

ANALYSIS OF CONTAINER TRAFFIC IN SELECTED MEMBER COUNTRIES OF THE ORGANIZATION FOR CO-OPERATION BETWEEN RAILWAYS (OSJD) UNTIL 2021

Mirosław Antonowicz ¹ 

¹ Kozminski University, Department of Marketing, Jagiellońska 57, 03-301 Warszawa, Poland, e-mail: maaw@kozminski.edu.pl
<https://orcid.org/0000-0001-7206-0625>

Reviewed positively: 26.10.2023

Information about quoting an article:

Antonowicz M. (2024). Analysis of container traffic in selected member countries of the Organization for Co-Operation between Railways (OSJD) until 2021. *Journal of civil engineering and transport*. 6(3), 9-24, ISSN 2658-1698, e-ISSN 2658-2120, DOI: [10.24136/tren.2024.009](https://doi.org/10.24136/tren.2024.009)

Abstract – The aim of the article is to analyze transport volumes in rail freight traffic between Asia and Europe in the selected countries of the members of the Organization for Co-Operation between Railways (OSJD) until 2021 and to indicate the competitiveness factors.

The research methodology is the analysis of secondary sources and materials of OSJD member countries. The research was carried out on the basis of data obtained as part of own analytical work carried out in the field of transport within the OSJD. In the final analysis, attention is drawn to the effects of the armed conflict between the OSJD member countries.

According to the obtained results, in 2021 rail freight services in the OSJD member countries demonstrated stability as regards transport volumes. Joint actions of the railways of the OSJD member countries led to positive results, including increased container volumes in international rail traffic between Asia and Europe. The analyses also showed transport increases in countries along the railway transport corridors under the New Silk Road concept and fluctuations in transport volumes in other countries. The main factors in the competitiveness of rail traffic between Asia and Europe turned out to be the speed of transport and delivery time.

Key words – CIM/SMGS consignment note, container traffic, New Silk Road, OSJD, TRAX competitiveness index

JEL Classification – L92, N70, O18, R49

INTRODUCTION

The Organization for Co-Operation between Railways (OSJD), headquartered in Warsaw, was established on 28 June 1956 in Sofia at a meeting of ministers responsible for rail transport in the countries of Asia and Central and Eastern Europe. Rail traffic between the OSJD member states is characterized by significant distances (from 5,000 to 10,000 km and more). Transport corridors, being part of the global transport network, constitute currently an important instrument that shapes the transport policy of many countries and international organizations [1-3]. As regards the Organization for Co-Operation between Railways, the important corridors are those of international character – there are as much as 13 international corridors within the OSJD, the longest of which, i.e. Corridor No. 1, is more than 20,000 km long. An international corridor is defined as a part of the national or international transport system that

ensures the transportation of significant passenger and freight flows between geographic regions, includes infrastructure facilities and means of transport of all modes of transport that are present in a given corridor, as well as the totality of technological, organizational and legal conditions for the implementation of such transportation [4]. This understanding is important for the development of transport corridors between Asia and Europe and confirms the interest in corridor initiatives of many international organizations (European Union, United Nations) and countries (e.g. Poland, Kazakhstan, Türkiye and especially China), for example in the New Silk Road Initiative, introduced by the President of the People's Republic of China, Xi Jinping, in autumn 2013. The OSJD work is in line with these economic assumptions, since the basic direction of the Organization's activity is the development and improvement of international rail transport primarily in communication between Europe and Asia, including combined/intermodal transport [5-6], as well as its

Analysis of container traffic in selected member countries of the Organization for Co-Operation ...

improvement by eliminating technical and legal barriers that hinder the development of rail transport between Asia and Europe [7]. The aim of this article is to provide a synthetic analysis of railway traffic in selected OSJD member countries with a special focus on countries on the New Silk Road [8]. Factors that determine the competitiveness of individual transport corridors within the NSR concept were also indicated. The analysis outlines the possible impact of the armed conflict between OSJD member states on freight transport between Asia and Europe.

1. SYNTHETIC DIAGNOSIS OF THE STATE OF OSJD TRANSPORTATION UNTIL 2021

International rail transport between Asia and Europe has been an important link in the exchange of goods between China and Western Europe since 2014. This issue was analyzed both in the context of supply chains involving rail transport and the volume of freight traffic within rail transport corridors connecting

Asia and Europe [9-11]. Activities related to the development of transport in the Eurasian space are aimed at modernization and development of rail transport by improving the technical and operational parameters of corridors in order to improve the competitiveness of railways in the transport of cargo from Asia to Europe. It is the corridors that are widely used to plan and organize the plying of container trains in international traffic between Asia and Europe. In the current very uncertain environment, it is important to assess the competitiveness of rail corridors for rail transport between Asia and Europe in the context of variant corridor solutions within the New Silk Road concept, which is part of a broader Chinese initiative, the so-called Belt and Road Initiative [12-13], aimed at maintaining internal control and political stability within the country and leading to a more dynamic Chinese economy and economic exchange. The idea is presented on the Map 1 below.



Map. 1. The idea of the Belt and Road initiative. Source: Mercator Institute for China Studies [14]



Map. 2. Railway Corridor Initiatives between Asia and Europe. Source: [15-16]

Dynamics of changes in freight volumes

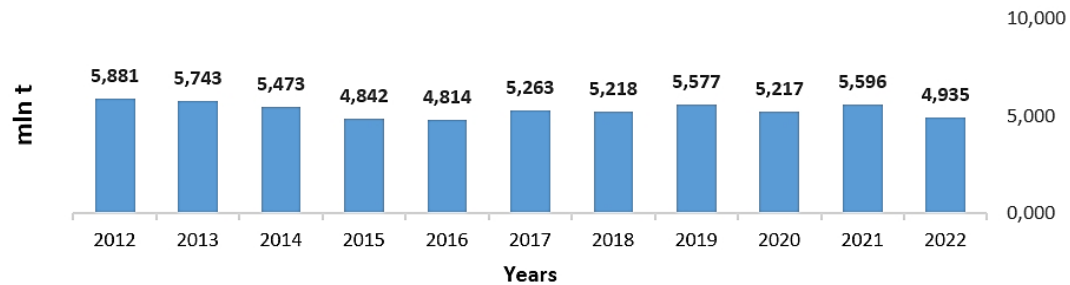


Fig. 1. Dynamics of changes in freight volumes in OSJD countries. Source: [18-19]

The possibilities and infrastructural potential of the countries through which the basic and variant transport routes run are also becoming important. A variant view of rail transport between China and Europe is shown in Map 2.

The China-Europe rail route remained a reliable transport route linking the two continents during the COVID-19 pandemic. The primary competitive factor of international rail transport in transit was the speed of transport and delivery time of goods, the quality of infrastructure and optimal pricing policy [17]. In general, 5.6 billion tons of freight were transported in OSJD member countries in 2021. Basic freight volumes

and dynamics of changes are shown in Figure 1.

Due to the constraints imposed by the spread of coronavirus infection, railroads proved to be a reliable mode of transportation for delivering medical supplies needed to combat the COVID-19 pandemic. During the pandemic, freight trains between China and Europe carried large volumes of anti-epidemic supplies and packages shipped via cross-border e-commerce, as well as goods that were previously delivered by sea or air.

Organization of China – Europe container trains contributed to international cooperation in epidemic prevention and to stabilization of supply chains

Analysis of container traffic in selected member countries of the Organization for Co-Operation ...

between countries along the Belt and Road Initiative. The dynamics of the changes are shown in Table 1 below.

Table 1. Changes in traffic volumes on the China – Europe – China route

Year	Number of container trains
2022	16,145
2021	15,183
2020	12,406
2019	8,255
2018	6,637

Source: [20]

This was confirmed by international agreements, e.g. the Joint Statement on Global Supply Chain Continuity during COVID-19 Pandemic, signed by the management of the Organization for Co-Operation between Railways (OSJD), the Intergovernmental Organization for International Carriage by Rail (OTIF) and the World Customs Organization (WCO); or Joint UNESCAP-OSJD Declaration on strengthening international rail transport on the Trans-Asian rail network and beyond in the conditions of the COVID-19 pandemic. The importance of these issues is constantly emphasized in the context of improvements in border crossings for international rail transport into the Eurasian space [21-22].

In 2022, 16,145 trains were dispatched between China and Europe, i.e. 7% more than in the same period last year. 1,600,000 TEUs (i.e. twenty-foot equivalent units) were carried, which was 10% more than in the same period of the previous year [23]. It should be noted here that more than 13,000 container trains passed through the infrastructure of OSJD member countries on 200 routes. On these routes, trains run regularly and depart on schedule. When analyzing the traffic, it should be noted that 15,183 container trains were dispatched by rail on the China – Europe - China route in 2021, i.e. a 22% increase was recorded compared to 2020. Trains carried 1.464 million TEU,

i.e. there was a 29% increase compared to 2020. 8,364 trains operated on China - Europe routes, which constituted a 20% increase compared to 2020. 831,000 TEUs were transported in this direction, a 29% increase compared to 2020. On Europe – China connections, 6,819 trains were dispatched, i.e. there was an increase of 26% compared to 2020. 633,000 TEUs were transported on this route, an increase of 29% compared to 2020. Container trains ran to 23 countries and 182 cities, including a new route from China via Kaliningrad to Norway, the UK¹ or France². In 2021, a total of 14,350 CIM/SMGS consignment notes were issued in export traffic at Chinese railway stations (e.g. 11,075 CIM/SMGS consignment notes were issued at the Alashankou border crossing in export traffic, and 3,275 CIM/SMGS consignment notes were issued at the Khorgos border crossing in export traffic). The CIM/SMGS consignment note is a uniform consignment note used to transport goods to countries that apply different international transport regulations (SMGS and CIM) and is issued for the entire journey without re-registration at the point of change of transport law. It is considered a customs document and it simplifies border crossing procedures for goods transported by rail [26]. When analyzing the abovementioned data, it should be emphasized that achieving such transport volumes was possible through improvement activities container transport such as:

- ensuring uninterrupted traffic through border crossings and carrying out work to modernize the infrastructure at border crossings, as well as actively increasing the capacity to deliver, transship and receive goods;
- innovations in the way transportation is organized and promoting work on the flexible replacement of broad and standard tracks with Russia, Kazakhstan and Mongolia;
- improving the efficiency of the use of empty wagons and containers on the way back [24];
- organizing work on the exchange of electronic data, based on the existing interaction mechanism with Kazakhstan, Russia and Mongolia, as well as actively studying the use of electronic digital signatures in

¹ In 2021, the first multimodal transit freight with transshipment was carried out at the Kaliningrad Sea Commercial Port (KSCP) from China to the UK. The container train, loaded with 50 forty-foot containers, traveled from the Chinese city of Xi'an via the Alashankou/Altynkol border crossing in transit through Kazakhstan before arriving on UTLC ERA JSC's regular service to the Kaliningrad Sea Commercial Port for transshipment on feeder ships and further shipment by sea to the port of Immingham (UK). The cargo with a total volume of 100 TEUs included auto parts, industrial equipment parts, video game consoles, medical supplies and other goods.

² In November 2021, a new container train from China to France was launched in addition to the existing 13 routes to Europe. It was a container train that connected the eastern Chinese city of Xinhua with the city of Dourges in France. Most of the freight was equipment for the engineering industry and anti-epidemic goods. The train made about 11,000 kilometers, passing through the territory of Kazakhstan, Russia, Belarus, Poland, Germany and other countries. It arrived in Dourges within 18 days. From the logistics center in Dourges, the goods were distributed according to their destination to various cities in France, Spain, Italy and other countries.

- transportation using electronic technologies³;
- promoting work on innovations in customs clearance at the borders based on the organization of work on electronic data exchange with customs;
- popularizing the use of the CIM/SMGS consignment note also in digital form [25].

It should be noted that the European Commission's analysis [14] shows that in 2020 China accounted for 18% of world exports, while the European Union (EU) accounted for 15.4% of world exports. China accounted for 14% of world imports, the EU for

13.4%. In trade with China, the EU's trade deficit increased from -€129 billion in 2011 to -€249 billion in 2021. Most EU countries import more from China than they export to China. Trade flows between the EU and China are shown in Figure 2.

The vast majority of EU member states import far more goods than they export. Only three countries have a positive trade balance with China. These are Germany, Ireland and Finland. The results in trade were reflected in the growing volume of goods transported by rail from China to Europe.

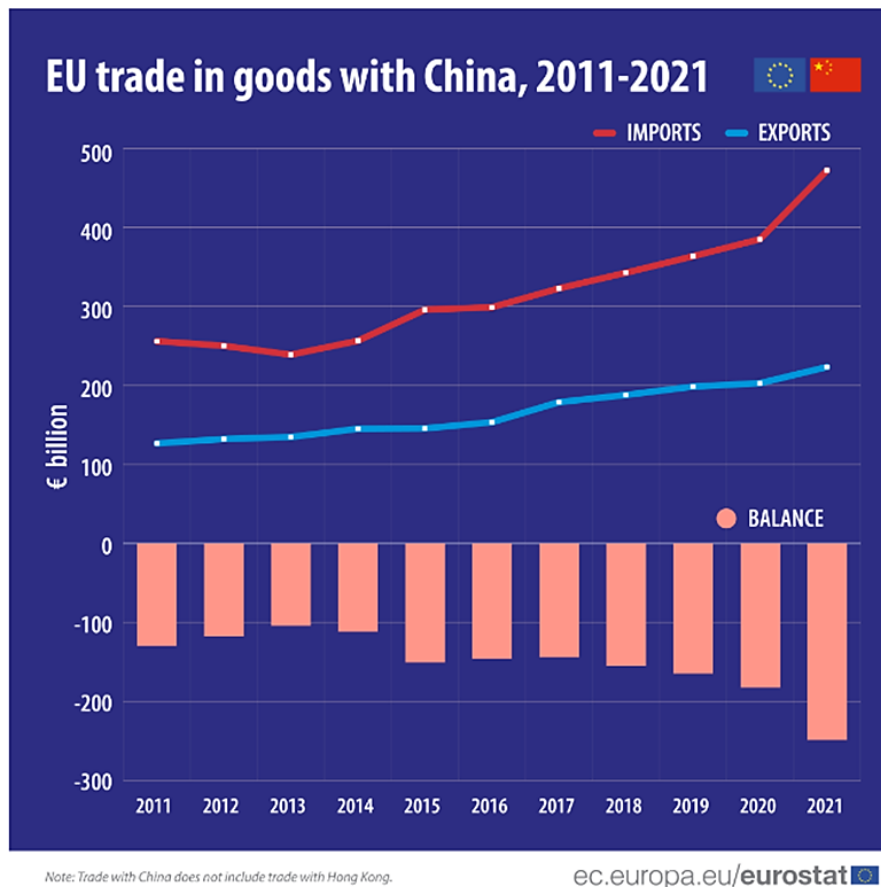


Fig. 2. EU-China trade flows THE QUALITY OF THE FIGURE WAS IMPROVED (and the source was changed accordingly in the References). Source: [14]

³ E.g. within the framework of the UN project "Transport and Trade Communications during the Pandemic" on the delivery of goods (sulfated cellulose) from the Republic of Belarus to Serbia, results were presented by PLASKE JSC, an expert of the United Nations Economic Commission for Europe (UNECE), of a study of the application of international standards and data models to electronic documents used in the transportation of goods by inland waterways, including transport corridors across the Danube and Dnieper. The UNECE project compared the reference data model for multimodal transport (UN/CEFACT MMT RDM) with documents used in real business operations on these transport routes, and prepared proposals for implementing the forms in accordance with UN/CEFACT requirements. Technology-neutral multimodal standards can serve as a basis for interoperability using XML, JSON API, blockchain or other new technologies.

From China’s point of view, China-EU rail transport is not of strategic importance and is not an alternative to maritime trade. In 2021, they accounted for only 0.6% of the total value of Chinese trade. However, they are an economically and politically important niche in trade with the European Union (they accounted for 4.6% of its total value in 2021), stimulating in particular exports from China [27-28]. On the other hand, China-EU rail transport has not reached the scale that would make the Railway Silk Road a strategic undertaking. Goods transported by New Silk Road - even during peak occupancy during the COVID-19 pandemic – accounted for no more than 5% of China-EU trade value, and less than 1% of total Chinese foreign trade.

2. SYNTHETIC ANALYSIS OF THE TRANSPORT RESULTS OF THE SELECTED MEMBER COUNTRIES OF THE ORGANIZATION FOR CO-OPERATION BETWEEN RAILWAYS UNTIL 2021

In order to improve the quality of services in the transport market, the railway companies of the OSJD member states organize and use various types of international freight transport [29]. Among them, the most promising is the development of combined, intermodal, multimodal transport [6, 30]. Over the years, the railway companies of the OSJD member countries have been working on the development and organization of combined, intermodal, multimodal freight transport [31]. Stimulation of the increase in container cargo flows in multimodal and mixed transport has been successively facilitated by the availability of high-quality logistics infrastructure and services, the appropriate design of which is essential for the development of intermodal transport [32]. Positive experience in the organization of combined, intermodal and multimodal transport has been accumulated, for example, by the railways of Azerbaijan, Belarus, Kazakhstan, China, Lithuania, Mongolia, Russia, Slovakia, Ukraine and the Czech Republic [33].

The role of railroads in intermodal transportation in the context of environmental protection is constantly growing. This is indicated by various authors in their

studies [34-37]. Examples of changes in freight volumes of the selected countries that participate in transit traffic from China to Europe are shown below.

AZERBAIJAN

In 2021, Azerbaijan’s freight traffic reached more than 15 million tons, i.e. an increase of almost 3% was recorded compared to 2020. International traffic including transit increased by almost 2%, reaching more than 12 million tons. Due to the launch of new rail transport corridors in 2021, e.g. Baku – Tbilisi – Kars, there were new projects launched for container transportation, e.g. the TURKUJAZ project from Türkiye to Baku. In general, by the end of 2021, transport operator ADY Container LLC had transported about 50 container block trains in the China - Azerbaijan direction. The organization of long-distance transcontinental container trains is one of the main goals of ADY CJSC. New projects were also launched in the North-South rail corridor from Finland to India (container train Helsinki - Mumbai transiting Russia, Azerbaijan and Iran). The dynamics of changes in container traffic in Azerbaijan until 2020 is shown in Figure 3. The performance of Azerbaijani Railways is the result of close cooperation with countries participating in the International North-South Transport Corridor (INSTC, a 7,200-kilometer multimodal network for transporting goods between India, Iran, Afghanistan, Azerbaijan, Russia, Central Asia and Europe) and the Trans-Caspian International Transport Route (TITR, established in 2014 to provide a transport link between China and Europe, via Kazakhstan, Azerbaijan, Georgia, Türkiye/ Ukraine). The result of this cooperation is the significant development of logistics infrastructure. Compared to sea routes, these routes significantly reduce transportation time and promote the development of transit transport of goods from China to European countries and in the opposite direction from Europe to China and the Persian Gulf countries [38].

Freight transport of Azerbaijani Railways in 2022 increased, compared to 2021, over 24%, reaching the level of 18.7 million tons.



Fig. 3. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

Transport in the international transport of Azerbaijani Railways increased by over 27% compared to 2021, reaching 15.2 million tons. This was influenced by the development of transport in the central corridor through the Caspian Sea and infrastructure investments, i.e. the development of the so-called Green Port in Baku, investments in new railway lines and increasing the quality of service offered to customers.

KAZAKHSTAN

The Railway of Kazakhstan (“Kazakhstan Temir Zholy National Company” JSC, “KTZ NC” JSC) plays a significant role in China - Europe transportation. It pays special attention to the development of multimodal transport involving Kazakhstan’s Caspian Sea ports. Kazakhstan’s ports on the Caspian Sea serve as a western gateway to Trans-Caspian transport and are a key link in the Eurasian multimodal transport corridor, i.e. the Trans-Caspian International Transport Route (TITR). The capacity of Kazakhstan’s ports has been increased to 26.7 million tons per year. The seaport of Aktau and the multimodal complex of the port of Kuryk are part of the network of international transport corridors, and operations and shipments are based on a relevant agreement aimed at simplifying and increasing the efficiency of multimodal transport along the TITR route. It is the agreement on the organization of container transport in direct international rail and water transport with the participation of feeder ships between the Caspian Sea ports (Aktau, Baku (Alat)). The uniqueness of the agreement lies in the fact that it establishes rules and regulates the procedure of interaction between the parties to retain and forward the original SMGS consignment note to the sea carrier for onward delivery to the destination port with the containers. Moreover, the agreement makes it possible to exclude the reissuance of SMGS consignment notes at ports in

the Caspian Sea and the use of SMGS consignment notes for the entire route, which has significantly reduced the processing time of shipping documents at seaports and the delivery time of container freight on the TITR route as a whole.

The dynamics of changes in container traffic over the past years are shown in Figure 4. The TITR project is now being actively developed and is increasing its commercial attractiveness (freight transportation time is 18 to 21 days, competitive freight cost – e.g. there are now competitive container shipping rates for transit and export traffic to ports in Georgia and Türkiye). In 2021, 582.6 thousand tons of freight were transported along the TMTM corridor, of which container cargo accounted for 25.3 thousand TEUs (a 20% increase compared to 2020 results).

In order to maintain competitiveness, the Railway of Kazakhstan is constantly improving the level of customer service and the quality of services provided, introducing new logistics products, taking active measures to stimulate transportation on this corridor. For example, work is underway to establish a container hub at Aktau Port, which will create a container fleet at the port for Caspian and Central Asian countries and provide favorable conditions for customers to deliver cargo to the port by both road and rail transport. In February this year, “KTZ NC” JSC, “Port Kuryk” LLP and “Kaspi Grain Way” LLP signed an agreement on cooperation in the construction of a terminal at Kuryk port. The terminal with a capacity of 1 million tons per year with a one-time storage of 25 thousand tons of goods has been launched. The terminal will provide the predicted increase in the volume of grain export in the direction of Kazakhstan – Iran / countries of the Caucasus region and further to the countries of Europe and the Persian Gulf.



Fig. 4. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

Analysis of container traffic in selected member countries of the Organization for Co-Operation ...

An analysis of freight performance in 2021 indicates that the volume of cargo transit through Kazakhstan amounted to 21 million tons, with container shipments exceeding the volume of 1 million TEUs (recording an increase of 22% compared to 2020). When analyzing freight routes, it should be noted that China - Europe - China transit transport reached 662,200 TEUs (representing an increase of 28% compared to 2020). In the China - Central Asia - China direction, the transport volumes reached 216.6 thousand TEU, i.e. the transport level of 2020 was maintained. Within 6 years, the transit of containers through the territory of the Republic of Kazakhstan increased 4.6 times (from 245 thousand TEU in 2016 to 1,129.2 thousand TEU in 2022).

The growing dynamics of transport are influenced by: delivery time and speed of container trains (952 km/day in the direction of China - Europe); stable tariff conditions; coordinated cooperation with partners and neighboring railway administrations.

LITHUANIA

The Lithuanian Railways ("Lietuvos geležinkeliai" JSC) in total carried 51.1 million tons of freight in 2021, registering a 4.4% decrease compared to 2020. Nevertheless, the Lithuanian Railways achieved good results in container traffic. The dynamics of changes in container traffic up to 2020 are shown in Figure 5. In 2021, intermodal transport increased significantly, reaching 255,000 TEUs. As for the development of intermodal transport, an important achievement for the Lithuanian Railways in 2021 was the connection of the European "Rail Baltica" line to the Kaunas Intermodal Terminal (KIT), which is the furthest point in the European rail system to the east and is directly connected to the European rail infrastructure. It has to be emphasized here that Rail Baltica is one of the European Union's priority projects and is on the list of the Trans-European Transport Networks (TEN-T). The rail route is expected to provide a high-quality

rail link of Finland and the Baltic countries with Poland and Germany, connecting the rail systems of northeastern Europe with the rest of the European Union. Currently, Lithuania has two terminals that combine rail gauges – 1435 mm and 1520 mm – the Šeštokai Terminal and the Kaunas Intermodal Terminal. Competitive international train transit services to Europe are provided there.

An important aspect is that the Kaunas terminal is equipped to load not only containers or other types of cargo, but also piggybacks. Piggyback technology is the organization of delivery by combined transport, under which most of the route goods in car trailers are transported on special rail platforms, and the last kilometers from the destination station to the customer are again delivered by road. Rail-road transportation has an international character. After a successful test transport in 2020 by LTG Cargo JSC, a regular piggyback transport was already carried out on the Kaunas - Western Europe - Kaunas route in 2021. A train departing from the Kaunas Intermodal Terminal twice a week can carry 36 semi-trailers or containers in a single train, travels 1,700 kilometers in 50 hours and arrives at its final destination, the Tilburg Terminal in the Netherlands. In 2021, 1,000 TEUs were transported via this route.

Kaunas Intermodal Terminal is also used to transport goods in transit to the north – to Estonia, Finland, to the east, to the seaport of Klaipeda. The terminal provides full capability to consolidate freight and continue its transport in any direction required by customers. Rail freight transport in Lithuania in 2022 decreased significantly, reaching 31.0 million tons of cargo, i.e. a decrease of 39.4% compared to the results of 2021. In international transport in 2022 they decreased by 53.1% and reached the level of 17.1 million tons. This was caused by the geopolitical situation and the reduction of transport in the direction of Kaliningrad NJS and in communication with Belarus to the port of Klaipeda.

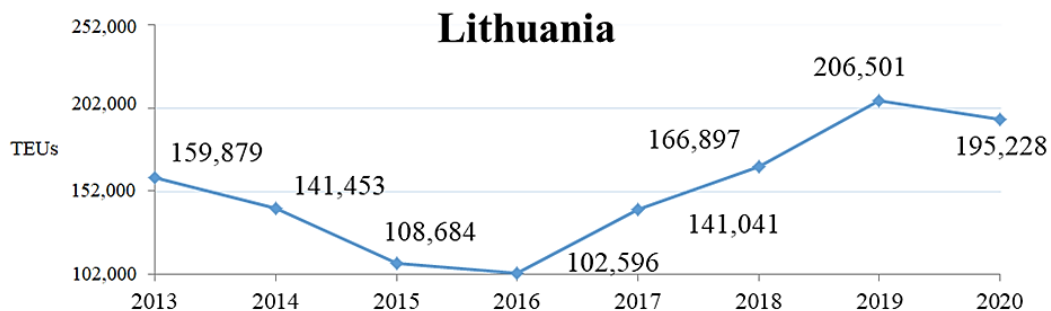


Fig. 5. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]



Fig. 6. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

UKRAINE

Carriage of goods by rail in Ukraine reached 314.3 million tons in 2021, about 3% more than in 2020. Transit transport through the territory of Ukraine reached 2 million tons, recording a decrease of 8.3% compared to the same period last year. In order to increase freight volumes, speed up deliveries and ensure the safety of goods, the Ukrainian Railway JSC (UZ) has organized and operates more than 90 container trains, including 17 international ones, which carried about 225 thousand TEUs through the Ukrainian territory in 2021. In total, more than 472 thousand TEUs were transported by rail through the territory of Ukraine in 2021, 11.1% more than the volume of container shipments in 2020, which accounted for 2.1% of total rail freight transport.

The dynamics of changes in container shipments over the past few years until 2020 are shown in Figure 6 below.

When analyzing shipments across Ukraine, it is worth noting the shipments carried out in 2021 by the Polish limited liability company PKP LHS (PKP Linia Hutnicza Szerokotorowa, a Polish rail carrier and infrastructure manager of railroad line No. 65, based in Zamość). This company has taken active steps to maintain existing and develop new intermodal transport, strengthening its position in the transport market along the New Silk Road. A number of additional container transport projects have been developed, including multimodal transport. In 2021, 105 container trains were sent to the LHS Sławków station from China in transit through Ukraine on the final section through Poland, and 20 trains were sent in the opposite direction (in 2020, 40 trains arrived at the Sławków station from China in transit through Ukraine). Thanks to cooperation with the logistics platform Xi'an Free

Trade Port Construction and Operation Co., Ltd. in 2021, PKP LHS began providing operator services for transporting containers from the Chinese city of Xi'an to the LHS Sławków station, and launched container transport from Sławków to Xi'an. In 2021, 32 operator trains from Xi'an and 19 operator trains to Xi'an were launched. The company's activities were aimed at expanding its logistics offer related to the onward transportation of containers arriving from China to the target customer in Poland and other EU countries. In 2021, the company took part in work related to the launch of long-distance container services from the Nakhodka station in the Far East (RZD) to the LHS Sławków station.

SLOVAKIA

Over the past few years, there has been a noticeable downward trend in container shipments in Slovakia, as shown in Figure 7. Nevertheless, the Slovak railways (Železničná spoločnosť Cargo Slovakia, a.s., ZSSK CARGO), in cooperation with the relevant authorities, e.g. the Ministry of Transport and Construction of the Slovak Republic, as well as with its business partners, have long been striving to ensure the transport of goods from China to Slovakia via the TKD Dobrá terminal as part of the New Silk Road project.

In 2021, deliveries were made from China to Slovakia via Ukraine for a customer of METRANS /Danubia/. Transshipment of containers took place at the TKD Dobrá Terminal.

In 2022, Slovak Railways transported 25.2 million tons of cargo in international traffic, recording a decrease of over 2 million tons of cargo compared to 2021 (27.8 million tons of cargo). In 2022, no new routes for transporting containers were created. New transport routes were created as a result of the armed conflict in Ukraine and the blockade of the port of Odessa.

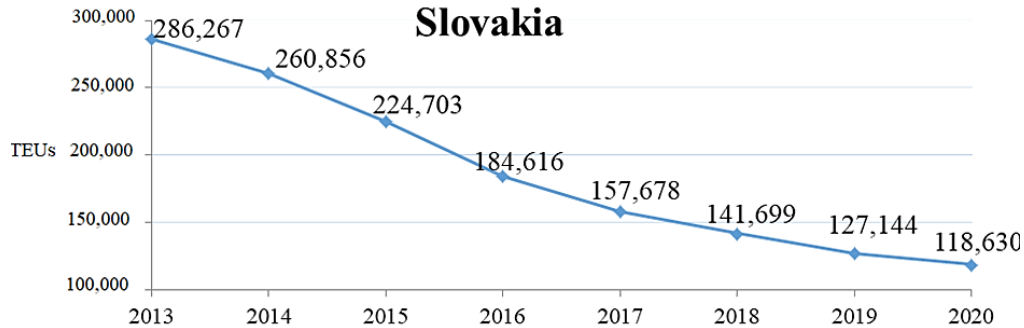


Fig. 7. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

BELARUS

Belarus is an important transit country on the East - West - East freight corridor. In 2021, the Byelorussian Railway transported 128.6 million tons of cargo, almost 3% more than in 2020. Transit traffic reached 27 million tons. One of the strategic directions of the Byelorussian Railway is the development of East-West transit transportation, taking into account the railway Silk Road. In 2021, the volume of container traffic reached 1.2 million TEUs. More than 735,000 TEUs were transported by transit in China – Europe – China communication. The dynamics of container traffic until 2020 is shown in Figure 8.

When analyzing the transport volumes of Byelorussian Railway, in 2022 there was a noticeable decrease in the total volume of transport of 25 million tons (Byelorussian Railway transported 103.3 million tons of cargo in 2022). In 2022, the total volume of container cargo transported by Byelorussian Railway

amounted to over 1.1 million TEU of containers, including over 450,000 containers in TEU in transit on the China-Europe-China route. In this segment, Byelorussian Railway also recorded a significant decrease compared to 2021 (over 250,000 TEU).

RUSSIA

In 2021, the volume of freight transport on the Russian Railways network reached 1403.1 million goods, i.e. over 3% more than in 2020. Transit traffic through Russia increased by more than 40% compared to 2020, reaching 33 million tons. In 2021, the Russian Railways transported 6,502.5 thousand TEUs, of which container transit transport increased by 34% (1076.0 thousand TEUs were transported). It should be noted that the main growth in container transport is due to the segment of transport on container trains. In 2021, 4,466.0 thousand TEUs were transported by container trains.

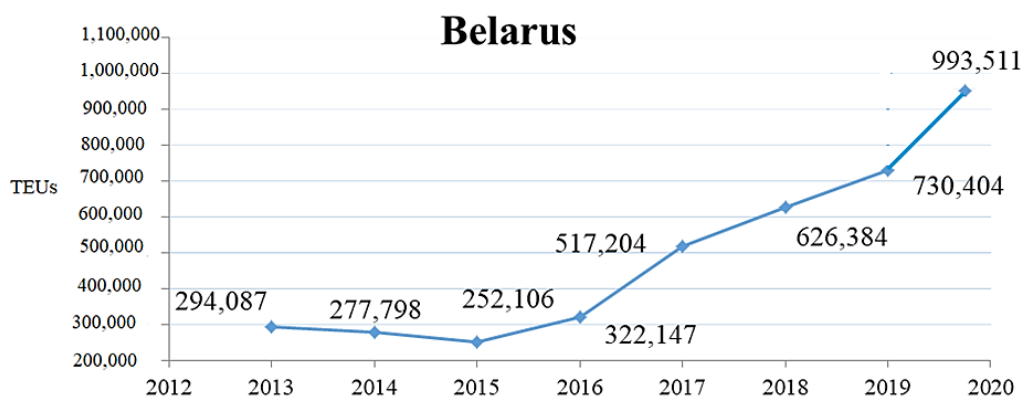


Fig. 8. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]



Fig. 9. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

For comparison, the dynamics of changes in container traffic in previous years is shown in Figure 9. As a result, based on the analysis of Russian Railways data, container transport services in 2021 on the Russian Railways continued to grow, including in communications with Asia-Pacific countries. For example, in 2021, container traffic on the Russia - Japan route through ports in the Far East region increased by 15% compared to the same period last year, reaching more than 67,000 TEUs. The main contribution to the growth was container transport along the Trans-Siberian Railway in transit traffic. For example, container transit from Japan tripled in 2021: from 1,657 TEUs to 4,891 TEUs, and in the eastern direction transit traffic increased by 195%: from 1037 TEUs in 2020 to 3,259 TEUs. In Russia – Republic of Korea communication, container traffic volume in 2021 increased by 37% to 164,000 TEUs, including transit traffic by 42% (16,000 TEUs carried) and 50% (67,000 TEUs carried) to/from the Republic of Korea, respectively.

The use of the Trans-Siberian Railway in transit traffic makes it possible to reduce the delivery time of goods from the Asia-Pacific region to Europe from 55-60 days to 20-25, as well as to reduce transport costs. Container corridors through the Russian ports of Baltiysk and Kaliningrad were actively developing in 2021. Freight volumes in 2021 in this direction amounted to 106,400 TEUs. In the context of the comparative analysis of container transport in 2022, transport volumes in international container transport are presented in Table 2.

The analysis of the above data shows that in 2022 6,521.1 thousand TEUs were transported by the Russian Railways, i.e. 0.3% more than in 2021. Internal rail transport in Russia increased by 3% (2,545.5 thousand

TEUs were transported); in imports, an increase of about 17% was recorded (1,625.2 thousand TEUs were transported); transit transport decreased by 21% (845.6 thousand TEUs were transported, export transport reached 1,504.8 thousand TEUs, i.e. 4% less than in 2021). The most popular and attractive way of transporting containers was transport as part of container trains. In 2022, 4,361.0 thousand TEUs were transported as part of container trains on the Russian Railways, i.e. by 2.4%, less than in 2021. To sum up, there is a noticeable decrease in international transit transport to Asia-Europe.

Table 2. Container transport in the Russian Federation

Container transport (thousand TEUs)	2021	2022	2022 in %
Total (in thousand TEUs)	6,502.5	6,521.1	0.3
Domestic transport	2,467.9	2,545.5	3.1
International shipments	4,034.6	3,975.6	-1.5
In this:			
Export	1,566.4	1,504.8	-3.9
Import	1,392.3	1,625.2	16.7
Transit	1,076	845.6	-21.4

Source: Own elaboration based on [40] and transport results of Russian Railways

GEORGIA

In 2021, a total of 58,685 containers (77,323 TEUs) were transported in international traffic on the Georgian Railway (GR) network, using 425 container block trains.

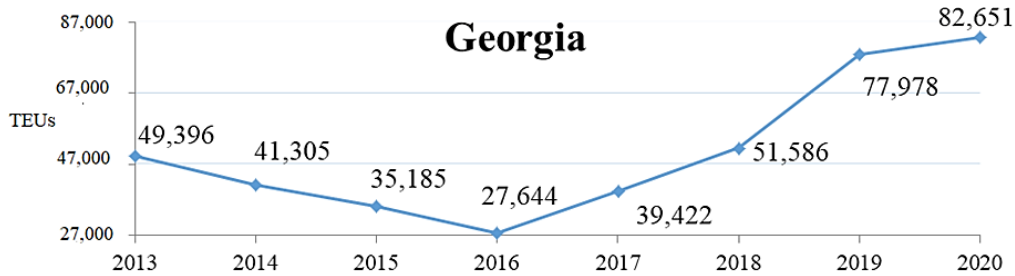


Fig. 10. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

The dynamics in container transportation to date are shown in Figure 10.

In 2022, Georgian Railway transported 14,773 thousand tons of cargo, i.e. over 21% more than in 2021, including 12,878 thousand tons in international transport, i.e. 25% more than in 2021. This testifies to the growing importance of the middle corridor in Asia-Europe transport. At the same time, it is worth noting that Georgian Railway attaches particular importance to the development of container transit potential through Georgia via the Baku-Tbilisi-Kars railway line (BTK).

As a result, the flow of container freight stabilized. In 2021, container trains in transit on the UBZD network were destined for ten European countries. The dynamics of changes in container freight in general on Mongolia's rail network is shown in Figure 11.

Freight transport on Mongolia's railways in 2022 reached the level of 27.7 million tons of cargo, i.e. there was about a 12% decrease compared to 2021. 265,793 containers were transported in transit through Mongolia as part of 2,324 container trains. This also represents a decrease compared to 2021.

MONGOLIA

An analysis of the Mongolian railway (Ulan-Bator Railway JSC, UBZD) performance shows that the number of transit container trains on the UBZD railway network increased in 2021, reaching 2,513 trains. 283,776 TEUs were transported. Compared to the same period of the previous year, this is an increase of 10% (respectively, in TEUs, it is an increase of about 20%). In general, in 2021, 13 operator companies took an active part in organizing container transportation.

3. THE COMPETITIVENESS OF TRANSPORT IN RAIL CORRIDORS BETWEEN ASIA AND EUROPE

Competitiveness is a fundamental objective for all economic operators and an indispensable condition for goods and services to be designed, produced and delivered in a way that enables investors to make a profit and ensure consumer satisfaction [41-42]. The concept of economic competitiveness appeared in the economic literature in the twentieth century and is used to refer to enterprises, sectors, regions, nations (states), as well as supranational organizations [43].

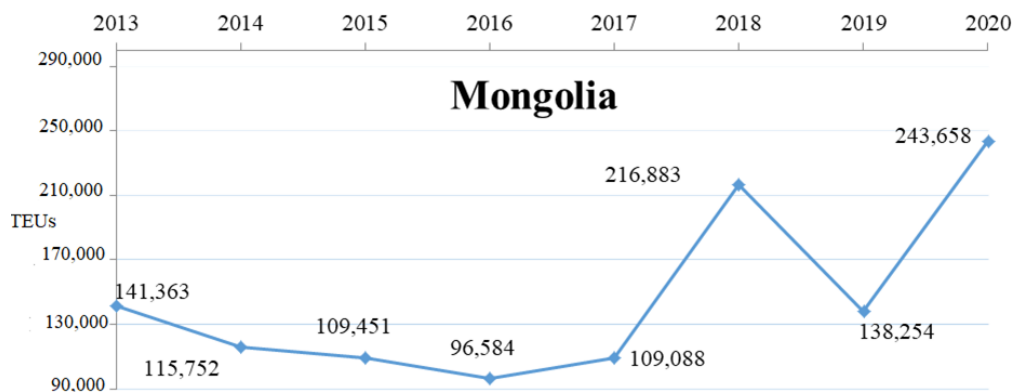


Fig. 11. Dynamics of changes in container traffic between 2013 and 2020 in TEUs. Source: Compilation based on [18, 39]

The understanding of competitiveness is derived from the broadly understood theory of economics and its basic pillars, including the theory of trade, theory of production, theory of economic growth [44]. As the European Commission notes in its communication, competitiveness and productivity are essential conditions for businesses to grow [45]. Competitiveness is also the ability of, for example, an industry, a sector to protect and/or improve its position in relation to competitors.

Within the framework of management theory, competitiveness is defined as the relative position of a given competitor in relation to others [45-46]. In this context, the competitiveness of enterprises should be considered as a system formed by four elements, i.e.:

- competitive potential, understood as all tangible and intangible resources of the enterprise, key competences and capabilities, enabling the acquisition of a lasting and difficult to undermine competitive advantage over rivals;
- competitive advantage (always relative), understood as the result of the effective use of the configuration of components of the competitiveness potential enabling the company to generate an attractive market offer and effective competitive instruments;
- competitive instruments, which can be defined as consciously and intentionally used tools and methods of building clients' capital and creating goodwill;
- competitive position, understood as the result achieved by the company competing in a given sector, considered against the background of the results achieved by competitors, in other words – a place on the scale of economic and non-economic benefits that the company provides to all its stakeholders, compared to the places occupied by competitors.

In the presented model, competitiveness is treated as an aggregate – a system composed of four elements that are closely related, are subject to the impact of the general environment and enter into interactive relations with the immediate competitive environment. When analyzing the dependencies between the separate components of this system, it can be said that the potential of competitiveness affects competitive advantages, which in turn determine the choice of competitive instruments enabling the acquisition and maintenance of the assumed competitive position. In the analysis for the purposes of this article, attention

should also be paid to the so-called concept of systemic competitiveness of the economy [47]. Within this concept, four levels of competitiveness analysis are distinguished: meta, macro, meso and micro [48]. For example, at the macro level, state policy shaping the macroeconomic economic environment is analyzed. This means, for example, creating unchangeable and transparent rules of activity, consistent with the direction of economic changes or creating a transparent system of pricing and financing activities. The meso level includes individual specialized economic policies of the state, including, policy on the creation, development and financing of infrastructure development. By investing in the development of transport infrastructure, it is possible to achieve objectives that consist in increasing the competitiveness of transport, but also the competitiveness of the entire economy⁴. The micro level, on the other hand, includes all those factors that are directly related to the activities of enterprises. The competitiveness of transport services is determined primarily by enterprises capable of functioning in the market economy system, rationally using factors of production other than infrastructure and the ability to operate on the market [49]. In systemic terms, competitiveness indicates the need for an active role of the state and social institutions as initiators of activities strengthening competitiveness [43]. In theory, we also find concepts of competitiveness of sectors [50]. This is important for the rail transport sector, the level of competitiveness of which is largely determined by linear and point infrastructure, its quality parameters and the ability to create competitive transport services based on it. That is why transport corridors for rail transport in the Eurasian space and the assessment of the competitiveness of individual corridors for Asia-Europe transport are so important the TRAX Index is used for this [51]. The TRAX index assesses the attractiveness/competitiveness of a transport route/corridor using attractiveness criteria for the carrier's choice of route. The criteria taken into account and in practice should be comparable with each other. The weight of each criterion reflects the priorities and importance of that criterion for the operator/carrier and is determined directly by the carrier. The purpose of the TRAX Index is to compare the attractiveness of alternative TRACECA rail routes through the Caspian Sea, the Caucasus and Türkiye/Iran compared to the attractiveness of transport on the route running through the Russian Federation.

⁴ Over the past 10 years, China has made significant investments in the development of transport infrastructure in the field of intermodal transport: the railway node in Zhengzhou, one of the key nodes in China and the centers in Chengdu. See presentations of the Ministry of Industry and Infrastructural Development of Kazakhstan for the meeting of Transport Ministers of the member states of the Organization for Economic Cooperation, Astana 2022.

As a result of the conducted research, the following criteria for assessing the attractiveness of the route were selected [52]:

- *time* - the transport time required to move the cargo from the place of origin to the point of final delivery;
- *cost* - the cost of transportation necessary to ensure the movement of cargo from the place of origin to the point of final delivery;
- *reliability* - transport reliability as an indispensable prerequisite for the level of logistic support for the transport process in world trade;
- *safety/security* - safety and protection of cargo as an indispensable element of the modern level of logistic support of the transport process.

As a result of the conducted analyses, it turned out that the trans-Russian route is the most attractive from the point of view of the 4 criteria indicated above. The trans-Russian route was twice as attractive as the trans-Turkish route and 3 times more attractive than the trans-Caspian one. The trans-Russian route leads through Poland, coincides in large part with the OSJD corridor No. 1 and the Northern NSR along with the border crossing in Brest/Małaszewicze.

4. THE IMPACT OF THE CHANGING GEOPOLITICAL SITUATION ON CONTAINER TRANSPORT ON THE NEW SILK ROAD

The geopolitical situation in the face of the armed conflict in Ukraine has changed the economic landscape for freight traffic between China and Europe. Although container traffic from China to Europe via Ukraine accounted for only about 2%, there is a noticeable decline in the positive growth trend. In 2022, the number of freight trains between China and Europe increased by 7% compared to the same period last year. The number of transported TEUs increased by 10%. Compared to the previous stable and continuous growth trend, the analyzed period is characterized by an evident stagnation.

The reasons for the slowdown in the significant growth rate can be explained by the following phenomena:

- the consequences of the armed conflict in Ukraine and the related economic sanctions imposed on Russia and Belarus;
- termination of cooperation with the Russian Railways by many companies;
- the need to bear the additional cost of freight insurance as a result of the additional war risks in order to ensure safety guarantees in transportation;
- growing perturbations of the Chinese economy⁵,

including disruptions and stoppages at Chinese ports and the China – Kazakhstan border.

According to data from Chinese Railways, the number of running trains to Europe was higher than in 2021 [54]. The dynamics of growth has decreased. When analyzing in detail the data presented by Chinese Railways (see main operational indicators of the railways of OSJD member countries for 2022), it appears that in 2022 the total volume of transported cargo amounted to 2.79519 billion tons, i.e. 1.7% more than in 2021. The transport performance reached the level of 2,571.665 billion ton km, i.e. 7% more than in 2021. In 2022, 63.83 million ton of import and export cargo were transported through all rail border crossings in China, i.e. 1.57 million tons (2.5%) more than in 2021. In 2022, Chinese Railways shipped 16,562 container trains on the China-Europe route. This represented a 9% increase compared to 2021. A total of 1.614 million TEUs were transported, i.e. a 10% increase compared to 2021. Over the years, 65,376 container trains have travelled on the China-Europe route, and 6.047 million TEUs have been transported. Examples of main routes and the number of trains are shown in Table 3 below.

Nevertheless, analyses indicate that in the face of the still uncertain geopolitical situation, new routes are being sought, new development agreements are being concluded (e.g. between Türkiye and Kazakhstan, between Türkiye, Bulgaria, Serbia, Hungary, between Kazakhstan, Azerbaijan and Georgia) and existing central and southern corridors bypassing Russia, Belarus and Ukraine are being improved. For example, much attention is being paid to the Trans-Caspian corridor, the course of which is shown in Map 3. The interest of logistics operators in transporting containers in this corridor (called the Central Corridor connecting China, Kazakhstan, Azerbaijan, Georgia, Türkiye and the European Union) has increased as a result of the conflict in Ukraine. Kazakhstan and Azerbaijan have invested in upgrading port and line infrastructure [56].

The length of the route is between 9,000 and 11,000 kilometers, and the transit time is up to 13 to 21 days. The development of traffic on this corridor is supported by a palette of new logistics services and competitive tariff rates (discounts reach up to 60% off base volumes). Traffic forecasts for this corridor in 2022 compared to 2021 indicated an increase up to 50,000 TEUs. Overall, the estimated increase in freight weight in this corridor was 3.2 million tons [58].

The forecast prepared by the United Nations UNCTAD for 2021 indicated a 13% increase in transport, while Oxford Economics research indicated

⁵ E.g. Bloomberg predicted that China's economic growth would be only 2 percent in 2022, the lowest since the 1970s. The zero COVID policy further prolongs supply chains. Retail sales fell by 11.1% in April 2022 compared to a year earlier, see [53].

an increase in the trade turnover of the Eurasian space until 2030 [59]. The Trans-Caspian corridor is used for transporting e.g. electronic equipment, machinery, steel products. Stable development is noticeable in the corridor, which is presented by the

data in the chart below. Transport in the direction of Kazakhstan - Azerbaijan and Turkmenistan - Azerbaijan is developing. Trends in transport across the Caspian Sea are shown in Figure 12.

Table 3. Examples of routes and number of trains on the route the table was formatted in the same way as the other tables

Route	Distance, km	Average speed, km/day	Transit time, days	Number of trains in 2021	Number of trains in 2022
Duisburg – Chongqing	10,769	1,021	15-16	522	531
				192	72
Wuhan – Hamburg	10,569	1,000	15-16	142	144
Chengdu – Łódź	9,600	990	12-14	626	450
Łódź – Chengdu				170	201
Zhengzhou – Hamburg	10,214	1,008	15	221	260
Hamburg – Zhengzhou				173	255
Yiwu – Madrid	13,000	990	18-20	114	162
Hefei – Hamburg	10,595	1,012	16	110	199

Source: [55]



Map 3. Trans-Caspian International Transport Route (TITR) the quality of the map was improved. Source: [57]

However, the Trans-Caspian corridor and the TRACECA corridors⁶ will not be able to handle all the increased volume of goods in the near future, attention to, for example, the quality of infrastructure and capacity. The bottleneck is the Caspian Sea. Returning to sea transport results in a longer delivery time. At the same time, it should be noted that sea freight is growing. In May 2022, long-term contract freight rates

were 150.6% higher than in May last year. They have increased by 55% since the beginning of 2022. However, in order to solve the bottleneck problems, significant investments are announced to improve navigation in the Caspian Sea and to improve transit time, i.e. transport time, which is an important factor in the competitiveness of rail transport.

⁶ TRACECA is an international transport program involving the European Union and 13 member states of the Eastern Europe, Caucasus and Central Asia region. The aim of the program is to strengthen economic relations, trade and transport in the Black Sea, South Caucasus and Central Asia regions.

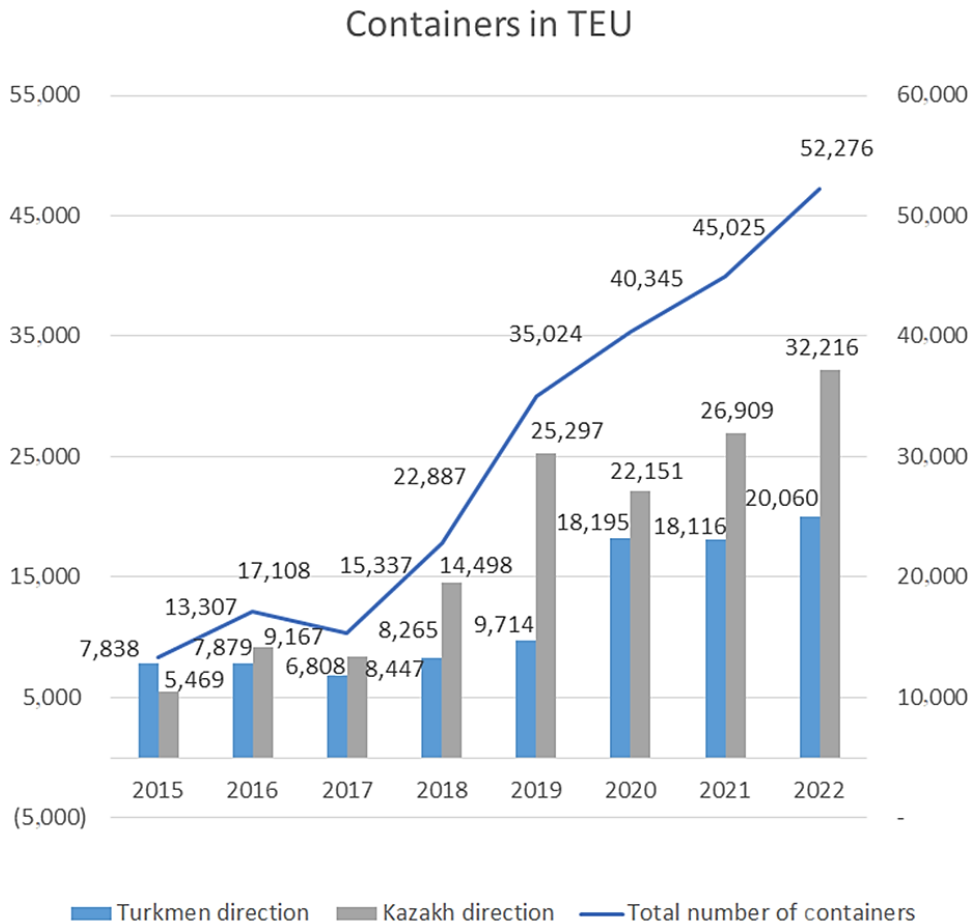


Fig. 12. Dynamics of container transport in the Caspian Sea in 2015-2022. Source: [60]

CONCLUSIONS

The unstable economic and geopolitical situation in the world resulted in several changes that affected railway landscape in the Eurasian space. First of all, there is stagnation in container transport from China to Europe via Russia and Belarus. Secondly, transit is redirected to other routes as a result of the exclusion of Ukraine's railway infrastructure from the Eurasian traffic, e.g. to TITR from China through Kazakhstan, Azerbaijan, Georgia, Türkiye. Investments in alternative transport corridors take place and they are being treated as a source of activation of economic cooperation between countries and regions.

The main factor in the competitiveness of rail transit is the speed of transport and the delivery time of goods. Currently, container trains move on various routes at

a speed of more than 1,000 km/day, which favors the development of land transit services. In the record year 2021, 692.5 thousand TEUs of cargo with a total value of EUR 32.4 billion were transported through the Eurasian railway network in both directions. The armed conflict between OSJD members caused the collapse of the upward trend. However, this did not lead to a complete freeze of the Railway Silk Road. After an initial shock in the global transport industry, which resulted in the suspension of many connections between China and the EU, traffic began to recover in the following months, with a value of 681,197 TEUs [61] at the end of 2021, according to ERAI (Eurasian Rail Alliance Index, created by the Kazakh, Russian and Belarusian railway holding JSC UTLC ERA, a company with about 90% share in the China-

Europe transport market). There was a decrease of about 2%. Declines were recorded in most groups of goods, including machinery, electrical equipment and parts (-32.25%), vehicles other than rail (-48.11%), furniture (-39.02%), toys (-50.84%) and clothing and accessories (-44.98%). The Asian-European transport market is undergoing a significant transformation. In the existing situation, modern solutions for transport are sought and transport systems in container transport are selected accordingly [62, 63]. However, as long as the sanctions do not concern the right to transit, rail transport between China – Europe – China via Russia and Belarus will be possible. The full use of the Central Corridor will be possible in the next few years, with the support of the European Union. These activities will serve the trade of Central and Central Asian countries – looking for alternative routes running to Europe and Türkiye. Goods destined from the EU to China, which cannot be transported by rail routes through Russia, may return to logistics chains based on sea and air transport.

As regards the practical applications of the conducted study, it should be noted that it provides valuable comprehensive data on rail freight traffic between the OSJD countries both for the period until 2021 and for the period after the beginning of 2022, when the geopolitical situation changed significantly, affecting international rail traffic between Asia and Europe. The presented data can be of interest not only for other researchers of the subject, but also for a broader audience involved in the railway industry in a more empirical way, namely railway operators, infrastructure managers etc., i.e. all entities that need to be given a broader picture of international railway traffic.

Bearing in mind that the trends in the freight transportation market are highly dependent on the overall geopolitical and economic situation and that the development of international rail transport interconnectedness means a reduction in transportation costs and acceleration of the delivery of goods [64], the study is planned to further monitor the relevant changes and challenges of the rail freight traffic between Asia and Europe in order to thoroughly capture the tendencies and perspectives in this area.

ANALIZA PRZEWOZÓW KONTENEROWYCH W WYBRANYCH KRAJACH CZŁONKOWSKICH ORGANIZACJI WSPÓŁPRACY KOLEI (OSZD) DO 2021 ROKU

Celem artykułu jest analiza wielkości przewozów w kolejowym transporcie towarowym między Azją a Europą w wybranych krajach członkowskich Organizacji Współpracy Kolei (OSZD) do 2021 r. oraz wskazanie czynników konkurencyjności.

Metodologia badań została oparta na analizie źródeł pochodzących z krajów członkowskich OSZD. Badania przeprowadzono w oparciu o dane pozyskane w ramach własnych prac analitycznych prowadzonych w obszarze transportu w ramach OSZD. W analizie końcowej zwrócono uwagę na skutki konfliktu zbrojnego pomiędzy krajami członkowskimi OSZD.

Jak wskazują uzyskane wyniki, w 2021 r. kolejowe przewozy towarowe w krajach członkowskich OSJD wykazały stabilność pod względem wielkości przewozów. Wspólne działania kolei krajów członkowskich OSZD przyniosły pozytywne rezultaty, w tym wzrost wolumenu kontenerów w międzynarodowym ruchu kolejowym między Azją a Europą. Analizy wykazały również wzrost przewozów w krajach położonych wzdłuż kolejowych korytarzy transportowych na Nowym Jedwabnym Szlaku oraz wahania wielkości przewozów w innych krajach. Głównymi czynnikami konkurencyjności ruchu kolejowego między Azją a Europą okazały się szybkość transportu i czas dostawy.

Słowa kluczowe: list przewozowy CIM/SMGS, przewozy kontenerowe, Nowy Jedwabny Szlak, OSZD, wskaźnik konkurencyjności TRAX.

REFERENCES

- [1] Belozеров V., Solop I., Seryapova I., Astafiev A., Majerčák J. (2022). Challenges and Methods for Developing the Productive Capacity of Rail Transport. *AIP Conference Proceedings*, 2503(1). <https://doi.org/10.1063/5.0099880>.
- [2] Engelhardt J. (2018). *Sektor kolejowy w polityce transportowej Unii Europejskiej* (Railroad sector in the European Union transport policy). *Edu-Libri*, ISBN 978-83-65648-26-6.
- [3] Gołemska E., Gołembski M. (2020). *Transport w logistyce* (Transport in logistics). Chapter IV and VI. CEDEWU, ISBN 978-83-8102-343-6.
- [4] Wielądek A. (2014). *Korytarze transportowe* (Transport corridors). [In:] L. Mindur (ed.), *Technologie transportowe* (Transport technologies). Instytut Technologii Eksploatacji – Państwowy Instytut Badawczy, ISBN: 978-83-7789-244-2.
- [5] Rydzkowski W. (ed.) (2015). *Przewozy intermodalne* (Intermodal transportation). Biblioteka Logistyka ILIM, ISBN 978-83-6318-605-0.
- [6] Wronka J. (2008). *Transport kombinowany / intermodalny. Teoria i praktyka*. (Combined / intermodal transport. Theory and practice). Wyd. Uniwersytetu Szczecińskiego, ISBN: 978-83-7241-676-6.
- [7] Dong J. (2016). The role of OSJD in the development of international rail freight transportation between China and Europe. [In:] *Directions for strategic development of rail transport in OSJD member countries*. OSJD.

- [8] Jakóbcowski J., Popławski K., Kaczmarski M. (2018). *The Silk Railroad. The EU-CHINA Rail Connections: Background, Actors, Interests*. Centre for Eastern Studies, ISBN 978-83-65827-19-7.
- [9] Motowidlak U., Kujawa M. (2018). *Transport towarów w projekcie "One Belt and One Road" jako component globalnego łańcucha dostaw* (Transport of Goods in the "One Belt and One Road" project as a component of the global supply chain). Wydawnictwo Uniwersytetu Łódzkiego, e-ISBN 978-83-8142-397-7.
- [10] Grzywna M., Szkoda M. (2018). Analiza towarowych przewozów kolejowych w wybranych euroazjatyckich korytarzach transportowych (Analysis of freight rail transport in selected Eurasian transport corridors). *Autobusy*, 19(6), 1039-1045. <https://doi.org/10.24136/atest.2018.225>.
- [11] Lorenc A.K. (2014). Transport intermodalny w przewozach dalekobieżnych na przykładzie połączenia Europa-Azja – Analiza i optymalizacja łańcucha dostaw (Intermodal transport in long-distance traffic on the example of Europe-Asia connection - Supply chain analysis and optimization). *Dokowania młodych naukowców*, 4, 655-660, ISSN 2300-4436.
- [12] McDonald S. (2023). China Belt and Road Initiative. In: Clarke S. J. (ed.) *Contemporary Strategic Chinese American Business Negotiations Market Entry*. Palgrave Macmillan, 495-516, <https://doi.org/10.1007/978-981-19-6986-7>.
- [13] Upadhyay S. (2023). The Belt and Road Initiative: Issues and Future Trends. *India Quarterly*, 79(2), 175-188. <https://doi.org/10.1177/097492842311651>.
- [14] Eurostat (2022). Significant increase in EU imports from China, <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20220401-1>.
- [15] Kubrak K. (2023). Kolejowy jedwabny szlak (Railway Silk Road). Unpublished material of Kozłowski University.
- [16] Waldtman M. (2023). Presentation "Zastosowanie IoT oraz AI w transporcie kolejowym na Nowym Jedwabnym Szlaku" ("Application of IoT and AI in rail transport on the New Silk Road"), Państwowy Instytut Łukasiewicz, Wisła.
- [17] Bessonov G., Stepanova N. (2021). Trans-Eurasian Routes. CCTT.
- [18] OSJD own analytical materials (2021). OSJD.
- [19] Kayumkhodjaev Sh. (ed.) (2022). OSJD Bulletin of Statistical data on Railway Transport for 2021. OSJD, <https://en.osjd.org/en/9194> (access date 10/09/2023).
- [20] Aspayeva Z. (2022). Own analytical materials of OSJD Commission on Freight Traffic. OSJD.
- [21] Sandeep R.J. (ed.) (2018). Study on border crossing practices in international railway transport. UNESCAP, <https://www.unescap.org/resources/study-border-crossing-practices-international-railway-transport> (access date: 21/06/2023).
- [22] Digitalization – next step for future international railway traffic (2022). OSJD/ESCAP, <https://osjd.org/ru/9062> (access date 10/09/2023).
- [23] Qun Z. (2022). Analytical materials of the Chinese railways. OSJD.
- [24] Krześniak M. (2017). Model symulacyjny planowania przemieszczania wagonów ładowanych i próżnych w sieci kolejowej (Simulation model for scheduling the movement of loaded and empty wagons in the railroad network). PW, PhD thesis.
- [25] Oleksiy O., Antonowicz M. (2022). Alternatywne Korytarze Transportowe: Transkaspjski Międzynarodowy Szlak Transportowy (TITR) oraz TRACECA (Europa - Kaukaz - Azja). Techniczne aspekty współpracy pomiędzy kolejami normalno- i szerokotorowymi (Alternative Transport Corridors: Trans-Caspian International Transport Route (TITR) and TRACECA (Europe-Caucasus-Asia). Technical aspects of cooperation between normal and broad gauge railroads). Presentation for Agro and Food Security Forum.
- [26] Abramović B, Zitricky V, Biskup V. (2016). Organization of railway freight transport: case study CIM/SMGS between Slovakia and Ukraine. *European Transport Research Review*, 8(27). <https://doi.org/10.1007/s12544-016-0215-7>.
- [27] Jakóbcowski J. (2022). Kolejowy Jedwabny Szlak w cieniu wojny na Ukrainie (Railway Silk Road in the shadow of the war in Ukraine), www.osw.waw.pl/pl/publikacje/komentarze-osw/2022-12-15/kolejowy-jedwabny-szlak-w-cieniu-wojny-na-ukrainie (access date: 9/06/2023).
- [28] Ismailov Z. I. (2022). *The New Silk Road: Current Financial Trends and Vulnerabilities in the Transport Sector*. Lecture Notes in Networks and Systems, 512-517. Springer Nature, ISBN: 978-3-030-94245-8.
- [29] Kayumkhodjaev Sh. (2022). Materials for the Report on the Activities of OSJD for 2021. Unpublished material.
- [30] Zielaskiewicz H. (2010). *Transport intermodalny na rynku usług przewozowych* (Intermodal transport in the market of transport services). PIB, ISBN: 978-83-7204-961-2.
- [31] Stokłosa J. (2011). *Transport intermodalny. Technologia i organizacja* (Intermodal transport. Technology and organization). Wyd. Naukowe WSEI, ISBN: 978-83-62074-04-4.
- [32] Jacyna M., Pyza D., Jachimowski R. (2017). Transport intermodalny, projektowanie

- terminali przeładunkowych (Intermodal transport, designing transshipment terminals). PWN, ISBN: 978-83-01-19680-6.
- [33] Mindur M. (ed.) (2011). *Transport v tovaroobmene mezhdu Evropoy i Aziyey* (Transportation of freight between Europe and Asia). Wydawnictwo Instytut Technologii Eksploatacji – Państwowy Instytut Badawczy, ISBN 978-83-7789-012-7.
- [34] Poliński J. (2015). Rola kolei w transporcie intermodalnym (The role of railways in intermodal transport). Instytut Kolejnictwa, ISBN 978-83-930070-2-8.
- [35] Zielaskiewicz H, Antonowicz M. (2019). *Konteneryzacja w logistyce materiałów niebezpiecznych* (Containerization in logistics of hazardous materials). PIB, ISBN 978-83-7789-568-9.
- [36] Wronka J. (2002). *Transport kombinowany w aspekcie wymogów zrównoważonego rozwoju* (Combined transport in terms of sustainable development requirements). Wyd. Naukowe OBET, ISBN 83-901858-1-4.
- [37] Świeboda J., Lysionok A., Majowicz A., Kulikowska-Wielgus A. (2020). Transport intermodalny na Nowym Jedwabnym Szlaku. Analiza potencjału. Bariery i szanse (Intermodal transport on the New Silk Road. An analysis of the potential. Barriers and opportunities). Polski Instytut Transportu Drogowego, <https://depot.ceon.pl/handle/123456789/19367> (access date: 10/09/2023).
- [38] Shurganova A. (2022). Analytical materials of Azerbaijani Railways. OSJD.
- [39] Antonowicz M. (2022). Own analytical materials.
- [40] Report on the Activities of the Organization of Co-Operation between Railways for 2022 (2023). OSJD, <https://en.osjd.org/en/9194> (access date: 9/06/2023).
- [41] Raport "Konkurencyjność kolei" (2022). ("Railway Competitiveness" Report) UTK, <https://utk.gov.pl/pl/dokumenty-i-formularze/opracowania-urzedu-tran/18799,Konkurencyjnosc-kolei.html> (access date: 10/07/2023).
- [42] Antonowicz M. (2015). Remarks on the competitiveness of rail freight transport in relation to road transport. Proceedings of the EUROTRANS Conference.
- [43] Bieńkowski W. et al. (2008). Czynniki i miary międzynarodowej konkurencyjności gospodarek w kontekście globalizacji – wstępne wyniki badań (Factors and measures of international competitiveness of economies in the context of globalization – preliminary research results). Prace i materiały 284, 75-100.
- [44] Dzierbunowicz E. (2013). Międzynarodowa konkurencyjność branży na przykładzie branży odlewniczej w Polsce w latach 1995-2010 (International competitiveness of the industry on the example of the foundry industry in Poland in the years 1995-2010). Uniwersytet Ekonomiczny w Poznaniu, PhD thesis.
- [45] Long-term competitiveness of the EU: looking beyond 2030. European Commission, Brussels (2023), https://commission.europa.eu/system/files/2023-03/Communication_Long-term-competitiveness.pdf (access date: 10.07.2023).
- [46] Stankiewicz M. J. (2005). Konkurencyjność przedsiębiorstwa. Budowanie konkurencyjności przedsiębiorstwa w warunkach globalizacji (Competitiveness of the firm. Achieving competitiveness in the global economy). Wydawnictwo „Dom Organizatora” TNOiK, ISBN: 83-7285-222-7.
- [47] Frączek P. (2009). Determinanty konkurencyjności branż i sektorów - ujęcie teoretyczne (Determinants of competitiveness of industries and sectors – a theoretical approach). Przedsiębiorstwo i Region 1, 7-17, [bwmeta1.element.ekon-element-000171511018](https://doi.org/10.13140/RG.2.2.26561.35684).
- [48] Radło M. J. (2008). Międzynarodowa konkurencyjność gospodarki, uwagi na temat definicji, czynników i miar (International competitiveness of the economy, comments on definitions, factors and measures). Wydawnictwo SGH. <https://doi.org/10.13140/RG.2.2.26561.35684>.
- [49] Burnewicz J. (2005). Ocena wstępnego Programu Operacyjnego "Konkurencyjność transportu" (Evaluation of the preliminary Operational Programme "Transport competitiveness"). Uniwersytet Gdański.
- [50] Porter M. (2001). *O konkurencji* (On competition). PWE, ISBN: 83-208-1287-9.
- [51] Witulski U. (2011). Transport dialogue and interoperability between the EU and its neighboring countries and Central Asian countries. TRT Transport e Territorio, Aften Consult GmbH, Dornier Consulting GmbH, PTV AG, http://www.traceca-org.org/fileadmin/fm-dam/TAREP/58jh/Third_Interim_Progress_Report_February_2011.pdf (access date: 09.06.2023).
- [52] TRAX. TRACECA Route Attractiveness Index – TRAX (2021), <http://www.traceca-org.org/en/routes/trax-index/> (access date: 09.06.2023).
- [53] Piechociński J. (2022). Wojna w Ukrainie. Konsekwencje dla europejskiej i światowej gospodarki, handlu i szlaków komunikacyjnych (War in Ukraine. Consequences for the European and global economy, trade and transportation routes). Presentation for the X Forum of Intermodal Transport FRACHT in Warsaw.

- [54] Ensuring interoperability for international railways (2023). Materials of the Administration of Chinese Railways.
- [55] Aspáyeva Z. (2023). Own OSJD analytical materials presented at the Meeting XXXVII of the Conference of General Directors (Authorized Representatives) of the OSJD Railways in Warsaw.
- [56] Kuś Ł. (2023). Rośnie ruch towarowy na Korytarzu Transkaspjskim (Freight traffic on the Trans-Caspian Corridor is increasing), <https://intermodalnews.pl/2023/05/18/rosnie-ruch-towarowy-na-korytarzu-transkaspjskim/> (access date: 15/06/2023).
- [57] Antonowicz M. (2022). Korytarz TMTM jako alternatywne rozwiązanie dla przewozów Chiny – Europa (TITR Corridor as an alternative solution for China – Europe traffic). Presentation for the Conference “Kolejowe przejścia graniczne” (“Railway Border Crossings”) in Warsaw.
- [58] Rastuschchiy potentsiyal Srednego Koridora (Growing potential of the Central Corridor) (2022). Informational and managerial materials of the Center of Scientific Information of the Russian Railways, https://lib.rgups.ru/site/assets/files/2829/rastushchii_potencial_srednego_koridora.pdf (access date: 15/06/2023).
- [59] Asavbayev A. (2021). Increasing the competitiveness of TRACECA's international freight services. Conference presentation. Baku.
- [60] Materials of Baku International Sea Trade Port (2023). Presentation. Baku.
- [61] UTLC Eurasian Rail Alliance (2023). Presentation. Ashgabat.
- [62] Engelhardt J. (2020). *Nowoczesne systemy transportowe w przewozach intermodalnych* (Modern transport systems in intermodal traffic). Wydawnictwo Uniwersytetu Szczecińskiego, ISBN: 978-83-797-2352-2.
- [63] Islam D. et al. (2013). The potential of alternative rail freight transport corridors between Central Europe and China. *Transport Problems* 8(4), 45-57, ISSN: 1896-0596.
- [64] Vinokurov E., et al. (2024), *Evrazijskiy transportnyi karkas. Doklad 24/6* (Eurasian transport network. Report 24/6). EABR, Almaty.