Rating model of logistic attractiveness on the example of the Russian Federation

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The purpose of the work is to determine objective criteria that can serve as the basis for complementing state statistics systems to assess the full potential of the logistics services market. Countries and world statistical systems have to highlight new competitive advantages of territories, regions, and states. Applying a systematic approach, economical methods for processing special data, and an analysis of data arrays we obtained a system of statistical indicators comprising five elemental databases, that allowed to assess logistics attractiveness of the subjects of the Central Federal District of the Russian Federation and Russia's logistics attractiveness relative to some other countries. The developed rating complements and refines the existing methods for assessing the investment attractiveness of regions. Evaluating the data to formulate the logistic attractiveness rating reveals additional competitive factors for certain territories, since the developed rating technique outlines the quantitative boundaries of the parameters of the created logistics infrastructure.

Keywords: statistics, rating, logistics attractiveness, logistics systems, regional logistics, investment attractiveness

Introduction

Central Federal District of the Russian Federation, based on of which the study was conducted, includes the Kaluga Region, that has an investment attractiveness (Investment portal of the Kaluga region, https://investkaluga.com/), generally higher than the national average, according to the results of numerous National ratings formed by the Agency for Strategic Initiatives, the National Rating Agency, and Expert-RA Agency, RIA Rating Agency, Association of Innovative Regions of Russia, Moscow School of Management Skolkovo, Infometer.

Here are just a few of these results (as of 31 March, 2020):

- 4th place (+9) is national investment climate rating (Agency for Strategic Initiatives, n.d.);
- IC3 is position in the rating of investment attractiveness (National rating agency, 2018);
- 13th place in the Green ranking (Green Patrol, n.d.);
- 25th place in the family welfare rating (RIA Rating, 2019);
- 24th largest middle class (RIA News, 2019);
- 19th place in the rating of Russian regions on the quality of life (RIA News, 2020);
- 2nd place in the Central Federal District by unemployment rate (Vest', 2020)

As for the innovative potential of the region and its contribution to the digitalization processes, the positions of the Kaluga Region are as follows:
- 3rd place (+5) in the rating of information transparency of regional authorities (Infometer, n.d.);
- 7th place / Group of strong innovators in the ranking of innovative regions of Russia (Association of Innovative Regions of Russia, n.d.);
- 10th place in the rating of innovative development of constituent entities of the Russian Federation (Gokhberg, 2020);
- Obninsk has a 7th place in the ranking of Smart Cities of Russia (Korobkin, 2018);
- 20th place in the Digital Russia Index (Center for Financial Innovation and Cashless Economy of the Moscow School of Management SKOLKOVO, n.d.);
- 31 place (+22) in the ranking of information and communication technology costs spending (CNews Analytics, 2018).

This situation is largely due to the favorable policy of the Government of the Kaluga Region in relation to large and high-tech foreign and domestic investors: the well-developed infrastructure of 12 industrial parks, 2 special economic zones, tax breaks and holidays in the framework of investment activities, accessibility of government.

At the same time, the fact is the methodology of all the above ratings for assessing the subjects of the Russian Federation does not include the monitoring of the logistics component of the innovation infrastructure.

The competitiveness of a region (or a territory), as a rule, is assessed using factors of the investment climate of the state. The factors of the transport network and the development of logistics are as considered as one of the indicators. This approach is used, for example, in publications (Ayvazyan et al., 2019; Bulochnikov & Smirnov, 2019; Zhukov & Telegin, 2018). The factor model affecting the inflow of foreign investment into the state was considered by Contractor et al. (2020).

According to world practice, the rating of the country logistics systems (Karkhova, 2019), is now often subjective in nature, using the expert method, which is explained primarily by the fact that the scientific and practical substantiation of logistics analysis does not keep pace with the emergence of new processes for economies such as logistics and digitalization.

Noteworthy is the development of tools for specialized logistics complexes from an article by Pokrovskaya and Zabolotskaya (2018), in which the authors combine several well-known management techniques, evaluating transport, and logistics centers in point based on the economic development of the region and the opinions of experts.

An approach to the analysis of logistics systems from the perspective of digitalization processes was proposed by Smirnova (2018).

A number of scientists cite in their works the experience of evaluating the development of urban logistics (Aditjandra & Zunder, 2018; Baglio et al, 2018; de Carvalho et al, 2019; Kondratowicz, 2003; Matusiewicz et al., 2019; Pretorius, 2013; Sadrnia et al., 2020).

According to Chausova et al. (2019), the following indicators are among the factors of the region's investment attractiveness: tax benefits and customs preferences, proximity to markets, good logistic appeal, quality of personnel, infrastructure development.

In the world practice of rating countries in the context of investment attractiveness, the following well-known specialized ratings can be distinguished: Doing Business, The Global Competitiveness

Index, the Global Enabling Trade Index, and The Global Enabling Trade Index. These approaches to assess the potential of world economies contain in their methods such qualitative criteria as ease of doing business, level of taxation of enterprises, development of export-import operations, expert level of transport infrastructure, scale, and development of sales markets for domestic products, technological development, expert assessments of customs clearance control, etc. As we can see, such methods do not include indicators related to the level of development of the newly emerged logistics parks and villages, the penetration of the Internet technologies in the economic turnover.

In addition, despite the industrial development at present, a number of infrastructure issues that impede the pace of economic growth are still not disclosed in science and practice. Thus, in the construction of logistics systems, the transport and warehouse sector predominate; management logistics occupies less than 5% of the logistics services market. And in the formation of the logistics zones of the micro- and meso-level, an information-statistical system is not enough to evaluate their activities and regulate logistics flows. In the absence of methods for constructing multi factorial analytical systems in the field of sales and supply, there is a mismatch in the modes of information and material flows of participants in distribution networks.

However, the trading activities of companies are increasingly moving into the plane of Internet technology. At the same time, insufficient penetration of electronic commerce into B2B markets should be noted.

We combine the experience of the logistic analysis of industrial structures proposed in the works of Greise (2017), Kuznetsova (2013), experience of some other countries (Jha, 2013; Basha & Rajput, 2019; Takmasheva & Tyaglov, 2019; Tovma et al., 2020), investment analysis of regions. The course of our study was based on the following hypothesis and logic. Regions and states are competing for the attraction of large investors in order to increase budget revenues at all levels. The logistics infrastructure is one of the important factors among all factors of the investment climate of a state or a region. In the world, as a whole and in Europe, attempts are being made to evaluate the activities of logistics parks, and the quality of logistics activities in certain territories. But existing valuation techniques are either subjective in nature and are based on point expert surveys, or do not fully consider all the spectra of the modern development of logistics institutions.

In our research, a systematic approach, economical methods for processing special data, an analysis of a set of data arrays were applied to reveal elements of the statistical indicators system that allows assessing logistics systems. To assess the development of distribution networks in Europe, an analysis of the structure of passenger and cargo flows by mode of transport was used.

In this regard, in this study, a transparency and objectivity is given to such an element of investment attractiveness as logistic accessibility for residents and investors, expressing it through the rating of logistic attractiveness that was compiled using an organized statistical database at the regional and state levels on various aspects of regional logistics.

Evaluating the effectiveness of meso-level and macro-level logistics systems

In accordance with the world practice in assessing logistics systems, the so-called logistics performance index (LPI) by the World Bank (https://www.worldbank.org/) is used, the methodology of which is currently based on subjective assessments of experts from several countries according to the groups of indicators: Customs (efficiency and speed of the work of customs authorities), Infrastructure (quality of infrastructure of logistics companies), Logistics quality and competence (level of competence of logistics providers), International shipments (interaction with international companies), Tracking and tracing (ability to track lanes displacements of goods), Timeliness (on-time deliveries).

Some progress in assessing the contribution to the GDP of the e-commerce sector at the state level is available in the statistics system in the European Union. So, in the framework of Eurostatistics, data are formed on sections:

- "Digital economy and society" (equipment of corporate personnel with portable computer equipment and communications, the purpose of using the Internet, and site structure);

- "E-business" (the number of the Internet buyers, the structure of electronic commerce, problem areas of the Internet commerce, the ratio of markets for online sales of goods and services).

To determine the contribution of the transport, and logistics services market, and as a tool for monitoring the activities of logistics complexes (in particular, the Freight Village format), we take into account a whole range of parameters, including standard parameters of the logistics infrastructure, analysis of their innovative potential, evaluation criteria for logistics services, development of electronic forms of service provision. Thus, the following statistical indicators system allows assessing logistics systems in order to objectively calculate their ranks. Further, we consider the content and possibility of calculations using the existing system of statistics of the Russian Federation for indicators that were united into the five groups.

1. Human resources of the logistics system:

1.1. Qualification level of the logistics system is a number of universities that train logisticians.

1.2. Staffing requirement of the logistics system is a % of the total number of vacancies.

1.3. The ratio of human capital in logistics, calculated according to the formula (1)

$$Rhcl = \frac{Nl}{Nwa} \qquad (1),$$

where

Nl is the number of employees employed in logistics companies;

Nwa is the working-age population of the region.

1.4. Weighted average personnel ratio in logistics.

Only two firsts indicators can be calculated. For the other two indicators, there are no data in the existing system of statistics of the Russian Federation.

2. Digital development of the logistics system:

2.1. The ability of customers to track the delivery routes of products passing through Freight Village, in the domestic and foreign markets in digital/Internet format. It is indicated as yes/no and by how many parameters.

2.2. The level of digitalization of logistics is calculated with the formula (2):

$$Dig = \frac{LSel}{LS} \qquad (2),$$

where

LSel is the volume of logistics services provided in the electronic (remote) form (in value terms);

LS is the volume of services provided by the regional logistics companies (in value terms).

2.3. The level of electronic business in the B2b markets is calculated with the formula (3):

$$Ce = \frac{B2Be}{GRPel} \qquad (3),$$

where

Ce is the coefficient of electronic business;

B2Be is the volume of transactions completed in electronic form and using Internet platforms;

GRPel is the volume of sales in electronic form and using Internet platforms.

2.4. The level of use of mobile applications for transactions in electronic form is calculated with the formula (4):

$$Cmob = \frac{Bmob}{B} \qquad (4),$$

where

Cmob is the coefficient of business mobility;

Bmob is the number of enterprises that have a mobile application for organizing electronic commerce;

B is the total number of enterprises in the region (country).

In this group, the first indicator can be calculated using several information systems, for the others there are no data in the existing system of statistics of the Russian Federation.

3. The general level of development of the market of transport and logistics services:

3.1. Share of exports in the gross regional product (%) is calculated with the formula (5):

$$Se = \frac{E}{GRP} * 100 \qquad (5),$$

where

E is the volume of goods and services produced in value terms, produced and shipped for export;
GRP stands for gross regional product.

3.2. Average PL of logistics companies in a region (company) is calculated with the formula (6):

$$S(pl) = \frac{\sum Ki}{L} \qquad (6),$$

where

Ki is a number of PLs of the i-th logistic company;
L is the number of logistic companies in the region.

3.3. Number of logistics companies per capital is calculated with the formula (7):

$$N1 = \frac{L}{P} \qquad (7),$$

where P is the population.

3.4. The share of transport companies in the gross regional product (%; perspective: the share of logistics companies) is calculated with the formula (8):

$$St = \frac{Trans}{GRP} * 100 \qquad (8),$$

where Trans is the gross value added by the transport companies.

3.5. Structure of freight transportation by mode of transport (tons and RUB), including air, water, auto, railway, and drones.

3.6. The structure of passenger transfers by type of transport (people and RUB), including air, water, auto, railway, and drones.

The first indicator in this group can be calculated; for the last indicator there are no data in the existing system of statistics of the Russian Federation. The values of the other four indicators can be calculated with the help of several information systems.

4. Customs and logistics infrastructure:

4.1. Volume of customs service (Cust) is the number of customs posts (terminals).

4.2. Level of customs service is calculated with the formula (9):

$$Ccust = \frac{Cust}{Bu} \qquad (9),$$

where Bu is the number of enterprises.

4.3. Violation of the terms for the provision of customs services by Freight Village (hours).

4.4. Price level for logistics services in Freight Village in comparison with similar entities in the country.

4.5. Customs payment ratio is calculated with the formula (10):

$$Cc = \frac{CP(+)}{Cy} \qquad (10),$$

where

CP(+) is the additional customs payments;
Cv is the customs value.

4.6. Customs service load is calculated with the formula (11):

$$Lcust = \frac{E+1}{Cust} \qquad (11),$$

where I is the volume of products and services in value terms purchased for import.

4.7. The share of export products sent through the logistics cluster, % is calculated with the formula (12):

$$Sfv = \frac{Efv}{E} * 100 \qquad (12),$$

where Efv is the volume of export products sent to consumers through Freight Village (in value terms).

Within this group, only the first two indicators can be calculated. For the others, there are no data in the existing system of statistics of the Russian Federation.

5. The efficiency of supply chains:

5.1. Violation of delivery schedules by residents of industrial parks (hours).

5.2. Violation of delivery schedules by suppliers of residents of parks (hours).

5.3. Ratio of logistics costs of enterprises in the region and GRP (%) is calculated with the formula (13):

$$Slc = \frac{LC}{GRP} * 100 \qquad (13),$$

where LC is the sum of the logistics costs of all enterprises in the region in value terms.

5.4. Structure of logistics costs of enterprises in the region (%), that includes transport costs, storage costs, costs of customs clearance, and losses from stock shortages.

5.5. Logistic flow density (flow per unit time) correlated with GRP growth rate is calculated with the formula (14):

$$PL = \frac{LC}{D} \qquad (14),$$

where D is the number of days in the period.

For all indicators in this group, there are no data in the existing system of statistics of the Russian Federation.

It should be noted that within the framework of existing state statistics systems in Russia and in the world, it seems problematic to use these assessment criteria. So, with official statistical accounting in the Russian Federation, a simple calculation of only 19% of the proposed indicators is possible (Figure 1).
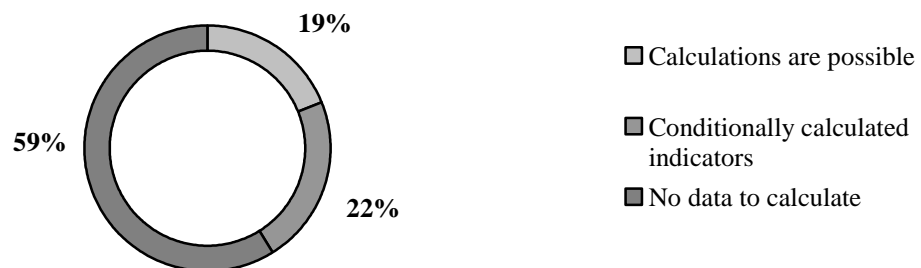
Figure 1. The structure of the proposed statistical base for assessing the logistics attractiveness of the regions of the Russian Federation

Logistics attractiveness rating model

The applicability assessment of the system of assessment criteria for the region/country logistics system was considered according to the data of the subjects of the Central Federal District of the Russian Federation (CFD) (Table 1, Figure 2). The CFD got its name because of its both the political and historical place in the life of the country. The CFD consists of 18 federal subjects, including the capital of the Russian Federation. The DFD is the most populated federal district and its area represents 3.8% of the total Russian territory). This district shares a border with the Republic of Belarus and Ukraine (Rusmania, n.d.).

As a result, it can be stated that despite the system of tax and customs incentives for investors, and in connection with the current state of industrial development in the industrial parks of the region, the presence of companies with world brands in them, the Kaluga Region is characterized by the level of development and maturity of the logistics system by the aggregate of available information very modest. However, it should be noted that this is not a final assessment in accordance with the developed system of indicators since 59% of them cannot be calculated in the current conditions of official information databases, 22% of the developed system of quantitative monitoring is considered step-wise using different sources.

Table 1

Positions of CFD regions according to the level of logistics attractiveness

Region	HR potential		Customs service		Export share in GRP		The share of transport in GRP		The density of logistics companies		Average PL (by type of transportation)	
	Coef.	Rank	Coef.	Rank	%	Rank	%	Rank	Coef.	Rank	Coef.	Rank
Smolensk	0.017544	11	0.00002835	4	26.7	4	12.1	2	0.00003895	5	2.74	9
Belgorod	0.032258	3	0.00003116	3	24.44	5	5.5	15	0.00003032	10	3.32	2
Bryansk	0.020644	7	0.00004875	1	6.1	15	9.8	5	0.00003221	7	3.27	3
Yaroslav	0.039494	2	0.00000883	15	11.24	9	1.,4	1	0.00003949	4	2.56	15
Orlov	0.111557	1	0.00001316	10	6.64	14	10.8	3	0.00003079	9	2.71	10
Moscow City	0.017133	12	0.000018	17	66.8	2	8.5	7	0.00004054	3	3	7
Ryazan	0.022282	6	0.00001007	14	18.93	7	8.9	6	0.000030 3	11	3.03	6
Moscow	0.00238	14	0.00001254	12	11.81	8	8.1	9	0.00018486	1	3	7

Voronezh	0.023813	4	0.0001219	13	10.06	13	8.2	8	0.00005444	2	2.58	14
Tver	0	15	0.0002334	6	4.25	17	10.3	4	0.00001791	15	3.56	1
Ivanov	0.017593	10	0.0001262	11	5.85	16	8.1	9	0.00003448	6	2.97	8
Kostroma	0	15	0.0002243	5	11.11	10	7.9	11	0.00002644	14	3.07	5
Vladimir	0.018142	9	0.0002162	8	10.94	11	6.8	12	0.00003121	8	2.59	13
Lipetsk	0.019763	8	0.0002244	7	58.86	3	4.9	16	0.000028 7	12	2.44	17
Kurskaya	0	15	0.0004475	2	10.92	12	5.7	14	0.00000179	18	3.15	4
Kaluga	0.022458	5	0.0001873	9	22.81	6	4.6	17	0.00002668	13	2.52	16
Tula	0.013963	13	0.0000848	16	67.08	1	6.5	13	0.00001743	16	2.61	12
Tambov	0	15	0.0000561	18	3.46	18	8	10	0.00001355	17	2.67	11

Compiled by the authors, based on information of Federal State Statistics Service of the Russian Federation (https://www.gks.ru/) and the developed methodology.

Table 2

**Ranks of elements of statistical indicators system for some countries**

Russia	Spain	Germany	Sweden	Finland	France	Netherlands	Belgium	Japan
The ratio of human capital in logistics								
2	5	8	6	3	7	1	4	9
Customs system load, on average, mln. at 1 customs								
9	4	3	6	8	5	7	1	2
Export Share in GDP								
9	6	3	4	5	7	2	1	8
The share of transport and logistics services in GDP								
9	7	5	1	2	3	4	6	8
The density of logistics companies								
7	4	6	3	1	9	5	2	8
The volume of electronic business per 1 person								
7	6	3	5	1	4	2	8	9
The share of e-business in B2B markets in GDP								
9	4	7	1	5	3	2	6	8

Logistics attractiveness								
8	6	5	2	3	7	1	4	8
LPI								
75	17	1	2	10	16	6	3	5
Compiled by the authors (author's methodology), based on information of Eurostatistics (https://ec.europa.eu/eurostat/web/main/home) and the developed methodology.								
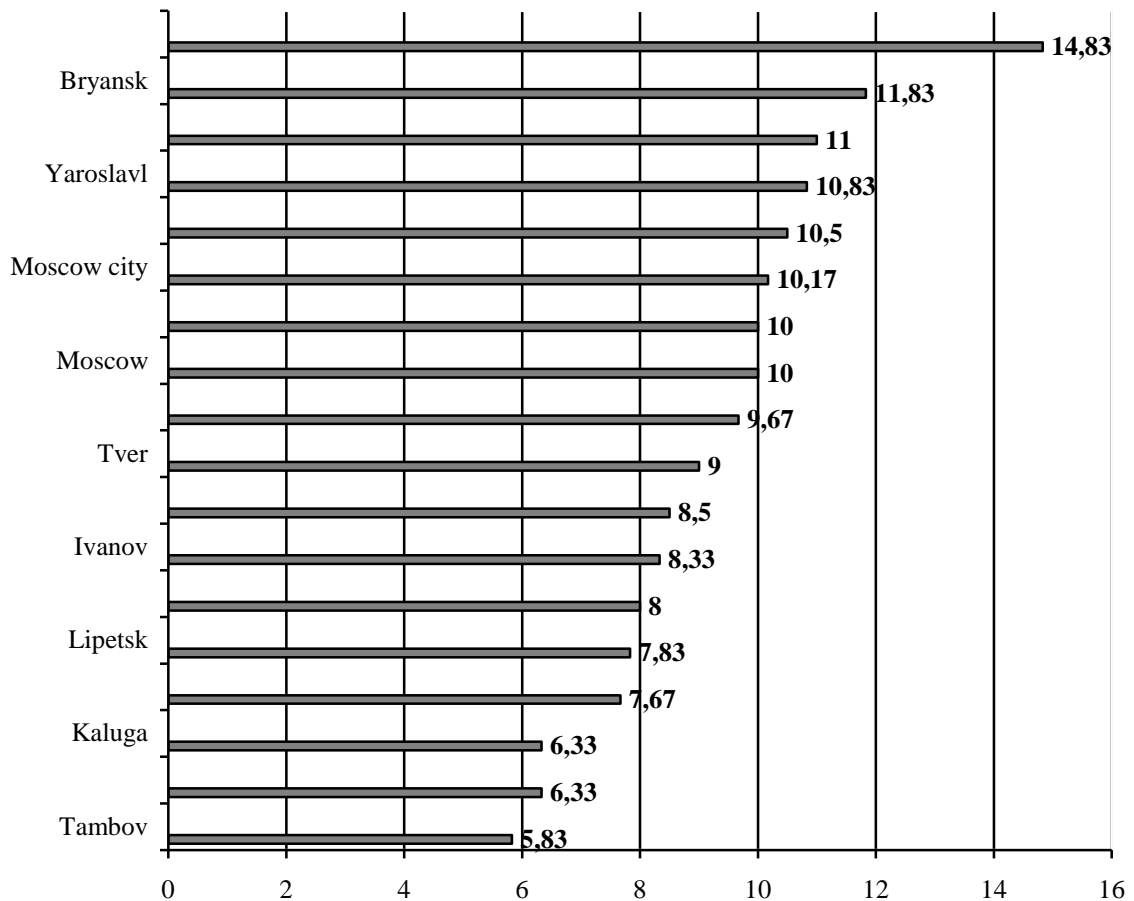
Figure 2. Rating (ranking) of the logistics attractiveness of the subjects of the CFD
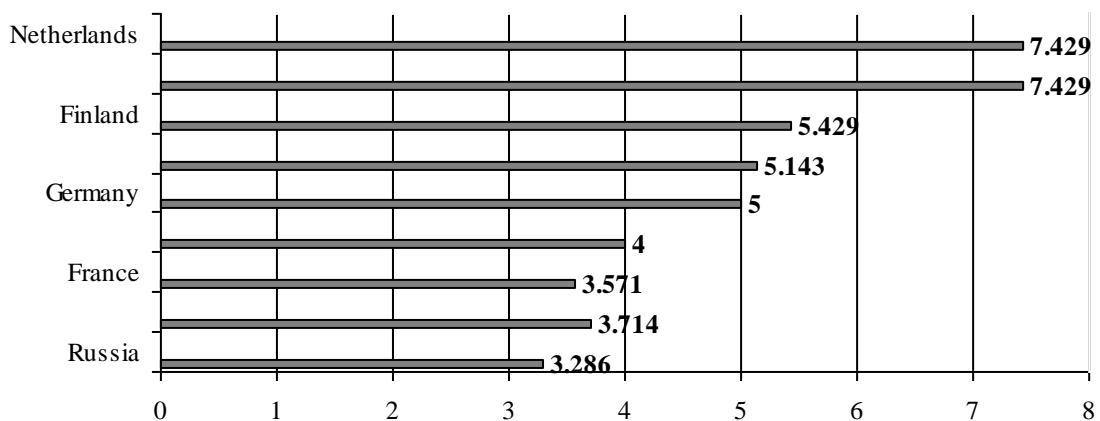
Figure 3. Weighted average positions of a number of countries in terms of logistic attractiveness rating

In the interest of analyzing the global situation of the existing logistics infrastructure, we will compile a rating of Russia's logistics attractiveness relative to countries in which, according to expert estimates, the new economic infrastructure facilities are most developed: logistics complexes, centers, parks with a decent PL level, as well as LPI leading countries. The obtained analytical data are shown in Table 2 and in Figure 3.

The resulting rating allows states looking at the problem of logistics development from different perspectives, focusing their efforts on their problem areas.

Conclusions

The result of the study was the system of statistical indicators of the logistics systems of regions and countries, rating of the logistics attractiveness of the subjects of the Central Federal District of the Russian Federation, and the rating of the logistics attractiveness of countries and regions calculated on the basis of the developed statistical system.

The obtained rating of the logistical attractiveness of the region/state, consisting of five elemental databases (the level of development of the transport and logistics services market, the human resources and digital development of the logistics system, customs and logistics infrastructure, the efficiency of supply chains) makes it possible to evaluate the effectiveness of country logistics systems.

The proposed methods are distinguished by their complete objectification, since in the considered model everything depends only on the quantitative characteristics of the processes of logistics of territories.

The developed rating complements and refines the existing methods for assessing the investment attractiveness of regions. At the same time, our research revealed the insufficiency of modern information systems for an extensive analysis of logistics systems.

The developed statistical indicators system expands the capabilities of existing state statistical systems, can serve as a basis for regulating the activities of logistics parks and complexes, and monitoring their compliance with the principle of "exactly on time".

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