



Volume 114

2022

p-ISSN: 0209-3324

e-ISSN: 2450-1549

DOI: <https://doi.org/10.20858/sjsutst.2022.114.9>

Journal homepage: <http://sjsutst.polsl.pl>



Article citation information:

Nekhoroshkov, V., Vakulenko, S., Kurenkov, P., Nekhoroshkov, E., Deruzhinskiy, G., Ignatenko, A., Aroshidze, A., Astafiev, A., Seryapova, I., Solaskaya, I. Optimization of the international multimodal container transportation. *Scientific Journal of Silesian University of Technology. Series Transport*. 2022, **114**, 103-114. ISSN: 0209-3324.
DOI: <https://doi.org/10.20858/sjsutst.2022.114.9>.

**Vladimir NEKHOROSHKOV¹, Sergey VAKULENKO², Peter KURENKOV³,
Evgeniy NEKHOROSHKOV⁴, Grigoriy DERUZHINSKIY⁵, Alexander IGNATENKO⁶,
Alyona AROSHIDZE⁷, Alexey ASTAFIEV⁸, Irina SER YAPOVA⁹, Irina SOLSKAYA¹⁰**

¹ Faculty International Business and Law, Siberian Transport University, 191, Dusi Kovalchuk street, Novosibirsk, 630049, Russia. Email: vpnekor@mail.ru. ORCID: <https://orcid.org/0000-0003-1276-3622>

² Institute of Management and Digital Technologies, Russian University of Transport (RUT-MIIT), 9, building 9, Obraztsova street, Moscow, 127994, Russia. Email: post-iuit@bk.ru.
ORCID: <https://orcid.org/0000-0002-6471-8690>

³ Institute of Management and Digital Technologies, Russian University of Transport (RUT-MIIT), 9, building 9, Obraztsova street, Moscow, 127994, Russia. Email: petrkurenkov@mail.ru.
ORCID: <https://orcid.org/0000-0003-0994-8546>

⁴ Faculty International Business and Law, Siberian Transport University, 191, Dusi Kovalchuk street, Novosibirsk, 630049, Russia. Email: en@stu.ru. ORCID: <https://orcid.org/0000-0002-7833-5674>

⁵ Faculty of Water Transport Operation and Navigation, Admiral F. F. Ushakov State Maritime University, 93, Lenin's avenue, Novorossiysk, 353918, Russia. Email: evropa@bk.ru.
ORCID: <https://orcid.org/0000-0003-4506-9549>

⁶ Marine Engineering Faculty, Admiral F. F. Ushakov State Maritime University, 93, Lenin's avenue, Novorossiysk, 353918, Russia. Email: iscander@hotmail.co.uk. ORCID: <https://orcid.org/0000-0002-5259-7713>

⁷ Faculty International Business and Law, Siberian Transport University, 191, Dusi Kovalchuk street, Novosibirsk, 630049, Russia. Email: aroshidzealyona@gmail.com.
ORCID: <https://orcid.org/0000-0002-5330-2294>

⁸ Institute of Management and Digital Technologies, Russian University of Transport (RUT-MIIT), 9, building 9, Obraztsova street, Moscow, 127994, Russia. Email: aleks-astaf@yandex.ru.
ORCID: <https://orcid.org/0000-0003-2009-1723>

⁹ Faculty of Economics, Logistics and Management, Samara State University of Railway Transport, 2V, Svobody street, Samara, 443008, Russia. Email: plushka_91.62@mail.ru.
ORCID: <https://orcid.org/0000-0001-6438-9340>

¹⁰ Administration, Irkutsk State Transport University, Chernyshevskogo str., bld. 15, Irkutsk, 664074, Russia. Email: solskaya_i@irgups.ru. ORCID: <https://orcid.org/0000-0002-2294-0920>

OPTIMIZATION OF THE INTERNATIONAL MULTIMODAL CONTAINER TRANSPORTATION

Summary. The development of international cargo transportation has been relevant since the emergence of the international division of labor. Billions of tons of goods of various names, values and volumes are transported across the borders of the Russian Federation every year. This paper examines the Eurasian Economic Union international transportation system, its transport system integration, and the formation of a common transport space. The authors analyzed the international transport market state and conditions and the level of containerization. The transport system is considered the country's economy "circulatory system", which makes it a key link in the implementation of economic reforms in the country. The transport industry has social significance, which also determines the specifics of the phased market transformations. The development of international multimodal container transportation is becoming a new trend in the development of the transport service market.

Keywords: development, cargo, international transportation, Eurasian Economic Union, social significance, market transformations, international multimodal container transportation, transport services market

1. INTRODUCTION

At each stage of international transportation, the cargo owners have to solve several standard tasks: the choice of the route of transportation, the transportation method selection, the vehicle type selection, the choice of the carrier, or the forwarder. All the above also includes signing off an international transportation agreement, and its content with a full list of the rights and obligations for the transport company covering a broad range of operations – transporting, forwarding, carrying out loading and unloading operations, as well as performing customs formalities and conducting customs control while importing goods into the buyer's territory. Every action on the cargo vehicle route has to be coordinated properly to ensure that the goods arrive intact to the recipient, exactly on time and with minimal costs.

The complications within the international cargo transportation industry are caused by the development of transport logistics, its principles, and models, as well as the complexity of foreign economic relations [8, 9]. The international level of commercial relations requires special attention to documenting, its unification, translation from foreign into the national language and the implementation of other national and international formalities. Together with these requirements, the range of transport services offered, their complexity and diversity, similarly grows.

Hence, the current trend is to use several types of transport in cargo transportation that can be organized both sequentially and by one company under one contract of transportation.

2. PROBLEM

There is a special part within the international transportation system that is occupied by multimodal international container transportation. Transport scientists note that Russia has become an active participant in the competitive global container shipping market since

the mid-90s of the twentieth century with an increase in foreign trade turnover and a change in the structure of transportation in favor of their multimodality. An extensive network of railways, highways, and an inland waterway transport system provided all the possibilities for the above goal. Presently, cargo flows from the countries of the Far East and the entire Asia, as well as from the Northern, Eastern, Western and Central Europe will have to pass through the Russian Federation territory. In addition, the system of intra-national communication has been significantly improved, and new conditions have been created to promote the internal economic development of remote regions that were previously distant from the developed infrastructure of the center of Russia [13].

At the end of the twentieth century, at the Second Pan-European Conference held at Crete Island, there were identified nine major international transport corridors (ITC). For Russia, the ITC No 9 (and its further development – ITC ‘North-South’) and the ITC No 2 (and its further development – ITC ‘East-West’), passing through the territory of Russia are particularly important.

The main idea of the “North-South ITC” is to create favorable conditions and opportunities for the transportation of goods between the Middle East and the Baltic region. From the Persian Gulf, India, and Pakistan, cargo will be delivered through Russian ports and inland waterways transferring to the Northwest and further to any country in Europe. The agreement on this ITC counts on the delivery of goods from the various ports of both the Caspian and Black Seas.

Further development of the ITC 2 is the ‘East-West’ transport corridor, which includes the Trans-Siberian Railway (TSR), as well as railway lines to the northern ports of Russia (Murmansk, Arkhangelsk), Baltic and other ports [18].

The EAEU integration interaction makes it strategically important to develop these two areas of multimodal transportation. In 2019, the state corporation, Rosatom, initiated the development of the Northern Sea Transit Corridor project. This project will become an international logistics service for the delivery of goods between North-Western Europe and East Asia through the Northern Sea Route (NSR). A joint project for cargo flows along the Northern Sea Route to and from China was named “the Ice Silk Road”. China, seeking to diversify its trade routes, is pursuing several options under the Belt and Road Initiative (BRI, or B&R) or One Belt One Road (OBOR).

3. RESEARCH

In modern conditions, transport plays a key role in the formation of new business models at the global level. The integration of different types of transport and transport systems of individual states allows businesses, regardless of nationality, size, and industry specifics, to produce and sell products all over the world. It is the emergence of high-performance and energy-efficient transport systems that have made it possible to reduce logistics costs significantly and increase the volume of world trade.

According to Sh. Stephenson (Sherry Stephenson), reducing the cost of global shipping has opened new business opportunities and drastically changed production models. The availability of reliable and efficient transport communications allowed companies to distribute their operations – product development, component manufacturing, assembly, marketing, etc. – around the world, that in turn, ultimately led to the international production chains formation, and triggered the effect known as “global value chains” (GVC) [16]. The transformation of the global economic model has caused an increase in trade flows of intermediate goods, the share of which, according to some estimates, exceeds half of the goods imported by the member

countries of the Organization for Economic Cooperation and Development (OECD), and almost three quarters of the imports of large developing countries such as China and Brazil [20]. The 1990s last century could be assumed as the conditional beginning of the “flourishing” of globalization, when the rate of growth of world trade exceeded the rate of global economic growth (Figure 1).

Currently, this trend continues, and most economies in the coming years will not limit their production only to domestic consumption. It is with the resumption of the growth of foreign trade within the Group of Twenty (G20) countries in 2016, after a long period of decline in exports and imports, that experts pin their hopes on the end of the crisis in the global economy [7].

In the global economy, most high value-added goods are transported by sea. These transportations have shown the highest growth rates. In the period from 1980 to 2014, the global volume of container traffic increased about 15 times (Figure 2) [19].

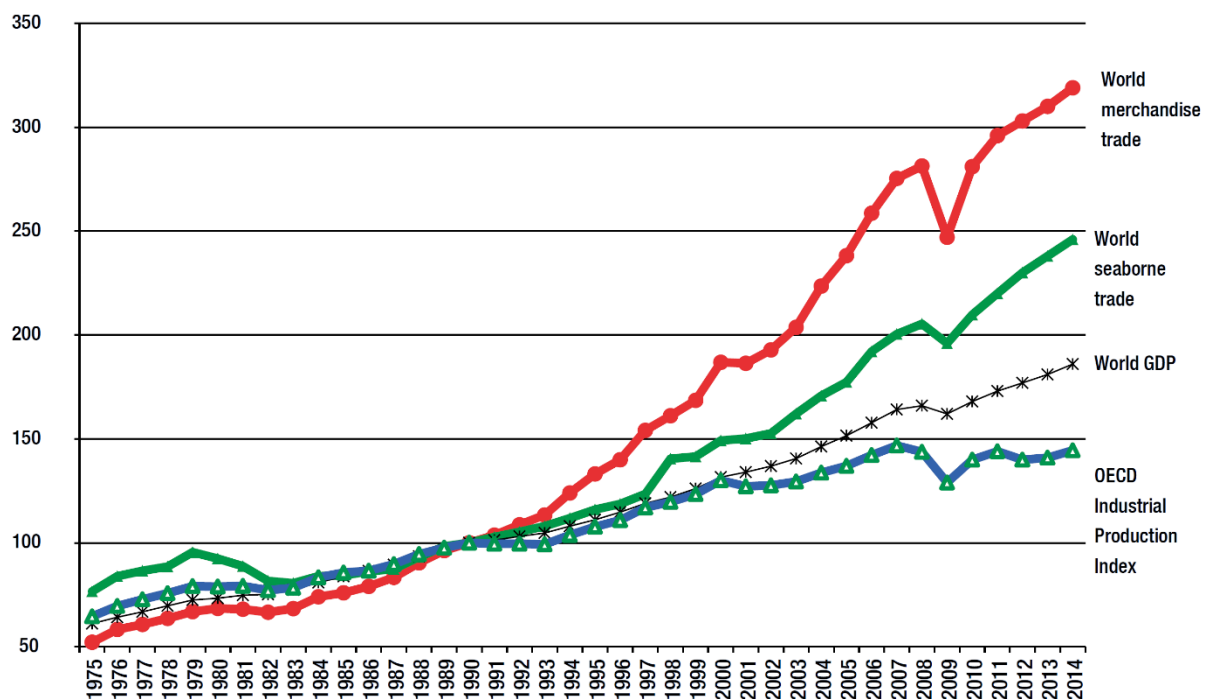


Fig. 1. Indexes of industrial production of the countries of the Organization for Economic Cooperation and Development (OECD), world GDP, trade in goods and the volume of shipping (1975-2014) (base year 1990 = 100)

Source: [21]

To maintain their share in the transcontinental transportation market, ship owners have to seek control of the entire transport chain from senders to recipients, based on the integration of their business processes with the operations of ports, terminal distribution complexes, river carriers, regional railway operators, interior freight forwarders and other supply chain participants [6]. This kind of integration forms a "logistics monopoly" since the logistics alliances can offer very favorable flat rates for the entire delivery route.

However, it is quite difficult for sea routes to compete with cargo flows within the Eurasian continent since the “cost factor” is often no longer an absolute priority in competition within the international transport market. A global business focused on operating with minimal stocks

in the face of a dynamically changing demand, is interested in reducing delivery times and actively exploring alternative transportation options between Asia and Europe. For example, the delivery time for containerized cargo from China to the EU by sea reaches 40-60 days [23], and the duration of delivery of the same cargo by railways of the EAEU does not exceed two weeks.

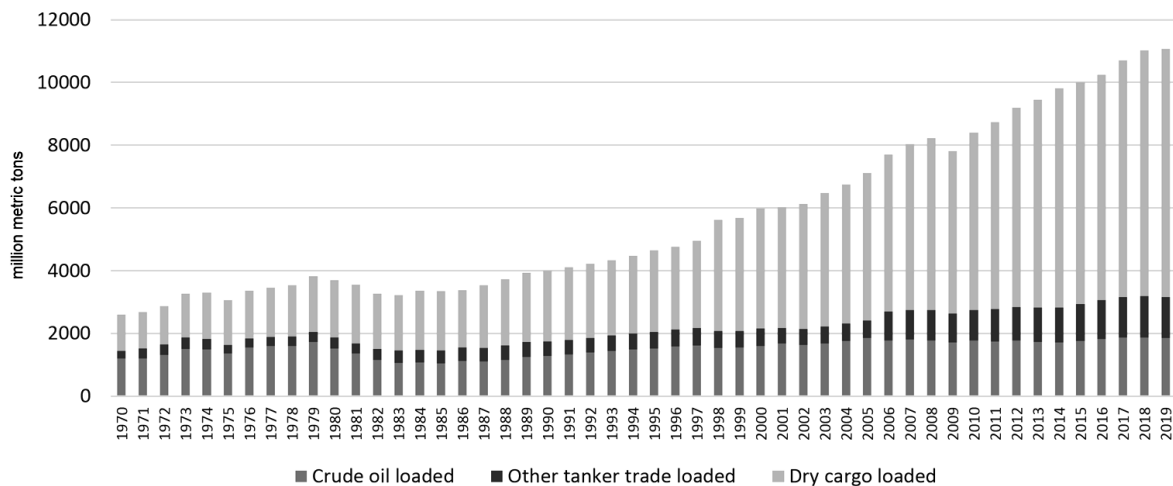


Fig. 2. World volume of sea transportation, mln. mt
Source: UNCTADStat

The EAEU countries have challenged the global logistics "monopolies" and are beginning to increase the volume of transit cargo between Europe and Asia. The overland Eurasian transit corridors passing through the territory of the EAEU can already offer an acceptable time and cost for the delivery of transit cargo between the EU countries and East Asia. The infrastructural basis of these corridors is the latitudinal railways of Russia, Kazakhstan and Belarus. To improve the efficiency of transit container traffic on the Eurasian Land Bridge, the state railway companies of Belarus, Kazakhstan and Russia created a joint stock company named "United Transport and Logistics Company" (UTLC) back in 2014. Due to inter-organizational coordination within the framework of a single holding, it was possible to increase the speed of container trains by almost 200 km per day.

The research of the features of the functioning of the system of international transportation by various types of transport, as well as the activities of transport companies engaged in international container transportation of goods, showed that until now the issues of scientific substantiation of modern innovative and effective methods for managing the international goods transportation competitiveness have not been fully explored.

Within the first quarter of 2021, the container traffic in the China - Europe - China route through the infrastructure of the Russian Railways has increased by 2.2 times compared with the same period in 2020 and reached the level of 162.6 thousand TEU. The transportation of loaded containers increased 2.1 times and reached the number 151.5 thousand TEU. The overall value of the transported cargo was about 1.2 million tons, with an increase of 2.7 times.

At the same time, the China to Europe transit has grown 2.1 times since the beginning of 2021 and reached 105.8 thousand TEU, and from Europe to China – 2.3 times and up to 56.8 thousand TEU. In addition, the China-Belarus-China container traffic increased by one third in January-March 2021, up to about 22 thousand TEU. Since the beginning of 2021, more than 180 thousand tons have been transported [15].

The growth of transit volumes is facilitated by the establishment of competitive pricing conditions, the expansion of the range and improvement of the quality of services, as well as the diversification of transit routes.

In August 2020, the Government of the Russian Federation signed a decree on subsidizing the railway transportation rate. One thousand dollars was allocated for one transported 40-foot container [22].

In April 2021, a new multimodal transit route from China to the UK via Kaliningrad was opened. The container train passes the Chinese city of Xian through the Altynkol border crossing Kazakhstan, heading to the terminal of the sea trade port of Kaliningrad for reloading to feeder ships and further shipment by sea to the port of Immingham in England.

4. GOAL AND TASKS

This study is aimed at the system of international multimodal container transportation as the basis for the formation of a common transport space of the Eurasian Economic Union.

To achieve this goal, the following tasks were identified:

- to study the prospects for the development of the international transport corridors "North-South" and "West-East";
- to determine the role of multimodal container transportation in the transport and logistics sector of the EAEU economy;
- to analyze the prospects for the development of multimodal container transportation in the world.

5. METHODS

The research methodology is based on the works of Russian and foreign scientists, specializing in the field of economic reform, the market systems regulation theory, assessment of the economic and technological potential of the transport complex and its operational efficiency. The information and empirical base of this study that ensures the reliability and validity of the conclusions, recommendations, and proposals, is the official data on the production and economic activities of transport companies.

To assess the competitiveness of transportation in this work, it is proposed to use both a structural and a functional analysis methods combination, as well as an integrated, systematic and process approach based on the product quality theory and modern marketing concept within the transport industry. Management of the competitiveness of transportation in specific market segments is based on the application of the provisions of the market systems regulation theory, and system analysis of economic processes in the field of transport.

6. OUTCOMES

The Russian transport system is one of the most developed in the world. In terms of the length of railways, the country is in third place in the world after the United States of America (USA) and China and holds the fifth place in road transportation. The role of the transport and logistics complex in the Russian economy is large: in 2018, the sector provided 7% of gross value added (GVA), which is more than twice the value of the United States (3,2%) but is

comparable to Russia's BRICS partners (6,8% in India and 8,7% in South Africa). Comparison of the Logistics performance index (LPI) for 2018 according to the World Bank is shown in Table 1.

Tab. 1

Logistics performance (LPI) for EAEU countries

	Russian Federation		Kazakhstan		Belarus	
	score	rank	score	rank	score	rank
LPI rank	2,76	75	2,81	71	2,57	103
Customs	2,42	97	2,66	65	2,35	112
Infrastructure	2,78	61	2,55	81	2,44	92
International shipments	2,64	96	2,73	84	2,31	134
Logistics competence	2,75	71	2,58	90	2,64	85
Tracking & tracing	2,65	97	2,78	83	2,54	109
Timeliness	3,31	66	3,53	50	3,18	78

Source: The World Bank

Over the past decade, both the transport and logistics sectors have been growing at an increased pace. Since 2016, the sector has been making a positive contribution to GDP growth (0.09 p. in 2016, 0.01 p. in 2017 and 0.19 p. in 2018) [17].

In the first and second quarters of 2019, the contribution amounts grew to 0.21 p. and 0.19 p., respectively.

As part of the study of this issue, it is necessary to consider Figure 3, which reflects the contribution of different economic activities of the transport and logistics sectors to GDP growth for the period from 2015 to 2018.

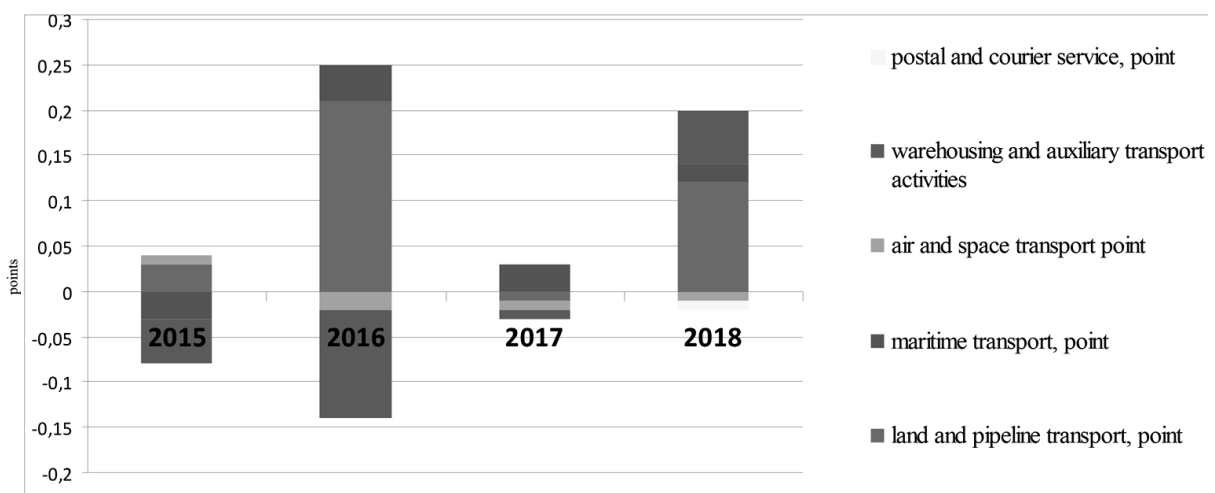


Fig. 3. Contribution to GDP growth of economic activities of the transport and logistics sectors, p., 2015-2018

Source: [3]

An analysis of the activities of foreign transport companies showed that until 2025, the volume of cargo transportation in containers would demonstrate a steady growth at the rate of about 8% per year. Within 10 years, the volume of container traffic may increase by 2-2.5 times. Combined road-rail traffic would also grow at around 8% per annum, well above the projected growth in conventional road and rail traffic [14].

The main growth in the volume of container traffic would occur due to the growing trade between the countries of the Asia-Pacific region and European countries, and most of this traffic would transit through Russia and other Commonwealth of Independent States (CIS) countries when the necessary technological, regulatory, legal and tariff conditions are created [5].

The level of containerization in the world averages 50-60% of the total volume of dry cargo shipments, and in several European ports, containerization exceeds 90% (Figure 4).

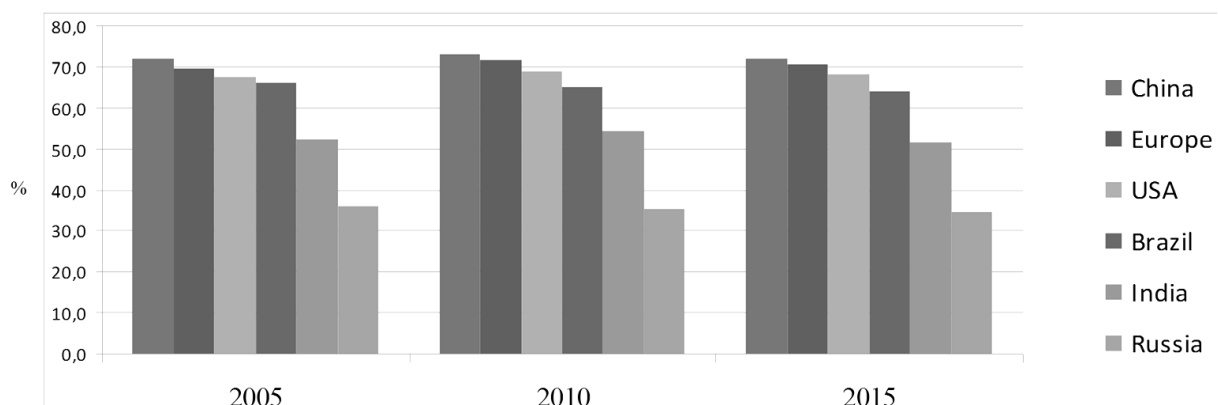


Fig. 4. Level of containerization of freight traffic in the countries of the world, %

In the medium to long term planning, container traffic between Asia and Europe is predicted to grow, driven by economic recovery and increased demand. It was estimated that for the period from 2014 to 2019, the increase in the volume of container traffic was approximately 7,9% per year, in the period from 2020 to 2025, the growth rates would decrease slightly and stay at about 6% per year (Figure 5). The flow of containerized cargo from the countries of South Asia, ASEAN and Northeast Asia to the CIS countries by 2025 would increase from 1,03 million to 5,5 million (5,4 times). At the same time, the volume of container traffic from these countries to Europe by 2025 would increase from 11,8 million TEU to 31,8 million (2,8 times), and most of these flows would transit through the CIS countries [3].

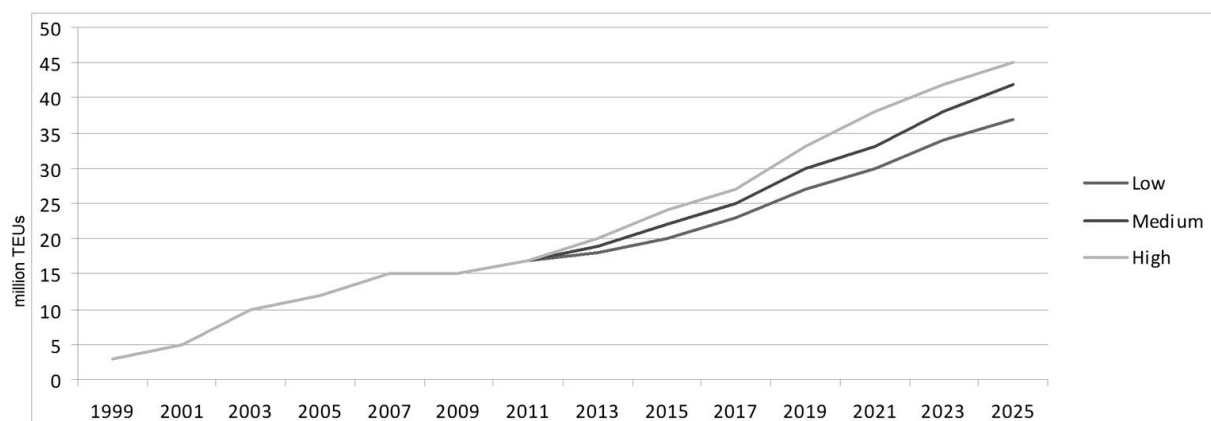


Fig. 5. Forecast of changes in the volume of container traffic in the world, mln. TEU

7. CONCLUSION

The research of the state of the international transportation market showed that multimodal container transportation is becoming a key trend in the development of the industry. The main share of container international cargo turnover on the territory of the EAEU falls on domestic and export-import traffic (59% and 34%, respectively), while the share in the segment of highly profitable transit traffic is small (7%), allowing in the future to develop the potential for a favorable geographical position of the Union that offers the most attractive international transport corridors [4].

The implementation of integration processes in the transport sector is influenced by numerous factors, including regional specifics, prospects for the development of the global economy, the state and level of development of transport infrastructure, etc. [2]. The transport systems of the EAEU countries have significant potentials, and their integration will contribute to further socio-economic development union education, improving the conditions and quality of life of the population [1].

The integration of the EAEU transport systems, despite the differences in legal regulation, the technological features of certain types of transport and the state of the transport infrastructure, should contribute to the economic growth of the union states, reduce their transport isolation, expand the intra-union and international economic ties and increase the volume of transit traffic [11].

The priority tasks of transport integration within the EAEU are: development of cross-border transport infrastructure (transport corridors, multimodal transport and logistics centers) to ensure territorial connectivity of all Union members, expand international trade and cooperation; the formation of a common market for transport services without exceptions and restrictions, stimulating competition and cooperation in the industry and assuring the harmonious interaction of different types of transport, the formation of integrated viable business structures in the transport and logistics sector; pursuing a coordinated tariff policy for the rational use of the transit possibilities of the Eurasian land corridors and increasing their competitiveness.

In general, the transport integration of the EAEU creates fundamental prerequisites for the formation of a common transport space within the Economic Union that will be mutually beneficial for all Eurasian countries and their development.

Creation of the logistics system, the Northern Maritime Transit Corridor (NSTC), is a “pioneering”, combinational and high-tech project that requires the consolidation of scientific and technical potential and cooperation at the intersectoral level.

The following basics were chosen as the fundamentals for the implementation of the NSTC project:

- information technology;
- model-based system engineering 2.0 (MBSE 2.0);
- simulation modeling;
- digital technologies and platform solutions;
- a new design paradigm based on the development and application at all stages of the life cycle of digital twins (Digital Twin) and digital shadows (Digital Shadow) on the digital platform CML-Bench;
- many other advanced technologies.

Their application will optimize costs, minimize the project development time, field tests and help create a competitive product based on a new type of business model, including a cybernetic digital platform of the ecosystem being created [10].

According to the Comprehensive Plan for the modernization and expansion of the trunk infrastructure for the period up to 2024 [21], adopted by the Government of the Russian Federation, it is planned to achieve the following indicators:

- delivery times for the transit container traffic on the North-South direction (Krasnoe, ports and border crossings North-West - Samur) should be reduced from 2.5 days in 2021 to 2.1 days by 2024;
- delivery times for the transit container traffic on the Europe – Western China route (Krasnoe – Iletsk, Ozinki, Kartaly, Petropavlovsk) should be reduced from 3.2 days in 2018 to 1.6 days by 2024;
- delivery times for the transit container traffic on the West-East direction (red, ports and border crossings of the North-West – Naushki, Zabaikalsk, ports and border crossings of the Far East) should be reduced from 8.9 days in 2018 to 7.0 days by 2024;
- the average speed of delivery of transit container traffic should grow from 810 to 1,319 km/day by 2024;
- the carrying capacity of the highways should grow from 12,34 million tons to 182 million tons by 2024;
- transit transportation of containers by rail should reach 1,656 thousand TEU.
- will rise from 75 to 50 in the Logistics performance (LPI) ranking.

References

1. Акопова Е.С., С.Ю. Нестеров, С.И. Самыгин. 2017. „Российская автомобильная транспортная инфраструктура: проблемы развития в условиях экономической глобализации”. *Гуманитарные, социально-экономические и общественные науки* 11: 141-144. [In Russian: Akopova E.S., S.Yu. Nesterov, S.I. Samygin. 2017. „Russian automobile transport infrastructure: development problems in the context of economic globalization”. *Humanities, socio-economic and social sciences* 11: 141-144].
2. Аветикян М.Л. 2011. „Высокие технологии транспортного процесса”. *Железнодорожный транспорт* 11: 73-77. [In Russian: Avetikyan M.A. 2001. „High technologies of the transportation proces”. *Railway transport* 11: 73-77].
3. Bubnova Galina V., Olga V. Efimova, Irina V. Karapetyants, Petr V. Kurenkov. 2018. „Digitalization of intellectualization of logistics of intermodal and multimodal transport”. In: *19th International Scientific Conference - LOGI 2018*: 02013. Russian University of Transport, České Budějovice, Czech Republic. 6-7 November 2018, České Budějovice, Czech Republic. DOI: <https://doi.org/10.1051/mateconf/201823602013>.
4. Drozdov Nikita, Elena Kuzina, Petr Kurenkov, Julia Tagiltseva, Marina Vasilenko. 2020. „Technological Safety Management of Electrotechnical Companies Production Activities”. In: *2020 IEEE International Conference "Quality Management, Transport and Information Security, Information Technologies" IT and QM and IS*: 02013. Pastukhov State Academy of Industrial Management, Yaroslavl, Russia. 7-11 September 2020, IEEE. ISBN:978-1-7281-8179-0. DOI: <http://dx.doi.org/10.1109/ITQMIS51053.2020.9322935>.

5. Elms K. Deborah, Patrick Low. 2013. *Global value chains in a changing world*. Switzerland: WTO Secretariat. ISBN: 978-92-870-3882-1. Available at: https://www.wto.org/english/res_e/booksp_e/aid4tradeglobalvalue13_e.pdf.
6. Hausken Kjell, Thomas Plumper. 1997. "Hegemons, Leaders and Followers: A Game-Theoretic Approach to the Postwar Dynamics of International Political Economy". *Journal of World-Systems Research* 3(1): 35-93. DOI: <https://doi.org/10.5195/jwsr.1997.118>.
7. International Transport Forum. „Transport Links between Europe & Asia”. Available at: <https://www.itf-oecd.org/sites/default/files/docs/06europe-asia.pdf>.
8. Jacyna M. 1998. "Some aspects of multicriteria evaluation of traffic flow distribution in a multimodal transport corridor". *Archives of Transport* 10(1-2): 37-52.
9. Jacyna M., M. Wasiak, K. Lewczuk, M. Kłodawski. 2014. "Simulation model of transport system of Poland as a tool for developing sustainable transport". *Archives of Transport* 31(3): 23-35.
10. Мачерет Д.А. 2019. „Транспортный фактор формирования эпохи современного экономического роста”. *Экономическая политика* 14(1): 154-179. [In Russian: Macheret D.A. 2019. „The transport factor of formation of the era of modern economic growth”. *Ekonomicheskaya Politika* 14(1): 154-179].
11. Macheret Pavel D., Dmitriy A. Macheret, Ramila R. Savchuk. 2019. „Economic Importance of Automation of Transport Infrastructure Design”. In: *2019 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus)*: 8657126. St. Petersburg Electrotechnical University “LETI”, National Research University of Electronic Technology “MIET”, Glyndwr University, UK, IEEE Russia Section and IEEE Russia North West Section (2019 EIConRus), Moscow and St. Petersburg, Russia. 28-31 January 2019, IEEE. ISBN: 978-1-7281-0339-6. DOI: <http://dx.doi.org/10.1109/EIConRus.2019.8657126>.
12. NTI Center. „Northern Maritime Transit Corridor Project”. Available at: https://nticenter.spbstu.ru/nti_projects/57.
13. Official Internet portal of legal information. „Agreement on the Eurasian Economic Union” (Signed in Astana on May 29, 2014). Available at: <http://www.pravo.gov.ru>.
14. Rezer S.M. 2012. *Konteinerizatsiya gruzovykh perevozok*. [In Russian: *Containerization of freight transportation*]. Moscow: VINITI RAN. 678 p.
15. Russian Railways. „News. 14.04.2021”. Available at: <https://eng.rzd.ru/en/9517/page/104070?id=4486>.
16. Safonov Pavel, Vincent Favrel, Walter Hecq. 2003. „Environmental impacts of mobility and urban development: A case study of the Brussels-capital region”. In: *Managing for Healthy Ecosystems*, edited by David J. Rapport, Bill L. Lasley, Dennis E. Rolston, N. Ole Nielsen, Calvin O. Qualset, Ardeshir B. Damania, 741-755. USA, Boca Raton: CRC Press. ISBN: 9780429143236.
17. Shkurina Lidia, Maria Maslova, Viktor Podsorin, Natalia Tereshina. 2019. „Effective investment management with elements of simulation modelling”. In: *Innovative Technologies in Environmental Science and Education (ITESE-2019)*: 04028. Russian University of Transport, Divnomorskoe village, Russian Federation. 9-14 September 2019, Moscow, Russia. DOI: <http://dx.doi.org/10.1051/e3sconf/201913504028>.

18. Stephenson Sherry. 2013. *Global Value Chains: The New Reality of International Trade*. E15 Initiative. Geneva: International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum. Available at: http://e15initiative.org/wp-content/uploads/2015/01/E15_GVCs_BP_Stephenson_FINAL.pdf.
19. Tagiltseva Julia, Nikita Drozdov, Elena Kuzina. 2017. „Monitoring socio-ecological-economic security of management environmental decisions”. In: *2017 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus)*: 1350-1354. St. Petersburg Electrotechnical University “LETI” (SPbETU), St. Petersburg, Russia. 1-3 February 2017, St. Petersburg, Russia. ISBN: 978-1-5090-4865-6. DOI: <https://doi.org/10.1109/EIConRus.2017.7910821>.
20. Tagiltseva Julia, Nikita Drozdov, Elena Kuzina, Marina Vasilenko. 2017. „The algorithm of making environmental management decisions”. In: *International Conference "Quality Management, Transport and Information Security, Information Technologies" (IT&QM&IS)*: 581-585. St. Petersburg Electrotechnical University “LETI” (SPbETU), St. Petersburg, Russia. 24-30 October 2017, St. Petersburg, Russia. ISBN: 978-1-5386-0703-9. DOI: <https://doi.org/10.1109/ITMQIS.2017.8085891>.
21. The Russian Government. „Comprehensive plan for the modernization and expansion of the backbone infrastructure”. Available at: <http://government.ru/docs/34297/>.
22. The Russian Government. „Resolution of the Russian Government of August 21, 2020 No. 1265 “On approval of the Rules for the provision of subsidies from the federal budget to the open joint-stock company "Russian Railways" for reimbursement of lost income arising from the establishment of preferential tariffs for transit transportation through the territory of the Russian Federation by rail in general use of cargo in containers”. Available at: <http://static.government.ru/media/files/vEoKMIxu3ZHARAtlq4zoBpOEP9WetAWA.pdf>.
23. UNCTAD. 2015. *Review of Maritime Transport 2015*. United Nations publication. Sales No. E.15.II.D.6. New York and Geneva. Available at: http://unctad.org/en/PublicationsLibrary/rmt2015_en.pdf.

Received 04.01.2022; accepted in revised form 22.02.2022



Scientific Journal of Silesian University of Technology. Series Transport is licensed under a Creative Commons Attribution 4.0 International License