Technological aspects of building the transport ecosystem of the Russian Federation: economic issues of energy engineering

Juliya Tsertseil¹, Tatiana Bondarenko¹, Natalya Prodanova¹*, and Dmitry Domnichev²

¹Plekhanov Russian University of Economics, 115093 Moscow, Russia
²A.N. Kosygin Russian State University (Technologies, Design, Art), 119071 Moscow, Russia

Abstract. The article discusses the prospects and technological steps for building and further developing the transport ecosystem of the Russian Federation. Such a transformation of the existing transport system is in demand due to the economic conditions of energy engineering and consumption. The article presents the drivers that ensure the growth and development of the transport ecosystem of the Russian Federation, describes the technological aspects that act as a limitation in its development. An analysis of the dynamics of the development of the transport ecosystem of the Russian Federation was carried out for the period 2022-2021 according to statistical reporting. Its functioning directly affects the socio-economic development and security of the Russian Federation, the development of transport and logistics technologies, and the creation of a trend towards low-carbon transformation of the industry. Such an approach will ensure the sustainable development of the economy of the industry and the country, and improve environmental hygiene and environmental health.

1 Introduction

To date, the Russian Federation has developed and is implementing the Digitalization Program in the road sector of the Russian Federation, which implies implementation dates starting from 2022. In this regard, the identification of real prerequisites for the transformation of the entire transport system of the Russian Federation, including its digitalization, is coming to the fore plan and explains the relevance of the study.

2 Methodology

The transport system plays a key role in the development of territories. According to the State Program of the Russian Federation "Development of the transport system" (as amended on September 07, 2022), transport is one of the most important basic sectors of the economy, its functioning directly affects the socio-economic development and security of the Russian Federation. According to this program, the strategic goals of the state transport policy for the

* Corresponding author: prodanova-00@mail.ru
development of the transport complex of the Russian Federation are to increase the spatial connectivity and transport accessibility of territories, increase the speed and volume of cargo delivery, including transit, develop multimodal and transport and logistics technologies, increase population mobility and develop domestic tourism, increase in the speed and volume of cargo delivery, including transit, development of multimodal and transport and logistics technologies, digital and low-carbon transformation of the industry.

One of the key priorities in the development of the transport complex will be the implementation of measures to form and develop the Unified Basic Transport Network.

The issues of the relationship between transport infrastructure and global competitiveness are discussed in the works of R. Cervero, A. Joko Purwanto, Christophe Heyndrickx, Jan Kiel, Ofelia Betancor, M. Pilar Socorro, Aday Hernandez, Juan L. Eugenio-Martin, Barbara Pawlowska, Przemyslaw Borkowski, Ralf Fiedler, Patricia C. Melo, Daniel J. Graham, Ruben Brage-Ardao and others.

In the work of R. Cervero [1] considers the role of transport infrastructure in the development of highly urbanized cities, which entails an increase in both the quality of life of the population and economic parameters, including the economic rate of return.

The team of authors A. Joko Purwanto et al. [2] in their work on the implementation of an effective strategy in creating a transport system assigns the role of a tool that increases the competitiveness of the national economy.

Patricia C. Melo, Daniel J. Graham, Ruben Brage-Ardao [3] also equate the concept of investment in transport infrastructure with the possibility of economic growth, especially during periods of economic downturn.

Today, the issues of digitalization of the transport system require effective solutions, which is reflected in the works of the authors: Louise Olsson, S.A. Tolkachev, P.S. Shcherbachenko, D.E. Morkovkin, A.A. Gibadullin, D.V. Andreev, M. Makarova, R. Chinoracky, J. Kurotova, P. Janoskova.

In a study by S.A. Tolkachev et al. [4] provides the proportion of transport organizations using digitalization tools. In general, today the process of digitalization of transport systems is not total, so in the direction of Cloud services, Web site, the share of organizations in the transport sector does not exceed 19.90 and 36.20%, respectively. In the work of D.V. Andreev, M. Makarova [5] considered the features of the development of the northern territories, using the example of Yakutia, which imposes features of the formation and development of both the transport system itself and the ways of using digitalization tools.

In a study by R. Chinoracky, J. Kurotova, P. Janoskova [6] there is a downward trend in the level in the transport system, due, in their opinion, to an increased level of digitalization of this sector of the economy. In this case, it is assumed that the workforce will be replaced by digital technologies.

Ruosi Zhang [7] introduces the concept of synergy between the transport system and other economic and social systems in order to create a single digital ecosystem based on innovation.

3 Results

The dynamics of cargo transportation volumes in the Russian Federation by all modes of transport remains practically unchanged over the period 2002-2021, as shown in Figure 1, while the trend line has a downward trend. The overall decrease in the volume of cargo transportation for the entire analyzed period amounted to 6.22%.
Figure 1. Dynamics of cargo volumes by all types of transport across the territory of the Russian Federation for the period 2002-2021, million tons (compiled by the authors).

Figure 2 shows the following types of transport: rail (blue line), road (red line) and pipeline (green line) modes of transport.

According to Figure 2, the largest share in the transportation of goods across the territory of the Russian Federation is accounted for by road transport. In general, for the entire analyzed period, the share ratio of these transport groups remains practically unchanged.

Let us consider in more detail the distribution of volumes of cargo transportation performed by road transport, in the context of the federal districts of the Russian Federation. The main volume of cargo transportation by road transport falls on the Central Federal District, which amounted to 366.4 million tons in 2021, then we can single out the Volga
Federal District - 292.3 million tons, the Siberian Federal District - 226.6 million tons and the Ural Federal District - 215.6 million tons.

It should be noted that, in general, the volume of cargo transportation is also influenced by the quality of the roads used, which is reflected in Figure 3. As we can see, the share of regional or intermunicipal roads that meet regulatory requirements for the analyzed period does not exceed 50%, which can also act as a deterrent; on the other hand, this circumstance can be considered as a prerequisite for the need to transform the transport industry, including its digitalization, which will improve the quality of transport services provided.

Fig. 3. The share of motor roads of regional or intermunicipal significance that meet regulatory requirements for the period 2007-2021, %.

4 Discussion

The digital transformation of the transport system involves the formation of investment flows directed to the creation and implementation of digital technologies. However, digitalization processes are closely interconnected with all processes of renewal of fixed assets, their reconstruction and modernization. According to the website of the Federal State Statistics Service of the Russian Federation, the coefficient of renewal of fixed assets is the ratio of fixed assets put into operation during the year to their availability at the end of the year, as a percentage, it reflects the share of new (commissioned during the year) fixed assets in their total volume. In order to analyze the dynamics of renewal coefficients, without taking into account the impact of price changes, their macroeconomic recalculation into comparable prices is applied. It should be noted that for the period 2017-2021. The coefficient of renewal of fixed assets in the Russian Federation as a whole for all types of economic activity is quite low and varies over the analyzed period in the range from 3.9% to 4.3%, which is reflected in Figures 4, 5.
The degree of wear and tear of vehicles in all sectors of the economy is quite high and ranges from 32.7% (financial and insurance activities) to 62.8% (culture, sports, leisure and entertainment) in 2021, which may act as a deterrent in the process of digital transformation of the transport industry.

The authors conducted a study to identify the relationship between the volume of cargo transportation by road transport and the share of roads that meet regulatory requirements in 2021. All territories of the Russian Federation participated in the study, but a significant relationship was obtained in relation to the territories of the Central Federal District of the Russian Federation, which shown in Figure 6. The calculated data on the construction of the curve in Figure 6 are presented in Table 1.

Table 1. Calculated Regression Statistics data (compiled by the authors).

<table>
<thead>
<tr>
<th>Regression Statistics</th>
<th>Value</th>
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<tbody>
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<td>Multiple R</td>
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<td>R Square</td>
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<td>Adjusted R Square</td>
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<td>Observations</td>
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</table>
5 Conclusion

In accordance with the Decree of the Ministry of Transport of the Russian Federation dated May 31, 2021 No. VS-105-r “On Approval of the Digitalization Program in the Road Sector in the Russian Federation”, the following are identified as measures to ensure digitalization processes in the road sector in the Russian Federation:
- formation of information models;
- creation of a national network of intelligent transport systems;
- creation of a federal platform for a network of intelligent transport systems;
- creation of regional platforms for intelligent transport systems.

As constraints on the digital transformation of the transport industry of the Russian Federation, the Program highlights the low level of integration of digital solutions at the macro level.

The total amount of funding from the federal budget for the project "Digital Transformation of Transport" will amount to 336.44 billion rubles. in accordance with the Passport of the Strategy for the Digital Transformation of the Transport Industry of the Russian Federation.

According to Figure 7, the share of investments in machinery, equipment, vehicles in the total volume of investments in fixed assets aimed at reconstruction and modernization for the period 2005-2021, decreases from 43.9% to 31.8%, which may act as a deterrent in the digital transformation of the transport system.

![Fig. 7](image_url) The share of investments in machinery, equipment, vehicles in the total volume of investments in fixed assets aimed at reconstruction and modernization for the period 2005-2021, % (compiled by the authors).

The following can be noted as growth drivers for this industry: the growth rate of gross value added in the transportation and storage industry amounted to 112.2% in January-June 2021 compared to the same period in 2020.

![Fig. 8](image_url) Specific ratio of the volume of fixed assets put into operation in 2021, shares of units.
According to Figure 8, the share of commissioning vehicles is the smallest and amounts to 12%, which in value terms is 2,807.473 billion rubles. In total, the volume of fixed assets put into operation in 2021 amounted to 22,863.184 billion rubles in value terms, the growth of this indicator was 23.44% compared to the previous period. At the same time, the growth in the volume of commissioning of fixed assets among vehicles in 2021 amounted to 37.5% compared to the previous period, which can be noted as a positive trend.

References

2. A. Joko Purwanto et al., Transportation Research Procedia, 25 (2017)
5. D.V. Andreev, M. Makarova, Transport Research Procedia, 61 (2022)