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Strategic Planning and Economic Assessment of Development of Intermodal Transport Infrastructure

Dmitry A. MACHERET **Ruslan A. TITOV**

Macheret, Dmitry A., *Russian University of Transport, Moscow, Russia.*
Titov, Ruslan A., *Russian University of Transport, Moscow, Russia*.*

ABSTRACT

The authors set the goals: to assess the socio-economic importance of construction of intermodal transport infrastructure in the Russian Federation in modern conditions, to analyse the degree of development of issues of assessing the economic efficiency of intermodal aspects. To achieve these objectives, the content of modern strategic documents (such as the Comprehensive Plan for Modernization and Expansion of Trunk Infrastructure, the Long-term Development Program of JSC Russian Railways until 2025, the Spatial Development Strategy of the Russian Federation, etc.), as well as the dynamics of container traffic volumes and results in construction of new and modernization of existing intermodal transport infrastructure were analysed. Based on this, a conclusion was made about relevance, importance, and prospects of development of intermodal transport infrastructure for both passenger and freight transportation.

The degree of elaboration of issues of assessing the economic efficiency of intermodal aspects is analysed, while the historical retrospective of evolution of methods for its assessment within the framework of state or sectoral methodological guidelines adopted in the former USSR and the Russian Federation is considered. When analysing approaches to assessing economic efficiency inherent in a planned economic model, several effects from improvements associated with the development of transport infrastructure and organisation of operation are described. Against this background, the authors reveal the difference between former and new approaches, characteristic of the modern market economy.

Through analysis and synthesis, conclusions were drawn for each part of the study. In the final part, using a dialectical approach, the results obtained are compared. Based on this, conclusions were made on the correlation between the importance of building an intermodal transport infrastructure, the degree of development of issues of assessing the economic efficiency of intermodal aspects and the prospects for development of this research area.

Keywords: building of intermodal transport infrastructure, economic efficiency assessment, strategic development, investment projects.

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*Information about the authors:
Macheret, Dmitry A. – D.Sc. (Economics), Professor, Head of the Department of Economics of Transport Infrastructure and Management of Construction Business of the Institute of Economics and Finance of Russian University of Transport, Moscow, Russia, macheretda@rambler.ru.
Titov, Ruslan A. – Ph.D. student at the Department of Economics of Transport Infrastructure and Management of Construction Business of the Institute of Economics and Finance of Russian University of Transport, Moscow, Russia, titov-r@ya.ru

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The implementation of both large-scale and less costly investment projects is preceded by an assessment of their feasibility and economic efficiency. In the context of limited investment resources, a multidimensional assessment of effectiveness of investments, which should be based on a scientifically grounded methodology, becomes especially important.

This study sets the following *objectives*:

• to assess the socio-economic importance of building of intermodal transport infrastructure in modern Russia;

• to analyse the degree of elaboration of the issues of assessing the economic efficiency of intermodal aspects.

To achieve the set goals using analysis and synthesis, as well as the historical *method*, conclusions are drawn for each part of the study. In the final part, using a dialectical approach, the results obtained are compared and the results are summed up.

Strategic planning

The vector of development of infrastructure projects in Russia is set by the adopted long-term strategic documents on a national scale and sectoral programs.

The Strategy for Development of Railway Transport until 2030 [1], approved in 2008, can be considered as the first state transport plan for such a long term in modern Russia [2; 3]. More important is its significance as a «pioneer» program in relation to intermodal aspects.

In the field of building of intermodal transport infrastructure, according to the Strategy, the following was envisaged:

1) In 2016–2030 organisation of intermodal traffic in the direction of Mineralnye Vody airport–Mineralnye Vody–Kislovodsk with reconstruction of railway lines.

2) Increasing the competitiveness of Russian railways in the system of international transport corridors (ITC) by introducing modern technologies for intermodal transportation, in particular, container block trains.

3) Creation of a network of information and logistics centres and development of infrastructure for intermodal transportation.

4) Dynamic development of intermodal transportation and development of new geographic market segments.

5) Timely and effective response to systemic problems that require an early solution, including formation of alternative intermodal routes using the railway transport of other countries.

In the same 2008, the Transport Strategy of the Russian Federation [4] was adopted, covering all modes of transport (subsequently, the strategy was updated). It supplements the previous document with provisions:

• On introduction of single technical and information standards and technologies, as well as single shipping documents in the field of intermodal transportation.

• On development of transportation in containers with participation of inland water transport.

• On the development of suburban speed passenger transportation, including intermodal, for communication between the airport and the city.

• On development of electronic data exchange, improvement of tariff schemes and customs technology.

• In the field of development of public passenger transport: on development of dedicated infrastructure for public passenger transport, urban off-street transport systems, intermodal passenger transport systems, as well as on modernization and expansion of rolling stock fleets.

According to this strategy, the transport complex of urban agglomerations requires:

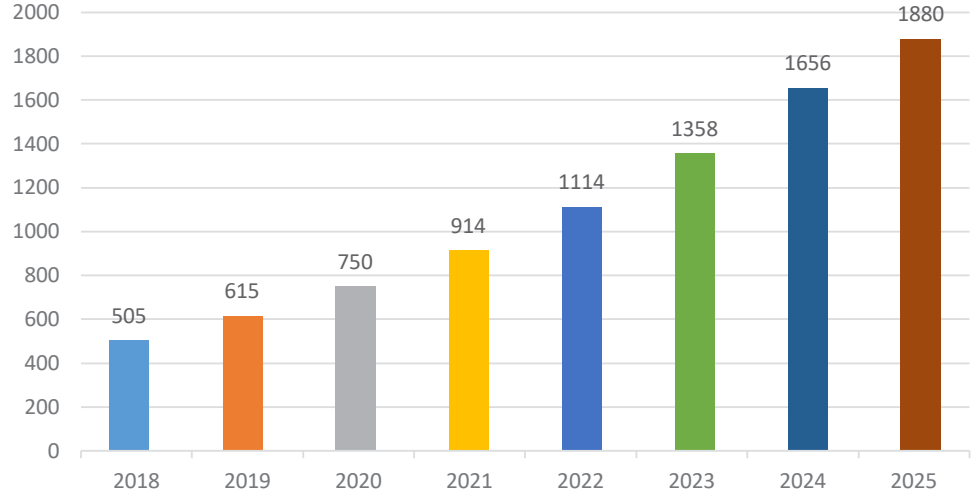
a) Creation of integrated intermodal transport systems, construction of comfortable transport interchange hubs (passenger hubs), priority conditions for public transport, introduction of a single urban electronic intermodal ticket and customer-oriented tariff solutions in this area.

b) Intensification of intermodal traffic of electric trains between Moscow airports and the city, Pulkovo airport and Baltiysky railway station in St. Petersburg.

c) Improving customer service through a full transition to processing of intermodal transport units at border crossings in the «single window» mode based on electronic date exchange.

These two strategic documents laid the foundation for long-term development of intermodal transport infrastructure in Russia.

It is worth to note in chronological order other strategic planning documents that are



Pic. 1. The volume of transit container traffic, thousand TEU units [7].

important from the point of view of development of intermodal transport infrastructure.

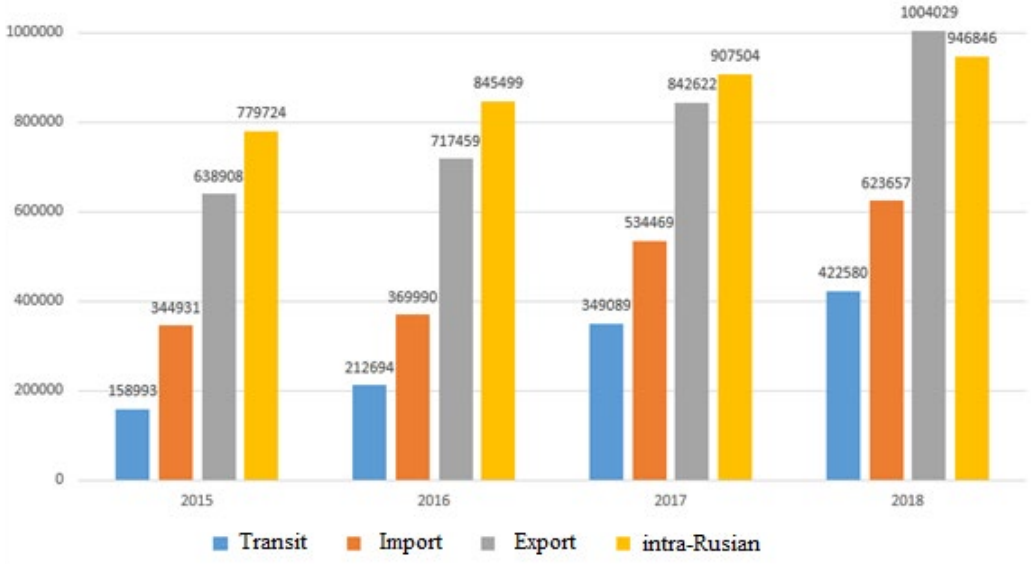
2018 – The strategy of scientific and technological development of Russian Railways holding company for the period up to 2025 and for the long term until 2030 (White Book) [5] identified the tasks of increasing the level of customer focus by developing piggyback transportation, using innovative types of containers for intermodal transportation for additional assortment of goods, as well as for increasing the range of goods transported.

2018 – Comprehensive Plan for Modernization and Expansion of the Trunk Infrastructure for the Period up to 2024 [6] set goals and key indicators that are directly related to intensification of intermodal transport infrastructure. For example, it set the terms of delivery of transit container traffic in the North–South direction (Krasnoe, ports and border crossings of North-West–Samur), Europe–Western China direction (Krasnoe–Iletsk–Ozinki–Kartaly–Petropavlovsk), West–East direction (Krasnoe, ports and border crossings of North-West–Naushki, Zabaikalsk, ports and border crossings of the Russian Far East), and the average speed of delivery of transit container traffic.

2019 – The long-term development program of JSC Russian Railways until 2025 [7] contains a provision stating that development of passenger traffic provides for formation of multifunctional intermodal hubs and transport hubs integrated with the modern urban environment and infrastructure environment, expanding the list of services (intermodal transportation).

For freight transportation the program indicated the vector towards growth in throughput and transit capacity of the infrastructure capable to increase the transit container traffic by 4 times, including reducing time for transporting containers by rail from the Far East to the western border of the Russian Federation to 7 days by 2024.

2019 – The strategy of spatial development of the Russian Federation for the period up to 2025 [8] provides for development of freight transport and logistics centers, an increase in volumes and a reduction in time of container transportation, including transit, by rail from the Far East to the western borders of the Russian Federation to 7 days. An increase in throughput capacity of the transportation routes, in speed of carriage of goods, as well as development of the container transportation market are forecasted, which will create conditions for the outstripping growth of exports and implementation of the transit potential of the Russian Federation. By 2025, the volume of transportation of export goods, carried out by all modes of transport, without considering pipeline transport, will increase by more than 30 percent. This strategy confirmed the



Pic. 2. Indicators of container traffic on the Russian railways network (compiled by the authors based on data of JSC Russian Railways).

contents of earlier documents as it proposed to eliminate infrastructural constraints of national significance, increase the availability and quality of the trunk transport, energy, information and telecommunications infrastructure, including through development of intermodal passenger transport infrastructure of agglomerations.

Target indicators of the program [7] in terms of the volume of transit container flow are presented in the diagram in Pic. 1.

Based on the analysis of strategic documents, considerable attention is paid to intermodal aspects of development. At the same time, it is necessary to consider operation of the law of advanced development of transport infrastructure [9, pp. 14–15], which is one of the basic conditions for ensuring the efficiency of the economy.

It should be noted that several important projects in the field of intermodal transport have already been implemented, which contributed to the high dynamics of that type of transportation.

Thus, the first stage of creation of the transport and logistics centres located at Kaliningrad and Chernyakhovsk has been completed. There containers transported in transit trains are transshipped from flat wagons of 1520 mm gauge to those of 1435 mm gauge. New services of transit container transportation were developed and launched on the routes China–Europe–China through the port of Kaliningrad and South Korea–Finland–South Korea through the port of Vostochny. As part of development of North–South ITC, test shipments of containers from India to Russia and Belarus were carried out. Experimental piggyback transportation along the route Kaliningrad–Moscow–Kaliningrad in transit through the territories of Lithuania and Belarus was organised, as well as, together with JSC FGK and CJSC Magnit, along the route Moscow–Novosibirsk [10].

Indicators of transportation in containers for the period 2015–2018 are characterized by sustainable growth and are presented in the form of diagrams in Pic. 2.

Evolution of methods for assessing economic efficiency, enshrined in official documents

The review of cost-effectiveness assessment methods should start with recommendations documented in government or industry documents, highlighting intermodal aspects. More general approaches to assessing economic efficiency are discussed in publications [11; 12].

Soviet period

The post-war history of emergence of methodological documents for assessing economic efficiency began around the 1950s.

This was due, inter alia, to creation in 1947 of the State Committee for introduction of advanced technology in the national economy of the USSR, as well as to the economic reform of the late 1950s.

The documents concerned both general approaches to assessing the effectiveness, for example, introduction of new technology, inventions and improvement suggestions without reference to the features of specific sectors of the national economy, or considering features of an industry, for example, construction, road either sea transport [13, p. 4], and acceleration of scientific and technological progress, including in railway transport. Besides, methods were approved for determining the economic efficiency of capital investments, including in railway transport and merchant marine [14, p. 3].

The general principle regarding approaches to evaluation necessarily entailed calculation and justification of effectiveness of capital investments in compliance with the national economic approach. The criterion of economic efficiency in the national economy was the increase in national income (in comparable prices) in relation to the capital investments that caused this increase.

In the process of developing capital investment plans, the emerging indicators of economic efficiency had to be compared with the standards and with similar indicators of the efficiency of capital investments, as well as with indicators of production efficiency at the advanced enterprises of the corresponding industries and sub-industries.

The indicator of comparative economic efficiency of capital investments was the minimum of reduced costs.

From about the end of the 1970s, references to container transportation appear in transport documents assessing the economic efficiency of capital investments in construction [14, p. 10]. So, for example, in the composition of the capital investments taken into account when determining the economic efficiency, a group of tasks was singled out for justifying coastal complexes for delivery of goods by large transport facilities (ferry crossings, container terminals, lighter carrier systems). For it they considered direct investments in construction of ferries or special ships, coastal and other structures and devices that provide loading and unloading of ferries, special ships, transfer or reloading to another mode of transport of large vehicles transported on ferries or special ships (wagons, trailers, containers, etc.). They also considered related investments in coastal facilities that ensure operation of a ferry or other transport systems (development of port railway stations, highways), development of a ship repair base, investments in vehicles, as well as the in freight current assets of consignors.

Transport specificity dictated the need to compare options and assess the effectiveness of capital investments, taking into account the cost of goods in transit, which are part of the current assets of the national economy. The effect of accelerating delivery of goods makes it possible to increase the turnover of the current assets of the national economy, and in terms of its economic value is equivalent to a reduction in the required volume of capital investments [14, p. 18].

The economic effect associated with release of the freight assets was proposed to be determined by the formula:

$$\Delta E_{\text{fr}} = \frac{C_{\text{fr}} Q \left(t_d^{'} - t_d^{''} \right)}{365}, \qquad (1)$$

where C_{fr} – average price of 1 ton of freight, roubles;

Q – annual shipment of freight, t;

$t_d^{'}$ and $t_d^{''}$ – cargo delivery time, respectively, before and after acceleration, days.

Along with the effects in freight traffic, it was pointed out that it was necessary to take into account the national economic effect of increasing or decreasing duration of a passenger's trip. The cost estimate of one saved passenger-hour in general transport calculations was estimated at 10–15 kopecks, which with an average monthly salary of a young specialist of 140 roubles [15, p. 46] was 0,1% for every hour saved.

The national economic efficiency of capital investments in development of container, unitized loads and other progressive methods of transporting goods was characterized by the following effects:

a) accelerating delivery of goods to consumers by considering current assets associated with cargo in the process of transportation;

b) saving on packing and packaging of goods by direct account for specific conditions of transportation;

c) improving quality of transportation of goods (safety, security, etc.) by direct account for specific transportation conditions;

d) simplification and reduction of the cost of freight forwarding and warehouse operations with the consignor and consignee by direct account for specific conditions of freight shipments.

When transporting railway wagons and other types of vehicles on ferries or other specialized vessels, according to the methodological documents of that period, it was necessary to take into account the costs of their maintenance during transportation by sea. It was recommended to determine these costs by the formula:

$$C_v = Ch_v (t_t + t_{fi}) n_v, \quad (2)$$

where Ch_v – hourly rate for keeping a car or a vehicle in operation;

t_t – time of trip turnover in hours;

t_{fi} – interval between ferries or ships in hours;

n_v – number of vehicles on the ferry.

Several specific examples of calculations were considered, for example, of determining the economic efficiency of capital investments when replacing conventional ships with container ships for transportation of a given volume of cargo. At the same time, it was noted that the efficiency of capital investments in construction of container ships in comparison with existing vessels was high: 32 million roubles of capital investments and 6,8 million roubles of operating costs at the prices of that period were saved. The use of container ships instead of conventional ships scheduled for construction, according to the results of calculations, provided an annual savings in operating costs of 1,8 million roubles, but an additional 2 million roubles of capital investments were required. The additional costs paid off due to the savings in operating costs in about a year, which testified to the high economic efficiency of the introduced container ships.

Two years later, in 1979, another method was published for sea transport, where the issue of intermodal transportation in containers and other enlarged cargo consignments was raised [13, p. 9].

In this methodology, a specific example of determining the annual economic effect from introduction of a new technology of loading and unloading operations at the container terminal in the seaport by including three schemes for cargo operations was considered.

The direct economic effect from introduction of a new technology of cargo operations is determined using the formula:

$$\Delta E = (z_1 - z_2) Q_2, \quad (3)$$

where ΔE – annual economic effect, roubles;

z_1, z_2 – reduced costs per unit of product (work) produced using basic and new technology, roubles;

Q_2 – volume of products (work) produced with the help of new equipment in the estimated year.

From these two examples, it can be seen that initially the issues of assessing the effectiveness of containerization in Russia were more related to sea transport, which is due to the priority of international intermodal links based on sea transportation.

Period of modern Russia

Recommendations of 1994 can be deemed to be among the first documents officially adopted in Russia to assess the effectiveness of investment projects [16]. They are based on the fundamental principles and approaches that have been developed in world practices for assessing the effectiveness of investment projects, adapted for the transition to a market economy, proposed by UNIDO.

In the Methodological Recommendations for Evaluation of Investment Projects in Railway Transport in 1998, the same indicators of economic efficiency are supplemented by natural indicators specific to the transport industry: the degree of increase in transportation service provision, throughput, saving free time, etc.

The Methodological Recommendations on Composition and Content of Substantiating Materials for Investment Projects [17] provide a classification of investment projects in JSC Russian Railways system and for the first time mention in this regard a project for organizing intermodal transportation on Sochi–Adler-airport–Sochi section. It is presented as an example of an investment project for integrated development of railway infrastructure in certain transport areas (sections, lines, routes, etc.), in implementation of which several sectors of the railway industry are involved.

The economic efficiency of the project, according to this document, is the essential, but not the sole criterion for assessing the effectiveness of the project. If the project does not have economic efficiency, other types of efficiency are considered: technological, social, budgetary, environmental ones.

The emergence of such projects in the methodological documents was associated with the strategic documents of 2008, which have been discussed above, where the emphasis was also placed on the need for construction and operation of intermodal transport infrastructure.

One of the latest official documents in this regard is the Methodology [18], adopted by the Government of the Russian Federation at the end of 2019.

According to it, assessment of the socio-economic effects of an infrastructure project with state support should be carried out by quantitative analysis of the following indicators:

• An increase in the gross domestic product of the Russian Federation, calculated based on an increase in gross value added, receipts of tax payments in connection with sale and import of goods (works, services), as well as in connection with saving travel time of passengers and goods, increasing safety of passenger and cargo transportation, agglomeration effect and the effect of eliminating infrastructure constraints as a result of implementation of an infrastructure project.

• Budgetary effect, calculated as the balance of the increase in tax and other mandatory payments to the budgetary system of the Russian Federation in connection with implementation of the infrastructure project and of the amount of state support.

Conclusions.

Studying the history of development of methodological tools for assessing economic efficiency allows us to draw the following conclusions.

Firstly, the post-war history of appearance of relevant documents begins approximately from the 50s of the last century and continues, undergoing a corresponding evolutionary development, consistent with changes in the socio-economic situation in the country.

Secondly, it is characteristic that some methodological documents contain both commercial and socio-economic, and budgetary estimates. However, there is a separate set of such official guidelines that focus on budgetary and socio-economic efficiency.

Thirdly, along with economic efficiency, it is proposed to determine financial and technological ones.

In conclusion, it should be noted that comparison of the content of strategic and methodological documents makes it possible to focus on specific features of strategic planning and economic assessment of development of intermodal transport infrastructure.

The construction and operation of intermodal transport infrastructure is a priority for development of the national economy, and it is given due attention in strategic documents. Analysis of strategic documents and indicators of growth in the volume of traffic indicates the prospects and importance of development of intermodal transport infrastructure.

The study of methodological documents at the level of the national, regional and sectoral economy shows that a general approach to determining economic efficiency has been developed. At the same time, in the methodological documents, using the example of construction of intermodal transport infrastructure, it can be seen that specific systems, projects and objects in them are considered without deep detailing. The assessment of construction of intermodal transport infrastructure is not given as much attention as it is necessary see its economic and social importance.

It is characteristic that some of the methodological documents discussed above are called «recommendations» or «model», thus suggesting the need for specification with regard to particular conditions. This testifies to the relevance of appropriate research in the area under consideration.

It is advisable to develop methodological tools for assessing the effectiveness of construction of intermodal transport infrastructure in a more profound and versatile manner. First of all, it is necessary to supplement the existing approaches to assessing economic efficiency with methodological tools for specialized projects, such as construction of intermodal transport infrastructure, providing for a deeper, more detailed, comprehensive

consideration of the full range of effects generated by an intermodal system or technology.

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