

INTERREGIONAL LOGISTIC CENTERS IN THE MODERN REGIONAL DEVELOPMENT: AN ESTIMATION OF NEEDS AND PROSPECTS (ON THE EXAMPLE OF THE SVIYAZHSK INTERREGIONAL MULTIMODAL LOGISTICS CENTER)

Assoc. Prof. Anatoly Shikhalev¹

Assist. Prof. Dmitry Vorontsov²

Assoc. Prof. Oksana Rozhko³

Rufia Mingafina⁴

Veronika Yalalina⁵

^{1, 2, 3, 4, 5} Kazan Federal University, Russian Federation

ABSTRACT

In this research, we investigate the location rationality and the need of further investment in the Sviyazhsk interregional multimodal logistics center development which is situated on the Republic of Tatarstan territory. The aim of the study is an estimation of this logistic center's possible load degree (as the capacities storage factor, etc.) from the perspective of freight turnover due to its physical location in the region and its impact on regional development. Basing on this analysis is determined the degree of conformity of the proposed picture to the real regional development. For the forecasting were used the formalized methods the advantages of which are the accuracy of results in the short term and the reproducibility ease. Also, there were some disadvantages as within the study was revealed some data collection complexities hereat the forecast is based fully on the open statistical data of regional and national economic indicators. For the more detailed results was made an attempt of data collection (using the created questionnaire) an analysis of which would show the most adequate picture of the real needs of companies coordinating the storage facilities, transport services, information support, and the degree of their interconnections on the territory of the republic. With the forecasting using the random-walk method and the moving average the received results of the real and the future picture comparison looks satisfactory proved. The results of our estimation confirm the necessity of this center and demonstrate its full load based on the dynamics of studied freight turnover indicators.

Keywords: logistics center, international transport corridors, freight turnover, Sviyazhsk interregional multimodal logistics center, random-walk method.

INTRODUCTION

Adopting the world experience of foreign countries in the management of freight flows Russia seeks to ensure the integration of national and regional

logistics centers, similar to the TEN strategy, which implies the creation of a unified transport system. In the field of cargo management Lean production (JIT, KANBAN), DDT (Demand-driven techniques) and their conceptually improved versions were used as one of the first methods. One of the current and demanded trends in the development of the logistics services market is the development, implementation and operation of smart machines for transportation tasks and rationalization of storage. Today the world's largest providers of logistics services use in the work drones and UAVs, robotic systems-loaders, automated storage and search systems in warehouses, IOT, smart sensors, RFID tags, etc. Now the technological development as an effective solution in the field of transport distribution is realized mostly in regional logistics distribution centers which unite and realize the possibilities of integrated supply chain management.

LITERATURE REVIEW

The modern economic development of all Russian regions and its innovation reciprocity are impossible without realising the regional logistics potential. The logistics potential of the region is a combination of logistics infrastructure factors and objects that are used in the decisions of regional and national strategic optimization tasks for material flows. One of the key links in the Russian economic growth is the development of the country's transport system and the realization its transit potential for securing the Euro-Asian links, therefore it is necessary to develop an effective logistics network. Modern methods allow estimating the logistics potential, and especially the possibilities of such logistic vehicles like logistic centers, which also allow transforming the foreign material flows to the interregional and intraregional [15].

The current problems in the development of logistic infrastructure and methods of its decision were studied by R. Alarcona, etc. [2], J. Blyde [3], H. Lean and others [4]. Issues of territorial development and impact assessment of logistical infrastructure on the competitiveness and efficiency of the regional economy were studied by O. Velychko [5], and in other researches [6]. While the number of researches of the logistics infrastructure development impact for the regional economies growth is serious, there isn't complex and easy in use (which is more necessary) methodological approach for evaluating this impact for the whole economy and separate territories. From the recognized point of view it is necessary to use the potential of the international transport corridors for the regional infrastructure development. Such position could be noted for example in such paper-like [1] in which V. Khomenko and co-authors concentrate on the role of integration of Russia and in particular the Republic of Tatarstan in the network of international and domestic regional transport corridors, etc. This aspect has a central place in our study basing for the estimation of the regional logistic development prospects on the possibilities of regional multimodal terminal complexes network and in particular for the Republic of Tatarstan on the Sviyazhsky interregional multimodal logistics center (SIMLC) data. For this aim, the estimation of the prospects for the possible SMLC load degree basing on its (physical) location is achieved with the forecasting methods using.

THE REGIONAL DEVELOPMENT OF THE REPUBLIC OF TATARSTAN IN THE GLOBAL LOGISTICS SYSTEM

Foreign and domestic experience shows that integrated logistics services which based on stable demand growth promote the greatest economic efficiency. This point of view is confirmed with such evidence like the world GDP from the beginning of the second half of the 20th century, exports and imports and positive income dynamics from the taken measures for the logistics centers creation. For example, in the Netherlands, the transit logistics centers bring about 40% of the whole transport complex income, about 31% in France and 25% in Germany. In the Central and Eastern Europe countries this share is about 30% in average. The total turnover of the European logistics services market is more than €600 billion. In these countries, about 30% of logistics functions in all sectors of the economy are annually transferred to logistics companies [7] outsource.

The logistics centers (parks) are the market enterprises that provide information and physical support for the goods' delivery. The concentration of complementary companies on a single platform makes it possible to reduce warehouse renting and logistics services costs. For the main part of the Republic of Tatarstan firms concerned with the tasks of storage, acquisition, packaging and distribution to the next level by various ways of transporting with the channels like a railroad, on water, automobile, aviation or with pipeline transport the cooperation will be the profitable decision (see for example Shikhalev, Vorontsov, etc., 2015). Analyzing the data available on the state statistic Rosstat website for the Republic of Tatarstan [8] for the period of 2011-2016 it is possible to note that about 80% of the region's total freight turnover was delivered with the railway transport. The majority of region's cargo turnover is concerned with the oil products, construction aggregates, and cargos, chemicals, and metals. Due to its geographical location the region has a strategically important position for the whole state in the cargo transportation system. The Republic of Tatarstan is the cross-over point for two important international transport corridors, "North-South" and "West-East" (Picture 1), so basing on these factors it is possible to predict an increase or decrease in freight flows through the region. Basing on these factors and due to the serious increase in the need for large logistics center on the regional territory as a result of research and comparative estimation was chosen the location for such center in the Kazan transport hub, Zelenodolsky district near the Sviyazhsk railway station and at the mouth of the Sviyaga river.

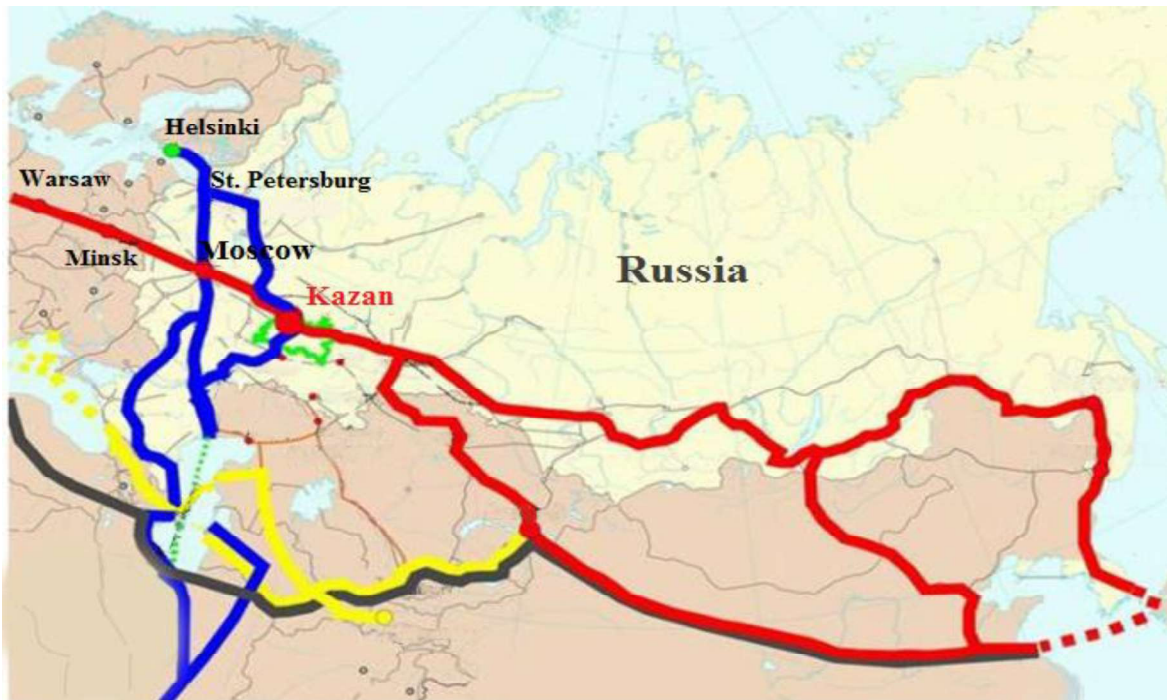


Fig. 1 The international transport corridors passing through the Republic of Tatarstan territory

The purpose of the work is to study the prospects of the possible load degree (the capacities storage factor) of the SIMLC basing on the possibilities of its physical location and its possible impact on the regional economic development. The project of the SMILC was firstly included in federal programs and different strategies in 2006[9]. Nowadays has been completed the construction of such objects like a moorage wall for receiving river and sea vessels, railway access roads, an anti-radiation shelter for 600 people, roads and a traffic intersection built on the connection with the federal M-7 highway, and an upgrade of all Sviyazhsk railway station's equipment[9]. According to the announced in 2012 data the estimated volume of SLC processing cargoes was 14.6 million tons a year; this is 25% of the total regional cargo traffic volume which is 45 million tons per year[8]. So, for the proposed aim of study, it is necessary to clarify the actual volumes of cargo flows on the international transport corridors passing through the territory of Tatarstan for the period from 2017 to 2018 on the ITC №2 "West-East" and ITC №9 "North-South".

For such a case it's better to analyze the part of "West-East" ITC as a Russian cargo transportation way to the Primorsky region ports and back. This includes Russian export-import and transit cargo traffic between Asia and Europe. The aggregate freight turnover between China and Europe in 2015 reached more than 100 mln tons/km and has a growth potential up to 120-160 mln tons/km to 2020. In fact, this value remained at 100 mln tons/km [9] in 2017 and the cargo turnover of such Caspian ports like the Astrakhan, Olya and Makhachkala decreased from 10.9 million tons to 6 million tons in 6 years from 2010 to 2016 [8]. The project of the ITC "North-South" already could be estimated as profitable. Only from the beginning of 2017 the volume of freight traffic in this direction has increased up

to 20% and reached the value of 5 million tons [10]. However, according to the Russian Federation Federal Customs Service data in the last 6 years, there was an opposite situation i.e. the volume of freight turnover with the major partners decreased [11], and the main types of goods were the food products, agricultural raw materials and timber, which are not fitted with the Tatarstan cargo turnover structure. An analysis for the Tatarstan of the typical trade turnover structure [8] with these corridors players and the same for Russia i.e. their trade linkages with the ITC "North-South" and "East-West" projects countries participating shows the total trade turnover in 2017 11.8 million tons and 41.2 million tons. However, could we propose for the crowd a depot to SMILC capacities? For this purpose i.e. for the estimation of the level of current needs, it is necessary to make a forecast basing on the open data and to concern it with today's realities.

METHODOLOGY

The intensive development of prognostication as science in recent decades led to the creation of a multitude of methods and procedures, and the value of these forecasting methods are not equal. There are hundreds of methods of forecasting [13] according to various estimates of foreign and domestic forecast systematics, with each author specifying his own classification of these methods. In our study, the chosen prediction methods are based on the approaches described below. For example, in the research of E. Tikhonov [12] in the part concerned with the classification of the methods, the methods of forecasting firstly could be represented in classes like the intuitive and formalized. To the intuitive methods, the author refers to the questioning method, brainstorming, the "commissions" method, etc. Intuitive methods are usually used in the auxiliary procedures for generating predictive information. For the purposes of the research and its specific (logistics) for the information, collection was chosen the questionnaire method. The organizations engaged in the cargo deliveries field were asked to complete a questionnaire to concrete their needs from the services of the regional logistics center. For the questionnaire results assessment was created the estimation method on the basis of generalized data of freight volumes. The advantages of this method are the cheapness and wide territorial coverage with the relatively short time costs but the lack of questioning is the reluctance of respondents to provide information, referring to the commercial secrets. In such a case, it's necessary to use the formalized methods to consider forecasting models which are divided into statistical and structural models. In the statistical models, the functional relationship between the future and actual values of the time series as well as with the external factors establish analytically. For the forecasting was chosen the method described below is due to its accuracy in the short-term forecast. As the forecasting process itself could be presented in two periods, the retrospection period T_r in the form of the available dynamic series and the prediction period T_f then we could note that for the larger ratio (T_r / T_f) it will be more reliable forecast value, in ceteris paribus. It is important that the period of retrospection T_r has the same causal (factorial) character in general because after all we determine the character of the random increment "e" as a continuation of the same conditions with which were formed the levels of dynamic series levels in the retrospective

period of T_r , before the main forecasting. Therefore, in a broad sense this type of forecast is concerned with extrapolation. One of the most famous prediction models is the autoregression of the integrated moving average with the external factor [14]. The moving average method is one of the widely known methods for time series smoothing. With this method applying this it's possible to eliminate the random oscillations and obtain the values corresponding to the influence of the main factors. The smoothing with the moving averages is based on the fact that the random deviations cancel out in the average values. This is realized as because the original levels of the time series were replaced with the average arithmetic value within the selected time interval. Then the period shifts to one observation and the average calculation is repeated. For such cases, the periods of average determining are taken the same at all times. Thus, in each analyzed case the average is centered, i.e. is referred to the midpoint of the smoothing interval and represents the level for this point. The choice of the smoothing interval depends on the study objectives. At the same time it's necessary to base on in which time period is the action and consequently, the elimination of the random factors influence. This method is used for short-term forecasting [14]. After the Rosstat data [8] analyzing and making the calculations of the growth and increase in freight turnover for the last 5 years we observe a consistently low average annual growth rate (Picture 2), related to the economic situation in Russia. A sharp jump up to 2017 corresponds with the terms of trade softening. Based on the obtained results after the Rosstat data[8] analyzis we could forecast the cargo turnover volume with the multiplicative time series model constructing [14] to the fourth quarter of 2018. The general form of the multiplicative model (Y is the model value) will be the next:

$$Y = T \times S \times R \quad (1)$$

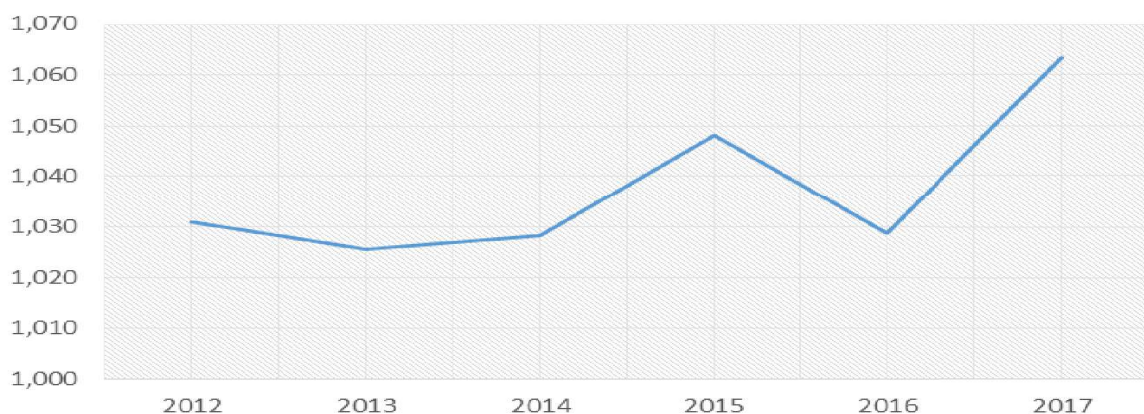


Fig. 2. An average annual road transport growth rate for 2012-2017

This model assumes that the each level of the time series could be represented as a product of trend (T), seasonal (S), and the random (R) components. The predicted F_t value of the time series level in the multiplicative model is the result of the trend and seasonal components. To determine the trend (T) component let's use the trend equation (2). It is a table below with the predicted values quarterly, mln tons/km (Table 1).

$T = 754.685 + 20.825t$ (2), where t – the calculated period.

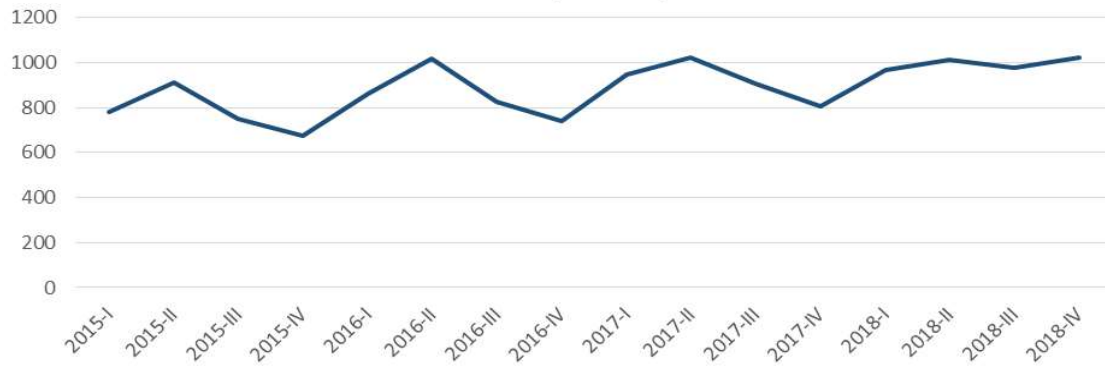


Fig. 3. The current and predicted volumes of cargo turnover

Table 1. The predicted cargo turnover values for 2018 in million tons/km.

Period	2017-3	2017-4	2018-1	2018-2	2018-3	2018-4
Forecast, mln t/km	905,21	807,10	969,71	1010,81	977,07	1022,25

Here is quarterly observed the seasonality (Picture 3). From the first to the third quarters there is growth, then a decline in the fourth quarter. The derived by years forecast shows a decrease in the cargo flows. For the reliability of the results we will construct the forecast using the random walk method and compare the results with the Table 1. Below are the forecasts for the 2018 quarters on quarterly 2015 - 2017 data with the random walk method (Table 2). The most of the Table 1 predicted values are within the forecast interval of Table 2. This means that the verification of results obtained by the random walk method with the dynamic series apparatus method should be considered as successful. So, the results of the quarterly forecasts given in Table 2 for all 2018 quarters should be considered as the fairly reliable.

Table 2. The forecast for 2018 with the random walk method.

Quarter	2018 – 1	2018 – 2	2018 – 3	2018 - 4
Forecast, mln t/km	933,8 ± 42,6	955,2 ± 48,5	974,1 ± 63,3	1082,6 ± 63,4
Interval	[891,2-976,4]	[906,7-1003,7]	[910,8-1037,4]	[1019,2-1146,0]

With the moving average method based on data for the period 2011-2016[8] made a forecast for the cargo transportation volumes of the Republic of Tatarstan in million tons (Table 3).

Table 3. The forecast for 2018 with the moving average method.

Period	2011	2012	2013	2014	2015	2016	2017	2018
Mln.t.	171	165,4	160,5	140,3	142	145,7	265	243,7

DISCUSSIONS

From the analysis of the obtained data, we could come to the conclusion that the freight turnover through the Republic of Tatarstan is going to increase, which is also observed in the forecasts based on Rosstat data. In our study with the formalized forecasting techniques, we tried to find the most adequate current picture of the real needs of regional companies. However, the study revealed difficulties in collecting data (especially with a created questionnaire) and it is difficult to predict the full picture without supplier response. Due to this, the realised forecast is based on the open regional and national data. The issue above remains necessary for the next part of the research i.e. to use the specific indicators for excluding the transport costs of large players of the regional logistics market. So, for the more precise estimation of the Sviyazhsky logistics center's possible load it will be necessary to use the main regional players of the logistics market more detailed data (also on economically advantageous types of cargo, etc.).

CONCLUSION

The territory of the Republic of Tatarstan is located very successfully in the logistics system of Russia which gives the region some advantages, but the development of the Sviyazhsk logistics center is still concerned with the number of controversial issues related to both the location of the facility and the prospects of its loading from all planned types of vehicles. The creation of regional logistics centers is always accompanied by risks related to their capacities storage factor (load degree) as it is necessary to crowd a depot to capacity. But as we could see the forecasts give an optimistic assessment which could be based on the total turnover of the corresponding weight of the Republic of Tatarstan in the ITC "North-South" and "West-East". About a third of cargo deliveries volume passing through international transport corridors could ensure the full loading of the Sviyazhsky logistics center, and therefore we could conclude that the need for the development of the SMLC is confirmed. It could be reasonably argued that further development of the Sviyazhsky interregional multimodal logistics center allows obtaining a synergistic and multiplicative effect, which will increase the interest of local commodity producers and the regional economic positions.

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