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METHODOLOGY FOR ASSESSING THE INNOVATION POTENTIAL OF THE TRANSPORT AND LOGISTICS COMPLEX

A.S. Lebedeva[1], E.V. Budrina[1] ✉, L.I. Rogavichene[1], N.N. Bulatova[2]

[1] State Marine Technical University, St. Petersburg, Russian Federation;
[2] East Siberia State University of Technology and Management, Ulan-Ude, Russian Federation

✉ boudrina@mail.ru

Abstract. The study is aimed at developing methodological tools for assessing the innovation potential of transport and logistics complex (TLC), which is the basis for forming strategic decisions regarding innovative development and increasing the competitiveness of transport and logistics structures of the country. Based on the analysis of the effects from the introduction of innovations in the structure of technologically advanced TLCs, the criteria of innovativeness and types of TLCs have been identified, which makes it possible to assess the level of object's lagging behind the leaders and the scale of the required innovative transformations. Because of a comparative analysis of existing methods and methodologies for assessing the objects' potential, some solutions applicable to the TLC assessment were identified, taking into account the specifics of its functioning and its difference from such objects as an enterprise or a region. At the same time, at least three aggregated approaches to the assessment of innovation potential were compared: resource, internal and resultant, which allowed to achieve a higher reliability of the developed methodology. Based on the integrated approach, a multilevel decomposition of the TLC innovation potential was made on four components: resource, management, performance, infrastructure. The authors also identified components and determined the assessment indicators of each of the components, which are assessed in the framework of the methodology developed by the authors, representing the synthesis of the elements of the studied methods. According to the methodology for assessing the TLC innovation potential by means of graphic visualization, analogy method and multidimensional scaling, the provision of the complex with resources for innovative development and infrastructure capabilities for the introduction of innovative technologies are displayed. Unlike the existing universal tools for assessing the objects' potential, the methodology takes into account the specifics of transport and logistics structures and the significance of the evaluation elements, as well as the need to assess the infrastructural component of the complex potential. The results of approbation of the methodology on the example of the Multipurpose Sea Cargo Complex Bronka (MSCC Bronka, St. Petersburg, Russia) with the use of systematization, interviewing, economic-mathematical and expert methods have not revealed any limitations in the use of the methodology. The tools presented in the work can be used to develop the strategy and policy of innovative development of TLCs of different types, scale and specialization.

Keywords: transport and logistics complex, innovation criteria, innovation potential, infrastructure, facility potential assessment tools, technologies, MSCC Bronka

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МЕТОДИКА ОЦЕНКИ ИННОВАЦИОННОГО ПОТЕНЦИАЛА ТРАНСПОРТНО-ЛОГИСТИЧЕСКОГО КОМПЛЕКСА

А.С. Лебедева[1], Е.В. Будрина[1] ✉, Л.И. Рогавичене[1], Н.Н. Булатова[2]

[1] Санкт-Петербургский государственный морской технический университет, Санкт-Петербург, Российская Федерация;

[2] Восточно-Сибирский государственный университет технологий и управления, Улан-Удэ, Российская Федерация

✉ boudrina@mail.ru

Аннотация. Исследование направлено на развитие методологического инструментария оценки инновационного потенциала транспортно-логистического комплекса (ТЛК), что является основой формирования стратегических решений относительно инновационного развития и повышения конкурентоспособности транспортно-логистических структур страны. На основе анализа эффектов от внедрения инноваций в структуру технологически развитых ТЛК были выявлены критерии инновационности и типы ТЛК, что позволяет оценить уровень отставания объекта от лидеров и масштабы требуемых инновационных преобразований. В результате сравнительного анализа существующих методов и методик оценки потенциала объектов были определены отдельные решения, применимые для оценки ТЛК с учетом специфики его функционирования и отличия от таких объектов, как предприятие или регион. При этом сравнивались как минимум три укрупненных подхода к оценке инновационного потенциала: ресурсный, внутренний и результативный, – что позволило добиться более высокой достоверности разрабатываемой методики. На основе комплексного подхода была произведена многоуровневая декомпозиция инновационного потенциала ТЛК по четырем составляющим: ресурсной, управленческой, результативной, инфраструктурной. Были также выделены компоненты и определены показатели оценки каждой из составляющих, которые оцениваются в рамках разработанной авторами методики, представляющей синтез элементов изученных методов. Согласно методике оценки инновационного потенциала ТЛК посредством графической визуализации, метода аналогии и многомерного шкалирования, отображается обеспеченность комплекса ресурсами для инновационного развития и возможности инфраструктуры для внедрения инновационных технологий. В отличие от существующих универсальных инструментов оценки потенциала объектов методика учитывает специфику транспортно-логистических структур и значимость элементов оценки, а также необходимость оценки инфраструктурной составляющей потенциала комплекса. Результаты апробации методики на примере многофункционального морского перегрузочного комплекса «Бронка» (ММПК «Бронка») с применением систематизации, интервьюирования, экономико-математического и экспертного методов не выявили ограничений в использовании методики. Представленный в работе инструментарий может быть использован для разработки стратегии и политики инновационного развития различных по виду, масштабу и специализации ТЛК.

Ключевые слова: транспортно-логистический комплекс, критерии инновационности, инновационный потенциал, инфраструктура, инструменты оценки потенциала объекта, технологии, ММПК «Бронка»

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Introduction

Constant changes and transformations in the modern economy are the driving force of the innovative development of the transport and logistics system elements. The introduction of sanctions, increased duties on the import of goods and raw materials, application of new models of interaction between suppliers, manufacturers and consumers – all this inevitably entails the redistribution of cargo flows and causes the necessity for rapid adaptation of production capacities and infrastructure of transport and logistics complexes (TLCs) to changing conditions, which presumes intensive development and significant financial costs. At the same time, not every existing TLC has conditions and resources necessary to implement technological innovations in the existing infrastructure, in other words, it has low innovation potential. In this case, investing in different innovations does not achieve the required improvement in process efficiency. That is why it is necessary to evaluate various components of the innovation potential of TLC, including infrastructure capabilities before financing innovative transformations.

The object of the study is TLC and its infrastructure.

The subject of the study is the methods of assessing the innovation potential of TLC.

The purpose of the study is to identify opportunities for developing the innovation potential of TLC.

Research objectives are the following:

1) To identify the criteria for classifying TLC as innovative one, to distinguish types of TLC by innovativeness;

2) To identify which infrastructure facilities are specific for innovative TLC;

3) To determine the possibility of using elements of the existing methodological apparatus to the evaluation of the innovation potential of TLC;

4) To decompose the innovation potential of TLC and to determine the elements, components and indicators of its assessment;

5) To formulate the logic of assessing the innovation potential of TLC;

6) To develop recommendations for evaluation results interpretation;

7) To determine the applicability and limitations of the author's methodology by testing it on the example of MSCC Bronka.

Methodological tools for assessing the potential of objects are sufficiently developed. The modern scientific community studies the essence, types and general approaches to determining the innovation potential of enterprises and regions [2, 4]. However, the main direction in this scientific category is the development of techniques and methods for evaluating manufacturing enterprises [3, 7, 11, 13–15, 23, 25] or specific methods for evaluating enterprises of a particular type of activity, for example, artificial intelligence companies [6]. The methods for evaluation of transport and logistics enterprises are not presented in the scientific literature.

There are also studies dedicated to assessing the innovation and logistics potential of territorial entities [1, 8, 9, 22].

However, TLC in its essence and principles of operation differs significantly from such facilities as a separate enterprise or region. Unlike the enterprise, within the complex interact several entities of different scales, areas of activity, with various strategies and management models. Both private organizations and representatives of state ones, for example, the Federal Customs Service, can be based on the territory of the TLC. At the same time, the activities of the entities are closely related to the common goal and tasks, common infrastructure facilities and government bodies. All the TLC subjects are interdependent – this fact distinguishes TLC from territorial formation.

In addition to that, existing methodologies are focused on object's resource potential evaluation. At the same time, the introduction of innovation in the work of TLC requires the availability of appropriate infrastructure, which can include various buildings, machinery and transport, equipment, telecommunications and engineering networks. Methods for assessing infrastructure capacity are common to regional one [5, 10, 12, 24] and are not applicable to the assessment of TLC.

This determines the necessity to develop methodological tools for assessing the TLC potential based on the relevance of the problem of creating innovative complexes and the lack of evaluation tools that take into account the specifics of TLC functioning.

When developing the tools at the first stage it is planned to identify which TLC can be classified as innovative, which infrastructure facilities distinguish them, since if a complex is already technically developed with highly efficient technological processes, its innovation potential has been realized and does not require investment at current moment. For the other complexes, a consecutive assessment of the potential is required according to the methodology developed based on the best practices analysis and the decomposition of the innovation potential of TLC, taking into account its specificity. Interpretation of the evaluation results will determine the directions for increase of the innovation potential and opportunities for innovation in the infrastructure of the complex. Based on the developed methodology the assessment of the potential of the Multipurpose Sea Cargo Complex (MSCC) Bronka) (St. Petersburg, Russia) will show its practical applicability and limitations.

Materials and Methods

The definition of TLC types in terms of innovation and inherent characteristics involves the use of formal logic, analysis and typologization methods. The comparative analysis of existing methods and methodologies reveals the best solutions for assessing the innovation potential of TLC. In this case, both methods of assessing the potential of enterprises [3, 23] and methods of assessing the potential of the region, infrastructure are analyzed [9, 24].

A comprehensive approach to the concept of innovation potential allows us to consider it as a set of components that characterize separate elements. In this regard, there is a need for a multi-level decomposition of the innovation potential of TLC.

The designed methodology takes into account the resource and resulting approaches to assessing potential and is an elements' synthesis of such methods as point, integral, graphic, expert analysis of financial indicators, security ratios. According to the methodology, the evaluation results are presented based on a graphical method (petal diagram), analogous to the indicators of a conditional ideal object, and are interpreted by multidimensional scaling. In the course of approbation of the author's methodology, infrastructure objects were systematized, competitive and SWOT-analysis of MSCC Bronka was carried out, interviews, economic and mathematical calculations, expert survey for collecting data, determination of indicators and weighting coefficients were also conducted. The experts were correspondents and leading observers of the analytical magazine PortNews, employees of the facility management company Fenix Ltd. (St. Petersburg, Russia).

The study highlights some methodological limitations that do not significantly affect the results. In the course of the study, it is planned to analyze a limited amount of data on the effects of the introduction of innovative technologies into the TLC structure, obtained from open sources with a sign of reliability. At the same time, the solution of the problem does not require an analysis of all existing TLCs, but only the most technologically developed ones. In addition, the most relevant and reliable in the absence of the possibility to conduct a field survey are the data on the work of MSCC Bronka obtained from the representatives of the management company.

Besides, the evaluation indicators of the components in the methodology are determined based on the condition of their availability and collection at the evaluation site.

Results

TLC innovation criteria

In a general sense, TLC is characterized as innovative if innovative technologies are actively introduced into their structure to improve operational efficiency. Most often it is port TLCs that are considered innovative, since this type involves a significant cargo turnover, the most complex organization and

processing cargo flows technologies, and the interaction of various transport modes. However, there is no clear understanding of the criteria by which a particular complex can be classified as innovative. In order to determine the criteria, the effects of introducing various innovative technologies (unmanned technologies, blockchain laboratories, remote-controlled mechanisms, artificial intelligence, environmental innovations, etc.) into the structure of the most developed foreign port TLCs, including cities as Antwerp, Montreal, Rotterdam, Qingdao [17–20] were analyzed. According to the innovative type, one of the main changes in the development of the complex is automation involved at all levels of cargo flow, which allows to accelerate the processes associated with cargo movement, and thus increase the throughput capacity of the complex and its efficiency. Table 1 presents the most significant criteria reflecting the compliance of the complex with a certain type of innovativeness.

Table 1. TLC innovation types

TLC innovation criteria	TLC innovation types		
	0	1	2
Share of automated manufacturing processes	0–33%	33–66%	> 66%
Innovation policy in place	yes/no	yes	yes
Availability of monitoring, assessment and implementation department	no	yes/no	yes
Use of innovative technologies to reduce emissions of harmful substances into the atmosphere	no	yes/no	yes
Use of innovative technologies to improve safety	no	yes/no	yes
Implementation of innovative technologies to accelerate cargo flow	no	yes/no	yes
Implementation of innovative technologies to accelerate associated flow	no	yes/no	yes
Availability of common data processing center	no	yes	yes
Share of labor costs	70%	40–70%	30–40%

Source: designed by the authors.

At the same time, each type of TLC is characterized by certain infrastructure objects that also determine its potential for innovation introduction. The innovative TLC of the second type has in its structure the following objects:

- autonomous transport, robots, drones, high-tech machinery and equipment;
- facilities to support the operation of high-tech equipment (stations for equipment recharge, rail tracks for autonomous cranes, sensors for drones, etc.);
- innovative environmental and safety monitoring systems (weather stations, research equipment, sensors, networks, software);
- high-speed Internet access (5G, IoT (Internet of Things), etc.);
- information and telecommunication systems.

TLC innovative organization processes requires creation of the uniform data-processing center (DPC) which is responsible for planning, management, control and functioning analysis of the automated equipment and systems. To increase the innovation complex efficiency, infrastructure facilities should share common information field.

Based on the determined criteria, the TLC innovation type is identified and decision is made to conduct further complex potential assessment. If, according to the major part of the criteria, the object belongs to the second type, then it meets up-to-date requirements for technological performance and efficiency of processes. If the object belongs to the zero (traditional) or first type, then it is necessary to evaluate its innovation potential and determine the directions for further development.

Analysis of methods and techniques for assessing the innovation potential of facilities

In the scientific literature, there are different approaches and methods for determining innovation potential depending on the characteristics of the object and the goals of the assessment presented.

In terms of goals, the resource, internal and resultant approaches are distinguished [26]. Resource approach is the analysis of available and necessary resources for acquiring or developing innovations. It includes financial, human resources, technological and scientific components. The resultant approach considers the achieved level of innovation potential, which is characterized by indicators such as innovative activity, the number of registered patents, and advanced technologies used. The internal approach examines the organization's ability to transform the resources of the object into an innovative product and evaluates management and organizational indicators.

The approach is chosen depending on the purpose and based on the available information. Often, not only one approach is used, but a complex with the most important and known metrics for a particular case. In addition to the approach, evaluation methods also matter. The most frequently used methods are expert methods (point and integral estimates), graphic method, analysis of financial indicators and calculation of resource capability ratios. Each of the methods has its own disadvantages, such as subjectivity, a limited number of indicators to be evaluated, assessment of only one type of resources.

That is why combining different approaches and methods the authors of scientific works propose methods for determining the innovation potential of various objects. For the purpose of this study, it is necessary to consider the potential, both in terms of common innovative development and in terms of infrastructure transformation. In this regard, the analysis of methods for assessing the innovation potential of facilities and methods for assessing the potential of infrastructure were carried out.

Kruglov A.V. proposes to evaluate the potential of the object using two stages: assessment of the innovation potential and determination of its necessity level in comparison with industry enterprises [14]. This methodology focuses more on the resultant component of innovation potential, and the degree of its own innovative developments is analyzed. This methodology is not suitable for TLC assessment, since the development of innovations is not implied in the activities of the complexes per se. Since the innovation of TLC is achieved by the use of innovation, the methodology needs to pay more attention to the assessment of financial and other resource indicators.

Evtushenko E.V. and Iusupova E.R. propose to evaluate the innovation potential based on the assessment of the internal and external environmental factors of the enterprise [7]. The methodology includes the evaluation of qualitative and quantitative indicators, based on which the integral one is calculated. However, it does not define a specific list of indicators and is too general so each time it is used it needs to be refined.

Imaikina O.I. in her research work proposes to evaluate the innovation potential of the production facility, based on its structural components: intellectual, research, production and technical, financial, marketing, organizational and managerial [13]. In general, the methodology with such components in its structure is inappropriate for TLC capacity assessment due to the lack of value of a number of important indicators for its development.

Terebova S.V. follows a similar approach. The author divides the components of potential into groups: resource, effective and managerial components [26]. The methodology lacks gradation of indicators and capacity components by their importance, which, in our opinion, is a disadvantage, as for different purposes of the study different indicators have different significance.

A fragment of the comparative analysis of the methods is shown in Table 2.

None of the methods considered can be used in their original form to assess the potential of TLC as it differs from the functioning of commercial enterprises. The operation of TLC does not mean the development of new technical or other innovations. The work of the complex consists in the effective use of production facilities in order to achieve maximum profit and in accordance with environmental and safety standards. When assessing the innovation potential of TLC, first, it is necessary to analyze the

availability, access and adequacy of resources. The next most important component is the management (internal one). Finally, the experience of innovation introduction should be taken into account as a resultant component.

Table 2. Fragment of comparative analysis of methods for assessing the innovation potential of objects

Analysis criteria	Authors of the methodology			
	Kruglov A.V.	**Evtushenko E.V., Iusupova E.R.**	**Imaikina O.I.**	**Terebova S.V.**
Comprehensiveness of the list of indicators under consideration	–	+	–	+
Consideration of quality indicators	–	+	+	+
Consideration of external factors	–	+	–	–
Simplicity of calculations	+	+	+/–	+/–
Ability to obtain results quickly	–	+	+	+
Consideration of evaluation elements significance	–	+	+/–	–
Objectivity of results interpretation	+	+/–	+	+
Visualization of results	+	–	–	–
Possible solutions for TLC capacity assessment	Visualization as a petal diagram	Impact of external factors on potential; Weighted average assessment	–	Components; Interpretation of results

Source: designed by the authors.

The introduction of innovations in the operation of the TLC invariably entails a modification of the existing infrastructure. New infrastructure creation means availability of free territory, buildings, networks with the necessary capacity and other resources.

The potential of region infrastructure or a separate industry was studied in scientific literature. Il'chenko A.N. and Abramova E.A. in the assessment of the infrastructure potential of the region consider the assessment methodology using the calculation of integral indicators of fund equipment taking into account the specific weight of the region [12].

Dorofeeva L.V. in her methodology for assessing the region proposes to divide 25 indicators for infrastructure assessment into 7 blocks in three focus areas: economics, social sphere, ecology and recreation [5]. However, in all the studied scientific works, the infrastructure potential is studied from the side of the one object competitiveness compared to another or from the side of identification of the trend of development or stagnation of the object. Such techniques are not suitable for the task of assessing the readiness of the infrastructure for innovation. The assessment of the infrastructure component of the potential will make it possible to predict more accurately the financial and time costs of modification and thereby determine the feasibility of the planned changes.

Methodology of TLC innovation potential assessment

To assess the potential, first, it is necessary to identify the purpose of the study. The importance and, accordingly, the weight of the components of innovation potential depends on it.

Based on the analysis results of existing methods and techniques for assessing the potential of facilities, taking into account the specifics of TLC functioning, the components of its innovation potential were identified: resource, management, resultant, infrastructure. Each component assumes assessment of several components by the indicators presented in Table 3.

Thus, it is assumed that a three-level assessment that is made sequentially from indicators to the components. Resource, management and resultant ones form the potential for innovative development.

Table 3. Evaluation indicators of components of TLC innovation potential

Components	Evaluated indicators, unit of measure
Resource component	
Financial component (shows the ability of TLC to attract its own or borrowed funds for the implementation of projects)	• Current liquidity, ratio; • Financial sustainability ratio more than 0.75, binary; • Capital-adequacy ratio more than 0.1, binary.
Human Resources Component (shows availability and readiness of required personnel for implementation and work with innovation)	• Percentage of educated employees with required qualifications; • Managers and specialists with academic degree, share of administrative staff; • Percentage of staff competent in innovation activity; • Competitive wages in the market and staff motivation programs, score.
Production and technical component (characterizes the quality of the technical means involved in the production process, the volume of necessary innovations is assumed)	• Capacity utilization of the complex efficiency, the share of actual freight turnover per year to planned one; • Degree of production processes automation, score; • Ensuring the security and compliance with environmental standards in the production process, score; • Organization of machinery and equipment maintenance, score; • Presence of warehouse management systems, binary; • Average loading/unloading speed, cargo units/hour.
Information component (allows to evaluate the availability of information and technologies in the field of innovative transport developments)	• Existence of contracts with research organizations, binary; • Participation in industry exhibitions, events, binary; • Availability of subscriptions to industry information resources, databases, binary.
Management component	
Management and organizational component (shows how ready the company is for innovations introduction, assesses the internal ability to transform the necessary resources into results)	• The company has an innovative development strategy, binary; • Presence of a structural unit that analyzes the latest developments in the industry, binary; • Share of specialists with higher specialized management education; • Good internal communications in the company, score; • Efficiency of using budget funds, score; • Efficiency of implemented projects, average for the last 3 (PI) > 1, binary.
Marketing component (shows the opportunity to explore the market and competitors, as well as constant analytics of own performance)	• Presence of a structural unit of the market research, binary; • Availability of employees analyzing the efficiency of production processes, binary; • Customer loyalty system, binary; • Brand recognition, score.
Resultant component	
Experience of working with innovative projects (allows to understand how long and successfully the TLC innovation strategy has been working, shows intentions for development)	• Successful implementation of ready innovations in TLC activities, score; • Agreements existence with third-party companies for testing innovations, binary.
Infrastructure component	
Territories (shows the possibility to build new infrastructure innovative facilities on the territory of the complex)	• Availability of free area for construction within the TL complex, binary; • Availability of industrial construction areas within 5 km from the TL complex, binary.
Stand-alone buildings (assesses the possibility of demolition or reconstruction of existing infrastructure facilities when introducing innovations)	• Availability of reserve buildings, constructions – evaluated, binary; • The share of warehouses built less than 30 years ago.
Transport and equipment (shows the need to upgrade transport and equipment for innovation introduction)	• Share of vehicles produced less than 20 years ago; • Share of handling and other equipment produced less than 20 years ago; • Share of office equipment exploited for less than 3 years.

End of table 3

Engineering facilities (assesses the need to expand or update communication, information and other networks to ensure the necessary indicators during the implementation of innovations)	• Share of qualitative pavement; • Availability of power supply reserve for connection of additional consumers, binary; • Presence of a connected fiber-optic communication line (FOCL), binary; • Network connection reserve (heating, water supply, drainage), binary.

Source: designed by the authors.

The infrastructure component is assessed separately and reflects the readiness of the infrastructure to modernize and introduce technological innovations.

Each element, component and indicator has weights corresponding to the level of assessment, which are assigned by experts with experience in scientific and/or practical activities in the field of transport and logistics for at least 5 years.

Assignment of the values to indicators depends on the type of the indicator: absolute, relative, binary or qualitative. To evaluate binary and quantitative indicators, it is necessary to collect information, qualitative indicators are evaluated by a group of experts using a point method, which includes at least three TLC managers. Qualitative indicators are evaluated on a five-point scale. At the same time, it is necessary to set both the actual value of the evaluation object and its possible best value, which is related to the characteristics of innovative TLCs of the second type (Table 1).

After evaluating the indicators, the actual and best values for the elements and components should be calculated sequentially by the formula:

$$P = \sum_{j=1}^{n} R_j * W_j, \quad (1)$$

where P is TLC innovation potential; n is the number of components/elements of innovation potential; R_j is j component/element of innovation potential; W_j is weighting coefficient of j component/element.

Finally, for the components of the potential, a petal diagram is designed and the value of the actual potential and its relation to the best one are calculated. The obtained value is evaluated on the following scale: 0–33% defines low level, 33–66% defines medium level, 66–100% defines high level of potential.

Figure 1 shows the sequence of TLC innovation potential assessment.

Figure 2, depending on the values obtained, shows the variants of result interpretation at the final stage.

Interpretation of the results begins with the potential for innovation development, since it is this potential that shows the possibility of introducing innovations as such. In case of low capacity for innovative development, a plan for improving individual components and indicators is needed. The results of the infrastructure component assessment show the possibility of introducing innovations that require the TLC infrastructure transformation to different extent.

Approbation of the developed methodology using the example of MSCC Bronka

Approbation of the method was carried out based on data of MSCC Bronka, located on the shore of the Gulf of Finland, 10 km from the Lomonosov city.

Based on the master plan and the information received, the existing TLC infrastructure facilities were systematized into five zones: a container terminal, a general and rolling cargo terminal, a customs zone, a service and administrative zones. Each zone has separate buildings and structures, transport and equipment, including communication equipment, intelligent video cameras, access and control systems, as well as engineering facilities. Among the innovative objects are: Kotta container, data collection terminals, network equipment, IoT sensors. The following products have also been introduced in order to automate internal workflow processes: 1C Enterprise, BIT.FINANCE: Management accounting, Directum. Warehouse Management System with web enhancement module has been implemented in the production process organization.

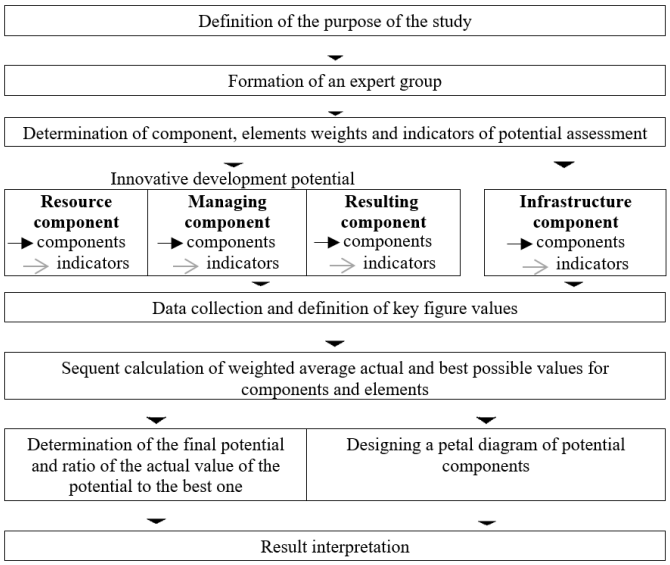

Fig. 1. The innovation potential of the TLC evaluation logic. *Source*: designed by the authors.

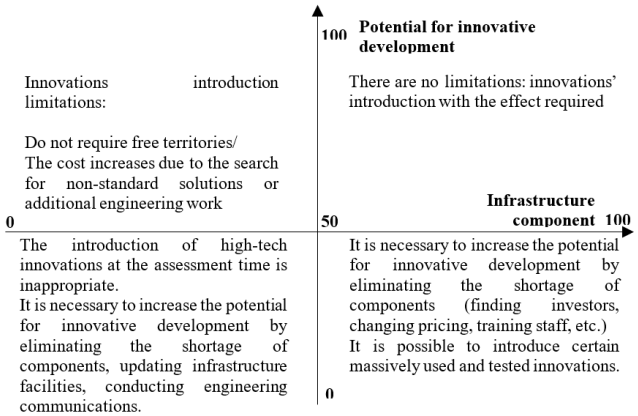

Fig. 2. Interpretation of TLC innovation potential assessment results. *Source*: designed by the authors.

Based on the activity analysis of MSCC Bronka in comparison with its competitors, SWOT-analysis and systematization of its infrastructure objects, its type of innovativeness belongs to the first one. Introduced innovative technologies ensure its competitiveness, but the level of competition remains high and requires intensive innovative development. In accordance with this, the aim of assessing the innovation potential of MSCC Bronka is to determine the possibility of innovative development of the complex by introducing the latest technologies and techniques into the existing infrastructure.

By the calculations results, according to the developed methodology, the value of the potential for innovative development was obtained. It is equal to 5.4 out of 7 possible, which is 77% of the maximum. The value of the infrastructure component corresponds to 82% of the maximum. The evaluation results of the separate components are shown in Figure 3.

The innovation potential components of MSCC Bronka are unevenly developed: the components that characterize the financial side of the port, personnel and production and technical are not sufficiently developed. Based on the performed studies' results related to MSCC Bronka, priority tasks were identified to ensure innovative development: increasing the level of cargo turnover, ensuring the equal

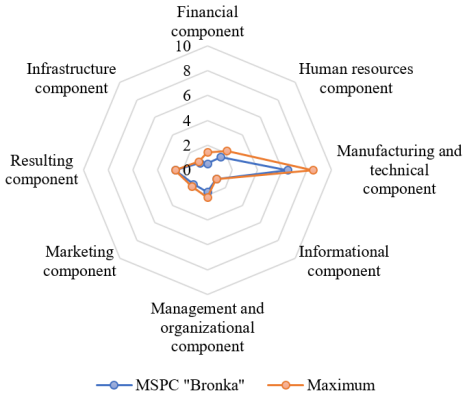

Fig. 3. Results of the innovation potential of MSCC Bronka evaluation. *Source*: designed by the authors.

load of warehouse space and terminals, increasing financial security, providing personnel competent in the innovation field, improving environmental friendliness and reducing labor costs.

Discussion

As a result of the methodology approbation, the possibility of innovative development of TLC was determined, underdeveloped components of the potential were identified and the main tasks that should be solved for the introduction of modern technologies into the infrastructure of the complex were set. The objective of the evaluation was achieved. All necessary available and reliable analytical information was collected and processed for the evaluation. Comprehensiveness of evaluation is ensured through synthesis of different methods and best practices, as well as through the three-level approach based on several components, elements and indicators.

Considering the developed methodology in comparison with studied ones, it should be noted that the methodology allows assessing the possibility of TLC to introduce innovations from the point of view of infrastructure modification.

Thus, in contrast to existing methods for assessing the potential of objects, the author's methodology is complex; it takes into account the infrastructure component of the complex and the specifics of transport and logistics systems operation in specific indicators. At the same time, the technique has no restrictions for application from the perspective of TLC type, territorial location, occupied area and production capacity, specialization. To the common advantages of the methodology belong the completeness of the list of various types of indicators under consideration, the simplicity of calculations, the ability to obtain results quickly, taking into account the significance of evaluation elements, and visibility of the results.

However, there is a subjective factor in setting weights and estimating score points.

Conclusion

In the course of the study, the worldwide experience of introducing innovations to improve the efficiency of TLC was examined, which made it possible to determine the criteria for assigning TLC to one of three types in terms of innovation, the main of which is the share of automated production processes. At the same time, the innovation of TLC also determines the availability of infrastructure such as autonomous transport, specialized facilities to ensure the operation of high-tech equipment, high-speed Internet access networks, IoT sensors, innovative environmental and safety monitoring systems.

The analysis of existing methods and techniques for assessing the potential of facilities showed that at the moment there is no tool for an integrated assessment of the innovation potential of TLC, taking into account its specifics. At the same time, solutions applicable for the development of the author's

methodology were identified, which involves assessing the innovation potential of TLC according to the elements of four components: resource, management, resultant, infrastructure. The evaluation results show the availability of resources for innovative development and the possibility of infrastructure for the introduction of innovative technologies. If estimates of the infrastructure component are low, there appear significant restrictions for the type of innovations to be introduced or additional financial and time costs.

For approbation of the developed methodology, the evaluation of the MSCC Bronka was carried out. The evaluation showed the presence of high innovation potential that is not fully realized owing to a lack of some components. In particular, the instability of the financial situation, lack of staff experience in working with innovations, insufficient and unequal loading of the terminal, lack of environmental innovation were identified. The approbation results proved the practical applicability of the method.

Thus, all the study tasks were solved. In the future, it is advisable to consider the possibility of improving the objectivity of the assessment and deeper and more detailed interpretation of the results, as well as clarifying the values of the innovation criteria of TLC.

The results obtained are of practical importance for the design of strategy and policy for the innovative development of transport and logistics structures both at the federal and regional levels.

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INFORMATION ABOUT AUTHORS / СВЕДЕНИЯ ОБ АВТОРАХ

ЛЕБЕДЕВА Анна Сергеевна
E-mail: aslebedeva11@gmail.com
Anna S. LEBEDEVA
E-mail: aslebedeva11@gmail.com
ORCID: https://orcid.org/0000-0002-5353-3885

БУДРИНА Елена Викторовна
E-mail: boudrina@mail.ru
Elena V. BUDRINA
E-mail: boudrina@mail.ru
ORCID: https://orcid.org/0000-0001-6719-7264

РОГАВИЧЕНЕ Лариса Ивановна
E-mail: rogavichene@list.ru
Larisa I. ROGAVICHENE
E-mail: rogavichene@list.ru
ORCID: https://orcid.org/0000-0002-7052-4227

БУЛАТОВА Надежда Николаевна
E-mail: bulatova_nad@mail.ru
Nadezhda N. BULATOVA
E-mail: bulatova_nad@mail.ru

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