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THE SOCIO-ECONOMIC IMPORTANCE AND THEORETICAL APPROACHES TO THE DEVELOPMENT OF TRANSPORT SERVICE INFRASTRUCTURE IN THE CONDITIONS OF A GREEN ECONOMY

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Abstract:

The concept of a green economy encompasses scientific ideas of economics such as resource-saving economy, ecological economics, environmental economics, green policy, the theory of international economic relations, economic modernization, and innovative economy. The green economy considers green transport and the transport infrastructure that creates the conditions for its functioning as one of the system-forming sectors of the regional economy, ensuring the territorial integrity of regions and the unity of their economic space. Therefore, the development of transport infrastructure is a necessary condition for implementing an innovative model of economic growth and improving the quality of life of the population in the region. In the article, the author describes the socio-economic significance and theoretical approaches to the development of transport service infrastructure in the context of a green economy.

Keywords: green economy, transport, services, green space, infrastructure, competitiveness, region, technocratic, function, investment, innovation, road transport, air transport, pipeline, waterways, communication lines, highways, tunnel, overpass, bridge, station, railway, bus station, metro, aerodrome, airport, navigation

INTRODUCTION: The development of the Republic of Uzbekistan in accordance with the requirements of a "green economy" is considered one of the most important tasks. Therefore, the regulatory legal documents adopted in our country in this regard serve as an important economic foundation. According to the "Uzbekistan–2030" strategy adopted on September 11, 2023, in our republic, the task of expanding the nationwide project "Green Space," aimed at stabilizing the ecological situation as an important basis of the economy, has been defined. This, on the one hand, creates opportunities for developing our economy in line with the requirements of a "green economy," and on the other hand, provides the necessary conditions for implementing systematic measures such as stabilizing the ecological situation in our country and expanding green areas. Therefore, conducting in-depth scientific research in this field is especially important for explaining to young people the economic foundations of the transition to a "green economy," as well as substantiating its economic mechanisms and providing students with deep knowledge on the efficient use of available resources in this direction.

The service sector is a key driver of the rapid development of the global economy, and its growth opens up significant economic opportunities. Unlike material production, this sector is primarily focused on performing functions and providing intangible services to customers. It is considered the largest driver of global economic activity and holds particular importance due to the wide range of employment opportunities in service provision. Therefore, studying the socio-economic essence of developing the infrastructure of the service sector is one of the main tasks today.

The success of regional socio-economic systems largely depends on certain conditions that create opportunities for the effective development of material production and social life. In the formation of such conditions, regional infrastructure—closely linked to a specific territory and its service functions—plays a key role.

Ensuring the sustainable development of countries around the world, comprehensively developing and supporting the territorial integrity of their economic space, as well as increasing the efficiency of the use of economic resources, raises the issue of creating a balanced regional infrastructure. Its most important component is transport infrastructure, which makes this issue highly relevant.

At present, various approaches and factors influencing regional development (such as differentiation of regions based on resource distribution,

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unfavorable geographical location, and limited investment flows) indicate that the current transport infrastructure system does not provide sufficient opportunities for the service sector—particularly transport services—to become a driver of the economy. As evidence, it can be noted that by the end of 2025, the share of the service sector in GDP is expected to reach 44.1%, while the share of transport services within the service sector amounts to 85,198.4 billion soums [1].

President Sh. M. Mirziyoyev emphasized: *"This sector is the lifeblood of the economy. Without bringing transport and logistics to a new level, we cannot ensure sustainable economic development"* [2]. It is also noted that competition in aviation has not been fully formed, and the efficiency of 10 airports remains low. As a result, the country ranks 120th among 160 countries in the International Logistics Performance Index in terms of delivery convenience at competitive prices. The head of state has outlined measures to sharply increase railway transit potential, transform aviation into a convenient, fast, and high-quality service sector, and expand the network of modern highways for international transit cargo.

LITERATURE REVIEW: The issues of formation and development of transport service infrastructure and transport systems in the context of a green economy have been studied in the scientific works of A. P. Abramov, V. M. Buneyev, G. V. Veselov, V. G. Galaburda, V. V. Gasilov, A. E. Gorev, E. A. Gorin, Yu. V. Zadvorny, P. V. Kurenkov, V. I. Mineyev, L. B. Mirotin, N. V. Penshin, and others.

In economic science, the American scholar P. Rosenstein-Rodan was the first to use the term "infrastructure," and he distinguished between production (economic) and social infrastructure [3].

The German researcher R. Jochimsen made a significant contribution to the development of the concept of infrastructure [4]. He defined infrastructure as a set of various conditions (material, institutional, and individual) necessary for creating a unified and continuous economy. He was also the first to propose classifying infrastructure based on the characteristics of the conditions supporting its formation.

D. Kotz [5] considers infrastructure as a separate category of management—namely, infrastructure management—and views it as one of the economic functions of organizations operating within the sphere of administrative and economic services.

Ye. B. Alayev [6] emphasizes that infrastructure is a unified complex of objects not directly related to production, but serving as factors of development for both production (production infrastructure—transport, water supply, electricity, communications, etc.) and the social sphere (social infrastructure—education, healthcare).

A. I. Kuznetsova [7], in her scientific research, examines the infrastructure sector based on a geo-economic approach, suggesting that it should derive its name from the geo-economic paradigm. In this context, she considers the geographical location of infrastructure to be of key importance. The scholar also discusses the role of geo-economic approaches in infrastructure, but pays less attention to its efficiency indicators.

Another Russian scholar, Ye. G. Kochetov [8], in his scientific studies, highlights the potential of infrastructure and notes that, under globalization conditions, it serves as a key element in achieving competitive advantages for regions. However, he does not elaborate on how these advantages increase infrastructure efficiency.

S. S. Nosova [9] states in her work that infrastructure "ensures the general conditions of production," which in turn is "necessary for the effective development of the entire economy and the daily life of people in any region." At the regional level, she defines infrastructure as a set of objects or structures serving a specific territory.

V. N. Stakhanov [10], in his scientific views, describes infrastructure as a dynamic system formed through the integration of various sectors and types of activities within the national economy, aimed at creating general conditions for production activities and human life. Thus, it can be understood as a type of activity that unites different sectors and branches of the economy.

L. G. Serebryakov and V. V. Yanovsky [11] also present their views, defining transport infrastructure as a set of transport communications included in engineering infrastructure, along with other facilities that ensure passenger and freight transportation. They consider it a fundamental component contributing to the sustainable development and functioning of countries and regions. This definition mainly reflects the indicators of the structural components of transport infrastructure and their role within the technical and technological system. According to this definition, the authors emphasize two main socio-economic functions of transport infrastructure—facilitating the movement of people and goods.

Another economist, M. V. Ivanov [12], in his scientific work, notes that creating a system of organizational and economic measures for the development of transport infrastructure cannot be limited solely to indicators of transport usage, since it is difficult to account for all the numerous factors that

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significantly influence its functioning. However, he does not address the specific features and capabilities of transport service infrastructure, which highlights another aspect that needs to be explored in our research.

O. A. Lebedeva, Yu. O. Poltavskaya, Z. N. Gammayeva, and T. V. Kondratenko [13] consider a fairly broad range of tasks intended to ensure transport infrastructure and emphasize that through these, transport infrastructure should not only perform its functions but also fully satisfy customer needs.

A review of economic literature shows that in many studies, transport infrastructure within public infrastructure, or transport assets derived from infrastructure, are included as a separate capital variable in measurement models used to assess production flexibility. Alternatively, their relationship with economic growth, changes in regional industrial structure, micro-individual behavior, and the specific impact of transport service infrastructure has been analyzed [14].

RESEARCH METHODOLOGY: The study analyzes the socio-economic importance and theoretical approaches to the development of transport service infrastructure in the context of a green economy. Within the scope of the research, methods such as induction and deduction, comparative analysis, and the study and analysis of scientific research conducted both abroad and in Uzbekistan were used. Based on the collected data, a comparative analysis method was applied to deeply examine the problems and develop scientifically grounded conclusions and recommendations.

ANALYSIS AND RESULTS: As a component of the regional service infrastructure complex, transport service infrastructure performs specific functions. At the same time, its economic essence and its role in shaping the region are determined by its main aggregate function—ensuring regional and interregional transport and economic relations.

In the conditions of a green economy, transport service infrastructure plays an important role in the spatial distribution of production. Without considering transport communications, it is impossible to achieve the rational placement of productive forces. Taking into account the demand for transport services, the possibilities of delivering finished goods, the characteristics and volume of raw materials, the availability and capacity of transport routes, and the location of enterprises should all be based on the influence of these components. The rationalization of freight transportation affects the efficiency of individual enterprises and, consequently, the production efficiency of regions and the entire country.

The development of transport service infrastructure in the context of a green economy helps create the necessary conditions for sustainable socio-economic development of regions by defining the main directions of their overall development. It also contributes to the formation and improvement of social, industrial, transport, and other engineering infrastructures, as well as systems for preserving the natural and historical-cultural environment. Transport provides a wide range of services, and all its types, which perform the main tasks of ensuring the functioning of national economic complexes in freight and passenger transportation, interact with each other and with most sectors of production. This forms the basis for considering transport systems and their overall formation mechanisms as an integrated whole.

In the context of a green economy, the objects of transport service infrastructure include railways, tramways, and inland waterways, communication lines, highways, tunnels, overpasses, bridges, stations, railway and bus terminals, subways, aerodromes and airports, communication system facilities, navigation and traffic management systems, as well as standards, structures, equipment, and devices that ensure the functioning of transport complexes. Today, in the conditions of a green economy, the term "transport infrastructure" is used in a broader sense. Since the transport sector is always closely linked with the comprehensive development of productive forces, it is studied as one of the most important components of the overall economic infrastructure.

Under a green economy, transport infrastructure is a part of the transport system of cities and states. However, in studying these aspects of the national economy, debates and discussions continue in scientific and political circles regarding the nature, boundaries, and role of the category "transport infrastructure" in the economy. Without a clear understanding of transport infrastructure as a subject of scientific research and public administration, it is impossible to speak about the effective development of the national economy of Uzbekistan.

In our view, under the conditions of a green economy, "transport service infrastructure" includes three main methodological approaches:

- **Technocratic approach** – within this approach, transport service infrastructure forms a specific engineering and technical infrastructure of a region. It represents a technological complex that ensures the fast and uninterrupted provision of transport services.

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- **Functional approach** – within this approach, transport service infrastructure is defined as a set of specific functions that create the necessary conditions for the smooth and rapid implementation of transport service processes.
- **Investment attractiveness approach** – within this approach, transport service infrastructure is considered as a type of regional infrastructure capital (Figure 1).

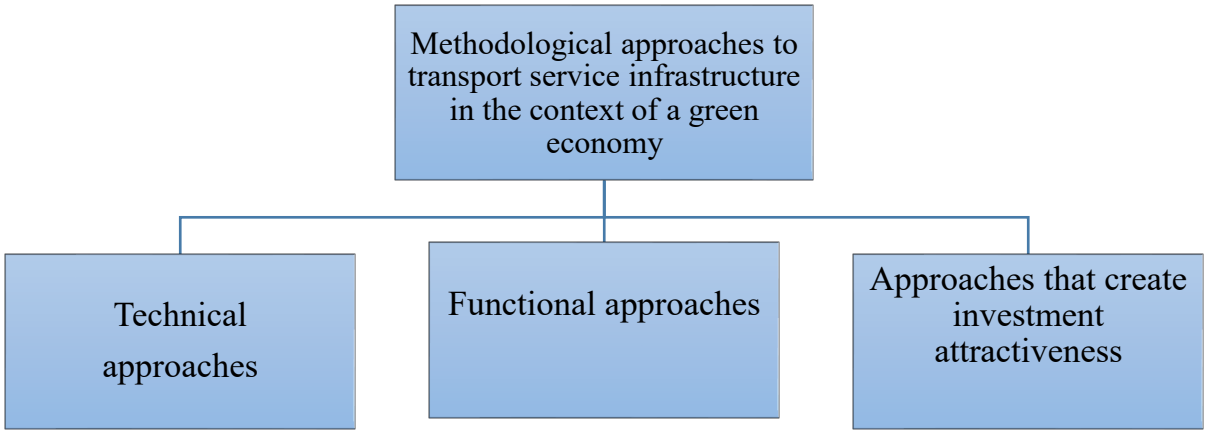

Figure 1. Methodological approaches to transport service infrastructure in the context of a green economy

The author identifies several groups of functions of transport infrastructure: economic (ensuring coordination of national economic sectors and their development); organizational (facilitating transport and economic relations between functional elements of a region or country); production-related (creating conditions for the uninterrupted and efficient transportation of goods and people); and social (reducing the workload on employees by saving travel time and making their work easier).

In addition, transport service infrastructure also performs the following functions: cultural (bringing cultural values closer to the population); scientific (on the one hand, transport infrastructure stimulates the development of various fields of science, and on the other hand, it requires its own improvement, thereby generating scientific problems and tasks); and defense (ensuring the rapid relocation of military units, enterprises, and the population in case of military threats).

From a cost-based approach, transport service infrastructure can be viewed as a specific type of infrastructure capital. Thus, Yu. N. Goltskaya [15] interprets regional transport infrastructure as a form of capital and also studies its unique social nature, expressed in its ability to generate not only economic but also socio-cultural benefits for the region, as well as its synergistic effect. Indeed, we are referring to a broad range of socio-economic relations associated with expanded reproduction at the local level (since a synergistic effect is observed). Transport service infrastructure participates in the formation of final product costs, ensures the existence of social facilities, supports population mobility, and thus makes a direct contribution to gross regional product formation. From the perspective of value reproduction, it should be emphasized that transport infrastructure is a capital-intensive and relatively inert component of the economy. Therefore, its synergistic effect may occur with a significant time lag, which must be taken into account when substantiating development directions. In our view, the amount of capital investment in transport service infrastructure is determined by the overall growth rate and scale of the regional economy. This position is undoubtedly valid, although alternative approaches to infrastructure investment may also consider not only meso-level but also macroeconomic and even global impacts. However, in any case, it is important to assess value flows between territorial and functional subsystems of the country.

It is also necessary to consider another version of the systemic approach. As noted above, within the systemic-technological approach, transport infrastructure is defined as a set of various engineering structures intended for the implementation of transport processes.

According to S. V. Ganzin [16], transport infrastructure is an integral part of transport systems and, in addition to communication lines and terminal facilities, includes auxiliary systems and tools such as

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traffic management systems, communication, information exchange, and others. Following this approach, the authors distinguish technological elements of transport infrastructure that are effective from a management perspective as objects of production.

Using a systemic approach, the study of the category "transport infrastructure" occupies an important place in the works of A. I. Kuznetsova, N. E. Shelestov, and others [17]. Considering transport infrastructure as a system makes it possible to identify the main classification features of infrastructure, including the selection of material for deeper study and the subsequent grouping of its structural components. Transport services, regardless of the mode of transport, together with telecommunications and energy networks, represent one of the key types of infrastructure and play a fundamental role in the national economy.

It can be stated that the scientific community recognizes the importance of developing the service sector of transport infrastructure (Table 1).

Table1
Various approaches to revealing the socio-economic essence of the concepts "transport infrastructure" and "transport service infrastructure"

Authors	Definition
L. Serebryakov, V. Yanovsky	Transport infrastructure is a part of engineering infrastructure… it ensures the transportation of goods and passengers within settlement systems and territories, as well as the sustainable development and functioning of settlements and inter-settlement areas.
A. B. Maksimov	Transport infrastructure is a set of public passenger transport routes intended to provide public transport services within a territorially defined administrative boundary (municipality) for passenger transportation.
E. A. Zhukov	The importance of transport infrastructure in increasing the socio-economic efficiency of state development lies in reducing transport costs, decreasing the "transport intensity" of social reproduction, minimizing all types of losses and damages in transport processes, and improving the quality and accessibility of transport services for the population.
OECD (Organization for Economic Cooperation and Development)	Transport infrastructure is an important component of economic development at all income levels, supporting personal welfare and economic growth. From a functional perspective, transport infrastructure is a type of large-scale public work that has an impact on countries' politics, economy, society, science, technological development, environmental protection, public health, and national security.
B. Flyvbjerg	Transport infrastructure has the main characteristics of general infrastructure such as high risk, high investment requirements, complex organization, and low profitability.
Martin P., Rogers C. A.	Transport infrastructure is often understood as the totality of all types of transport systems and structures aimed at creating favorable conditions for the functioning of all sectors of the economy.
M. Q. Pardayev, Q. J. Mirzayev, O. M. Pardayev	Transport service refers to the purposeful activity of transport workers aimed at satisfying the needs of individuals, labor collectives, territories, states, and society for passenger and freight transportation through quality service delivery.
Kasatkin F. P.	The transport services market is a heterogeneous, multi-approach structure whose characteristics may vary depending on the consumer properties of services and the composition of consumer groups.
Ryabchinsky A. I.	Transport services are a type of transport activity aimed at satisfying human needs and characterized by the availability of necessary technological, economic, informational, legal, and resource support.

Based on the analysis of the definitions presented in Table 1 above, we propose the following definition of transport service infrastructure:

"Transport service infrastructure is a special sector of the national economy represented by a complex of engineering facilities aimed at ensuring the continuity of

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all processes related to freight and passenger transportation services, including technical services, waiting, coordination, and other related processes, by creating the necessary conditions for them."

Thus, in our view, transport service infrastructure objects serve to support the activities of transport service provision. In other words, transport service infrastructure enables transport services to function and operate effectively.

Based on the above definitions, and considering the specific characteristics of transport service infrastructure as well as the features of the transport environment, the category "types of transport services" can be presented as a concentration of its five main segments shown in the diagram (Figure 1).

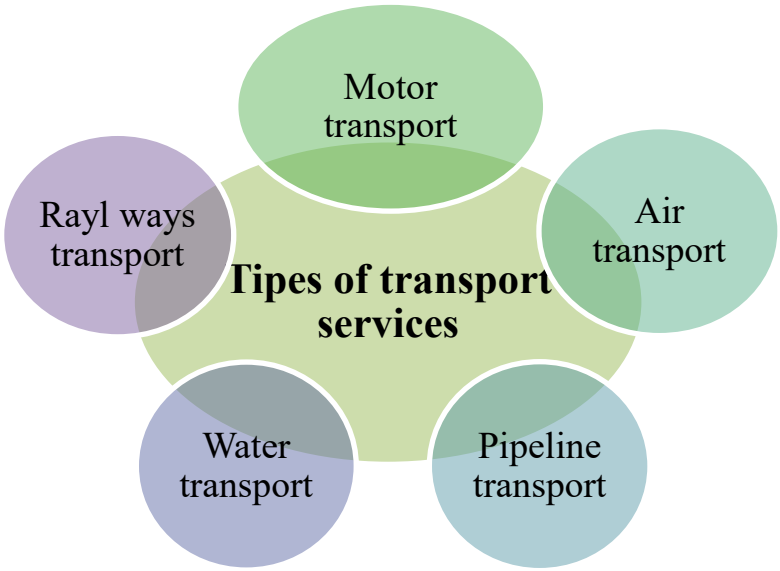

Figure 1. Types of transport service delivery tools in the context of a green economy.

However, the ideas of transport infrastructure as an element of the economic system and as a component of the transport complex differ to some extent and are based on different approaches. These include:

1. functional approach;
2. systemic approach.

Each approach offers its own interpretation of the concept of "infrastructure" in the transport sector. In order to develop a complete understanding of "transport infrastructure" as a research object, the results of these approaches should be analyzed in the summary presented below.

Transport infrastructure plays an important role both within cities and across the entire country, as it performs a number of functions essential for the national economy:

- **Integral function** – all types of transport contribute to ensuring the stable functioning of the state or city, as well as the existence of individual regions, institutions, and other entities;
- **Mobility function** – transport infrastructure provides citizens, including foreign nationals, with the opportunity to move within the country, enter, and exit it;
- **Competitive function** – since transport services do not create a material product but rather provide services consumed in production processes, its most important task is to transport goods for enterprises in other sectors in less time and with lower physical losses compared to competing transport companies;
- **Market function** – as a facilitator of commodity circulation, it ensures the full functioning of market mechanisms at the city, national, and international levels.

The general characteristics of the presented infrastructure distinguish transport infrastructure from other industrial sectors, allow it to be presented as a system of elements, and, based on its functional features and segmentation depending on the movement environment shown in Figure 2, enable its classification (Table 2).

All types of transport service infrastructure face issues related to the need for long-term development, mutual competition, and the requirement to ensure monitoring

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of the current condition of existing infrastructure facilities, as well as systems for their reconstruction and maintenance. When designing new engineering structures and improving existing ones, it is necessary to ensure the strength and continuous operation of facilities, as well as their reliability, while also guaranteeing the safety of transport users and pedestrians.

Table 2
Classification of transport service infrastructure objects by types and functions in the context of a green economy

Functions	Road transport	Railway transport	Water transport	Air transport	Pipeline transport
Providing basic conditions for the movement of transport vehicles	Roadways, bridges, tunnels, ferries	Railways, bridges, tunnels, ferries	Canals, lakes, canal-bridges, sea and ocean routes	Runways, taxiways	Pipelines, main pipeline systems
Coordination of transport vehicle movement	Traffic lights, road signs, markings, barriers	Semaphores, switches	Beacons, radio stations	Landing lights, control towers	Compressor units and stations
Waiting infrastructure for cargo/passenger transport	Warehouses, logistics centers, bus terminals, stops	Warehouses, logistics centers, marshalling yards, railway stations, metro and monorail stations, tram stops	Warehouses, logistics centers, port passenger waiting halls, river stations	Airport waiting halls, airport warehouses	Underground gas storage facilities, storage tanks (for oil, water, etc.)
Energy supply for transport movement	Petrol, gas and electric fueling stations	Communication systems, railway power and communication networks	Coastal or floating fueling stations	Airport fuel complexes, fuel tankers	

Transport infrastructure provision indicators can be grouped into two main categories. Capacity indicators reflect the state of transport infrastructure in a given territory, expressed through measures such as the total length of highways or the number of railway stations (Figure 2).

Capacity indicators are used to measure the suitability of a region for economic activity. They may include traditional location factors such as skilled labor force, business services, and capital resources, as well as interregional transport infrastructure. In addition, "soft" location factors are also considered, such as higher education institutions, quality housing, a favorable climate, and environmental conditions.

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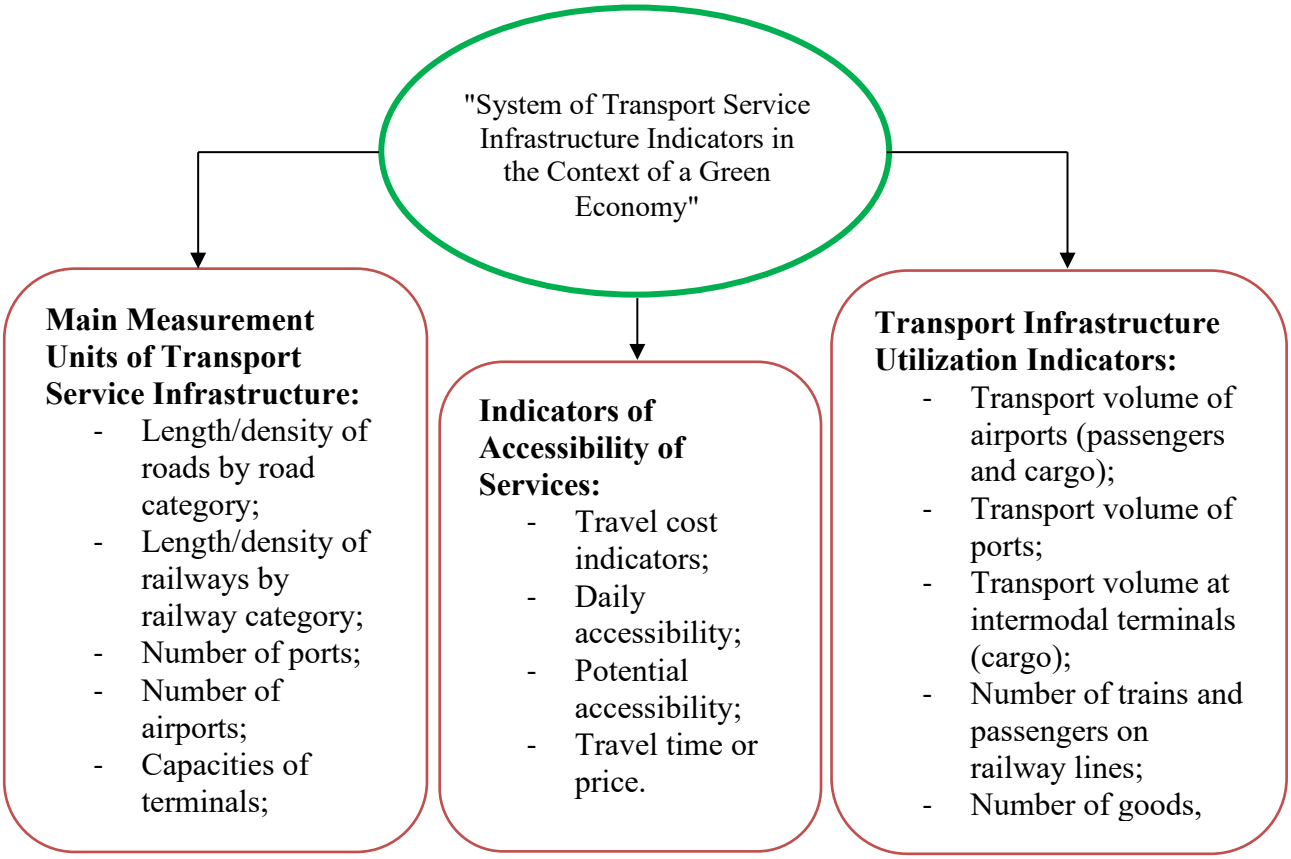

Figure 2. Main measurement units of transport service infrastructure and their usage indicators in the context of a green economy.

In the context of a green economy, transport service infrastructure capacity indicators can be divided into two main types: the first describes the capacity of network participants, and the second describes the capacity of terminals.

Utilization indicators can be calculated for road, railway, inland waterway, or air transport. Multimodal accessibility indicators combine the availability of several modes of transport. Intermodal accessibility indicators include travel involving multiple transport modes or systems.

Accessibility indicators can also be measured from the perspective of different population groups, such as social or age groups, and various occupational categories such as businesspeople, tourists, or industrial enterprises and firms. Accessibility can also be assessed in relation to the location of a region in comparison with population centers, economic activity zones, higher education institutions, or tourist destinations.

Policies aimed at improving regional accessibility through investment in transport infrastructure are among the most effective measures for enhancing regional competitiveness and stimulating economic development.

Transport service infrastructure today plays an important role in the high level of industrial development in countries worldwide and contributes to increasing the potential of transport service delivery.

According to World Bank data, the global transport services sector accounts for 4.3 trillion USD (6.9%) of global GDP, transporting over 110 billion tons of goods annually and more than 1 trillion passengers. The

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transport sector employs around 100 million people worldwide [18]. In Uzbekistan, as of January 1, 2023, the number of enterprises engaged in transport services—i.e., transportation and storage activities—amounted to 20,666 units, or 5.3% of all enterprises. Of these, 20,451 units (99.0%) are small business entities.

CONCLUSION:

Efficient organization of goods and other material flows in the economy is directly related to improving the efficiency of transport infrastructure and solving organizational and economic problems. Therefore, increasing the competitiveness, accessibility, efficiency, quality, safety, and environmental sustainability of transport services has been defined as one of the main directions of state policy in the transport sector. In this regard, it is essential to ensure effective organization of this system's activities.

Taking into account the growing competition between different modes of transport, it is important to clearly define tasks for the effective development of transport infrastructure. The implementation of these tasks will help improve the country's transport infrastructure ranking in global development indices.

The presented methodologies and resulting conclusions and recommendations for improving the efficiency of transport infrastructure development in a green economy allow for the development of short- and long-term strategies, modernization of the system, effective cooperation and integration with business partners, provision of high-quality transport services to customers, and enhancement of the competitiveness of logistics service providers, thereby increasing the overall efficiency of transport infrastructure development.

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