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DEVELOPMENT OF TRANSPORT AND LOGISTICS INFRASTRUCTURE IN CENTRAL ASIA

Jumakhanov Shavkatjon Zairjanovich
Doctor of Geographical Sciences (DSc), Associate Professor
Namangan State University, Uzbekistan

Osimov Bakhodirjon Bakhromjon ugli
Master's degree in Geography
Namangan State University, Uzbekistan

Abstract. *The article analyzes the transport and logistics infrastructure of Central Asian countries. Annual indicators of freight and passenger transportation by transport types in the regional countries are presented. Proposals and recommendations have been developed regarding the development of the region's transport and logistics infrastructure.*

Keywords: *integration, macroeconomy, modernization, transit, diversification, multimodal*

РАЗВИТИЕ ТРАНСПОРТНО-ЛОГИСТИЧЕСКОГО ПОТЕНЦИАЛА И ИНФРАСТРУКТУРЫ В ЦЕНТРАЛЬНОЙ АЗИИ

Аннотация. *В статье анализируется состояние транспортно-логистической инфраструктуры стран Центральной Азии. Приведены ежегодные показатели грузовых и пассажирских перевозок по видам транспорта в государствах региона. Разработаны предложения и рекомендации по дальнейшему развитию транспортно-логистической инфраструктуры региона.*

Ключевые *слова: интеграция, макроэкономика, модернизация, транзит, диверсификация, мультимодальность.*

Introduction. Transport holds a special place in international and regional economic relations, as the opportunities, efficiency, and timing of any country's integration into the global economy depend on its state. Transport is one of the main sectors of the macroeconomy, the lifeblood of the economy, and a driving force. It connects production with consumption, ensuring the continuity of the social production process [5; 272-p].

In this sense, transport not only ensures the continuity of the production–consumption chain but also determines the degree of connection of regions to the global economy. This functional role is directly related to spatial location, serving as a natural transit hub for the Central Asia–Europe–Asia–Middle East corridors at

the geostrategic intersection. Accordingly, modernizing the transport infrastructure in the region becomes a key condition for enhancing the efficiency of international and regional economic relations as well as the logistics system.

Kazakhstan, Uzbekistan, Turkmenistan, Kyrgyzstan, and Tajikistan make up Central Asia, a strategically important geographic region. It borders Russia to the north, China to the east, and Iran and Afghanistan to the south, serving as a vital bridge connecting Europe, Asia, and the Middle East [7; 224-p]. The development of the transport system in Central Asia plays a key role in the international and regional economic relations of these countries as well as in the formation of the logistics sector.

The development of the transport system is greatly influenced by factors such as the natural conditions of the region, its political and geographical location, the distribution of the economy and population, and the size of the territory. In Central Asian countries, including Kazakhstan and Turkmenistan, there are no obstacles to the development of the transport system due to favorable natural conditions. However, the situation is fundamentally different in Kyrgyzstan and Tajikistan within the region. In these countries, the relief conditions hinder the development of the transport system, as 90 percent of the land area consists of high mountain ranges [1; 106, 112-p]. For example, the Tashkent-Andijan-Osh-Ergashtom-Kashgar highway passes through the Kyrgyz territory over the Chayirchiq Pass (2406 m), Toldiq Pass (3645 m), and Taunmurun Pass (3536 m). On the road connecting Dushanbe, the capital of Tajikistan, and the city of Khujand, there is the Istiklol Tunnel with a length of 5040 meters, located at an altitude of 2720 meters above sea level.

The location of the economy and population also determines the type and composition of transport. In oases and valleys where industry and agriculture are well developed and the population is densely settled—around cities and recreational areas - the transport system is accordingly formed in a well-developed manner [5; 281-p]. This, in turn, activates economic activity, strengthens

interregional integration, and leads to an intensification of transport flows. For example, the Fergana Valley is considered one of the most densely populated areas not only in Central Asia but also in the world. Therefore, the transport system in the Fergana Valley is very dense and well-developed.

The political-geographical factor also plays an important role in the location of transport. For example, as a result of the collapse of the former Soviet Union and the emergence of new independent states, internal borders became international state borders, creating the need to develop transport systems that connect the internal parts of the countries [5; 282-p]. Furthermore, the political-geographical factor changes the priorities of transport routes. New independent states, considering their economic interests, strive to diversify external trade routes, that is, to develop transport connections along several directions. This requires the reconstruction of existing transport infrastructure based on modern demands and strengthening transit partnerships with neighboring countries. As a result, the transport system serves not only as a means of internal integration but also as a tool for regional cooperation and geopolitical stability. Political unrest in Afghanistan negatively affects the development of transport in the region because Afghanistan serves as a bridge between Central Asia and South Asia. Consequently, regional transport-transit projects are being delayed or halted.

Materials and Methods. The article utilizes scientific-theoretical analysis, processing of statistical data, and comparative analysis approaches. Statistical indicators related to the countries of the region were systematically analyzed based on data from their official statistical agencies and used as the main information source in the article.

Discussion. The transport system is not only a collection of means for transporting people and goods from one place to another but also a complex system closely linked with the country's economy, social development, and technology. In Central Asia, the transport system is a complex and vital sector that

plays a decisive role in the region's economic, political, and geostrategic development.

Table 1

Transport Systems of Central Asian Countries[1]

№	Country	Transport types			
		Lenght of Roads, km	**Lenght of railway**, km	**Lenght of Pipelines**, km	**Inland waterways**, km
1.	Kazakhstan	95 000	16 000	12000	4302
2.	Uzbekistan	44 000	6200	14 000	-
3.	Kyrgyzstan	34 000 km	417	383	-
4.	Tajikistan	15000	620	587	-
5.	Turkmenistan	22 000	6500	1343	-

Source: Table compiled by the authors based on [10, 11, 12, 13, 14, 15].

Kazakhstan′s transport potential in the Central Asian region is more developed compared to other countries (Table 1). It ranks first in the region in terms of the length of both roads and railways. The country plans to build 4,700 km of new roads by 2030, of which 3,700 km will be first-degree highways [8]. In 2024, 1,078.8 million tons of cargo were transported via the country's transport system, which is a 10% increase compared to the same period in 2023. The railway density in the country is approximately 5,9 kilometers per 1,000 km², which is significantly lower than in developed countries. For example, it is 1,5 to 3 times lower than in countries like India and Vietnam, and several times lower compared to developed European countries [3; p. 831].

In 2024, compared to 2023, Kazakhstan saw a 9.4% increase in passenger transport by road, a 19.5% increase in freight transport, a 24.6% rise in passenger turnover, and a 19.7% increase in freight turnover. In the railway sector, the number of passengers transported in 2024 reached 20.8 million people, reflecting a 5.1% increase compared to the previous year. Passenger turnover grew by 0.5%,

[1] The table shows the length of the main transport routes.

reaching 16.2 billion passenger-kilometers. A total of 437.1 million tons of cargo were transported by rail, showing a 5% increase from the previous year. Freight turnover amounted to 327.9 billion ton-kilometers, increasing by 0.3% [9]. These figures indicate a high growth rate in road transport and stability in the railway sector.

Kazakhstan ranks second in the region after Uzbekistan in terms of the length of pipeline networks. From January to December 2024, 295.4 million tons of cargo were transported through pipelines, which is 7.4% more than in 2023. Freight turnover amounted to 149.1 billion ton-kilometers, showing 3.7% increase compared to 2023.

The total length of inland waterways in Kazakhstan is 4,302 kilometers, making it the leader in the region in this regard (Table 1). These inland waterways are primarily concentrated in the Ural–Caspian, Ili–Balkhash, and Irtysh river basins. However, the majority of cargo transportation is carried out via the Irtysh River. On this river, vessels navigate through three lock-equipped dams located in Bukhtarma, Ust-Kamenogorsk, and Shulbinsk. Experts have identified the integration of inland waterways into the multimodal logistics system as a strategic priority. This is particularly relevant in the context of heavy congestion on rail and road networks, the redirection of import-export cargo to the transport system, and active discussions on developing the Russia–Kazakhstan–China transit corridor. If implemented, the project would enable cargo to be transported via the Irtysh River to Lake Zaysan, then loaded onto trains and shipped to China through the Maikapshagai–Jeminay border crossing. This initiative would create an alternative transport route to rail and road and could increase trade volume between Kazakhstan, China, and Russia by up to 3.6 million tons per year [6]. The integration of inland waterways into the multimodal logistics system could serve not only as infrastructure development for Kazakhstan but also as a means of gaining an advantage in geoeconomic competition. In 2024, 349.7 thousand tons of

cargo were transported via inland waterways (54.1% decrease compared to 2023), while 231.1 thousand passengers were transported (90.9% increase) [12].

In Central Asia, Uzbekistan ranks second after Kazakhstan in terms of the length of road networks, third in the length of railway lines after Kazakhstan and Turkmenistan, and holds the first place in pipeline length (Table 1). According to data from the State Committee of the Republic of Uzbekistan on Statistics, the volume of cargo transported in 2020 amounted to 1,366.7 million tons, and by 2024, this figure had reached 1,521.2 million tons - an increase of 11%. This is the highest figure recorded over the past five years. Among the modes of transport, road transport leads in terms of cargo volume, accounting for 1.4 billion tons, which makes up 92% of the total cargo. Rail transport handled 73.9 million tons (4.9% of the total), while pipeline transport accounted for 61.8 million tons (4.1%) [18]. The key factors behind this growth include the gradual modernization of transport infrastructure, the expansion of trade turnover, and the recovery of economic activity following the pandemic-related restrictions.

In the early 20th century, a significant amount of passenger and cargo transportation took place along the waterways of the Amu Darya and the Aral Sea. In 1924, the total length of navigable waterways for boats and ships was 887 km. By 1980, this figure had increased to 2,800 km. Steamships operated on the Amu Darya from the Panj port to Muynak. However, due to the decline in the river's water levels and the shrinking of the Aral Sea, the length of navigable waterways sharply decreased [4; 86-p]. Today, ferries still operate in some sections of the Amu Darya and Syr Darya rivers. Currently, inland water transport holds little significance in Uzbekistan's economy and logistics. The limited use of water transport can be attributed to a lack of infrastructure and poor navigation conditions.

Kyrgyzstan ranks third in the region in terms of the length of road networks, following Kazakhstan and Uzbekistan (Table 1). In 2024, a total of 48.638 million tons of cargo were transported across the country, which is 5.9% more than in

2023. Over 82% of total cargo - namely 40.001 million tons - was transported by road, representing a 7.8% increase compared to 2023. In contrast, Kyrgyzstan ranks last in the region in terms of the length of railways and pipelines. As a result, cargo volumes transported by these modes are very low. For instance, in 2024, 8.227 million tons of cargo were transported by rail, which reflects a 3.1% decrease (0.261 million tons) compared to 2023. Meanwhile, 368 million tons of cargo were transported via pipelines in 2024, marking a 25.6% increase from the previous year. Kyrgyzstan is a landlocked country with no inland waterways, and its economy mainly relies on road, rail, and air transport. Consequently, water transport holds very little significance in the national economy.

In Central Asia, Tajikistan ranks last in terms of road network length and fourth in the length of railway and pipeline networks, following Kazakhstan, Uzbekistan, and Turkmenistan (Table 1). In 2024, a total of 134.4 million tons of cargo were transported by all modes of transport in the country, which represents an 11.5% increase compared to 2023. Among the modes of transport, road transport dominates cargo movement, accounting for 127.7 million tons, or 95% of the total volume. The shares of rail and pipeline transport in total freight movement are relatively small, indicating a high reliance on road transport in Tajikistan’s freight system.

The regional structure of freight transport in 2024 shows that 37.1% of the total cargo was transported in the Khatlon region, 29.8% in Sughd region, 16.5% in the capital Dushanbe, 15.7% in districts directly subordinate to the republic, and only 0.9% in the Gorno-Badakhshan Autonomous Region.

In 2024, over 1 billion passengers were transported by various types of passenger transport, which is 13.4% more than in the previous year. Road transport plays a critical role in passenger mobility in the country, accounting for 99.9% of the total passenger traffic. During this period, 996.1 million passengers were transported by road transport (including services by ministries, agencies,

enterprises of various ownership forms, and private entrepreneurs), which is a 13.6% increase compared to the previous year [10].

Turkmenistan ranks fourth in the region in terms of the length of road networks, following Kazakhstan, Uzbekistan, and Kyrgyzstan, and second after Kazakhstan in the length of railway lines. As a major gas exporter, the country has developed a network of main gas pipelines. However, the total length of trunk pipelines within the country is 1,343 km, placing Turkmenistan among the top three in the region in this category (Table 1). In January-April 2025, the volume of transit cargo transported through Turkmenistan exceeded 2 million tons, which is a 20% increase compared to the same period in 2024 [7]. Through pipeline transport, the country exports large volumes of oil and natural gas to other states. For instance, in January-July 2025, oil delivered from Turkmenistan and Kazakhstan to the Baku-Tbilisi-Ceyhan (BTC) pipeline accounted for 16.2% of the pipeline's total flow. These figures highlight Turkmenistan's significant role in regional transit and resource logistics.

Conclusion and Recommendations. As the key infrastructure for economic development, the transport system plays a decisive role in forming interstate economic relations and integrating the Central Asian region into global markets. Kazakhstan and Uzbekistan are considered regional leaders due to the development of their transport infrastructure and favorable geographic location. Turkmenistan's transport system outperforms those of Kyrgyzstan and Tajikistan, as certain factors hinder the development of transport systems in these countries.

To develop the transport and logistics infrastructure in Central Asia, the following recommendations can be made:

1. Attract national and foreign investments to modernize modern highways, railways, logistics centers, warehouse systems, and border crossing points in Central Asian countries.

2. Diversify transport routes to avoid reliance on a single direction (for example, reduce dependence on China or Russia). Developing Trans-Afghan

projects passing through Afghanistan will expand new routes and provide regional countries access to markets in the Middle East, Africa, and India through the seaports of Karachi, Qasim, and Gwadar.

3. Digitize customs procedures and implement a “single window” system across the region to speed up cargo flow and reduce excessive paperwork.

4. Harmonize logistics strategies among Central Asian countries and adopt unified standards and regulations in the transport sector.

5. Ensure ecological sustainability of the region by transitioning to environmentally friendly transport vehicles, reducing waste, and applying energy-efficient technologies.

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