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Transport system as a determinant of the spatial development of the region

The purpose of the article is to highlight of the role of the transport system as a determinant of spatial development in a region (the case of Kharkiv region).

Basic material. The interaction of settlements is essentially carried out through the transport system, as the transformation of the settlement network into a settlement system occurs precisely due to the presence of various hierarchical connections between settlements. An efficiently functioning transport system not only contributes to regional development but also affects spatial organization, as the mobility of passengers and goods is an essential component for economic and social activities, commuting migration, production, distribution of goods and services, or energy supply.

Kharkiv region has traditionally been characterized as an economically developed region, a logistics hub with a well-developed transport system and logistics. However, the region is one of the most affected by military actions. Nevertheless, the restoration of transport infrastructure in Kharkiv is one of the priority tasks for the region and the country, as it ensures high-quality logistics and effective transport communication, which forms a reliable rear for accomplishing tasks at the front line. The detailed analysis of Kharkiv region's transport system showed that the region has a developed and extensive transport infrastructure, which is an important factor in ensuring population mobility and freight transport. This, in turn, stimulates economic development and urbanization, particularly the formation of the Kharkiv agglomeration. The network of roads and railways is key to the region, providing connections both within the region and with other regions of Ukraine and European countries. However, extreme events caused by the war have inflicted severe damage to the transport system, requiring significant efforts and investments for restoration. Moreover, the destruction of infrastructure, significant mine contamination of territories, and temporary occupation of part of the region complicate the recovery work due to the challenging security conditions. Despite these difficulties, the region continues to function as an important logistics hub thanks to support from national and international donors. The transport system of Kharkiv Region is characterized by a multi-component structure with numerous transport hubs of varying hierarchical levels. The largest transport hubs in the region include the cities of Kharkiv, Lozova, Izium, Kupyansk, Chuhuiv, Zlatopil, and others.

The restoration of transport infrastructure, including bridges and roads, is necessary to ensure the region's development and its further integration into the European transport network. This requires comprehensive reconstruction, particularly in the most affected areas, using modern materials to ensure long-term durability. An important stage of recovery is the development of a demining program for the safe restoration of infrastructure and attracting state, international, and private investments through grant programs, among other sources.

Conclusions. The analysis of the transport system of Kharkiv region confirms its significant role in spatial development, ensuring mobility for the population, transportation of goods, and supporting the economic and social activity of the population. An efficiently functioning transport system contributes to rapid urbanization, the formation of the Kharkiv agglomeration, and forms the basis for logistical connections of various hierarchical levels. However, due to military actions, the region and its transport system have suffered significant damage, requiring substantial efforts for restoration, considering security risks and the considerable mine hazard. The restoration of transport infrastructure, particularly bridges and roads, is critically important for the region and its integration into the European transport system.

Keywords: *transport system, settlement system, transport hub, territorial recovery.*

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Introduction. Ukraine's aspiration to transition to European principles of spatial development, along with the ongoing decentralization processes, highlights the need to improve the spatial organization of regions, an essential component of which is the settlement system. Spatial organization is traditionally characterized by geographic location, population density, and the uneven distribution of the population. This territorial differentiation occurs through settlement processes, population concentration, and the formation of various types of spatial interconnections. Strengthening these connections contributes to the formation of a settlement system, where the interaction between settlements is primarily facilitated by the transport system. The transformation of the settlement network into a settlement system happens due to the existence of various hierarchical links between settlements, including transport ones. The intensity and direction of transport flows determine the type of hierarchical connections, helping to identify the center and periphery. An efficiently functioning transport system not only promotes regional development but also influences the organization of space, as the mobility of passengers and goods is a critical component of economic and social activity, pendulum migrations, production, distribution of goods and services, and energy supply. These features can be examined using the example of Kharkiv region.

Kharkiv region is traditionally characterized as an economically developed region, a logistics hub with a well-developed transport system and logistics infrastructure. The city of Kharkiv is the center of the interregional settlement system, characterized by a powerful organizational function, which has formed the Kharkiv urban agglomeration. The historically established settlement system of the region is distinctly monocentric. However, Kharkiv region is also one of the most affected by military actions in Ukraine [1, 3]. Significant destruction has been inflicted on housing, industrial enterprises, service sector institutions, the agro-industrial complex, and the transport system. Some cities in the region, including Izium, Balaklia, and Kupiansk, experienced occupation and devastating effects but have since been liberated and partially restored. Some settlements remain under occupation or have been reoccupied (e.g., Vovchansk), which significantly affects the settlement system in the region. Given that an effective transport system promotes the integration of settlements, the development of both urban and rural areas, the activation of economic activities, and the mobility of the population, the issue of modernizing the transport system of Kharkiv region, restoring settlements, and the region's settlement system is highly relevant and requires attention from scholars in various fields. In particular, studying the role of the transport system in the transformation of the settlement system will allow us to identify regional development patterns, assess the effectiveness of existing transport links, and propose ways to optimize

and modernize the transport system in the context of current challenges and the prospects of European integration.

Initial conditions. The spatial organization of society, the settlement system it forms, and its level of development influence the regional transport system. At the same time, the transport system exerts a corresponding influence on the development of the settlement system, optimizing the spatial structure of the region. Thus, by studying the nature and intensity of these interrelationships, it is possible to identify the issues and prospects of post-war recovery and development of the settlement system in Kharkiv region, as well as develop recommendations for the optimization and modernization of the region's transport system. These issues have been extensively studied in the works of specialists in social geography, including transport geography, logistics, economics, etc. [2-4, 6-10, 12].

This work employs the following approaches and methods of scientific knowledge: the systemic and synergistic approach (particularly when studying the settlement system of the region as a functional component of the socio-geosystem, and the transport system as one of its elements), the historical approach (for the retrospective analysis of the formation and development of the region's settlement system), the informational approach (for determining the role of transport infrastructure in the evolution of the regional settlement system), philosophical methods, including induction and deduction (to determine the nature of the interdependence between the level of development of transport infrastructure and the evolution of the regional settlement system), general scientific methods (retrospective analysis, modeling, systematization, etc.), as well as a set of specific scientific and special methods of social-geographical research, including the IFI-modeling method (for constructing a model of transport accessibility of cities in the region based on demographic potential).

The purpose of the article is to highlight of the role of the transport system as a determinant of spatial development in a region (the case of Kharkiv region).

Basic material. The spatial organization of the region's population is manifested in the formation of the regional settlement system. The settlement system of the region represents the territorial basis and functional subsystem of the regional socio-geosystem, which is a complex, open, multi-level system of settlements characterized by intensive socio-geographical, informational, and communication links. Settlement systems are quite inert formations, which do not evolve quickly in response to the dynamics of economic, social, and demographic processes. The transport system is the basis for communication links, ensuring the transportation of passengers and goods. It is transport that ensures the mobility of the population, connecting labor resources with places of

employment. The development of the transport system in the region depends on natural conditions, which affect the accessibility of territories (in particular, orographic features, relief, etc.), investment volumes, infrastructure construction intensity, transportation efficiency, and the range of possible transport modes. For example, large flat rivers are natural transport routes that historically facilitated regional development. The historical features of regional development and unique geographic conditions determine the location and functioning of transport hubs in the region, mostly cities involved in trade.

A distinctive feature is that the transport system connects both urban and rural settlements, allowing rural residents to access high-quality social services on par with urban residents. Additionally, the spatial impact of transport systems is reflected in the acceleration of urbanization processes and the formation of extensive urbanized areas—urban agglomerations. The development of the transport system and the improvement of infrastructure contribute to the settlement of population in suburban areas, forming suburbs. As a result, the territorial distance between the place of residence and work for residents of urbanized areas increases, which in turn

motivates the automobilization of space, as suburban residents mostly use private transport. [6, 7]. Given the development of the transport system, the spatial structure of a city can be classified based on the level of centralization (when the main functions of the city are concentrated in the central part) and clustering (when economic activity of the population is intensively manifested in various areas of the city – subcenters or clusters). A cluster of economic activity represents a concentration around a specific coordination point, such as a transport interchange, etc. [12].

Additionally, the directions of transport flows define so-called «areas of attraction» – territories to which a large population moves for professional activities, service access, shopping, etc. According to the central place theory, a hierarchical system is formed within the urban area, starting from the central district, which offers a wide range of specialized services, to regional centers [7]. Thus, the intensive development of cities and urban agglomerations is driven not only by the rapid growth of industry and the service sector, but also by the evolution of the transport system, expansion of public transport types, their speed, etc.

The transport system is characterized by the presence of the following components (Fig. 1):

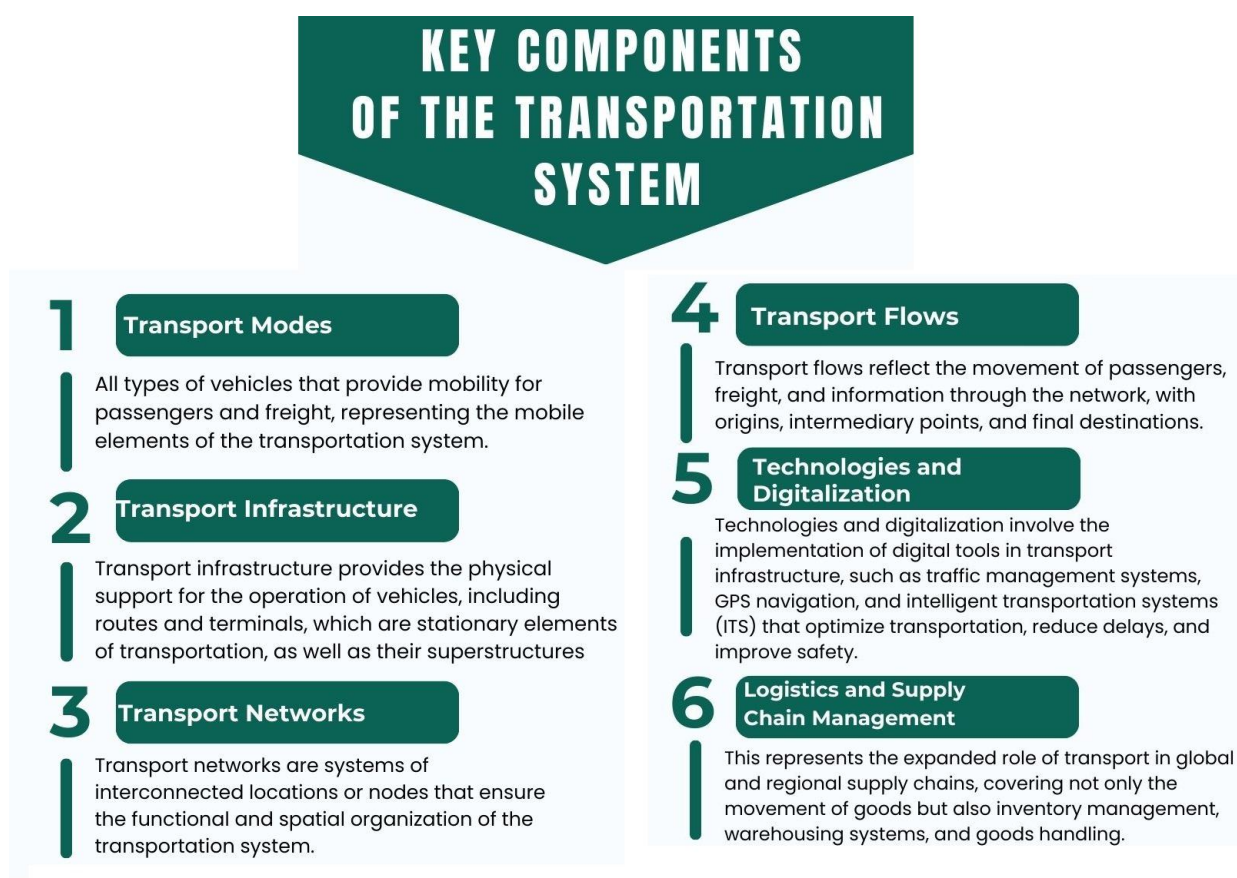


Fig. 1. Components of the Transport System (created by the authors to [12])

Six main elements of the transport system can be distinguished: transport modes, transport infrastructure, transport networks, transport flows, technologies and digitalization, and logistics. Transport modes encompass all types of vehicles that ensure the mobility of passengers and freight. These are the mobile elements of the transport system, such as cars, trains, airplanes, and ships, which provide movement across different routes and networks. Some types of transport are designed to carry only passengers or cargo, while others can carry both.

Transport infrastructure includes the physical means necessary for the functioning of transport: roads, railways, ports, airports, terminals. These elements are stationary, providing support and conditions for the movement of vehicles. Transport networks represent a system of interconnected locations or nodes that provide functional and spatial organization of transport. Nodes may include stations, ports, and logistics centers that interact with each other via transport corridors. Transport flows, in this context, reflect the movement of passengers, freight, and information through the network. Transport flows have their starting points (origins), intermediate stations, and final destinations, forming a continuous transportation process. Technologies emphasize the importance of integrating digital technologies into transport infrastructure: traffic management systems, GPS navigation, intelligent transport systems that improve efficiency, reduce delays, and enhance transportation safety.

Logistics and supply chain management extend the role of transport in global and regional supply chains by not only facilitating the movement of goods but also managing inventories, warehousing systems, and product handling, ensuring the continuity of logistics processes. The diagram comprehensively analyzes the transport system as an interconnected structure, where mobile elements (modes) interact with stationary ones (infrastructure), forming networks and ensuring operational transport flows. An important modern component of the transport system is the role of technologies that optimize these processes and logistics, which adds strategic value to the transport system in supply management.

The development of the transport system contributes to the formation of new elements of spatial organization – transport hubs, which are key points in the transport system where various modes of transport (rail, road, air, river, maritime, etc.) intersect and connect. These hubs play an exceptionally important role in the spatial organization of the settlement system. Transport hubs create a hierarchy of settlements: hubs with a high level of transport accessibility and large flows of people and goods transform into cities and regional centers, while less significant centers, in turn, form a network of smaller towns and villages.

Industrial zones actively develop near transport hubs, and logistics centers and warehouses are

established, stimulating employment and making the settlement attractive for labor migrants. Thus, transport hubs contribute to the formation of transport-logistics hubs, which become important for interregional trade. They also provide connections between settlements and ensure the mobility of the population, access to labor markets, and quality social services, which stimulates pendulum migration and contributes to the formation of urbanized areas, and at the highest level of development – urban agglomerations. Moreover, transport hubs contribute to the creation of a unified settlement space, where distances between settlements become less critical due to fast and regular connections. The areas around transport hubs usually exhibit a high level of economic activity, while more distant, peripheral areas retain agricultural specialization.

The current settlement system of Kharkiv Region is, in many aspects, a derivative of the historical and geographical features of settlement and economic development of the region: it has 1,755 settlements (of which 78 are urban, forming the backbone of the population settlement structure) and an extensive transport network that not only facilitates intra-regional connectivity between settlements but also enables informational and material exchanges with other regions of Ukraine [2, 4]. The structure of the settlement system in Kharkiv Region reflects the historical development characteristics of the region. The highest concentration of settlements is in the northeastern part of the region, with significant clustering around the regional center – the Kharkiv city.

An analysis of the spatial development of the settlement system in Kharkiv region prior to the war shows that the region is characterized by rapid socio-economic development of the administrative center – the Kharkiv city, as evidenced by the continuous expansion of its organizational functions and sphere of influence, strengthening and complicating the connections and interactions with district centers. This trend intensifies internal contradictions in the settlement system and leads to the hypertrophy of the settlement core. There was also a suppression of the development of peripheral areas, which, in turn, causes the formation of spatial asymmetry in the settlement system of the region and characterizes it as sharply monocentric [4].

As a result of Russia's military aggression, beginning in 2014, the economic-geographical and transport position of Kharkiv Region has acquired negative characteristics due to its proximity to the aggressor country. Kharkiv region, its transport system, and transport infrastructure have suffered significant damage from military actions, with the region being one of the top three regions in terms of incurred losses. At the same time, the restoration of Kharkiv Region's transport infrastructure is one of the region's and the country's priority tasks, as it ensures high-quality logistics and efficient transport communication, forming a reliable rear for carrying out tasks at the front line [3, 8].

Let us analyze the transport system of Kharkiv Region according to the elements defined in Figure 1, taking into account the modern challenges of wartime.

Kharkiv Region is characterized by a wide range of transport types, including rail, road, and public transport in the cities of the region. The extensive network of roads and railways provides mobility for passengers and goods both within the region and beyond its borders. Before the full-scale invasion, the Kharkiv airport was operational; however, from the first days of the war, it was heavily bombed and destroyed, and the airspace over Ukraine was closed to passenger traffic [3].

Kharkiv Region traditionally has a developed transport infrastructure, including international highways, railway stations, cargo terminals, etc. This infrastructure serves as the physical basis for the functioning of transport flows. The region ranks first in Ukraine for the length of public roads (over 9.6 thousand km), with nearly 98% of them having a hard surface [1]. The region has a dense railway network that connects both within the region and with other regions of Ukraine and European countries. The extensive network of roads of various significance provides mobility for the population and goods. Major highways connect Kharkiv with other large cities, stimulating the development of adjacent areas and contributing to urbanization.

The extreme events during the full-scale invasion caused severe physical damage to transport infrastructure with long-term socio-economic consequences. Kharkiv Region is one of the most mined regions in Ukraine. The destruction of bridges and bridge crossings is also a representative indicator of the losses, as bridges are capital structures that are extremely difficult and costly to restore. Due to constant shelling and the movement of heavy equipment during the occupation, the road surface in the region was significantly damaged. However, the roads are gradually being restored. The regional road service was reorganized into the "Infrastructure Restoration and Development Service of Kharkiv Region" in response to current tasks. As a result of military actions and occupation of the territory, almost all bridges across the Siverskyi Donets and Oskil rivers were destroyed, particularly near the cities of Izium, Balakliya, and Chuhuiv, as well as in the areas of the Pechenizke and Oskil reservoirs, with a total of 24 bridges destroyed, 17 of which are currently being restored (including: T-21-04 Kharkiv – Vovchansk, located within the village of Fedorivka, T-21-10 Shevchenkove – Balakliya – Zlatopil – Kehychivka, located within the village of Oleksiivka, etc.).

The main donors supporting and financing the restoration of transport infrastructure in Kharkiv Region today are the Armed Aggression Consequences Liquidation Fund (operating under the Ministry of Communities, Territories, and Infrastructure Development of Ukraine) and the World Bank. They have

financed the reconstruction of destroyed infrastructure objects in the region [1, 3, 5].

The transport network of Kharkiv Region connects cities, towns, and industrial zones, ensuring effective spatial organization. The city of Kharkiv serves as the central hub, from which the main transport routes radiate, characterizing the transport system as radial-ring. The developed transport network of the region influences the placement and development of settlements. High transport accessibility contributes to the concentration of the population in cities and towns located near the main transport arteries. This leads to the formation of agglomerations, such as the Kharkiv agglomeration, where the main industrial, scientific, and cultural centers are concentrated. Peripheral areas of the region, distant from major transport routes, typically have lower population density and less developed infrastructure. The transport network of the region has undergone significant transformations, with some elements—rural settlements and cities—currently temporarily under occupation, and communication with them is non-functional. Additionally, some settlements close to the front line (e.g., Liptsi, Kupiansk, etc.) are closed off for civilian access.

Kharkiv Region is a region through which significant flows of passengers, goods, and information pass. Transport flows in the region reflect the movement of goods between regions of Ukraine, European Union countries, and the relocation of the population, including internally displaced persons from Donetsk and the more dangerous areas of Kharkiv Region to safer regions of Ukraine or abroad (to European and other countries). Transport links with the aggressor country have been severed since 2014. Despite the challenging wartime conditions, modern digital technologies are being implemented for transport management in Kharkiv Region. However, some systems currently have limited access due to the security situation (such as online platforms that track public transport in cities via GPS signals). The region is an important logistics center serving international and regional supply chains.

Thus, the transport system of Kharkiv Region is complex and well-developed, ensuring effective mobility of the population (including during the evacuation of internally displaced persons from dangerous areas), supporting the region's economic development, and facilitating its integration into the national and European transport super-system. However, significant damage caused by the war requires detailed study and urgent restoration. It is currently impossible to establish the full extent of the damages, as the war is ongoing, and some areas of the region remain temporarily occupied. Historically, Kharkiv has been an example of a major transport hub in Ukraine, which has determined its status as a powerful industrial-economic center and influenced the development of the settlement system in the region: the formation of the Kharkiv agglomeration,

the development of satellite cities (Lyubotyn, Merefa, Derhachi), and the growth of economic activity in transport-accessible areas. Let's analyze the spatial development model of Kharkiv Region based on the demographic potential and transport accessibility of the region's cities (Fig. 2).

The transport system of Kharkiv Region is characterized by a multi-component structure with numerous transport hubs of different hierarchical levels. Transport hubs are extremely important for the spatial organization of the settlement system, determining the possibilities for economic development, migration processes, population density, and functional

specialization of territories, and their development is a key factor in forming regional planning and management strategies.

The Kharkiv city serves as a key regional center and the largest transport hub in the region, ensuring connectivity at the intra-region, national, and European levels. From Kharkiv, a dense network of road and railway routes radiates, making it the main logistics and passenger hub of the region.

Powerful transport hubs also include the cities of Lozova, Kupiansk, Izium, Chuhuiv, and Bohodukhiv, which facilitate transport flows at the subregional level. Lozova is an important railway hub at the intersection

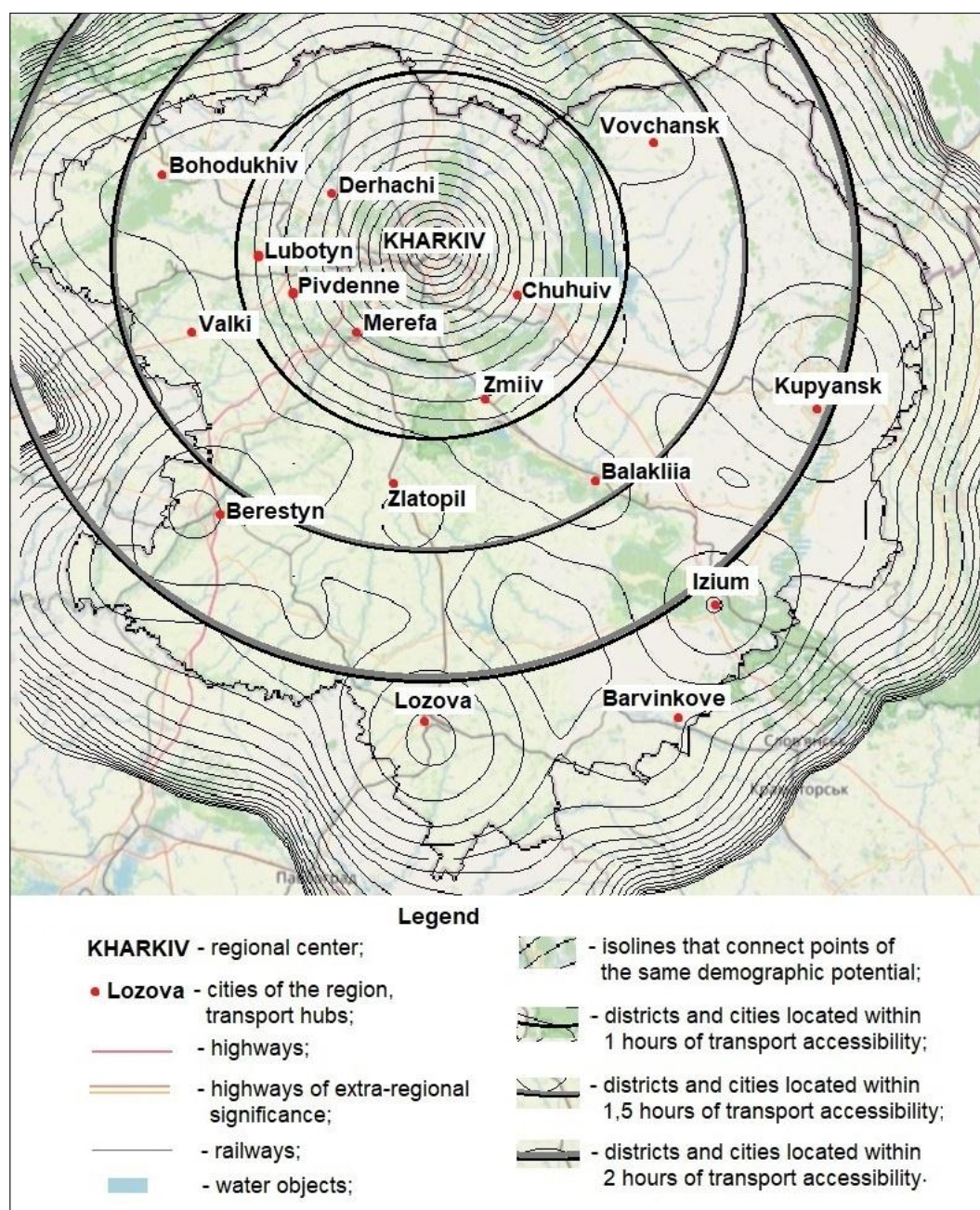


Fig. 2. Spatial development model of Kharkiv Region based on the demographic potential and transport accessibility of cities (created by the authors to [9, 11])

of several transport routes and connects Kharkiv Region with Donetsk Region.

Kupiansk serves as a strategic hub, but due to active combat, the city is effectively a stronghold. The cities of Izium and Chuhuiv have advantageous locations in terms of the concentration of passenger and freight flows; however, as a result of the hostilities, Izium has suffered significant damage, including the destruction of residential buildings and transport infrastructure, such as bridges, which have been temporarily replaced with pontoons. Zones of transport accessibility determined through IVR modeling show that residents of the city and most districts of the region have access to the regional center within 1-2 hours, which is important for economic and social integration. However, military actions have significantly impacted the functioning of these hubs, causing damage to infrastructure, particularly in the southeastern areas (Izium, Kupiansk). Thus, the transport hubs of Kharkiv Region are critical elements of the regional and national transport system, ensuring the mobility of the population, the transportation of goods, and supporting economic development even under the challenges of wartime.

One of the most important and priority tasks for the restoration of the Kharkiv region is the reconstruction of the transport system in the most affected cities

and districts, where possible, taking into account the security situation.

This task is urgent and critical, as an efficient transport system can provide effective logistics for the military, influence the country's defense capabilities, and determine the speed of response to changes on the front. It also allows for rapid evacuation of the population when necessary and supports humanitarian corridors for the delivery of food, medicine, and other aid to frontline communities that suffer the most from the fighting. The restoration of the transport system is also crucial for the region's economy, as the repair of roads, bridges, and railways enables businesses operating in the region to maintain connections with suppliers and markets, which is critical for the survival of businesses and the preservation of employment. Furthermore, transport corridors play an important role in the restoration of infrastructure overall, as they are used to deliver construction materials, machinery, and equipment necessary for reconstruction. Among the main recommendations for the restoration of the transport system in Kharkiv Region are the following (Fig. 3).

The gradual implementation of these measures will contribute not only to the restoration of the transport system in the Kharkiv region but also to its modernization based on the principles of sustainable

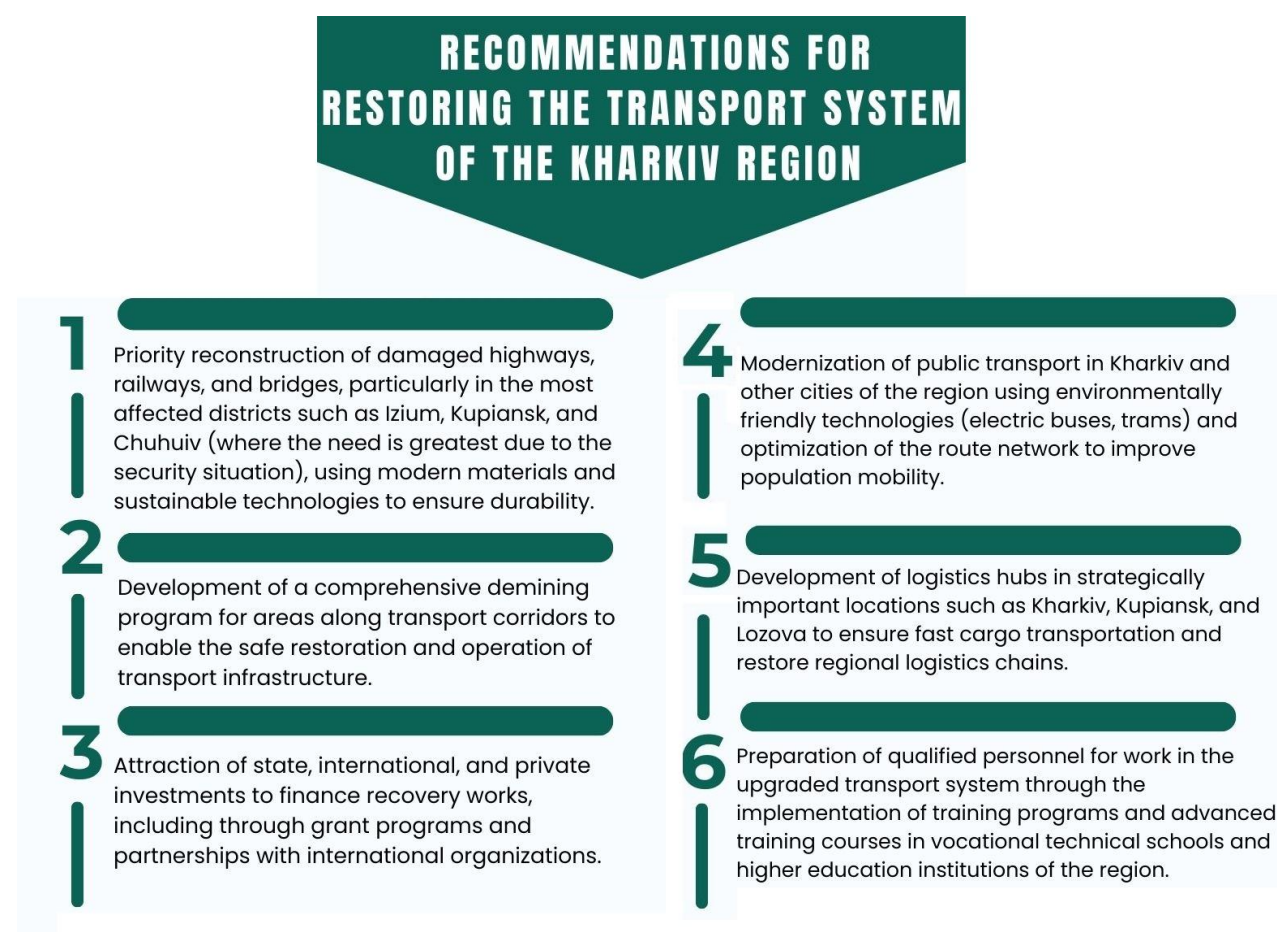


Fig. 3. Recommendations for restoring the transport system of the Kharkiv region (created by the authors to [1, 3])

development, which will be a crucial factor in the region's economic revival and improving the quality of life for the population. The main principle of restoration should be reconstruction based on the "build back better" approach.

Conclusions. The analysis of the transport system as a determinant of spatial development in the Kharkiv region has shown that the interaction of settlements is primarily enabled by the transport system, as the transformation of the settlement network into a settlement system occurs through the hierarchical connections between settlements. An efficiently functioning transport system not only contributes to regional development but also affects spatial organization, as the mobility of passengers and goods is a vital component of economic and social activities, pendulum migrations, production, distribution of goods and services, and energy supply.

The Kharkiv region is traditionally characterized as an economically developed area, a logistics hub with a well-developed transport system and logistics. However, it is also one of the most affected by military actions. Despite this, the restoration of the region's transport infrastructure remains one of the region's and country's top priorities, as it ensures quality logistics and effective transport communication, providing a reliable rear for operations on the front line.

A detailed analysis of the transport system in Kharkiv region confirms that the area has a developed and extensive transport infrastructure, which is a key factor in ensuring the mobility of the population and cargo

transportation, stimulating economic development and urbanization, particularly in the formation of the Kharkiv agglomeration. The network of roads and railways is crucial for the region, ensuring connectivity both within the region and with other regions of Ukraine and European countries. However, extreme events caused by the war have led to severe damage to the transport system, requiring substantial efforts and capital investments for recovery. Additionally, the destruction of infrastructure, widespread landmines, and the temporary occupation of part of the region complicate the recovery efforts due to the challenging security situation. Despite these difficulties, the region continues to function as an important logistics hub thanks to the support of national and international donors.

The transport system in Kharkiv region has a multi-component structure with numerous transport hubs of varying hierarchical levels. The largest transport hubs of the region include the cities of Kharkiv, Lozova, Izyum, Kupiansk, Chuhuiv, and Zhatopil, among others.

The restoration of transport infrastructure, particularly bridges and roads, is essential for the region's development and further integration into the European transport network and requires comprehensive reconstruction, especially in the most affected areas, utilizing modern materials to ensure the durability of operations. An important stage of restoration is the development of a demining program to ensure the safe recovery of infrastructure, along with the involvement of state, international, and private investments through grant programs, etc.

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ТРАНСПОРТНА СИСТЕМА ЯК ДЕТЕРМІНАНТА ПРОСТОРОВОГО РОЗВИТКУ РЕГІОНУ

Метою статті є дослідження ролі транспортної системи як детермінанти просторового розвитку регіону (на прикладі Харківської області).

Основний матеріал. Взаємодія населених пунктів фактично здійснюється завдяки транспортній системі, адже трансформація мережі розселення до системи розселення відбувається саме завдяки наявності різного роду ієрархічних зв'язків між поселеннями. Ефективно працююча транспортна система не тільки сприяє регіональному розвитку, але й впливає на організацію простору, адже мобільність пасажирів і вантажів, є важливою складовою для економічної та соціальної діяльності, маятникових міграцій, виробництва, розподілу товарів та послуг, або постачання енергії.

Харківська область традиційно характеризується як економічно розвинений регіон, логістичний хаб з добре розвиненою транспортною системою та логістикою, проте регіон є одним з найбільш постраждалих від воєнних дій. Проте, відновлення транспортної інфраструктури Харківщини є однією з пріоритетних задач для регіону та країни, адже вона забезпечує якісну логістику та ефективну транспортну комунікацію, що формує надійний тил для виконання задач на лінії фронту. Поелементний аналіз транспортної системи Харківської області засвідчив, що регіон має розвинену та розгалужену транспортну інфраструктуру, яка є важливим фактором забезпечення мобільності населення та перевезення вантажів, що зумовлює стимулювання економічного розвитку і розвиток урбанізації, зокрема – сформовано Харківську агломерацію. Мережа автомобільних доріг і залізниць є ключовою для регіону, забезпечує зв'язки як всередині області, так і з іншими регіонами України та країнами Європи. Однак, екстремальні події, спричинені війною, завдали серйозних руйнувань транспортній системі, що потребує значних зусиль та капіталовкладень для відновлення. Окрім того, знищення інфраструктури, значна замінованість території та тимчасова окупація частини регіону ускладнюють відновлювальні роботи з огляду на складні безпекові умови. Незважаючи на ці труднощі, регіон продовжує функціонувати як важливий логістичний хаб завдяки підтримці національних і міжнародних донорів. Транспортна система Харківської області характеризується багатокомпонентною структурою з численними транспортними вузлами різного ієрархічного рівня, до найбільших транспортних вузлів регіону відносять міста Харків, Лозову, Ізюм, Куп'янськ, Чугуїв, Златопіль, тощо.

Відновлення транспортної інфраструктури, зокрема мостів та доріг, є необхідним для забезпечення розвитку регіону та подальшої інтеграції в європейську транспортну мережу та потребує комплексної реконструкції, особливо у найбільш постраждалих районах, з використанням сучасних матеріалів для забезпечення довговічності експлуатації. Важливим етапом відновлення є розробка програми розмінування територій для безпечного відновлення інфраструктури, залучення державних, міжнародних та приватних інвестицій через грантові програми, тощо.

Висновки. Аналіз транспортної системи Харківської області свідчить про її вагомий роль у просторовому розвитку регіону, забезпеченні мобільності населення, транспортування вантажів та підтримці економічної та соціальної активності населення. Ефективно функціонуюча транспортна система сприяє швидкій урбанізації, формуванню Харківської агломерації, та є основою для логістичних зв'язків різних ієрархічних рівнів. Проте, внаслідок воєнних дій регіон, та зокрема, транспортна система зазнали значних руйнувань, що потребують вагомих зусиль для відновлення, зокрема з урахуванням безпекових ризиків та значної мінної небезпеки. Відновлення транспортної інфраструктури, зокрема мостів і доріг, є критично важливим для регіону та його інтеграції у європейську транспортну систему.

Ключові слова: *транспортна система, система розселення, транспортний вузол, відновлення території.*

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