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THE INFRASTRUCTURE OF THE LOGISTICS SYSTEM

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Abstract

The purpose of the article is to study the problems of transport infrastructure as a key factor in the formation of the transport logistics system of the region by the example of Sverdlovsk Region of Russian Federation. To achieve the purposes of the present study, there was conducted a comprehensive analysis of the dynamics and structure of the distribution of goods and passenger transport in relation to modes of transport in Sverdlovsk region for the period from 2000 to 2015. The authors of the article proposed a method for determining the imbalance in the possibilities of the transport logistics system and the needs of the industries producing goods. As a result of the work, a complex of infrastructure constraints, characteristic of the Sverdlovsk region, was noted with respect to certain modes of transport, including railway, automobile and air. In the conclusion of the article, the authors formulated the main strategic directions for the medium-term perspective on overcoming the current situation.

Keywords

Transport-logistic system – Transport infrastructure – Infrastructural disproportions
Connecting traffic

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Introduction

The efficient organization of goods distribution decreasing the costs of conversion of economic entities is one of the main tasks of the transport logistic system; such issues were represented in the works of Proost, &Thisse¹ and Fujita et al.². The spatial distribution of activities is the outcome of a trade-off between different types of scale economies and the costs generated by the transfer of people, goods, and information. We may thus already conclude that high transport costs promote the dispersion of economic activities, while strong increasing returns act as an agglomeration force, and the other way round. This trade-off is valid on all spatial scales (city, region, country, and continent), which makes it a valuable analytical tool. Thus, the change in the cost of the transportation in the US, as estimated in the work of Glaeser, &Kohlhase³, decreased; in 1890, the cost per ton-mile was 18.5 cents, as opposed to 2.3 cents today.

This issue is especially relevant for the regions of the Big Ural that provides the connecting traffic between Europe and Asia finally determining the efficiency of the functioning of the global transport logistic networks.

The infrastructure and infrastructural disproportions connected to it transform the transport logistic system spatially increasing the cost of transportation. We can say that it forms systematically the internal and external factors of the economic activity combining and consolidating the objects for the realization of their individual advantages.

Basing upon the above, the objective of the article can be formulated as the formation of the directions of minimization of the impact of the infrastructural disproportions on the transport logistic system of the region regarding the types of transport.

Methodology

Nowadays, the approaches to the determination of the content and structure of the transport logistic system are rather completely formed, distinguishing the blocks of the transport and logistic infrastructure, material, financial and information flows⁴.

The setting of the problem of research presupposes the analysis of a variety of transport logistic systems and the corresponding approaches to their organization and control. The reactions of various transport logistic systems to the same external conditions will be different as well as their transformations under the impact of the external and internal environment⁵.

¹ S. Proost; J. Thisse and J. Skilled, Cities and efficient urban transport. Economics without borders: economic research for European policy challenges, Chapt, 9, 2017.

² M. Fujita; P. R. Krugman & A. Venables, The spatial economy: Cities, regions, and international trade (Moscú: MIT press, 1999).

³ E. L. Glaeser & J. E. Kohlhase, Cities, regions and the decline of transport costs. In Fifty Years of Regional Science (Berlin: Springer, 2004).

⁴ Andrey Plakhin; Ekaterina Ogorodnikova and Mikhail Sidorenko, Industrial parks as an effective instrument of regional investment policy. In 2nd International Conference on Economics and Management, Education, Humanities and Social Sciences. Atlantis Press. 2018

⁵ A. V. Silant'ev, "Theoretical analysis of the influence of peculiarities of transport and logistic systems in their formation and function", Manager, num 5 Vol: 51 (2014): 20-23.

As the frame upon which the transport logistic system is built is formed by infrastructure, we can talk about the direct dependence of the efficient functioning of the transport logistic system of the region upon the availability of the infrastructural restrictions of the territory. Among such restrictions, we can distinguish the low traffic capacity, low competitiveness of the logistic and transport enterprises of the region, lack of storage and distribution base, etc. One more problem is the imbalance of the use of various types of transport, lack of information systems providing the possibility of the complex use of the elements of the transport complex of the region. Also, the high investment costs for entering into the branch determine the non-competitive structure in the segments of the railway and air transport decreasing the efficiency of the goods distribution. The particular issues of this range of problems are reflected in the works mentioned in the reference ⁶.

The method of the determination of the imbalance of the possibilities of the transport logistic system and the demands of the cargo generating branches is shown in Figure 1.

Stage 1	Estimation of the demand for transportation of cargo-generating complexes of the industry of the region		Stage 2	Estimation of the connecting traffic coming into the TLS of the region
<p><i>Result of the implementation of 1 and 2 stages</i></p> <ol style="list-style-type: none"> 1. The structure of the main types of products of the cargo-generating complexes of industry and connecting traffic 2. Volume indicators of the output of the main types of products of the cargo-generating complexes of industry and connecting traffic 3. Territorial siting of the main enterprises of the cargo-generating complexes of industry 4. Structure of cargo transportation and raw material of the cargo-generating complexes of industry according to the types of transport 				
Stage 3	Estimation of possibilities of the transport complex of the region			
<p><i>Result of the stage implementation</i></p> <ol style="list-style-type: none"> 1. Balances of the cargo traffic and possibilities of the transport complex of the region according to the types of transport 				
Stage 4	Determination of disproportions of TLS and demands of the transit cargo-generating complexes			
<p><i>Result of the stage implementation</i></p> <ol style="list-style-type: none"> 1. Offers to develop the infrastructure of TLS of the region to extend the possibilities of goods distribution 				

Figure 1

Method of the determination of the imbalance of the possibilities of the transport logistic system and the demands of the cargo generating branches

⁶ O. N. Frolova and S. O. Tibilova, "Management System in the transport and logistics system", Logistics system in the global economy, num 6 (2016): 342-346.

The represented method is used for the grounding of investments in the long-term perspective in the issues of reconstruction and development of the railway, motor and air infrastructure. For practical realization, it is planned to introduce and actualize the system of prediction of cargo traffic on the base of the transport and economic balance determining the places of appearance (and/or increase) and merger of the cargo traffic and key projects of every branch (also the projects associated and dependent from them) directed to the transport provision of this cargo traffic.

Results

The geographical location (on the junction of two geographical continents – Europe and Asia) enables the regions of the Big Ural to play the leading role not only in the development of the national but also in the Eurasian transport connections. Many economically profitable surface and air routes connecting the European and Asian parts of Russia, European and Asia-Pacific countries go through this territory⁷.

Within the borders of the region, one of the main railway junction functions, that is Yekaterinburg railway junction, located on the main way of the Trans-Siberian Railway. In total, seven railway accesses come to this junction. Perm, Kazan, Tyumen, Chelyabinsk junctions have the all-Russian significance; Nizhny Tagil and Egorshinsky junctions have the regional significance.

Yekaterinburg railway transport junction is located in the Yekaterinburg agglomeration through which the road transport corridor "West-East" goes directly. Within the borders of agglomeration on the base of the motor road around Yekaterinburg (Yekaterinburg Ring Motorway) a large highway junction was formed in which four federal-aid highways and the most important regional roads cross.

Koltsovo Airport is located near Yekaterinburg; it is one of the largest, modern and dynamically developed airports in Russia.

The developed railway and highway network, the availability of the modern airport, the own powerful export-oriented cargo base possessing the big potential of containerization and the work of the largest transport logistic companies of Russia in the territory of the region, including JSC "Transcontainer" enables the Sverdlovsk Region to play the role of the distributional center not only for the neighboring regions, but also in the remote regions.

The step-by-step implementation of the method is shown below.

⁷ V. N. Klochkov; S. A. Gusev and N. Loginov, "To Transport and logistics systems", Bulletin of Saratov state technical University, Vol: 2 num 3 (2004): 139-142 y A. Plakhin; R. Kampf; E. Ogorodnikova & A. Kokovikhin, "Localization strategies of the Czech companies on the basis of industrial-logistics parks in the Sverdlovsk region", MATEC Web of Conferences EDP Sciences. Vol: 134 (2017).

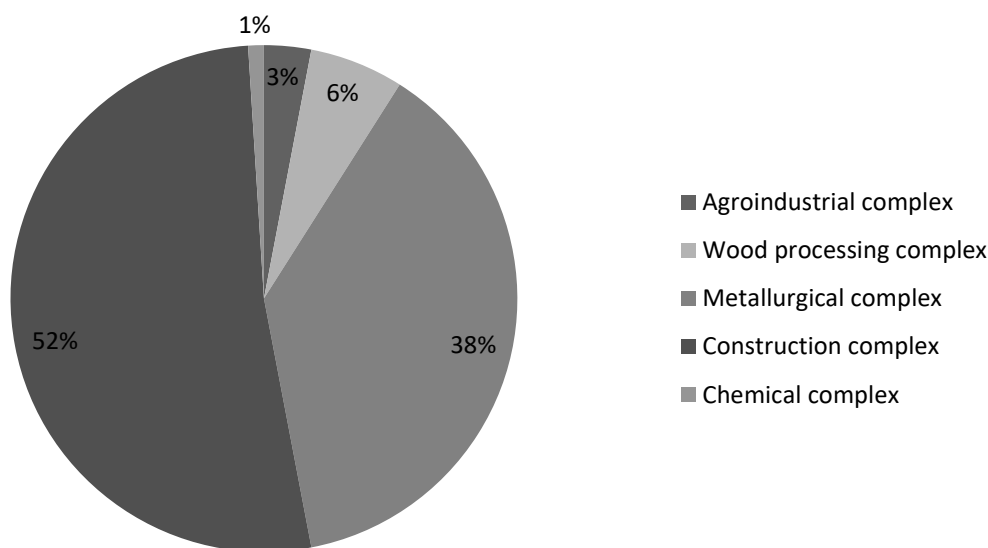


Figure 2
Structure of cargo traffic, %⁸

The distribution of cargo traffic according to the types of transport is shown in the Table.

Enlarge industrial complexes	Railway transport	Motor transport	Air transport	Water transport	Pipeline transport
Agroindustrial complex	17	12	77	5	0
Wood processing complex	6	29	2	65	0
Metallurgical complex	34	9	2	7	0
Construction complex	36	38	7	8	0
Chemical complex	7	12	12	15	100

Table 1
Distribution of cargo traffic according to the types of transport, %⁹

We can state the fact of the main role of railway transport for the cargo transportation in the territory of the Big Ural. Characterizing the structure of transportation, we can say that nine types of cargo are prevailing, that make 90.8% of the total volume. There is a sustainable demand for the railway transportation services from the industry of the Sverdlovsk Region and in case of transit traffic.

⁸ Government of the Russian Federation, 2008, Transport strategy of the Russian Federation order of 2008, 22.11.2008 N 1734-R (edition of 11.06.2014)

⁹ Government of the Russian Federation, 2008, Transport strategy of the Russian Federation...

In general, during the period since 2000, the growth of a share of railway transport for the cargo transportation in the region is distinguished. In 2015, this indicator was 84.3%.

The highest demand for the railway transportation services is made by the enterprises of the metallurgical complex, construction complex and fuel and energy complex; other industrial complexes form less than 5 percent of demand.

The analysis of the own loading and unloading of railway transport showed that more than 90 percent of the demands for railway transportation is determined by 75 large and middle-size enterprises of the region. The demand for the motor transportation is determined to a large extent by the enterprises of the construction complex and in rather smaller volumes by the agro-industrial and wood processing complexes. The other industrial complexes take less than 20 percent of the road freight transport.

Infrastructural disproportions of the connecting traffic between Europe and Asia according to the types of transport

The infrastructural disproportions of the transport logistic system in the sphere of railway transport mostly damage the cargo flows of the branches specified in Figure 2. The railway sections Bazhenovo – Bogdanovich and Kamensk-Uralsky – Nizhnyaya can be referred to the most problematic sections, for which the low technical speed of technical trains is typical.

Now the main part of the "north bypass" of Yekaterinburg, the section Vostochnaya – Zvezda is overloaded. At the same time the section Reshety– Aramil that is the "south bypass" of Yekaterinburg is not loaded enough, mainly due to the insufficient development of the station Sedelnikovo.

The high load of the Yekaterinburg railway junction prevents the development of the commutation services, and together with the existing problems of capacity in other sections in the mid-term perspective (up to 2020) will lead to the impossibility of the efficient use of the main railway of Russia – the Trans-Siberian Railway.

The overcoming of the infrastructural restrictions in the field of railway transport presupposes the realization of the task of increasing the capacity and speed parameters of the transport infrastructure including the creation of the infrastructure of the speed and high-speed running. The strategic documents of the federal and regional level include more than 20 measures with a time lag of implementation up to 2020. The elimination of the break sand "narrow places" of the transport network that restrict its capacity provides for the development of the railway infrastructure of the Yekaterinburg transport junction, the construction of the second and third railway tracks and the electrification of the sections of railways. The increase in the capacity and speed parameters of the transport infrastructure provides for the construction of the high-speed railway Kazan- Yekaterinburg within the frameworks of HSR-2 Moscow – Nizhny Novgorod – Kazan – Yekaterinburg – Chelyabinsk, and the organization of trains of enhanced comfort in the field of high-speed suburban trains.

The main infrastructural restriction is the exhaustion of the capacity and overload of the motor roads; the most overloaded sections are the approach roads to Yekaterinburg from Perm, Polevskoy, and Tyumen.

The program of the overcoming of the infrastructural restrictions presupposes the reconstruction of the federal and regional roads in the overloaded sections, including the approach roads to the federal motor roads to Yekaterinburg, Yekaterinburg Ring Road, and the construction of alternative roads for some directions.

Then we will consider the infrastructural restrictions of the transport logistic system of the Sverdlovsk Region in the field of the air transport. During last 15 years, the volumes of work of Koltsovo Airport increased significantly and this was, firstly, due to the growth of the demand for the air transportation and also the performed works of modernization of the airfield infrastructure and the terminals of the airport.

The sharp decrease in the amount of operated airfields shall be called the infrastructural restrictions. As a result of the bankruptcy of the Second Sverdlovsk Aviation Enterprise and cancellation of its certificate for the airport activity by the beginning of 2013 the following airports were closed and excluded from the State Register of Air Fields of the Russian Federation –Severouralsk, Tavda, Alapaevsk, Krasnoufimsk, Sosva, Serov, Ivdel and also Yekaterinburg (Uktus). The transportation by the local air lines to the remote districts located in the north and north-east of Sverdlovsk Region was performed in 2004-2012 by CJSC Air Company "Uktus"; however, their volumes were insignificant. Thus, the only operated airfield of the civil aviation now is Yekaterinburg (Koltsovo). One of the reasons that led to the cancellation of the air transport on local airlines is the high level of the wear of infrastructure (including the complete absence of the modern air navigation facilities at small air fields), the depletion of air worthiness resource and the inefficiency of the air forces fleet of the local and regional aviation, the low level of development of business aviation in the region.

The overcoming of the infrastructural restrictions in the field of air transport can be at the support of the serviceability, reconstruction and retrofitting of Koltsovo Airport, airports of Ivdel, Krasnoufimsk, Serov and Tavda, the formation and implementation of the zonal unified integrated military and civil automated subsystems of planning of air transport use to equip the enlarged center of the Unified system of air traffic management of the Russian Federation in Yekaterinburg.

Conclusion

Summarizing the above, we can say that the transport infrastructure plays the main role in the cargo traffic in the territory of the Sverdlovsk Region, the main part of which is made by means of railway transport. Besides the measures aimed at overcoming the infrastructural restrictions mentioned above, there is a necessity of the formation of the balanced efficient transport infrastructure of the Sverdlovsk Region as a part of the single transport space of Russia. During the integration of the Sverdlovsk Region into the international transport space to avoid the discrimination of the domestic carriers, special attention shall be paid to the establishment of parity in the international road transportation. The task can be performed due to the decrease in a share of carriers of the third countries that are not included into the Eurasian Transport Union, for which the following is provided for:

- organization of monitoring of parity of the international motor freight traffic;
- assistance in establishment of parity of the international motor freight traffic;
- distinguishing of services for the international freight traffic in the tender procedures for the state procurement at the municipal and regional level;

- reflection of the preferences for the domestic carriers in the tender procedures for the state procurement of the international motor freight traffic in at the municipal and regional level.

The mechanism of measures implementation is an interaction of government agencies of the Sverdlovsk Region with associations and independent domestic and foreign international carriers.

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