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Assessment of the Impact of the Spatial Model of Terminal and Warehouse Complexes on Regional Economic Indicators

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ABSTRACT

The purpose of the article is to assess the impact of the spatial model of terminal and warehouse complexes, the location of which is localised on the territories of industrial parks, on regional economic indicators.

The article examines the regional spatial model of terminal and warehouse complexes (TWCs) operating at the site of an industrial park (IP). A review of foreign and domestic literature has revealed a certain shortage of methods for assessing TWCs as initiator and facilitators of regional economic activity. Potential sources of growth in the region's economic indicators are identified implied by the impact of the spatial factor and the advantages of locating terminal and warehouse complex facilities on IPs' sites. Approaches to the statistical interpretation of regional indicators are proposed. Their development in relation to the assessment of the potential of TWCs will make it possible in the future to include many indicators of the regions to analyse the economic impact of IPs

Keywords: terminal and warehouse system, industrial park, economic growth of the region, investment attractiveness, regional economic development

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BACKGROUND

Over the past decades, a wide variety of freight transport and logistics facilities have emerged. Containerisation, nearshoring, outsourcing of transport and logistics activities, improvements in information technology and international standardisation, global supply, strengthening safety and security measures in supply chains, sustainable transport and shortening the life cycle of products are just some of the most important changes in logistics and the transport industry that significantly affect the range and quality of services offered by terminal and warehouse complexes (TWCs). During this time, the way goods are packed, stored and transported has changed, and therefore the demand for various services leads to highly differentiated logistics solutions such as industrial parks (IPs). As a result, the close links between integrated logistics services and customer satisfaction not only lead to the initial adoption of the IP concept but also serve rationale for their continuous development.

At present, a developed system of terminal and warehouse complexes (customs and excise warehouses, intermodal cargo centres, logistics centres, dry ports, domestic and intermodal terminals, distribution centres and others) has been created around the world, which has a positive effect not only on the overall quality of transportation services, but also on the economy of the respective regions.

By jointly using their infrastructure and functional resources, IPs offer both high quality and regularity of transportation services and constant warehouse capacity in real time. Since companies spend a lot of money to increase their flexibility in the face of constantly changing demand in the markets, their main goal is to gain an advantage through direct or indirect interaction with IPs.

Despite the economic challenges of a volatile business environment, many countries have already expanded their transport and logistics services to include both bimodal and trimodal inland terminals and IPs in their transport system.

Modern theories of regional development, which are classified as institutional theories, derive from previously developed theories and emphasise the need to support the creation of predominantly small and medium-sized companies (as small and medium-sized companies can respond quickly to the business needs of the market), creating and changing the business climate in the region. On the other hand, the development of the regions is influenced by their socio-economic specialisation, the development of IPs. In world practices, IPs have gone through several stages of development, and now we can talk about several generations of industrial parks.

The first-generation IPs, built in the 1970s, differ from other generations in their rather simplified architecture. With each new generation, it became more complex, while the territory was used more comprehensively, the portfolio of services expanded, and the number of administrative staff and employees increased.

IPs undoubtedly have a positive impact on business in the region where they are located. They are advantageous because they apply modern technologies and innovations in production processes, while manufacturing of higher-class goods; besides, the region profits from foreign companies located in parks, as they bring economic and innovative capacity or internationally proven know-how to the region and thus support the process of reconstruction and modernisation of the industry and at the same time cover high trade deficit balance if any.

Another positive aspect of the industrial parks is that they create conditions for the development of small and medium-sized enterprises and their cooperation with entities engaged in foreign economic activity, which means that they have a positive effect on competitiveness, labour productivity and employment growth.

The influence of individual entrepreneurs on the overall development of the region is also important. Obviously, IPs cannot be expected to produce immediate results, however, it can be predicted that the jobs created or the transfer of technology between companies will lead to synergies. The concentration of certain types of companies can attract many investors to the region, which will lead to the need to recruit new employees.

The purpose of this study is to identify the impact of the potential of TWCs concentrated on the sites of industrial parks of a constituent entity of the Russian Federation on the economic growth of the region.

The study has applied *methods* of empirical analysis, system approach, logical, statistical and economic methods, correlation analysis, and the method of rating assessments.

BRIEF REVIEW OF LITERATURE AND RESEARCH

Many economists have studied the role of TWC as of a generator of economic growth in depth. Even though there is a wide range of different methodological studies on the impact of TWCs on improving the efficiency of a region's economic system, there is a noticeable lack of methods for assessing its role as initiators and facilitators of regional economic activity. The existing theoretical basis of such a statement seems to be completely insufficient.

S. Lyapin and his co-authors consider the theory of «poles of growth» in the regional, federal and world economy, proposing active management of the development of the region's TWCs regarding the criteria of efficiency. This approach considers not only the development of the TWC of the region, but also the socio-economic development of the adjacent entities, besides, it accounts for the regional influence of enterprises, the sustainability of which depends on the work and productivity of IPs [1].

M. Boile and co-authors analysed the impact of logistics facilities, notably of «freight villages» on the development potential of the regions [2].

The main issue considered by D. Banister and Y. Berechman is the ability of investments in the field of IPs to contribute to economic growth at the regional and local levels, to additional benefits for development. Failure to accurately identify and measure these estimated development benefits will inevitably lead to their double counting, thereby creating the risk of implementing incorrect TWC's projects [3].

According to T. Notteboom and J.-P. Rodrigue, terminals, IPs, and other logistics facilities have become an integral part of the transportation system, especially in regions heavily dependent on trade. The development of TWCs is gradually shifting to the regions due to the complexity of modern cargo distribution, increased attention to intermodal transport solutions and capacity issues. The tasks of reducing the congestion of the transport network, decreasing energy consumption and empty miles are becoming strong incentives for considering the creation and development of regional TWCs [4]. Local freight flows are the result of global and regional economic processes aimed at using core just-in-time and door-to-door strategies. The authors suggested that at the regional level, activities related to the distribution of goods can be changed through the development and construction of new TWCs in response to the growth of consumption and demand, as well as the need to change supply chains [4].

The paper [5] notes the promising character of TWCs as of economic driving forces of the regions. In addition, another interesting element of IPs is their general independence from other clusters and industries, combined with the fact that many enterprises in various industries are economically based on, and sometimes located around logistics facilities [5; 6].

The authors [7] note that regional authorities seek to attract IPs to promote economic development, local entrepreneurship and employment levels.

The relationship between IPs and regional economic development is presented in the paper [8], which notes that the creation of IPs makes a significant contribution to the sustainable economy.

The work [9] is aimed at identifying the key macroeconomic factors affecting the creation of IPs that have a positive impact on sustainable regional development.

The study [10] notes notably the focus of IPs on the expansion of intermodal transportation.

The authors [11] studied possibilities of improving the image and competitiveness of IPs through the implementation of modern concepts of creating and developing synergies between manufacturing, industrial and logistics companies to increase the efficiency and sustainability of cargo and logistics processes. All companies in the territory of an IP can develop joint marketing services, so that small and medium-sized firms will benefit the most from such situations.

The study [12] proposes to develop clustered IPs as an effective method for the growth in competitiveness of industries and for the organisation of jobs.

RESULTS

In parallel with the main and broader role of TWCs in promoting intermodal transport, there is also their additional and no less important role as initiators of regional economic development. Regional industrial parks are platforms for this, since they create the ground for the development of the economic, intellectual and industrial potential of the region, import substitution, and increase in tax revenues to the budgets of all levels. IP's infrastructure is logistics one, as it includes class A and B warehouses, corporate distribution centres, marketplaces.

Table 1

Employment in the transportation and warehousing

Federal constituent entities	Share			
	2020	2021	2022	2023
Russian Federation	7,4 %	7,6 %	7,77 %	7,82 %
Volga Federal Distirct	6,46 %	6,46 %	6,83 %	7,07 %
Republic of Bashkortostan	5,49 %	5,53 %	5,84 %	6,19 %
Republic of Mari El	4,46 %	4,67 %	4,91 %	4,92 %
Republic of Mordovia	5,21 %	5,19 %	5,36 %	5,77 %
Republic of Tatarstan	7,22 %	7,17 %	7,45 %	8,12 %
Udmurt Republic	5,93 %	5,95 %	6,34 %	6,16 %
Chuvash Republic	3,72 %	3,86 %	4,31 %	4,47 %
Perm Krai	7,46 %	7,39 %	7,89 %	7,56 %
Kirov region	5,26 %	5,59 %	6,18 %	6,59 %
Nizhny Novgorod Region	5,94 %	5,97 %	6,74 %	6,93 %
Orenburg Region	6,60 %	6,56 %	7,52 %	7,64 %
Penza Region	5,80 %	5,80 %	6,63 %	6,66 %
Samara Region	8,38 %	8,32 %	8,44 %	8,98 %
Saratov Region	7,56 %	7,53 %	7,14 %	7,03 %
Ulyanovsk Region	5,83 %	5,83 %	5,93 %	6,28 %

Source: Federal State Statistics Service https://rosstat.gov.ru/

IPs act as the driving force of the economy of their regions, which potentially affect the regional unemployment rate, gross regional product (GRP) and job creation, investment attractiveness and trade volumes (regional imports/exports). The unemployment rate and GRP can be described as the most characteristic economic indicators of the regions. Investment attractiveness illustrates the overall attractiveness of domestic and foreign investment for each region.

Industrial parks provide an excellent institutional framework, additional services and high-performance infrastructure. They contribute to attracting and implementing the necessary investments, increasing employment, competitiveness, sustainable implementation of business and regional economic development strategies. They also create an environment for the introduction of new technology, training and innovation, creation of jobs and markets, and, as a result, for the consolidation of existing industries [13–16].

Industrial parks, located in 72 regions of Russia, provide convenient access to large urban agglomerations and product markets. Enterprises operating in industrial parks are important actors in the local economy (especially firms that employ a larger number of people), and this situation is likely to continue in the next 4–5 years.

By creating jobs and increasing investment in production, industrial parks develop the economy of not only the region, but also the country.

After a thorough review of the statistical data, it is possible to confirm an overall increase in the concentration of employment in the transportation and warehousing sector, both for the Russian Federation and for the subjects of the Volga

Table 2

GRP dynamics in 2020–2023, billion rubles

	2020	2021	2021/2020	2022	2022/2021	2023	2023/2022
Russian Federation	94410,2	121183,0	128,36 %	140 670,8	116,08 %	171041	121,59 %
Volga Federal District	13655,4	15963,18	116,90 %	19664,6	123,19 %	20188	102,66 %
Kirov region	396,9	452,7	114,06 %	554,6	122,51 %	575,1	103,70 %
Nizhny Novgorod Region	1 600,30	1730,6	108,14 %	2287,9	132,20 %	2390	104,46 %
Orenburg Region	1 046,70	1239	118,37 %	1571,4	126,83 %	1500	95,46 %
Penza Region	484,8	586	120,87 %	592,9	101,18 %	593	100,02 %
Perm Krai	1 385,40	1400	101,05 %	2002,8	143,06 %	1800	89,87 %
Republic of Bashkortostan	1 694,20	2 059,4	121,56 %	2242,6	108,90 %	2544	113,44 %
Republic of Mari El	198	214	108,08 %	262	122,43 %	247,7	94,54 %
Republic of Mordovia	266,4	299,8	112,54 %	342,6	114,28 %	361,5	105,52 %
Republic of Tatarstan	2 631,30	3400	129,21 %	4179,3	122,92 %	4153,7	99,39 %
Samara Region	1 625,50	1 969,6	121,17 %	2378,5	120,76 %	2800	117,72 %
Saratov Region	856,5	984,8	114,98 %	1194	121,24 %	1300	108,88 %
Udmurt Republic	684,4	790,68	115,53 %	965,7	122,14 %	956	99,00 %
Ulyanovsk Region	439	484,6	110,39 %	588,8	121,50 %	571	96,98 %
Chuvash Republic	346	352	101,73 %	501,5	142,47 %	396	78,96 %

Source: Federal State Statistics Service https://rosstat.gov.ru.

Federal District (see Table 1). The exceptions are the Udmurt Republic and the Perm Territory, where in 2023 compared to 2022 there was a decrease in the share of those employed in this sector.

GRP is still the main indicator of the level of regional socio-economic development. The dynamics of the total GRP of Russia and the Volga Federal District is presented in Table 2 and shows its growth in 2020–2023. The total volume of GRP of the Russian Federation in nominal terms increased by 76,630.8 billion rubles during the analysed period. In total terms, for all constituent entities of the Russian Federation for the analysed period GRP increased by 1,8 times. In the constituent entities of the Russian Federation in the Volga Federal District - by 1,5 times.

The stability of economic development is ensured by the positive dynamics of GRP in the transportation and warehousing sector that witnessed a growth in the Russian Federation by 1,7 times and in the Volga Federal District by 1,6 times in 2017–2023.

Another important factor contributing to the region's economic growth is investment capital, which is analysed on the example of the Russian Federation and the Volga Federal District (Table 3). The growth dynamics indicates that the Russian Federation and the Volga Federal District are following the path of economic growth thanks to increasing their capital, which has recently been actively channelled and invested in the transportation and warehousing sector.

High investment activity in the Volga Federal District is due not only to the localisation of large enterprises of the manufacturing and mining industries in this district, but also to the active development of small and medium-sized businesses, which generate significant demand for the locations within industrial parks.

Thus, the past four years have demonstrated positive rates of all regional economic activity that are directly or indirectly related to the transportation and warehousing sector. The development and expansion of IPs and their various modifications (technology parks, business incubators, free economic zones, etc.) create an infrastructure for industrial production, especially in the Volga Federal District, where a third of the country's operating IPs is concentrated.

Table 3

Dynamics of investments in fixed assets and the transportation and warehousing sector (TW)

	Investments, billion rubles									
	2021		2022		2023		Absolute change 2023/2021		Relative change 2023/2021	
	total	TW	total	TW	total	TW	total	TW	total	TW
Russian Federation	17690	3226,4	21829	4219,8	34036	4963,7	16346	1737,3	192,40 %	153,85 %
Volga Federal District	2073,3	314,2	2565,2	601,4	4830,2	778,92	2757	464,72	232,97 %	247,90 %
Kirov region	52,1	6,9	59,2	8,6	106,24	10,4	54	3,5	203,92 %	150,72 %
Nizhny Novgorod Region	265,6	33,7	462,1	164,5	686,93	226,7	421	193	258,63 %	672,70 %
Orenburg Region	149,3	15,3	179,5	24,9	293,4	32,5	144	17,2	196,52 %	212,42 %
Penza Region	53,8	9,1	60,3	12,7	121,81	13,6	68	4,5	226,41 %	149,45 %
Perm Krai	242,2	21,8	290,2	33,02	370,3	49,5	128	27,7	152,89 %	227,06 %
Republic of Bashkortostan	247,9	45,6	305,6	53,25	620	58,575	372	12,975	250,10 %	128,45 %
Republic of Mari El	22,2	2,9	25,5	3,3	52,23	3,63	30	0,73	235,27 %	125,17 %
Republic of Mordovia	41,1	6,6	48,6	12,7	74,1	13,97	33	7,37	180,29 %	211,67 %
Republic of Tatarstan	451,2	59,4	597,5	143,9	1180,4	158,29	729	98,89	261,61 %	266,48 %
Samara Region	264,8	66,6	306,6	97,8	516,6	107,58	252	40,98	195,09 %	161,53 %
Saratov Region	123,1	27,5	149,9	42,5	286,54	46,75	163	19,25	232,77 %	170,00 %
Udmurt Republic	70,3	5,9	85,96	8,3	166,3	9,13	96	3,23	236,56 %	154,75 %
Ulyanovsk Region	50,2	7,6	56,7	7,7	120,8	8,47	71	0,87	240,64 %	111,45 %
Chuvash Republic	39,5	5,2	71,6	36,2	123,4	39,82	84	34,62	312,41 %	765,77 %

Source: Federal State Statistics Service https://rosstat.gov.ru.

To study the degree of relationship between variables, correlation analysis is most often used in economic research, which is a tool that allows you to show the proximity of one variable to another. Linear correlation analysis is most often used in such studies [17–19].

For the Volga Federal District, to assess the impact of the development of IPs on its economic growth (GRP, volume of investment, number of employees), a correlation coefficient was calculated (a detailed calculation is not described in this article), which indicates a close relationship between the number of IPs and the main socio-economic indicators of the region.

In the Volga Federal District, the leading regions in terms of the number of industrial parts are the Republic of Bashkortostan. the Republic of Tatarstan, the Ulyanovsk region (ten or more industrial parks per each region). This distribution is due to the level of socio-economic activity, developed transport and logistics infrastructure,

the presence of large industrial facilities, and the demand of manufacturers.

CONCLUSIONS

The review analysis shows that IPs play a significant role in ensuring the dynamic growth of regional economies, creating competitive conditions for new industries, attracting domestic and foreign investment in the regions, reducing unemployment by creating new jobs, using the labour potential of the nearest settlements.

The study allows us to positively estimate the contribution of IPs to the achievement of the goals of sustainable development of the regions, through the creation of the necessary infrastructure, growth in employment and industrial production, as well as through replenishing regional and local budgets.

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