**Sustainable Transport Technologies Current to Reach into Account Received Without of the Region Logistics Potential Assessment**

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**Abstract.**This article presents an integral approach to assessing the transport and logistics potential of a region, considering infrastructure, transport product, spatial location, and organizational aspects. The aim of the study is to develop a comprehensive indicator for evaluating and comparing the transport and logistics potential of different regions, enabling the formulation of strategies to enhance their competitiveness. The methodology is based on an integral indicator that combines four key coefficients: infrastructure Kinf, transport product KPL, spatial location Kfj, and organizational aspects Ktj. Weight coefficients are determined using the Fishburne rule, ensuring an objective distribution of indicator significance. Formulas for each component are developed using accessible statistical data, making the method applicable across various regions. The research results demonstrate that the proposed integral indicator allows for a comprehensive assessment of transport and logistics potential, identifying strengths and weaknesses in a region's transport system. The approach is characterized by simplicity of calculations, data accessibility, and universality of application. The conclusions emphasize that the developed method can be used for strategic planning and decision-making in transport infrastructure and logistics development. Limitations of the method relate to the need for up-to-date data, particularly in digitalization and transport environmental friendliness. Further development of the model is recommended, incorporating additional indicators such as energy efficiency and innovative transport technologies.

**Keywords:** infrastructure, transport capacity, transport availability, transport services, transport product, spatial location, contextual aspects

**INTRODUCTION**

The transport and logistics potential of a region is one of the key factors determining its economic development and competitiveness. An efficient transport system ensures the smooth movement of goods and passengers, which is critical for sustainable economic growth. However, assessing transport and logistics potential is complicated by its multifactorial nature, including the state of infrastructure, the volume of transport services, geographical location, and organizational aspects such as digitalization and personnel qualifications. Existing assessment methods often focus on individual components without considering their interrelationships, leading to an incomplete picture.

The purpose of this study is to develop an integral indicator for the comprehensive assessment of a region's transport and logistics potential, taking into account infrastructure, transport product, spatial location, and organizational aspects. The main research questions include: how to measure each of these components? How to determine their relative importance? What data are needed for calculations? In the literature, transport and logistics potential is often viewed through the lens of physical infrastructure, but comprehensive approaches that include digitalization and human resources remain understudied. The proposed integral indicator addresses this gap by providing a universal tool for assessing and comparing regions [1, 2, 5].

**METHODS**

Formulas and descriptions for each component Kinf, KPL, Kfj, Ktj are structured. Fishburne table is included for clarity.

The resource potential of the region mainly describes the state of transport and logistics infrastructure, the transport product describes the volume of services provided by existing transport companies, the spatial location takes into account the convenience of transport, while organizational aspects describe new projects, digitalization, and staffing (Figure 1).

groups

resources (infrastructure)

spatial location

organizational aspects

A group of indicators that determine the transport and logistics potential of the region

Production

Non-production

transport product

**FIGURE 1.** Components of transport - logistics capacity

The resource part of transport potential reflects the state of development of the region's transport and logistics infrastructure in terms of the availability of transport systems and the level of their utilization.

Some sources consider transport and logistics capacity and transport and logistics infrastructure separately. They are two different, but interrelated, concepts in the field of transport logistics [4].

Transport and logistics capacity is the sum of the resources, capabilities and conditions of the transport system of a given region or country to perform the functions of transporting goods and passengers. It includes not only physical resources (for example, the number and quality of vehicles, the capacity of transport nodes (terminals)), but also human resources (qualifications of personnel), as well as economic factors (financial capabilities and investments). Transport and logistics capacity can also take into account the level of development of technologies, logistics services and other aspects that contribute to increasing the efficiency of transport operations [3].

Transport and logistics infrastructure is considered to be physical objects and structures that ensure the movement of goods and passengers, including highways, bridges, railways, airports, terminals, ports, etc., and serves as the basis for the operation of transport and logistics capacity, providing the necessary conditions for transportation and storage.

It is important to note that infrastructure can be important for developing transport and logistics capacity, but the presence of good infrastructure does not always guarantee high levels of transport capacity if other necessary resources are not available.

Thus, the main difference between transport and logistics capacity and transport and logistics infrastructure is that the former is a general concept that includes various aspects and resources, while the latter is specific physical objects and structures that provide movement [7, 9, 10].

The following formula is used to assess the transport potential of a region using an integral indicator:

(1)

where: *K inf* – coefficient of the transport and logistics infrastructure indicator of the region; *K PL –* coefficient of the transport product indicator of the region; *K fi –* coefficient of the spatial location indicator of the territory;   
*K tj –* coefficient of the indicator of organizational aspects of the territory; w 1 , w 2 , w 3 , w 4 – coefficient characterizing the significance of the indicators.

The advantages of the developed integral indicator are as follows [6]:

• simplicity and transparency of the step-by-step formation of an integral (complex) indicator;

• availability of all necessary primary statistical data for general use;

• the possibility of application regardless of any individual characteristics of the territories.

The system of indicators selected for assessing the transport potential of the region was comprehensively reviewed. For this, an integral indicator was developed, which includes four indicators with different levels of importance. Specific aspects reflecting the importance of each of the components: the more important the indicator, the greater its relative weight, and vice versa [1, 7].

The Fishburne rule is used, which involves determining the indicators in order of decreasing significance according to the formula (a 1 ≥a 2 ≥…a n ):

(2)

where: n – the number of indicators accepted for evaluation

**TABLE 1.** The significance level of indicators determined according to Fishburne's rule

|  |  |  |
| --- | --- | --- |
| Indicator | Place | Level of importance |
| Infrastructure | 1 | 0.4 |
| Transport product | 2 | 0.3 |
| Spatial location | 3 | 0.2 |
| Organizational aspects | 4 | 0.1 |

Sub-groups (subcomponents) of the production group are considered separately.

To assess the state of the region's transport and logistics infrastructure, we base our assessment on its aggregate (integral) indicators: the coefficients of provision with transport and logistics enterprises, the provision with operational communication routes, the provision with transport and service facilities, and the provision with rolling stock:

(3)

(4)

(5)

(6)

where: – the number of transport and logistics enterprises in the area; – length of paved roads in the region, km; – number of transport service facilities in the area, pcs; – the number of vehicles carrying out international transportation in the region; – the total number of vehicles (automobiles) in the region.

Using these formulas, it is possible to determine the development coefficient of the transport and logistics infrastructure of the region:

(7)

where: n – number of districts.

The second subgroup (subcomponent) of the production group is transport output, which mainly describes the work performed by transport in ton-km.

In practice, the volume of transport work is expressed through coefficients that take into account various operational indicators that affect the efficiency and size of transportation. These are:

- the level of utilization of freight transport distance;

- carrying capacity of the vehicle;

- number of trips;

- speed of movement;

- vehicle loading.

The load capacity (coefficient) of a vehicle is determined by the ratio of the actual volume of cargo loaded on the vehicle to its maximum load-bearing capacity:

(8)

Distance utilization coefficient - determined by dividing the distance traveled by a vehicle with a load during a trip by the total distance:

(9)

The coefficient of time spent on performing transport work is found by dividing the actual time spent on performing the trip by the planned time spent on the trip:

(10)

Frequency coefficient – is determined by the ratio of the number of trips made during a certain period to the time period:

(11)

Road condition quality coefficient - determined by the ratio of the part of international, state and local roads with a "satisfactory" rating to the total length of roads in the period under review:

(12)

Seasonality coefficient K mavs – the effect of the season on the transport volume, K mav – 0.7 for the winter season;   
1.1 for the summer season.

Considering that the integral indicator should be between 0 and 1, we will take the average result of the transport performance indicator as the evaluation criterion.

The transport work coefficient can be described as follows:

(13)

where: *n* – the number of indicators taken into account.

The first subgroup of the non-production group is the spatial location of the economic territory.

Spatial location is the set of factors and characteristics that determine how and why certain activities, populations, and resources are concentrated in a given geographic area [8, 10].

The spatial layout of a territory is closely related to transport, and the placement of facilities and infrastructure directly affects transport processes.

The density of a transport network is a characteristic that describes the number of transport nodes and routes in a given geographical area. A dense transport network helps to move people and goods more efficiently, reduce travel times, and improve the use of services.

The density of the transport network describes the extent to which an area is provided with transport routes. For road transport, it indicates how many hard-surfaced public roads there are per km2 of the area.

In rail transport, the density of the transport network is found by determining the number of kilometers of railway per capita in the area.

* for road transport:

(14)

where: – operational length of transport routes, km; – area of the territory, km2.

* for rail transport:

(15)

where: – operational length of the railway; – population of the area.

In addition, the area must have a convenient environment for residents to use transport services, which can be determined by the following formula:

Coefficient of ease of use of transport services:

(16)

where: – number of transport stops or terminals; – area of the territory, km2.

Cost-effectiveness coefficient of transport services:

(17)

where: Q t – cargo volume in 1 ton; *l –* distance, km.

We describe the spatial location model based on indicators as follows:

(18)

We will determine the current status of prospective programs related to the regional transport system based on the following formula.

Level of development of promising programs (regarding transport infrastructure):

(19)

where: –Prospective programs developed for the transport and logistics activities of the Khorezm region;   
– Promising programs developed across the republic.

A number of tasks have been set in the Republic of Uzbekistan for the digitalization of transport activities within the framework of the "Digital Uzbekistan-2030" strategy.

There are few national digital programs that are needed for transport companies and private carriers. Therefore, it is necessary to assess the level of development of this issue, which we will determine through the transport digitalization coefficient.

Transport digitalization coefficient:

(20)

where: – the number of digital solutions in transportation (e.g., number of smart stops, traffic monitoring applications, etc.); – total number of active transport units.

The organizational aspects should include the share of potential personnel in the logistics sector. Because the successful operation of transport and logistics enterprises in the country or in the global transport services market directly depends on these personnel. The potential of personnel is manifested in their ability to use new information technologies, develop various programs, know foreign languages, conduct marketing research to strengthen customer relationships, and apply various regulatory and legal information in their activities. Based on this, the level (coefficient) of provision with qualified personnel can be assessed as follows:

(21)

where: – the total number of personnel with higher education in the field of transport logistics, people;   
– number of transport enterprises in the region, pcs.

Transport environmental friendliness level Special attention should be paid to road transport.

When determining the level of environmental friendliness of transport, we take into account that currently in the CIS countries, road transport must meet at least EURO-4 requirements, and determine the number of vehicles permitted for international transportation in the region as a ratio to the total number of vehicles.

(22)

where: – these are vehicles that meet stricter emission standards (e.g. EURO-5 or EURO-6), reflecting progress in reducing environmental impact; – vehicles with sustainable technologies that have minimal or zero emissions (e.g. electric vehicles); – total number of trucks in the region, units.

Taking into account all organizational indicators, its current level can be determined as follows:

(23)

**RESULT**

Using the method, we evaluate the transport and logistics potential of Khorezm region.

**TABLE 2.** Evaluation criteria

|  |  |  |  |
| --- | --- | --- | --- |
| **Index** | **Indicator level** | | |
| **low** | **average** | **high** |
| Transport capacity | ≤ 0.50 | 0.50 < f <0.80 | >0.80 |

According to Table II, the obtained value Trs=0.461 falls into the “Low” category, since: Trs=0.461≤0.50Trs.

This indicates that the transport potential of the Khorezm region is currently low. However, it also suggests that there are untapped or underutilized resources and opportunities that, if developed (especially in financial and geographical aspects), could significantly improve the region’s logistics and transport efficiency.

**CONCLUSION**

The developed integral indicator of a region's transport and logistics potential represents an effective tool for the comprehensive assessment of the transport system. It integrates key aspects such as infrastructure, transport product, spatial location, and organizational factors, providing a holistic view of the region's status and capabilities. The application of the Fishburne rule to determine weight coefficients ensures objectivity and balance in the assessment. The methodology is distinguished by its simplicity of calculations and data accessibility, making it applicable to various regions without requiring significant resources.

A key outcome of the study is the demonstration that the integral indicator can be used to identify the strengths and weaknesses of the transport system, as well as to compare regions and develop development strategies. A limitation of the method is its dependence on current and accurate statistical data, especially in the areas of digitalization and transport environmental friendliness, which necessitates regular data updates. Future research is recommended to expand the model by including additional indicators, such as transport energy efficiency and the level of innovative technology adoption. This will make the assessment even more comprehensive and aligned with contemporary sustainable development challenges. The proposed approach can serve as a basis for informed decision-making in transport policy and strategic planning.

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