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Development of transit potential of Central Asian countries in the context of economic and integrational cooperation

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Abstract. The study was dedicated to assessing the impact of economic and integrational cooperation on the development of transit potential in the Central Asian states. Analytical methods were employed to examine the influence of infrastructure projects, integration processes, logistics systems, and environmental factors on the dynamics of transit development in the region. The research confirmed that the expansion of transit potential in Central Asia is closely linked to the development of transport infrastructure and the deepening of integration within international economic and trade unions. The implementation of projects aimed at modernising railways and highways has significantly boosted cargo turnover and strengthened transport links both within the region and with neighbouring countries. The establishment of joint logistics hubs and the simplification of customs procedures have substantially reduced delivery times and related costs. Integration into the Eurasian Economic Union and the Shanghai Cooperation Organisation has reinforced trade, economic, and investment ties, positively affecting the volume and efficiency of transit traffic. In particular, transit of goods along key routes increased by 15%, and foreign trade turnover grew by 20%. These findings highlighted the need for further investment in infrastructure modernisation, customs regulation improvement, and expanded cooperation with international trade organisations. The implementation of these measures will ensure stable growth of transit potential and enhance the region's competitiveness in the global market. This research contributes to the scientific field by providing an analytical foundation for strategies aimed at boosting the transit capacity of Central Asian countries through the integration of infrastructural and economic aspects in the context of international cooperation

Keywords: transport infrastructure; logistics centres; customs procedures; trade relations; competitiveness

Introduction

The transit potential of Central Asian countries is a vital factor in their socio-economic development and a key element of global trade flows. The region's geographical location at the crossroads between Europe, China, India, and the Middle East underscores the need to develop transport and logistics infrastructure. In recent years, there has been active modernisation of transport hubs, expansion of major corridors, and the introduction of digital technologies for cargo flow management. The integration of regional countries into international economic unions such as the Eurasian Economic Commission (EEC) and the Shanghai Cooperation Organisation (SCO) facilitates regulatory harmonisation, reduction of administrative barriers, and increased efficiency in transit transportation. Amid growing global trade volumes, the modernisation of infrastructure, development of logistics centres, digitalisation of transport systems, and attraction of foreign investment become particularly significant. These measures collectively form the foundation for strengthening Central Asia's role as a strategic transit hub in the Eurasian space.

The issue of developing the region's transit potential remains relevant due to the need to improve transport infrastructure and effectively utilise international trade corridors. Q. Tong *et al.* (2024) highlighted the importance of modernising railway and road routes to enhance the region's transit appeal. They emphasised that infrastructure improvement not only accelerated transportation processes but also reduced logistics costs. L. Xin & Yu. Wang (2021) explored the impact of integration into the Eurasian Economic Union and the Shanghai Cooperation Organisation on the development of transit potential. Their studies demonstrated that harmonised customs procedures and reduced trade barriers had a significant positive effect on international trade facilitation.

B.-R. Yan *et al.* (2021) analysed coordination of logistics networks between countries as a critical factor in enhancing transit capabilities. They noted that the creation of joint logistics centres and route optimisation significantly increased cargo turnover. G.Zh. Kulintai *et al.* (2024) examined the impact of global trade processes on Kazakhstan's transport routes, pointing out that changes in the global economy necessitated timely adaptation of transport systems to maintain competitiveness. K.J. Shah *et al.* (2021) addressed the issue of introducing environmentally sustainable technologies in transport systems, emphasising that green initiatives can serve as a significant component of strategic development amid global environmental challenges.

A. Yermekbaykyzy *et al.* (2022) stressed the importance of political coordination between countries in aligning transport and economic strategies. Their research noted that successful integration required coordinated actions at the state level aimed at forming a unified and effective transport system. Y. Wang & J. Sarkis (2021) studied the impact of digitalisation on improving the speed and efficiency of goods transit. The authors argued that the introduction of modern information technologies, including automated transport management systems, digital monitoring platforms, and data analytics tools, greatly improved coordination of logistics flows, optimised transport routes, and minimised time costs. Moreover, they underscored the importance of integrating blockchain technologies and artificial intelligence into logistics processes to ensure operational transparency and enhance cargo security.

S. Alotaibi *et al.* (2022) investigated the influence of private investment on the development and modernisation of transport infrastructure. Their analysis revealed that attracting private capital is a crucial factor in accelerating transport network development, improving operational efficiency, and introducing innovative solutions in logistics management. Public-private partnership mechanisms were found to play a key role in financing major infrastructure

projects, alleviating pressure on state budgets and ensuring the long-term sustainability of transport systems.

M.G. Cedillo-Campos *et al.* (2022) highlighted the importance of establishing modern logistics centres to enhance transit capacity. They viewed such centres as trade hubs that could become critical links in transregional logistics. G.D. Yesenzholova & R.T. Dulambaeva (2024) analysed key directions in the development of Kazakhstan's foreign economic activity, focusing on customs regulation and integration into global trade processes. Their work underscored the role of international economic agreements in strengthening transit potential and enhancing competitiveness in global markets. The authors emphasised the need for logistics infrastructure modernisation, adoption of digital solutions, and increased efficiency of customs procedures. At the same time, tasks such as expanding the use of environmentally sustainable technologies and deepening coordination of politico-economic strategies at the intergovernmental level across the Eurasian space remain highly relevant.

The study aimed to conduct a comprehensive analysis of the factors influencing the formation and development of the transit potential of the region's countries, taking into account the processes of economic integration and the expansion of interregional cooperation.

Research objectives:

- to analyse the impact of integration processes among countries joining international economic unions on the enhancement of international trade and the reduction of trade barriers;
- to assess the influence of logistics network coordination on improving transit efficiency and increasing freight turnover;
- to investigate the role of private investment in the development of transport infrastructure and its impact on enhancing transit capabilities.

Materials and Methods

In the period from 2015 to 2024, the study examined the conditions and trends influencing the formation and growth of the transit potential of Central Asian countries, with a particular focus on economic integration and the development of interregional connectivity. Special attention was given to key infrastructure projects, such as the construction of the Kazakhstan-China railway (Bodaubayeva *et al.*, 2024), the expansion of the Aktau port in Kazakhstan (Kegenbekov *et al.*, 2024), and the modernisation of the international airports in Almaty and Tashkent (Kukeyeva *et al.*, 2024). These initiatives have been identified as strategically important for improving transport networks and strengthening the region's position within global logistics systems. Their role in establishing efficient transport corridors – facilitating uninterrupted movement of goods and passengers, accelerating transit operations, and reducing overall costs – was particularly emphasised.

The study also explored integration processes within international organisations such as the Eurasian Economic Commission (n.d.) and the Shanghai Cooperation Organisation (n.d.). These processes were analysed in terms of their impact on trade facilitation and the harmonisation of transport infrastructure standards in the region. Special emphasis was placed on the alignment of economic and customs procedures as key factors in accelerating trade and enhancing the transit potential of Central Asian countries, as well as their influence on infrastructure development.

A central aspect of the study was the comprehensive analysis of the region's logistics and customs systems. Current logistical challenges were identified, and possible optimisation pathways were outlined through the adoption of advanced technological solutions. The research discussed directions for improving the performance of logistics centres and the use of cutting-edge customs technologies that can accelerate the movement of goods, reduce costs, and improve the overall efficiency of transit operations. The potential for establishing new logistics hubs and strengthening Central Asia's role as a key transit node was also considered.

The influence of economic policy on attracting both public and private investment into transport infrastructure development was also examined. The study highlighted the main mechanisms of public-private cooperation that facilitate the timely implementation of infrastructure projects. International best practices and various economic strategy models aimed at mobilising financial resources for the expansion of the regional transport network were reviewed, showing their direct influence on strengthening transit capacity.

Environmental considerations were also integrated into the scope of the research. The planning of transport infrastructure projects was assessed in terms of their impact on the environment, particularly in the context of global climate change. The extent to which Central Asian countries incorporate environmental risks into the design of new routes and facilities was analysed, along with the application of sustainable approaches to minimise environmental harm.

The final section of the study focused on evaluating the impact of logistics and customs infrastructure development on the transit capabilities of Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Turkmenistan. It examined the functioning of existing logistics centres and customs procedures, as well as the implementation of digital solutions aimed at improving transport operations. It was stressed that optimising these components accelerates transit, reduces logistical costs, and enhances trade connectivity, thereby strengthening Central Asia's competitive position in global markets.

Results

Infrastructure projects form the foundation for sustainable development and enhanced regional competitiveness. Beyond their material contribution, they create favourable conditions for effective interstate cooperation, expanded trade relations, increased investment inflows, and improved quality of life. In the context of Central Asia – where

transport infrastructure plays a pivotal role in successful integration into the global economy – the development of modern transport networks emerges as a cornerstone of the region's economic strategy (Table 1).

Table 1. Infrastructure projects as a foundation for enhancing the competitiveness of the Central Asian region

Project	Cost (USD million)	Length/area	Expected increase in trade turnover (million tonnes)	Increase in throughput capacity (million people/ cargo)	Delivery time reduction (hours)	Start year	Completion year	Funding
Kazakhstan-China Railway	6,000	1,300 km	15%	10 million tonnes/year	48 hours	2015	2025	Kazakhstan (50%), China (50%)
Aktau Port	1,500	2,000,000 m²	20%	5 million tonnes/year	36 hours	2013	2023	Kazakhstan (100%)
Almaty International Airport	1,200	100,000 m²	10%	4 million passengers/ year	20% faster	2010	2020	Kazakhstan (100%)
Tashkent International Airport	800	90,000 m²	12%	3.5 million passengers/ year	25% faster	2012	2022	Uzbekistan (100%)
Turkmenistan-Iran Railway	620	677 km	10%	3 million tonnes/year	30 hours	2017	2024	Turkmenistan (70%), Iran (30%)

Source: compiled by the authors based on M. Augan & A. Alipbayev (2023), A. Beifert & A. Moldabekova (2024), C. Wu *et al.* (2024)

According to Table 1, the implementation of the Kazakhstan-China railway project has reduced cargo delivery time by 48 hours compared to the previous route through Russia, which relied on a combination of rail and road transport and involved prolonged border delays and transhipments. The new route provides direct rail connectivity, significantly accelerating the movement of goods (Augan & Alipbayev, 2023). The modernisation of airports in Kazakhstan and Uzbekistan has led to a 25% reduction in passenger and cargo handling time. This improvement was achieved through the adoption of digital solutions, upgrades to runways, and the enhancement of security and processing procedures. Compared with pre-modernisation figures, the average time savings per flight amount to approximately two hours. The Turkmenistan-Iran railway project has cut transportation time by 30 hours compared to the earlier route, which traversed Uzbekistan, Kazakhstan, and the Caspian Sea, involving a multimodal combination of road and maritime transport. The new railway offers a direct connection between Ashgabat and Bandar Abbas. This development creates new opportunities for Kazakhstan as a key transit hub, strengthening its position within global trade routes. The railway's construction enables deeper integration into international transport networks and facilitates the strategic use of the region's location to develop new logistics corridors, which contributes to the economic advancement of both Kazakhstan and its neighbouring countries.

In addition to rail infrastructure, port facilities have been actively developed, exemplified by the modernisation of the Aktau Port in Kazakhstan. Situated on the Caspian Sea, this maritime hub plays a pivotal role in facilitating trade flows between Central Asia, the Caucasus, Iran, Turkey, and Europe. The port has undergone significant upgrades to optimise logistical operations. As a result, cargo delivery time has been reduced by 36 hours compared to routes via Bandar Abbas (Iran) and Alat (Azerbaijan), which previously required additional transhipment and administrative procedures, such as document clearance and vessel waiting times. The development of Aktau Port enhances Kazakhstan's ability to increase transit volumes and solidify its role as a vital component of international transport corridors (Beifert & Moldabekova, 2024; Kegenbekov *et al.*, 2024). Improvements at the Aktau Port include the expansion of port infrastructure, the modernisation of berths, the construction of new terminals, and enhancements to container handling capabilities. These upgrades have increased cargo throughput and service quality, thereby reduced business costs and improved overall logistics efficiency. Moreover, port expansion creates new opportunities for the development of transport and economic ties with neighbouring regions and countries, fostering trade and investment. The upgraded infrastructure also supports the development of multimodal transport. Alongside railways and ports, roads and airports remain crucial to the region's internal and external mobility of passengers and goods. Major highways and international airports – such as Almaty International Airport and Tashkent International Airport – are undergoing continuous expansion as part of large-scale infrastructure modernisation projects. These initiatives aim to boost capacity, improve passenger and cargo service quality, and strengthen international connectivity. Notably, the international terminal in Almaty has been renovated, and a new passenger terminal has been constructed in Tashkent, further integrating the region into global logistics networks. Such projects play a central role

in ensuring an efficient transport system, accelerating the movement of goods and people, and thereby enhancing the region's competitiveness on the international stage (Wu *et al.*, 2024; Kukeyeva *et al.*, 2024).

Infrastructure projects, such as the Kazakhstan-China railway and the development of the Aktau Port, form the backbone of Kazakhstan's competitiveness. These initiatives not only enhance transport networks but also create new opportunities for business development, logistics improvements, and the strengthening of trade positions. Advancing transport infrastructure contributes not only to regional economic growth but also to greater geopolitical influence, allowing the region to assume a more prominent role in the international arena.

Integration processes are particularly significant in today's globalised world, where intergovernmental cooperation is a key driver of economic development and stability. For Central Asia, participation in organisations such as the Eurasian Economic Commission (EEC) and the Shanghai Cooperation Organisation (SCO) presents new opportunities for regional growth, improved trade relations, enhanced political and economic cooperation with neighbouring countries, and higher standards in transport infrastructure (Table 2).

Table 2. Impact of integration processes on trade and transport in Central Asia

Organisation	Member countries	Expected outcomes	Impact on goods transit (% increase)	Impact on trade relations (% growth in turnover)
Eurasian Economic Commission	Kazakhstan, Russia, Belarus, Armenia, Kyrgyzstan	Simplification of customs procedures, increase in trade turnover	10	15
Shanghai Cooperation Organisation	China, Russia, India, Kazakhstan, Uzbekistan, Tajikistan, Pakistan, Mongolia (observer status), Iran (observer status since 2021)	Enhanced competitiveness, creation of free economic zones	12	20
China-Central Asia Transport Corridor	China, Kazakhstan, Kyrgyzstan, Uzbekistan	Faster delivery of goods, development of new logistics routes	15	18

Source: compiled by the authors based on T. Kenderdine & P. Bucsky (2021), P. De Lombaerde *et al.* (2024), H. Mubarak & S. Akhtar (2024)

According to the data presented in Table 2, integration frameworks in Asia involving China deliver a higher growth rate in transit and trade relations compared to the Eurasian Economic Commission (EEC). The China-Central Asia transport corridor has the greatest impact on accelerating cargo flows, with an increase of 15%, underscoring its key role in the region's logistics development. The participation of Central Asian countries in the EEC holds strategic significance, as it facilitates the expansion of trade ties with the region's largest economies, improves business conditions and investment attraction, and optimises the internal transport network. Within the framework of the Eurasian Economic Union, substantial infrastructure projects are being implemented, aimed at enhancing industrial capacity and strengthening economic ties among member states. For instance, Kazakhstan is undertaking the construction of a polyethylene production plant in the Atyrau region, with an investment volume of 486.2 billion tenge, equivalent to approximately USD 1.1 billion (Performance under investment…, n.d.).

The Shanghai Cooperation Organisation (SCO) focuses on political, economic, and cultural integration among its members, establishing a foundation for cooperation in security, trade, energy, and infrastructure sectors. For Central Asia, the SCO represents a crucial mechanism to reinforce regional cooperation and expand economic linkages, especially with major economies such as China and India. Key cooperation priorities within the SCO include the improvement of transport infrastructure, development of transit routes, and simplification of trade processes. SCO member states have agreed to cooperate based on principles of mutual benefit, harmonisation of transport standards, simplification of customs procedures, and the creation of favourable conditions for investment projects. In particular, agreements have been developed to support joint infrastructure initiatives, such as the construction and modernisation of roads, railways, and ports, alongside the introduction of new logistics technologies. These measures contribute to enhancing the region's attractiveness for foreign investors and improving the business environment in SCO countries (Mubarak & Akhtar, 2024).

A key element of integration within both organisations is the establishment of a unified transport network, which strengthens economic links and improves logistics. Notably, the development of transport corridors such as China-Kazakhstan–Europe, along with projects focused on modernising ports and railways, plays an essential role in reducing delivery times and lowering logistics costs. Integration of transport systems enhances access to global markets and consolidates Central Asia's position as a vital transit hub (Kenderdine & Bucsky, 2021).

The participation of Central Asian countries in organisations like the EEC and SCO is crucial for ensuring economic stability and growth in the region. Integration processes within these frameworks promote the enhancement of trade relations, the creation of a unified transport space,

standardisation, and increased competitiveness. Deepening cooperation with neighbouring countries opens up opportunities for Central Asia to strengthen its global standing and improve the quality of life for its population through infrastructure development and better economic indicators. In the context of globalisation, where the speed and efficiency of goods delivery are decisive for the growth of international trade, the improvement of logistics and customs systems becomes essential for boosting regional competitiveness. Of particular importance are the development of logistics centres and the implementation of modern technologies in customs procedures. These advancements not only accelerate the movement of goods but also reduce costs, thereby ensuring higher overall transit efficiency (Table 3).

Table 3. Impact of EEC and SCO on logistics and customs systems in Central Asia

Country	Implementation of new logistics technologies (year)	Implementation of digital customs systems (year)	Reduction in logistics costs (%)	Reduction in customs processing time (days)	Notes
Kazakhstan	2021 (digitalisation of transport and warehouse systems, introduction of monitoring systems and process automation)	2022 (implementation of automatic declaration system, integration with international platforms)	8	3	In Kazakhstan, the implementation of technologies includes real-time monitoring systems, automated cargo handling, and new platforms for integration with global markets, accelerating cargo processing.
Kyrgyzstan	2020 (introduction of GPS tracking for goods, warehouse operation automation)	2021 (digitalisation of customs clearance, electronic declaration systems)	10	2	In Kyrgyzstan, technologies such as GPS tracking and warehouse automation are used to increase transparency in freight transport, alongside electronic declarations to speed up customs procedures.
Uzbekistan	2023 (digitalisation of logistics chains, introduction of unmanned delivery vehicles)	2024 (implementation of electronic customs clearance system, integration with the European Union (EU))	7	4	Uzbekistan is developing innovations in unmanned technologies and digital logistics platforms, as well as implementing electronic declaration systems and automated customs control to improve transit speed.
Tajikistan	2022 (innovations in transport and warehousing, introduction of new cargo management methods)	2023 (development of digital platforms for customs clearance)	6	3	Tajikistan is introducing new technologies for logistics flow management and digitalising customs procedures to accelerate the movement of goods across borders and enhance transparency.

Source: compiled by the authors based on K. Kim *et al.* (2022)

According to Table 3, the greatest reduction in logistics costs (10%) resulting from the influence of the EEC and SCO was achieved in Kyrgyzstan, thanks to the early implementation of GPS monitoring and electronic declarations. Meanwhile, Uzbekistan demonstrates more innovative technological solutions, particularly the use of unmanned transport and integration with the EU, indicating the country's strategy for modernising logistics and customs. Kazakhstan has become one of the regional leaders in adopting digital solutions in logistics. In 2021, the "Digital Transport Corridor" system was launched, encompassing the automation of warehouse processes as well as real-time cargo monitoring through the Kazakh Transporters' Union platform, KazLogistics. This has significantly increased the transparency of logistics operations and reduced delivery times (JSC KTZ Express…, 2024). These measures have strengthened Kazakhstan's position as a key transit hub on the China-Europe and North-South routes.

In 2020, Kyrgyzstan implemented GPS cargo monitoring as part of the TIR-EPD project within the framework of the International Road Transport Union (IRU) (The TIR-EPD system..., 2024). The automation of warehouse operations has enhanced the efficiency of distribution centres, especially in Bishkek and Osh. These steps, carried out to comply with EEC requirements, reduced logistics costs by 10% and improved delivery predictability, positively impacting the country's appeal as a transit route between China and Russia. Tajikistan began an active upgrade of its transport and warehouse infrastructure in 2022, including the implementation of digital freight flow management systems under the CAREC Corridors project, sponsored by the Asian Development Bank (Hussain *et al.*, 2024). In 2023, an electronic customs clearance system based on the Automated System for Customs Data (ASYCUDA) Lite version was introduced, accelerating data exchange between customs authorities and businesses. These initiatives reduced logistics costs by 6% and customs procedure times

to under three days, particularly on routes through the land borders with China and Uzbekistan. Increased transparency and predictability of deliveries position the country as an important transit element within SCO corridors.

Despite its non-aligned neutral status, Turkmenistan has shown interest in developing partnerships with regional integration bodies such as the EEC and SCO. The country is gradually strengthening cooperation with these organisations in logistics and digitalisation. The focus is primarily on transport-logistics and digital sectors, driven by Turkmenistan's advantageous geographical location. The country is actively modernising transport infrastructure, including high-speed highways and multimodal hubs, potentially laying the foundation for integration into international transport corridors supported by EEC and SCO member states. In 2022, the modernisation of Turkmenistan's transport corridors began with the introduction of high-speed rail systems and automated control points (Malakhov *et al.*, 2023). In 2023, pilot projects for digital customs control based on the "single window" principle were launched jointly with Iran and Kazakhstan. Future cooperation prospects include the exchange of customs data, the introduction of electronic platforms, and the standardisation of technical logistics norms. Thus, in each Central Asian country, the implementation of new logistics and customs technologies has had a significant impact on reducing costs and accelerating trade turnover. In most cases, these projects have been carried out in collaboration with international organisations or within the framework of regional initiatives under the EEC and SCO, enhancing transit potential and making the region increasingly attractive for international trade.

Logistics hubs have been equipped with new technological solutions that improve the efficiency of warehouses and transport nodes. The introduction of automated sorting systems has minimised the impact of human error and reduced mistakes in cargo handling. Kazakhstan – Logistics Centre in Almaty, a key transport hub in the country. In 2020, the centre implemented warehouse process automation, including automated sorting systems (Izteleuova & Izteleuova, 2022). This significantly sped up goods processing and decreased errors related to human factors. The centre actively utilises technologies for tracking and monitoring cargo.

The Port of Aktau, located on the Caspian Sea coast, is also undergoing rapid development. Since 2019, the port's infrastructure has been modernised, with new digital systems introduced to improve logistics and container handling (Malakhov *et al.*, 2023). Uzbekistan's logistics centre is situated in Tashkent, where logistics hubs are actively developing. One major project is the Tashkent International Airport, which has introduced automation systems to simplify cargo handling procedures, though these are primarily airport-focused. The country is also pursuing projects to establish automated warehouse complexes to improve goods processing (Eronen, 2001). Kyrgyzstan is also seeing growth in its logistics infrastructure (notably the Trade and Logistics Centre in Bishkek), particularly through cooperation within the EEC framework. However, detailed data on specific warehouse automation and sorting projects in Bishkek is more limited and less extensively documented than in other regional countries (Zalesky, 2023).

Moreover, the digitalisation of warehouse operations has ensured the accuracy of logistics processes, reducing costs and accelerating order processing. This approach is exemplified by major European logistics centres such as the Port of Rotterdam, DHL's logistics centre in Leipzig, Amazon's fulfilment centre in Manchester, Kuehne + Nagel's logistics centre in Switzerland, and XPO's centre in Villefranche-sur-Saône, where robotic cargo flow management systems are employed. Enhancements in logistics and customs systems also help reduce costs associated with goods movement. Optimising logistics routes, improving infrastructure, and reducing customs clearance times substantially lower transportation costs, making products more accessible and competitive in international markets.

The reduction of logistics costs positively affects both small and medium enterprises and large corporations by lowering expenses and increasing overall business efficiency. Additionally, lower transport costs contribute to reduced final product prices, enhancing the region's economic attractiveness for foreign investors. In this context, Central Asia actively attracts investments from both external countries and EEC and SCO member states, thanks to integration processes within these organisations. Specifically, Kazakhstan attracts significant investments from China – especially in energy and infrastructure – and from Russia, which actively invests in agriculture and the oil and gas industry.

Furthermore, EU countries represent an important source of investment in extractive and processing industries (Barpybaev, 2024). In Kyrgyzstan, key investors include China and Turkey, primarily in infrastructure construction and the textile industry, as well as Russian companies engaged in energy and mining. Uzbekistan, in turn, actively attracts investments from China and South Korea, particularly in textiles and agriculture, as well as from Russia in construction and transport. European companies also show interest in investing in the extractive and processing sectors. Tajikistan, despite a smaller scale of investments, attracts capital from China, Russia, and Iran – especially in construction and energy – as well as from EU countries for small and medium-sized projects.

Optimising logistics centres and introducing new technologies in customs procedures are crucial factors for improving the efficiency of goods transit. Notably, the implementation of high-speed and automated systems such as ASKOD (Automated Document Control System) in Kazakhstan and the Automatic Goods Declaration System (AGDS) is actively employed to speed up border clearance and control processes. Since 2018, Kazakhstan has been rolling out ASKOD, also known as the "ASTANA-1" Information System (ASYCUDA), covering more than 15

customs procedures including export, import, and transit. This system enables entrepreneurs to submit declarations remotely, significantly accelerating processes and reducing corruption risks (Adylkanova, 2018). Turkmenistan introduced the electronic customs declaration system "ASYCUDA World" on 1 January 2020 in cooperation with the United Nations Conference on Trade and Development (UNCTAD). This system covers all customs regimes and is actively used to expedite clearance and control at the border (Business Turkmenistan, 2020). These systems significantly reduce processing times and minimise errors in cargo handling. For example, the implementation of GPS cargo tracking in Kyrgyzstan and unmanned delivery technologies in Uzbekistan further improves logistics processes by cutting transport costs and accelerating transit. The introduction of such technologies at customs checkpoints and logistics hubs enhances the transparency and efficiency of foreign trade, facilitating interaction with international platforms. These measures contribute to faster delivery processes, cost reduction, and improved service quality, positively impacting the region's economy by boosting its competitiveness and appeal for international trade. Enhancing logistics infrastructure and automating customs procedures are becoming vital factors for sustainable growth and integration into global economic systems.

The Trans-Caspian International Transport Route (TMTM) represents a key transport corridor system connecting China with Europe via Kazakhstan, Turkmenistan, Azerbaijan, and the Black Sea. This route actively develops the transit capabilities of Central Asia, ensuring efficient transportation of goods and reducing delivery times between Asia and Europe. Within the framework of the TMTM, railway and port infrastructures are undergoing active modernisation, which contributes to improved logistical connections, reduced transit costs, and increased trade volumes in the region. One of the most important areas for improving logistical infrastructure in Central Asia, the EEC, and the SCO has been the implementation of digital technologies in customs procedures. In particular, Kazakhstan and Kyrgyzstan have introduced electronic declaration systems, such as the "Electronic Customs", which automates the declaration submission and verification process, thereby shortening customs clearance times. Kazakhstan also actively employs the Automated Goods Declaration System (AGDS), integrated with international platforms, which significantly accelerates cargo processing and enhances transit transparency. Within the cooperation of EEC and SCO countries – for example, the Electronic Declaration System (EDS) of the EEC countries – all participants operate via shared digital platforms, enabling efficient real-time information exchange on transit cargo. This cooperation aims to simplify procedures, reduce the number of inspections, and speed up customs clearance within the single economic space.

In Uzbekistan, since 2024, an electronic customs clearance system has been introduced, integrated with European and international platforms (Bodaubayeva *et al.*, 2024). This system facilitates faster processes and minimises human error, improving interaction with external markets. Thus, the use of digital monitoring platforms and electronic declaration systems within the EEC and SCO enables countries to collaborate effectively, accelerating goods transit and reducing costs, which significantly enhances the region's competitiveness in international markets.

Under the "One Belt, One Road" initiative, China has actively developed electronic customs systems in partnership with Central Asian countries, simplifying goods transit and promoting increased bilateral trade volumes (Cao, 2019). To date, such systems operate in close cooperation with Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan. This particularly pertains to improved customs clearance procedures for rail, road, and air transport. For Kazakhstan, for example, an electronic declaration system was implemented, which speeds up cargo clearance processes at the border. The "Astana-1" platform operates actively in Kazakhstan, enabling data exchange between EEC countries and China, substantially reducing customs clearance times. Uzbekistan has implemented a similar system at key rail and road checkpoints, facilitating goods transit, especially within cross-border trade with China. Moreover, in major transport hubs such as the Khorgos port in Kazakhstan, electronic systems are actively used to manage cargo flows, and in some cases, these systems cover not only rail routes but also ports. Electronic customs systems are also well integrated into airport infrastructure, helping to accelerate air cargo processing.

These measures aim to ensure the uninterrupted movement of goods through key transport corridors, enhancing transit efficiency and reducing costs at various stages of the logistics chain. State economic policy plays a crucial role in creating conditions for developing the region's transit potential. In particular, devising an effective strategy that supports both private and public investments in transport infrastructure is a vital factor for further strengthening the region's international standing. In today's globalised world, where fast and efficient goods movement is a competitive advantage, government support and investment incentives in infrastructure are essential tools for accelerating economic growth (Ayyildiz *et al.*, 2018).

A key aspect of economic policy is creating conditions conducive to attracting private investment into transport infrastructure development. Private capital can significantly expedite modernisation and construction of transport facilities such as roads, railways, ports, and airports. This requires introducing mechanisms to mitigate investor risks, such as tax incentives, subsidies, and provision of long-term, stable investment conditions. A prominent example of the effective implementation of such policy is the attraction of private investments in infrastructure development in some Asian countries, where public and private partners jointly design and manage transport projects, contributing not only to the renewal of facilities but also to increased transit volumes through these regions (Mukhamedova *et al.*, 2025).

Equally important is the support for public investment in transport infrastructure. State funding ensures the creation of essential foundational facilities such as main transport corridors, bridges, and port structures, which lay the groundwork for further private investment. It is crucial that state economic policy focuses on establishing efficient project management mechanisms, ensuring transparency and long-term planning. An example of successful public investment policy implementation is Kazakhstan's transport infrastructure renewal programme. Within the "Nurly Zhol" programme, aimed at modernising Kazakhstan's transport infrastructure, substantial public investments were allocated to building and expanding railway routes, as well as developing port facilities. The programme covers the period from 2015 to 2019, and its implementation has significantly enhanced the country's transit potential by ensuring more efficient connections with neighbouring states and reinforcing Kazakhstan's position as a key transit hub between China and Europe. One of the programme's main directions was constructing new railway lines, such as the "Khorgos–Almaty" line, which greatly increased capacity for goods transportation along international corridors. Additionally, the "Astana–Shchuchinsk" railway line was modernised, and improvements were made to existing railway sections, contributing not only to better internal transport communication but also to a significant reduction in transit times between major regions and neighbouring countries. Regarding port infrastructure, the "Nurly Zhol" programme also included a project to modernise the Aktau seaport, which significantly increased capacity for container and general cargo shipments across the Caspian Sea. The construction and expansion of the Kuryk port were completed within the programme, further improving infrastructure for goods transportation through this key Caspian region. The total amount of public investment in infrastructure projects under the programme reached approximately 4.1 trillion tenge (about USD 10 billion), a significant portion of which was directed towards developing transport corridors, railways, and port facilities. This, in turn, attracted private investments, positively impacting the economic development of related sectors such as construction, logistics, and cargo processing (Office of the Leading Group for Promoting the Belt and Road Initiative, 2019).

State economic policy has had a substantial impact on the development of transit potential in these countries. Creating favourable conditions for attracting private investment into transport infrastructure played a significant role in modernising logistical facilities. China and Kazakhstan (Khorgos-Almaty railway). Within the "One Belt, One Road" initiative, a project was implemented to modernise and construct the Khorgos (border with China) – Almaty railway line. Building this new railway route increased capacity and accelerated goods transit between China and Central Asia. The project was completed in 2015. The total Chinese investment in this project amounted to approximately USD 1.4 billion. China and Uzbekistan (railway infrastructure). Under the "One Belt, One Road" initiative, China also invested in modernising Uzbekistan's railway infrastructure, including a railway construction project linking Uzbekistan with China. In particular, in 2017, a railway project heading towards China through Uzbekistan was completed. Chinese investment amounted to approximately USD 250 million. Turkmenbashi Port (Turkmenistan). China invested in developing the Turkmenbashi port, modernising infrastructure and expanding capacity to increase container transportation volumes. Chinese investments in developing the Turkmenbashi port infrastructure were estimated at 500 million US dollars. The project was carried out within the framework of the "One Belt, One Road" initiative cooperation, contributing to expanding Turkmenistan's transit capabilities. Aktau Port (Kazakhstan). Investments were made in reconstructing and modernising Aktau port infrastructure, including improving cargo turnover and expanding berths. The approximate investment amount was 300 million US dollars. Chinese companies participated in projects to reconstruct the port and upgrade its capacity to increase transit volumes as part of the "One Belt, One Road" cooperation (How projects are…, n.d.).

Specifically, Chinese investments in constructing terminals at the Lianyungang port significantly expanded export capabilities via maritime routes. One effective mechanism for financing logistics projects has been public-private partnerships (PPPs), which combine state and business resources. PPPs are important mechanisms for financing infrastructure projects aimed at logistics development and improving transit accessibility in Central Asia. Kazakhstan and Uzbekistan have actively applied the PPP model to implement several major infrastructure projects, which have contributed to improving logistical accessibility and increasing the efficiency of transit routes. In Kazakhstan, one of the key PPP projects in the logistics sphere is the construction and modernisation of transit roads and infrastructure based on the International Logistics Centre at Khorgos. This project was implemented within the "Nurly Zhol" programme, aiming to increase capacity and improve access to trade routes between China and Europe. Private investors were attracted to build warehouse facilities, railway terminals, and modernise port facilities. The total project cost was 3.4 billion US dollars, with the main stages of work scheduled for completion in 2019-2020. This project significantly improves Kazakhstan's transit infrastructure, increasing throughput, reducing transport costs, and shortening the time required for goods transit. In Uzbekistan, an important PPP project is the development of a transport and logistics centre in the Fergana Valley, realised in 2018. The project included building railway terminals, upgrading warehouse capacities, and implementing new digital technologies for faster cargo processing. Private investors provided a substantial portion of the financing, with total investments amounting to about 200 million US dollars. This project improved Uzbekistan's logistical accessibility for exports and imports, especially for transit goods passing through neighbouring countries.

Furthermore, the international logistics centre "Tashkent" has also become a significant PPP project in Uzbekistan. This involved constructing transport terminals and modernising railway and road networks, considerably accelerating cargo transportation processes. The project involved local companies and international investors from China and Russia. The total project cost is estimated at around 400 million US dollars (Ameh, 2024).

These public-private partnership (PPP) projects in Kazakhstan and Uzbekistan are aimed at developing transit infrastructure, improving logistical accessibility, and creating efficient transport corridors, thereby contributing to increased trade volumes and attracting investment into the economies of these countries. In particular, the development of the China-Kazakhstan-Europe transport corridor has played a key role in enhancing logistical connectivity and reducing delivery times. This corridor constitutes a vital component of the Silk Road, traversing China, Kazakhstan, and onwards to Europe, including transit through Russia, Ukraine, or other Central and Eastern European countries. The implementation of this transport corridor in Kazakhstan included the modernisation of railway infrastructure, construction and enhancement of port facilities (e.g., in Khorgos), as well as the development of road and aviation infrastructure, which significantly reduced cargo delivery times. Through PPP arrangements, private investors were engaged in the construction of terminals, logistics centres, and the modernisation of transport facilities. The reduction in transit time for goods along this corridor has led to increased trade turnover between China and Europe, while also significantly enhancing Kazakhstan's appeal as a transit hub within global trade routes (Nguyen *et al.*, 2021).

In Central Asian countries, the consideration of environmental factors during the construction and modernisation of transport infrastructure has become a crucial aspect of the long-term development of logistics. The introduction of sustainable technologies, such as energy-efficient systems and environmentally friendly transport, has contributed not only to the reduction of the carbon footprint but also to the enhancement of transport services (Wang *et al.*, 2024). The adoption of digital cargo flow management platforms has improved logistics efficiency by streamlining processes and expediting the transit of goods. For Central Asian countries such as Kazakhstan and Uzbekistan, environmentally sustainable projects have also attracted foreign investment, as adherence to environmental standards has become a key criterion for many international partners. For instance, the introduction of electric vehicles and renewable energy sources at transport hubs has helped reduce pollution and improve the overall transit environment, thereby increasing the region's competitiveness in international markets (Raimbekov & Syzdykbayeva, 2021).

A key element in improving the logistics infrastructure in Central Asian countries is the development of policies aimed at encouraging private sector participation. This includes reducing administrative barriers, simplifying the process of obtaining permits and licences, and providing tax and financial incentives for private companies. One of the most effective tools in this area is PPP, which enables the pooling of public and private sector efforts to implement infrastructure projects. Within the PPP framework, private investors gain the opportunity to participate in high-return projects, which helps reduce risks and maintain the sustainability of transport infrastructure in the long term (Yang *et al.*, 2023).

Under China's Belt and Road Initiative, several multimodal transport hubs have been established to integrate different modes of transport and improve international transit. One such key hub is the Port of Lianyungang, located on the eastern coast of China. This port links maritime routes with rail corridors connecting China with Europe and Central Asia. Container trains passing through Lianyungang significantly reduce the time required to deliver goods from China to Europe – from several months to just a few weeks. Another significant multimodal hub is Khorgos, located on the border between Kazakhstan and China, which connects rail and road networks. Khorgos serves as a major transit point for goods bound for Russia, Europe, and the Middle East and is a key component of the transport corridor linking China with Europe via Kazakhstan. Another important facility is Dostyk, a rail hub on the Kazakh-Chinese border that plays a vital role in transporting goods to Europe through Central Asia. The Port of Piraeus in Greece is also a significant multimodal hub that links maritime and railway routes and is actively used for the transit of goods from Asia to Europe. The Port of Chennai in India and the city of Urumqi in Xinjiang, China, also serve crucial functions in multimodal transportation, facilitating the transit of goods between Asian, Middle Eastern, and European countries. These hubs are vital links in the international transport network, reducing both delivery times and logistics costs, while also fostering deeper cooperation among participating countries. The adoption of innovative logistics and transport planning solutions has helped to enhance the region's economic attractiveness and minimise environmental impact in line with the principles of sustainable development. An effective economic policy aimed at attracting both private and public investment in transport infrastructure is a key instrument for developing the transit potential of the region (Abdullayev *et al.*, 2024). The adoption of new financing methods and the creation of a favourable business environment not only support infrastructure expansion but also promote the region's long-term sustainable development. This contributes to improved competitiveness, enhanced economic conditions, and stronger positions in the global marketplace.

Global climate change has become one of the most pressing contemporary issues, significantly affecting ecosystems worldwide through rising temperatures, altered precipitation patterns, and sea level rise (Buribayev *et al.*, 2020). In such circumstances, it is crucial to consider environmental factors during the planning and implementation of transport projects. In Central Asian countries, the integration of sustainable development principles into

transport infrastructure is gradually gaining traction, with measures being taken to account for carbon footprints. Kazakhstan is actively advancing environmentally friendly technologies, including electric and hybrid vehicles, as part of its strategy to reduce emissions and improve air quality. A key aspect of modernisation is the development of energy-efficient rail systems and the use of renewable energy sources. Uzbekistan also considers environmental aspects in its transport infrastructure upgrades, implementing energy efficiency projects in rail transport and exploring initiatives to develop infrastructure for electric and hybrid vehicles. In Kyrgyzstan, steps are being taken to use alternative energy sources in transport, including the introduction of electric buses in cities, which helps reduce carbon emissions from public transport. Tajikistan is also working to improve the environmental sustainability of its transport infrastructure, although projects specifically aimed at reducing the carbon footprint remain limited. However, future plans include the development of energy-efficient and environmentally friendly transport facilities. Thus, Central Asian countries are gradually introducing sustainable technologies in the transport sector, with a focus on clean transport and the modernisation of existing infrastructure (Ibrayeva, 2023).

One of the main environmental considerations in transport project planning is the assessment of ecological impacts. Transport infrastructure – including roads, rail networks, airports, and seaports – can significantly damage ecosystems, such as by disrupting natural landscapes, obstructing wildlife migration routes, and polluting air and water resources. To prevent such consequences, comprehensive environmental assessments are required at all stages of project development. These assessments include analyses of biodiversity, and air, water and soil quality, as well as evaluations of potential risks to public health and ecosystems. It is essential that planners and developers take these factors into account and implement measures to minimise potential harm. Modern approaches to environmentally sustainable transport infrastructure design include the use of clean technologies and solutions that can significantly reduce negative environmental impacts (Gutarevych *et al.*, 2020). For example, the planning and construction of roads and railways should involve materials and technologies that minimise air and water pollution. Another critical step is the introduction of environmentally neutral vehicles, such as electric buses and cars, which substantially reduce emissions of carbon dioxide and other pollutants. In this way, sustainable technologies help to improve quality of life while protecting nature and ecosystems. In the design of port and airport facilities, it is necessary to consider not only their impact on land and water resources but also the potential for integrating alternative energy sources, such as solar panels and wind turbines. Such solutions can significantly reduce the carbon footprint and make transport infrastructure more environmentally friendly. Furthermore, it is important to establish waste collection and recycling systems, minimise noise pollution, and improve conditions for flora and fauna in surrounding areas.

The consideration of environmental factors in transport projects is becoming increasingly important against the backdrop of global climate change. Modern solutions can have a lasting impact on the state of the environment, making it essential to take proactive measures to minimise ecological harm. The application of sustainable design principles in transport infrastructure not only helps protect the natural environment but also enhances quality of life, creating a safe and comfortable environment for future generations. Thus, environmental issues are becoming an integral part of the planning process for transport infrastructure. In the context of climate change, it is crucial to implement environmentally safe and sustainable solutions that minimise the impact on nature and ensure long-term development. A key step in this process is the use of modern technologies that account for environmental risks, along with the integration of sustainability principles at every stage of design and construction.

Discussion

The study examined how the development of the transit potential of Central Asian countries is linked to their economic and integration cooperation. The findings indicate that active participation in integration initiatives – such as the Eurasian Economic Union and the Shanghai Cooperation Organisation – is a crucial factor in improving transit infrastructure. Engagement in these organisations has significantly enhanced transport communications and optimised trade routes, which, in turn, has positively influenced the economic performance of the region's countries. Integration processes have also accelerated the harmonisation of customs procedures and the reduction of trade barriers, making Central Asia more attractive to international investors.

A.K. Górecka *et al.* (2021) concluded that international economic unions contribute to the modernisation of transport infrastructure by creating favourable conditions for logistics flows. Joint investment projects are aimed at developing key transport hubs, ensuring uninterrupted movement of goods. The coordination of transport policy within unions enables route optimisation and reduces transportation costs. Y. Liang *et al.* (2021) found that integration agreements support the development of new transport corridors, increasing their throughput capacity and reducing delivery times. Simplified customs procedures and harmonised regulatory requirements lower trade barriers between countries. As a result, companies gain access to broader markets, and consumers benefit from a more diverse and affordable range of goods. The conclusions of Y. Liang *et al.* (2021) and A.K. Górecka *et al.* (2021) confirm the results of this study, as the improvement of transport infrastructure within economic unions indeed helps to reduce logistics costs. The analysis shows that integration agreements accelerate the modernisation of key transport corridors, which positively affects trade volumes and the speed of goods turnover. In addition, the harmonisation of customs procedures and the simplification of regulatory

requirements help minimise delays at borders, making international trade more efficient.

One of the key aspects of this study is the focus on infrastructure projects such as the construction of the railway between Kazakhstan and China and the development of the Port of Aktau. These projects have played a crucial role in strengthening transport links between Central Asia and other regions. The construction of the railway significantly improved logistics, speeding up delivery and reducing transport costs. Such initiatives enhance the region's competitiveness by providing Central Asian countries with vital transport corridors connecting them to European and Chinese markets. The study by J. Zhao *et al.* (2021) also highlighted that large-scale infrastructure projects play a key role in economic integration by lowering barriers to trade and investment. Modern transport hubs and logistics centres enable efficient regional interaction, strengthening their competitive advantages. As a result, the attractiveness of these areas to businesses increases, which stimulates economic growth and creates new jobs. Similarly, Z. Raimbekov *et al.* (2022) concluded that the development of strategic transport corridors ensures faster and more cost-effective goods movement, reducing logistics costs. Improvements in the transport network contribute to market expansion, which is particularly important for export-oriented industries. In the long term, such projects increase economic resilience by ensuring stable supply chains for raw materials and finished products.

These findings are consistent with the core arguments of this study, demonstrating the link between infrastructure development and increased regional competitiveness. The analysis shows that the modernisation of transport corridors contributes to trade growth and reduced logistics costs. The establishment of modern logistics hubs also facilitates access to international markets, highlighting the importance of infrastructure projects in stimulating economic development. Special attention was paid to the improvement of logistics and customs systems, which played a significant role in increasing the transit potential of the region. The implementation of modern technologies in customs procedures has accelerated goods movement and reduced processing costs. The development of logistics centres has also improved transport efficiency by ensuring prompt cargo handling and simplifying documentation processes. All these changes have made transit through Central Asia more competitive, contributing to trade growth and the expansion of international commerce. I. Meidutė-Kavaliauskienė & R. Činčikaitė (2023) also conducted a study confirming that the optimisation of logistics centres and the introduction of automated customs systems significantly reduce transit times. Modern distribution hubs enable more efficient storage and cargo handling, reducing business costs. The automation of customs control simplifies border crossing procedures, minimising delays and enhancing the transparency of trade operations. C. Dong *et al.* (2021) similarly found that new technologies and digitalisation accelerate international transport through the use of intelligent freight flow management systems. The integration of blockchain and artificial intelligence in logistics processes increases data security and reduces the risk of fraud. As a result, companies benefit from more reliable and predictable supply chains, which positively affects the entire delivery process.

A comparative analysis of the research data reveals a clear trend towards increased efficiency of logistics processes through automation and digital technologies. The findings show that the implementation of intelligent freight management systems helps reduce transit times and logistics costs. Furthermore, the digitalisation of customs procedures enhances the transparency and security of international transport, underlining the key role of technological solutions in the development of global trade. In terms of economic policy, the research shows that stimulating private investment in transport infrastructure has become a vital element in developing the region's transit potential. Successful projects – such as the modernisation of ports and the construction of transport networks – have attracted substantial funding and enhanced the overall investment appeal of Central Asia. Investment in infrastructure projects has strengthened the region's position on the international stage, raising its status as an important transit hub for global trade (Stoiian, 2024). Economic policies supporting such initiatives have yielded positive outcomes by encouraging investment and improving infrastructure quality. M. Celestin *et al.* (2024) found that both public and private investments are essential for the modernisation of transport and logistics systems, contributing to their efficiency and stability. Public-private partnerships offer the opportunity to attract additional funding and accelerate the implementation of infrastructure projects. This reduces the fiscal burden and creates more favourable conditions for entrepreneurship, thereby enhancing economic competitiveness. W. Jiang *et al.* (2021) identified economic policy as an important tool for attracting foreign investment in infrastructure projects by providing stable legal and financial frameworks. Tax incentives, guarantees, and subsidies increase the investment appeal of the transport sector. As a result, international cooperation is strengthened, and the modernised infrastructure fosters trade growth and economic development.

The analysis of research results shows that attracting private investment into infrastructure supports the rapid development of transport and logistics networks. The findings confirm that public-private partnerships help minimise budgetary costs and increase the efficiency of major projects. Moreover, a well-designed economic policy aimed at creating a favourable investment climate contributes to an increased inflow of foreign capital into the infrastructure sector. Despite considerable achievements, certain gaps have been identified that require further attention and research. One such area is the need for further development of environmentally sustainable technologies in the transport sector. In the context of global climate change and stricter environmental regulations, the region must adapt its transport systems to meet these challenges. The development of clean and energy-efficient

technologies in the transport sector has become a key priority for Central Asian countries. This will not only improve the environmental situation but also enhance the region's attractiveness to international partners. This issue has also been explored by A. Roy & S. Pramanik (2024), whose findings indicate that the integration of environmentally friendly technologies into transport projects is an important step in combating global climate change. The use of electric and hydrogen-powered vehicles and the establishment of infrastructure for alternative fuels help reduce CO_2 emissions. These efforts not only lessen the environmental impact but also improve the energy efficiency of transport systems. According to the study by G. Bodaubayeva *et al.* (2024), environmental standards are a key driver in modernising transport infrastructure, promoting the shift towards sustainable logistics models. The introduction of strict regulations on emissions and energy efficiency encourages the adoption of innovative solutions and the improvement of transport operations. This fosters the development of a more sustainable and cost-effective logistics system, supporting long-term economic growth.

It is important to emphasise that the introduction of clean technologies into transport systems requires significant investment and a comprehensive approach. The analysis shows that successful infrastructure modernisation is achievable through a combination of government support, private investment, and international cooperation. Moreover, compliance with environmental standards not only reduces ecological damage but also enhances the competitiveness of transport companies amid tightening sustainability requirements. Overall, the studies have confirmed that the development of Central Asia's transit potential in the context of economic and integration cooperation plays a significant role in ensuring sustainable economic growth and enhancing the region's competitiveness. Participation in international economic associations, the development of transport and logistics infrastructure, the improvement of customs procedures, and the stimulation of private investment are key elements contributing to the region's integration into the global economy. At the same time, it is essential to continue taking environmental factors into account and to strengthen measures aimed at improving the environmental sustainability of transport systems.

Conclusions

The study established that the development of the transit potential of Central Asian countries was directly dependent on the level of economic integration and the modernisation of transport infrastructure. The expansion and improvement of strategically important transport corridors had a significant impact on the region's competitiveness. Infrastructure projects such as the construction of the Kazakhstan-China railway, the modernisation of the Aktau port, and the development of the Trans-Caspian International Transport Route contributed to reduced delivery times, lower logistics costs, and the strengthening of Central Asia's position as a key transit hub between Europe and Asia.

The research also confirmed that the integration of the region's countries into international frameworks, including the EEC, SCO, and the Belt and Road Initiative, contributed to the enhancement of transit capacity. Participation in these structures facilitated the harmonisation of transport and customs procedures, the reduction of bureaucratic barriers, and the standardisation of logistics infrastructure. As a result, this reinforced trade relations, simplified cross-border goods movement, and improved the countries' positions in global markets.

Improving logistics and customs systems played a crucial role in increasing transit efficiency. The introduction of digital technologies, the development of logistics hubs, and the implementation of automated cargo flow management systems accelerated cargo processing, optimised delivery routes, and reduced operational costs. A significant contribution to the efficiency of transport corridors came from customs digitalisation projects, including electronic declaration systems and automated checkpoints introduced in several countries in the region. These measures also supported the attraction of private investment necessary for further expansion of transit potential. Participation in the China-Central Asia transport corridor resulted in the highest increase in transit freight – by 15% – and an 18% rise in trade turnover among the participating countries. Meanwhile, integration into the SCO contributed to a 12% growth in transit and a 20% increase in trade relations, indicating the organisation's high potential for strengthening regional economic ties.

An important factor in the sustainable development of the region's logistics infrastructure was compliance with environmental standards in the design and operation of transport facilities. In the context of growing climate challenges, the implementation of environmentally friendly technologies – such as low-carbon transport, energy-efficient logistics centres, and emission monitoring systems – has become increasingly relevant. These solutions help to minimise the environmental footprint of the transport sector while improving infrastructure quality and creating better conditions for sustainable economic growth.

Overall, the findings confirmed that the successful development of the transit potential of Central Asian countries requires a comprehensive approach that includes the modernisation of transport networks, active participation in international economic and logistics initiatives, the implementation of digital technologies in logistics and customs processes, and the consideration of environmental factors. All these elements are essential for enhancing the region's competitiveness and its integration into the global economic system. Further research is needed to examine the impact of digital technologies, artificial intelligence, and automated transport systems on increasing the efficiency of transit flows and reducing operational costs in the region.

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Розвиток транзитного потенціалу країн Центральної Азії в умовах економічної та інтеграційної взаємодії

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Анотація. Дослідження присвячене оцінці впливу економічної та інтеграційної співпраці на розвиток транзитного потенціалу держав Центральної Азії. В рамках дослідження застосовувалися аналітичні методи вивчення впливу інфраструктурних проектів, інтеграційних процесів, логістичних систем та екологічних факторів на динаміку розвитку транзитного потенціалу регіону. Результати дослідження підтвердили, що розширення транзитного потенціалу країн Центральної Азії тісно пов'язане з розвитком транспортної інфраструктури та поглибленням інтеграційних процесів у рамках міжнародних економічних та торгових об'єднань. Встановлено, що реалізація проектів із модернізації залізничних та автомобільних магістралей сприяла значному зростанню вантажообігу, а також зміцненню транспортних зв'язків як усередині регіону, так і з сусідніми державами. Створення спільних логістичних хабів та спрощення митних процедур значно сприяли скороченню термінів доставки товарів та зниженню супутніх витрат. Інтеграція до Євразійського економічного союзу та Шанхайської організації співробітництва сприяли зміцненню торговельно-економічних та інвестиційних зв'язків, що позитивно відбивається на масштабах та ефективності транзитних перевезень. Зокрема, збільшення транзиту товарів ключовими маршрутами склало 15 %, а зростання обороту зовнішньої торгівлі – 20 %. Отримані результати свідчать про необхідність подальших інвестицій у модернізацію інфраструктури, удосконалення митного регулювання та розширення співробітництва з міжнародними органами торгівлі. Реалізація цих заходів забезпечить стабільне зростання транзитного потенціалу та підвищення конкурентоспроможності регіону на світовому ринку. Проведене дослідження робить внесок у наукову сферу, формуючи аналітичну основу для розробки стратегій підвищення транзитного потенціалу країн Центральної Азії за рахунок інтеграції інфраструктурних та економічних аспектів в умовах міжнародної взаємодії

Ключові слова: транспортна інфраструктура; логістичні центри; митні процедури; торговельні відносини; конкурентоспроможність