive spillover effects that enhance the commercial viability of infrastructure projects. The China–Kyrgyzstan–Uzbekistan (CKU) railway project, for which an intergovernmental agreement was signed in Beijing in June 2024, exemplifies both the geopolitical complexity and economic potential of such multinational initiatives (Connective Think, 2024).

Transport pricing mechanisms play an essential role in allocating scarce infrastructure capacity, generating maintenance revenues, and influencing modal choice. In border transport systems, however, pricing structures have often been distorted by political-economy factors, regulatory inefficiencies, and the absence of cost-reflective charging mechanisms. The OECD (2025) identifies informal payments and non-transparent charges as significant constraints on corridor competitiveness, as they create unpredictable transaction costs for freight operators and discourage corridor utilization.

Germany's phased truck toll reform implemented during 2023–2024 provides an instructive example of successful pricing reform. Introduced in four stages between January 2023 and July 2024, the reform adjusted toll rates based on updated infrastructure cost assessments, extended obligations to lighter commercial vehicles, and introduced permanent exemptions for zero-emission vehicles (DHL Freight, 2023). This experience demonstrates how cost-reflective pricing reforms can be implemented gradually, communicated effectively, and aligned with broader environmental policy objectives.

Railway freight tariff reform presents additional regulatory challenges. Research published in *PLOS ONE* (2025), based on continuous-time regulatory impact analysis, shows that government regulation of railway tariffs produces significant short-term effects on both operators and shippers. The outcomes largely depend on tariff design and the degree of market liberalization. Therefore, harmonization of tariff structures and transit fee regimes across Central Asian countries remains a priority. This issue has been explicitly identified by the EU–Central Asia Connectivity Study as a key reform area (EBRD, 2024).

Logistics costs as a share of GDP in Central Asia remain substantially higher than comparable benchmarks in other middle-income regions. Uzbekistan's freight flow distribution is heavily concentrated along eastern corridors, while long transit distances increase cross-border risk exposure and maintain a high demand for transport services relative to GDP (Springer, 2024). Historically, smallholder farmers and small and medium-sized enterprises (SMEs) have faced transport costs reaching up to 200 percent of production costs, significantly limiting their access to export markets (Eurasian Research Institute).

Multimodal integration—the coordinated use of rail, road, air, and maritime transport under unified documentation, pricing, and liability frameworks—represents one of the most effective approaches to reducing logistics costs. The OECD (2025) reports notable progress in this area, highlighting positive private-sector responses to the development of multimodal logistics hubs at border railway stations and container-handling facilities. The planned transport and logistics hub in Andijan, developed in partnership with Rhenus Logistics, serves as an example of international private investment that can be attracted through targeted policy reforms.

In 2023, Uzbekistan Railways established JSC *Temiryulkargo* as part of a broader restructuring of the railway sector aimed at promoting multimodal transport throughout the country (OECD, 2025). This institutional restructuring, which separates infrastructure management from freight operations, constitutes an important prerequisite for market competition and private-sector participation. Research on cross-border e-commerce logistics (*PLOS ONE*, 2024) further demonstrates that competitive advantage in international trade increasingly

depends on flexibility, real-time cargo tracking, and high-quality documentation systems—capabilities that modern border logistics hubs must provide.

Regulatory institutions and digitalization serve as the foundational enablers of the other three pillars. Without transparent and coherent regulatory frameworks, infrastructure financing faces elevated risk premiums, tariff reforms lose credibility, and logistics modernization efforts become constrained at border crossings. Uzbekistan's institutional reforms since 2019 provide a notable example in this regard. The establishment of the Ministry of Transport in February 2019 consolidated previously fragmented governance structures under a unified institutional framework. Within this structure, the Center for Transport and Logistics Development is responsible for strategic planning, digitalization, corridor development, and international transit cooperation (Asian Transport Observatory, 2025).

The OECD (2025) identifies the digitalization of customs procedures and border controls as one of the most significant ongoing reforms along the Trans-Caspian International Transport Route (TITR). Electronic documentation systems reduce processing times, lower transaction costs, improve transparency, and create a data foundation for evidence-based policymaking. Similarly, the European Union's decision to place high-level twinning advisers within the transport ministries of all five Central Asian countries beginning in 2024 reflects the importance of institutional capacity building in sustaining digital transformation efforts (EIAS, 2024).

The Eurasian Development Bank's guidelines for cross-border PPPs in the Eurasian Economic Union and Central Asia (2023) emphasize that effective regulatory frameworks should address jurisdictional overlaps, dispute-resolution mechanisms, regulatory risk allocation, and the harmonization of technical standards to ensure road–rail interoperability at border nodes. Likewise, the U.S. Federal Highway Administration's *Border Planning Toolkit* (2023) highlights the importance of data-driven decision-making in cross-border transport planning and emphasizes measures such as dedicated lane management, border waiting-time reduction, and the implementation of comprehensive cross-border operational protocols.

CONCLUSION AND RECOMMENDATIONS

Border transport systems function simultaneously as economic infrastructure, geopolitical instruments, and institutional frameworks. Their effective development requires coordinated reforms in financing structures, pricing mechanisms, logistics organization, and regulatory institutions. The four-pillar framework proposed in this article provides a coherent analytical basis for diagnosing existing weaknesses and designing targeted policy interventions.

Empirical evidence from Uzbekistan and the broader Central Asian corridor landscape demonstrates that meaningful progress is achievable when political commitment, international financial institution financing, and private-sector engagement are aligned around clearly defined corridor strategies. The Trans-Caspian International Transport Route represents such an emerging alignment, with the potential to transform the economic geography of Central Asian trade, provided that institutional, regulatory, and commercial foundations are developed in parallel with physical infrastructure.

The four-pillar analysis reveals strong interdependencies among the key components of border transport system development. Regulatory reform without investment financing remains limited in its practical effect; investment without tariff reform may generate commercially unviable assets; and logistics modernization without digitalization may continue to produce bottlenecks. Therefore, effective policy packages should address all four pillars simultaneously.

Based on the analysis, the following recommendations are proposed:

Establish harmonized cross-border public-private partnership legal frameworks within regional organizations, such as the Shanghai Cooperation Organization (SCO) and the Eurasian Economic Union (EAEU), to enable bankable multi-country concession structures for corridor infrastructure.

Implement cost-reflective and transparent tariff structures at border crossings by replacing informal fee regimes with digitally administered formal charges, with revenues ring-fenced for infrastructure maintenance.

Accelerate the development of multimodal hubs at strategic border nodes through dedicated investment programs that combine sovereign lending from international financial institutions with equity participation from private logistics operators.

Prioritize railway sector unbundling and container transport development, following the Temirylkargo model, in order to introduce competitive dynamics into the freight transport market.

Invest systematically in the institutional capacity of transport ministries and sustain the digitalization of customs and border management processes through international advisory partnerships.

Establish regional data-sharing platforms that enable real-time monitoring of corridor performance indicators, thereby supporting evidence-based regulatory adjustment and strengthening investor confidence.

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