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ECONOMIC AND FUNCTIONAL DIMENSIONS OF THE DEVELOPMENT OF INTERNATIONAL TRANSPORT CORRIDORS IN THE CONTEXT OF GLOBALIZATION

ABSTRACT

Under current conditions of growing interdependence of national economies, global supply chains are being transformed and trade flows are being reoriented. The dynamics and scale of these processes are largely determined by the efficiency of international transport corridors. Investments in transport corridors have a significant multiplier effect on the entire economy by stimulating the development of transport and logistics and related sectors of the economy, creating a growing demand in labour markets, and developing global value chains, international production, trade and logistics networks. The purpose of the article is to study the impact of international transport corridors on the development of territories at the national and regional levels. The use of descriptive statistics allowed to assess the impact of international transport corridors on the level of economic development, trade openness and foreign trade volumes based on the analysis of data from 121 countries. The links between the zones of influence of international transport corridors and other functional types of territories in Ukraine were investigated. The territorial coefficient of environmental load in the context of Ukrainian regions was calculated. The results of the study will be useful for both researchers in the field of logistics and transport infrastructure development and policymakers in the field of transport and economic policy.

Keywords: international transport corridors, foreign trade, functional types of territories, economic development, globalization

JEL Classification: R40, F01

INTRODUCTION

Current trends in economic development include the fragmentation of production, the formation of network structures in the field of economic relations, and the growing role of global value chains in ensuring competitiveness at the national and international levels. Globalization processes have a significant impact on the development of the world economy, especially in the field of world trade (S. Cooper, 2024). The high growth rates of trade corridors in Asia, Africa, and the Middle East are 4% ahead of the global average. China will remain the main supplier of both exports and imports, while Europe and the United States will continue to be the main destinations for Asian exports. Better connectivity between markets remains critical to future global growth (Winters, 2023). Logistics productivity is a central factor that ensures supply chain reliability and the competitive ability of countries.

Today, international transport corridors play an important role in ensuring spatially balanced and sustainable development of territories and improving the quality of life. Ukraine is located at the crossroads of global trade routes of Europe and Asia ("New Silk Road"), India and Scandinavia, etc. (Prytula et al., 2022). In accordance with the functional types of territories defined by the State Strategy for Regional Development of Ukraine for 2021-2027 (hereinafter referred to as the Strategy) and the decisions of the General Scheme of Planning of the Territory of Ukraine, eight international transport corridors (ITC) pass through the territory of Ukraine: Pan-European Corridors III, V, IX;

Europe-Asia; Eurasian; Baltic - Black Sea; North-South; BSEC (Black Sea Economic Cooperation). The territories falling within the ITC zone of influence receive an additional impetus for economic growth.

The temporary occupation of the Autonomous Republic of Crimea by the Russian Federation and the outbreak of the war in eastern Ukraine in 2014, as well as Russia's large-scale invasion of Ukraine on February 24, 2022, have affected the functioning and development of the ITC. The work of some of them, in particular BSEC, is completely blocked due to active hostilities and partial occupation of the corridor's territory. Pan-European Corridor IX and Europe-Asia will develop new routes bypassing Belarus and the Russian Federation in the future. The activities of the Eurasian, Baltic-Black Sea and North-South ITCs are limited due to the blocking of Ukrainian ports in the Black Sea.

Today, the busiest ITCs or their individual branches in the central and western parts of Ukraine are the ones heading to the seaports of the European Union. At the same time, along with the implementation of ITC development projects under the national program "Expansion and Integration of Logistics with the EU" of the Post-War Recovery Plan of Ukraine, the zones of influence of ITCs will remain the focus of Ukraine's state regional policy at the macro level. The studies of the impact of the ITC on the development of territories in terms of obtaining certain economic, social or environmental effects are the subject of special attention of researchers and practitioners.

LITERATURE REVIEW

Decisions on the development of ITCs, their routes, and the construction of infrastructure facilities along the corridors are made after studying their potential impact on adjacent territories, regions, and the country as a whole. Therefore, assessment of such impact, determination of the nature of the impact, substantiation of the prospects for cargo and passenger flows, etc. are important areas of research.

A study conducted in Southeast Asia based on a gravity model showed that the development of cross-border road infrastructure has a positive effect on intraregional trade in major goods with an elasticity in the range of 0.6-1.4 (Fujimura & Edmonds, 2006). Shepherd and Wilson (2007) on the example of Eastern European countries substantiated a similar impact on trade growth. Based on the gravity model, they show that road modernization can increase trade in the region by 50% from the baseline, which exceeds the expected effects of tariff cuts or trade facilitation programs.

A comparative analysis of 60 countries over the period 1980-2010 (Ng et al., 2017) in terms of transport mobility, accessibility, and economic development showed that improved mobility contributes to economic growth by increasing exports in middle- and high-income countries.

The development of border transport infrastructure along the ITC has an impact on reducing transaction costs. In particular, a study conducted in Asian countries showed that a 10% reduction in transaction costs at the border increases exports by about 2% (De, 2011) which is facilitated by the efficient functioning of the checkpoint network, improved transit procedures, etc.

Transport development is also linked to many of the Sustainable Development Goals (SDGs) and can be used as a tool to achieve some of them. For example, the development of corridors and transport networks can contribute to the achievement of Goal 9. Industry, innovation and infrastructure (targets 9.1-9.4) and Goal 10: Reduce inequality (targets 10.3-10.4).

The impact of transport corridors on adjacent territories and their development potential also largely depends on the stages of development of the corridors and their types. There are transport corridors of national, international and transit importance (Arnold et al., 2005). In the UN report on the development of least developed countries, landlocked developing countries and small island developing states, in addition to the main stages of ITC development (transport and economic corridors), multimodal and logistics corridors are identified as intermediate stages (UN-OHRLLS, 2019). Depending on the modes of transport involved, corridors can be unimodal (single-route corridor), multimodal (parallel routes using different modes), or intermodal (individual routes that include more than one mode with intermodal connections) (Arnold et al., 2005).

The Asian Development Bank (ADB), which first used the term "economic corridor" in 1998, defines economic corridors as important networks or links between economic agents along a defined route that connect the supply and demand sides of markets (Octaviano, 2014).

The innovation of information and communication technologies, the intellectualization of transport systems, and the significant impact of the transport sector on the environment have led to the emergence of new approaches to the study of ITC development. The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) has proposed to

supplement the list of stages of transport corridor development with "smart corridors and green corridors" (Moon et al., 2019).

Most studies are devoted to analyzing the impact of ITC functioning on certain aspects of national economic development. At the same time, current trends in the development of the national ITC network and analysis of the world, including European, experience of their impact on the development of adjacent territories show that ITC zones of influence are special functional territories that at the local level should first of all be integrated into the system of spatial and functional planning of the territory and not violate its integrity, at the regional level - should become catalysts for the formation of new and development of existing points of economic growth, and at the national level – should contribute to the development of logistics and transport infrastructure at the local level in order to increase Ukraine's trade and transit potential.

AIMS AND OBJECTIVES

The purpose of the article is to study the impact of international transport corridors on the development of territories at the national and regional levels.

In order to achieve this purpose, the following tasks were set:

- to assess the impact of the ITC on the country's economic development, openness of its economy and foreign trade activity;
- to determine the nature of the ITC's influence on the development of functional types of territories of Ukraine.

METHODS

Statistics provided by EUROSTAT, the World Bank, and the State Statistics Service of Ukraine were used in this study.

The methods of descriptive statistics are used to assess the impact of ITCs (based on the Logistics Performance Index (LPI) as a generalized indicator of their development) on GDP per capita, economic openness per capita and trade volume (export and import of goods) per capita through correlation and regression analyses, calculation of medians and quantiles. The analysis includes 121 countries.

A comparative analysis of international transport corridors passing through the territory of Ukraine is carried out in terms of their routes, length, and the area of their potential impact. The nature of the impact of international transport corridors on adjacent territories is determined on the basis of system-structural analysis, and content analysis of domestic and foreign academic papers. The authors have identified functional links between the zones of influence of ITCs and other functional types of territories in Ukraine. The environmental impact of the ITC on the development of regions is studied by calculating the territorial environmental load coefficient. Graphical analysis is used to analyze the role of ITC in ensuring spatially balanced and sustainable development of territories and to better visualize the study results.

RESULTS

Assessment of the impact of international transport corridors on the country's economic development, the openness of its economy and foreign trade activity

At the macro level, the transport network is linked to national output, employment and income. At the micro level, interconnected transport networks connect producers and consumers and affect human well-being, including poverty reduction through increased production and wages, job creation, and lower costs. Transport networks also facilitate access to education, work, healthcare and other social and cultural institutions (Quium, 2019).

The international transport corridor includes a complex of land and water transport highways with the corresponding infrastructure in a certain direction, organizational and technical measures, and legislative and regulatory acts that ensure the transportation of goods and passengers (Customs Encyclopedia, 2013). Therefore, in order to assess the impact of the ITC on the development of national economies, we will use the Logistics Efficiency Index, which is calculated annually by the International Bank for Reconstruction and Development together with the World Bank. The 2023 LPI report presents the latest view on trade logistics performance across 139 countries. Logistics is understood as a network of services that support the physical movement of goods, trade across borders, and commerce within borders. It includes transportation, warehousing, brokerage, express delivery, terminal operations, and related data and information management (The World Bank, 2023). The aggregate indicator that reflects the level of economic development of the country is GDP per capita.

The analysis of LPI and GDP per capita on the example of 121 countries showed a close correlation between the studied indicators (correlation coefficient = 0.77) (Figure 1).

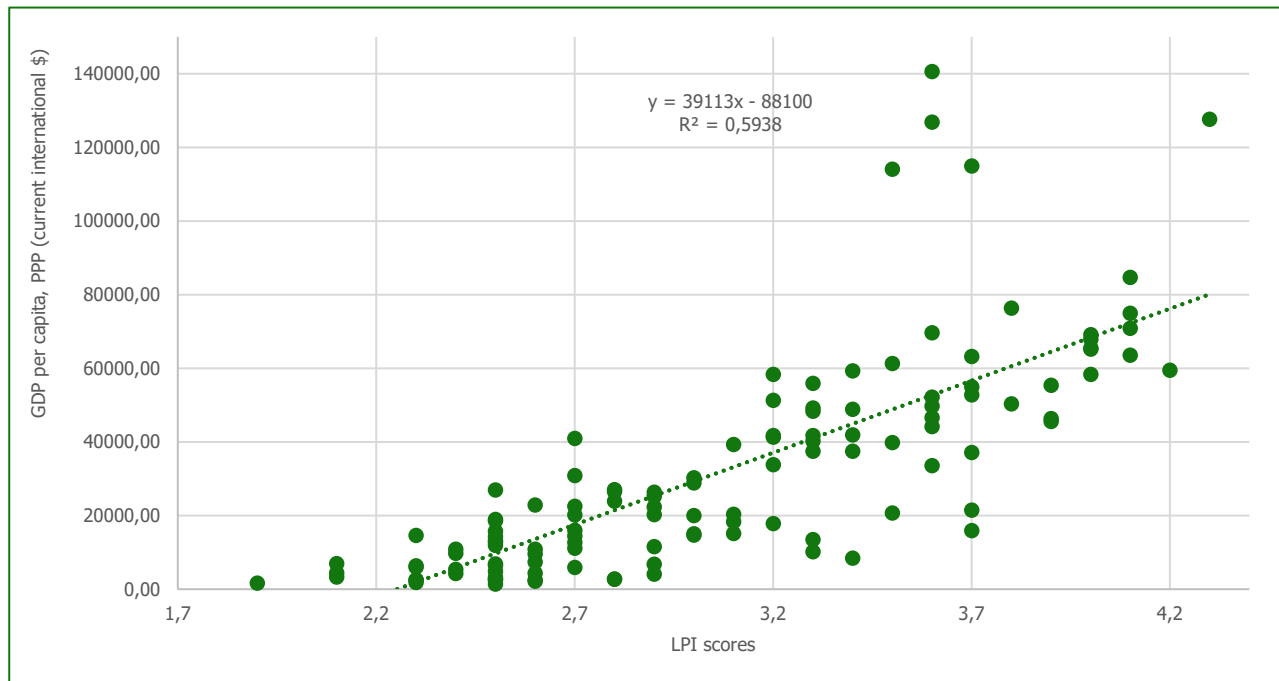


Figure 1. The relationship between LPI scores and GDP per capita. (Source: The World Bank, 2022; The World Bank, 2023)

Figure 1 shows an upward trend line: a more efficient logistics system ensures a higher level of economic development in countries. The distribution of countries by their LPI scores is shown in Figure 2.

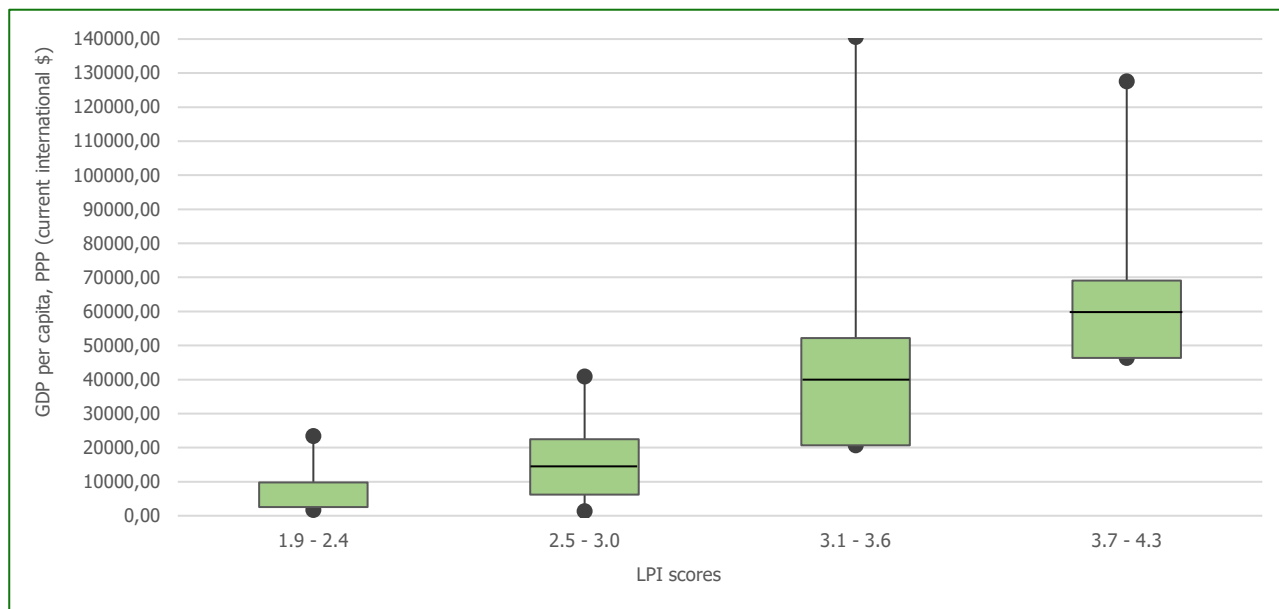


Figure 2. Distribution of countries' GDP per capita by their 2023 LPI scores. Note: The shaded areas are the middle 50 per cent of countries. The median is indicated by a line in a square.

In countries with LPI scores ranging from 1.9 to 2.4, the median of GDP per capita is USD 5.355. If LPI scores are between 2.5 and 3.0, then the median of GDP per capita is USD 13.743. Accordingly, for the next two groups of countries, the median is USD 41.738 and USD 59.470, respectively. This dispersion of the level of GDP per capita relative to the median is explained not only by the multifactorial influence on the processes of economic development but also by the level of development of the corridors themselves.

At the initial stage of development, ITCs are "basic Transport Corridors" (Youssef, 2019). Over time, they can become "Economic Corridors". The remaining stages are intermediate. In particular, Srivastava (2011) and FAO (2014) identify five stages of the transformation of ITCs. In the first stage (Transport Corridor), the corridor connects large agglomerations (economic hubs) with a number of transport routes. The main task of such a transport corridor is to provide more efficient transport services in terms of time, economy and ecology by improving the transport infrastructure and transport services and ensuring the capacity corresponding to the expected volumes of transport. In the second stage (Logistics Corridor), the corridor not only physically connects the territory or region, but also harmonizes the institutional structure of logistics and all technological, organizational and legal conditions of transportation. Transport and Trade Facilitation Corridor ensures the smooth movement of vehicles, goods and passengers by optimizing and simplifying trade/customs procedures and trade policies. An Urban Development Corridor is a corridor in which several urbanized spaces of various sizes are linearly connected by transport networks, improving connectivity within and between cities. In such a corridor, urban development occurs in parallel with the development of strategic transport infrastructure necessary to support urban growth. An Economic Corridor is a corridor capable of attracting significant amounts of investment, stimulating economic activity and developing additional services even in sectors not related to the transport sphere.

The basic transport corridor mainly affects the development of only those areas directly adjacent to the corridor. At the same time, the zone of its influence is gradually increasing, stimulating the development of territories that run along it: industrial zones, urban and rural areas, etc. Over time, the specified processes also form reverse processes: the intensification of economic activity in the territories that are in the zone of influence of the ITCs prompts an increase in trade flows and further development of transport infrastructure (Hope & Cox, 2015).

ITCs play the role of blood vessels in world integration processes. The multi-functionality of ITCs also affects the complex nature of their impact on the development of the country, regions, and communities.

Liberalization of international financial flows, development of international trade relationships, and integration into global value chains make national economies more open. The paper assesses the impact of the development of the ITCs on the level of openness of the countries' economies. The distribution of countries by the indicator of openness of the economy (Trade, % of GDP), based on the LPI scores, is shown in Figure 3.

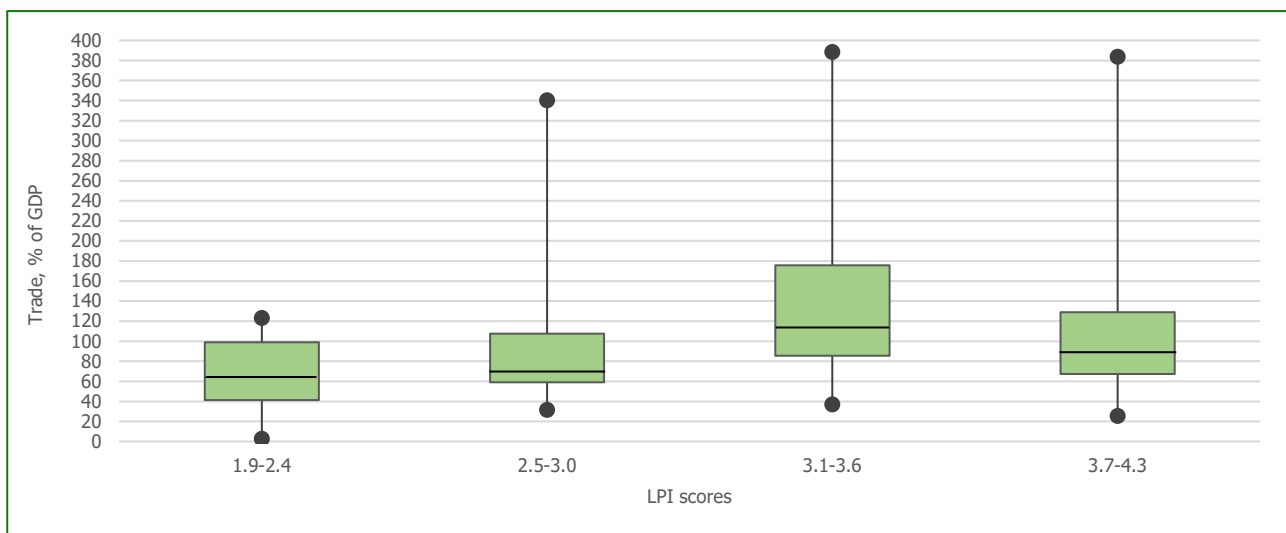


Figure 3. Distribution of countries' economic openness by their 2023 LPI score. Note: The shaded areas are the middle 50 per cent of countries. The median is indicated by a line in a square.

The development of logistics and transport infrastructure does not have a decisive influence on the openness of the economy. The correlation coefficient between the LPI score and the indicator of openness of the economy is 0.34. At the same time, if we analyze the medians in countries with LPI scores of 1.9–3.6, it is 67.8% (1.9–2.4), 78.6% (2.5–3.0) and 124.52% (3.1–3.6), respectively. That is, the level of openness of the economy is higher in countries with a higher level of development of logistics and transport infrastructure. In countries whose LPI scores range from 3.7 to 4.3, the median index of economic openness is 92.99%. Among the 23 countries with the highest logistics development rating, 18 countries are among the top 30 countries with the highest level of GDP per capita. Such large and highly developed countries as the United States (25.5%), Australia (45%), Japan (47%), Canada (67.4%), the United Kingdom (69.3%), France (72.25%), Italy (74.78%), Spain (80.54%), Norway (82.97%) are characterized by a lower level of economic openness compared to

Asian countries (Singapore (336.86); Hong Kong SAR, China (383, 79)) or maritime countries with the largest world ports (Netherlands (176.71); Belgium (193.09)).

The level of development of logistics and the volume of foreign trade per capita show a closer relationship, compared to the openness of the economy. The strength of their relationship is 0.64.

The median of the trade per capita across countries by their LPI score is 1.64; 3.02; 19.09 and 30.38, respectively. The countries with the highest level of trade per capita include Singapore - USD 181.402; Hong Kong SAR, China – USD 168.121; Ireland – USD 103.705; Switzerland – USD 94.760; Luxembourg – USD 84.042; Netherlands – USD 78.122; Belgium – USD 72.705; Norway – USD 68.525; Qatar – USD 61.030; Denmark – USD 48.148 (Figure 4).

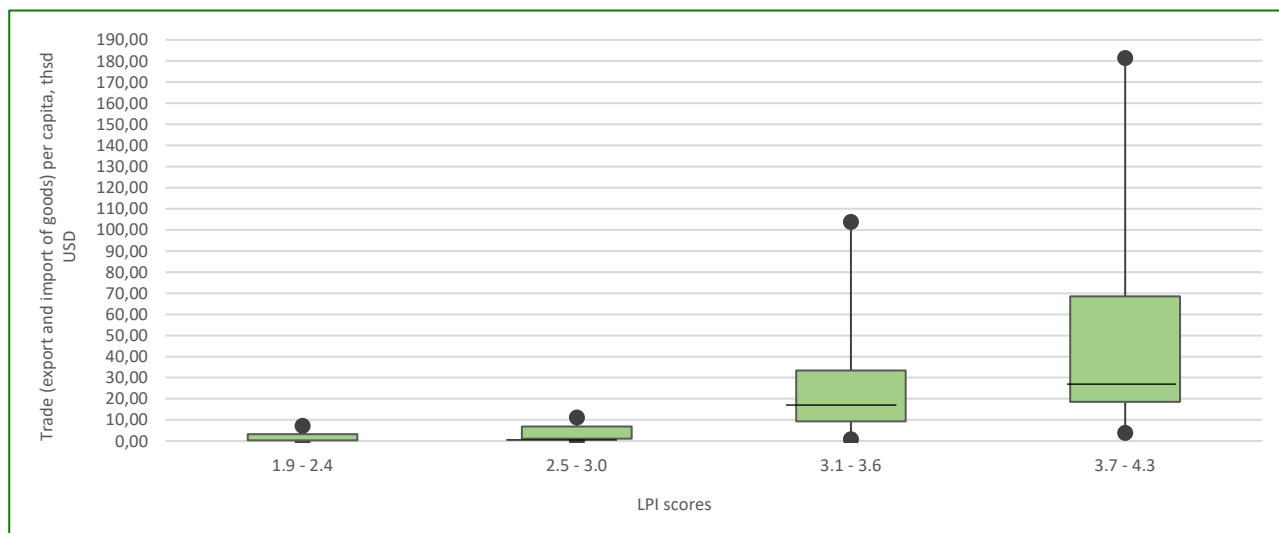


Figure 4. Distribution of Trade (export and import of goods) per capita by their 2023 LPI score. Note: The shaded areas are the middle 50 per cent of countries. The median is indicated by a line in a square.

There is a relationship between the levels of development of the transport corridor and the territories of their passage. More developed countries and regions have greater resources for the further development of ITCs. The volume of investments in the development of major transport corridors has a tendency to increase (Figure 5), which ensures the stimulation of regional integration and economic growth (Alam et al., 2019). At the same time, the reduction of technical and economic barriers when crossing the border, spatial planning of territories involves the formation of joint regional plans or joint plans for the development of cross-border territories by the respective countries, or at least the coordination of national plans (including investments and activities of the private sector) (Srivastava, 2011).

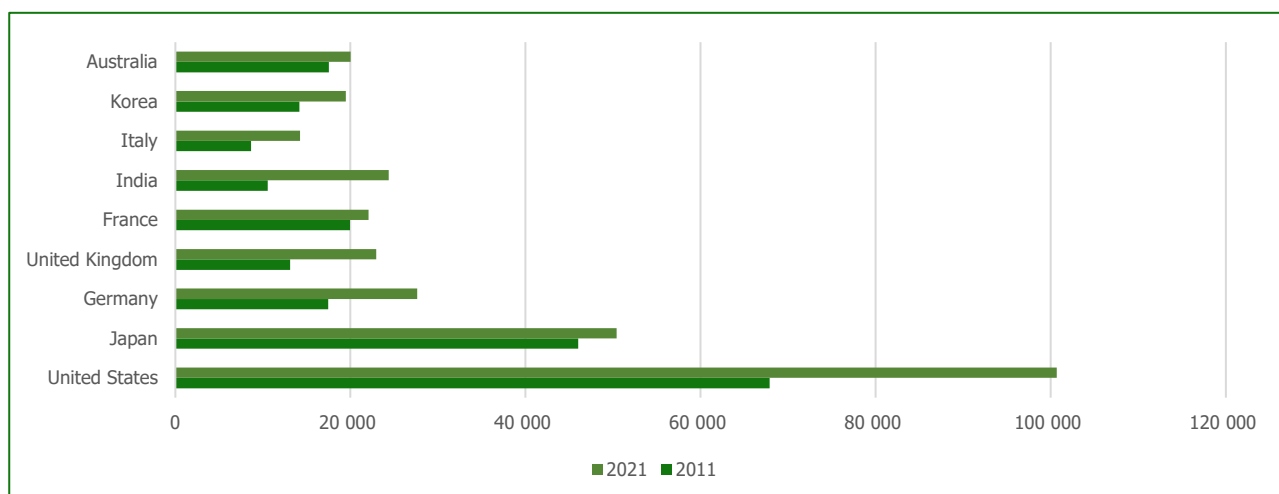


Figure 5. Total inland transport infrastructure investment in some countries with the largest economies, EUR million. (Source: OECD.Stat. Transport infrastructure investment and maintenance spending. Retrieved from: https://stats.oecd.org/Index.aspx?DataSetCode=ITF_INV_MTN_DATA#)

The United Nations Economic and Social Commission (UNECE) identifies the following factors for the successful development and functioning of the corridor: infrastructure; appropriate volumes of traffic; legal framework; coordination, institutional structure; initiative, leadership of participants; resource base; participation of interested parties and final beneficiaries; monitoring (Moon et al., 2019).

Analysis of the impact of ITCs on the development of functional types of territories

At the end of 2021, before Russia's full-scale invasion of Ukraine, the length of ITC routes was equal to 20.7% of the total length of the state-importance roads and 6% of the total length of all Ukrainian roads (see Table 1). The approximate length of the ITC routes, taking into account the common sections of the routes, was 9,676 km (Prytula & Kalat, 2020).

Table 1. Zones of influence of international transport corridors: roads. Note: * - approximate value; ** - the project route is taken into account.

ITCs	Length through the territory of Ukraine*, km	Large nodal cities in Ukraine	The area of the zone of influence of MTC on the territory of Ukraine*, km ²
Pan-European Corridor III	731	Lviv - Rivne - Zhytomyr - Kyiv	21930
Pan-European Corridor V	1396**	Ternopil - Khmelnytskyi Chop - Lviv - Rivne	41880
Pan-European Corridor IX	1046**	Odesa - Uman - Kyiv	31380
Baltic - Black Sea	2926**	Kovel - Mykolaiv - Kherson - Autonomous Republic of Crimea Kovel - Lutsk - Ternopil - (2.1) Chernivtsi or (2.2) Khmelnytskyi - Vinnytsia - Odesa	87780
Europe-Asia	3978**	Ternopil - Khmelnytskyi - Vinnytsia - Mykolaiv - Kyiv Lviv - Rivne - Zhytomyr - (2.1) Kyiv or (2.2) Poltava - Kharkiv	119340
North-South	825	Kharkiv - Kremenchuk - Odesa	24750
BSEC	926	Odesa - Mykolaiv - Kherson - Mariupol	27780
Eurasian	1171	Odesa - Mykolaiv - Kherson - Crimea	35130

Not all routes of ITCs run along the state-importance roads of the international category (M-network). The list of this category of roads through which ITCs pass is given in Table 2.

Table 2. The state-importance roads of the international category, through which ITCs pass.

Index and number of the road	ITC	Coverage of the ITCs
M01, M02, M05	Pan-European Corridor IX	fully
M03	Europe-Asia	partially
M06	Pan-European Corridors III, V; Europe-Asia	partially
M07	Baltic - Black Sea	partially
M08	Pan-European Corridor V, Europe-Asia	partially
M10	Pan-European Corridor III, Europe-Asia	fully
M14	BSEC, Eurasian	partially
M15	BSEC	fully
M17, M18	Baltic - Black Sea, Eurasian	partially
M19	Baltic - Black Sea	fully
M20, M22	North-South	fully
M25	Pan-European Corridor V, Europe-Asia	fully
M30	Pan-European Corridor V, Baltic - Black Sea, Europe-Asia	partially

Functional types of territories can both territorially overlap each other and be in a close functional relationship. The directions and presence of functional interrelationships between the zones of influence of the ITCs and other separate functional types of territories of Ukraine are shown in Figure 6.

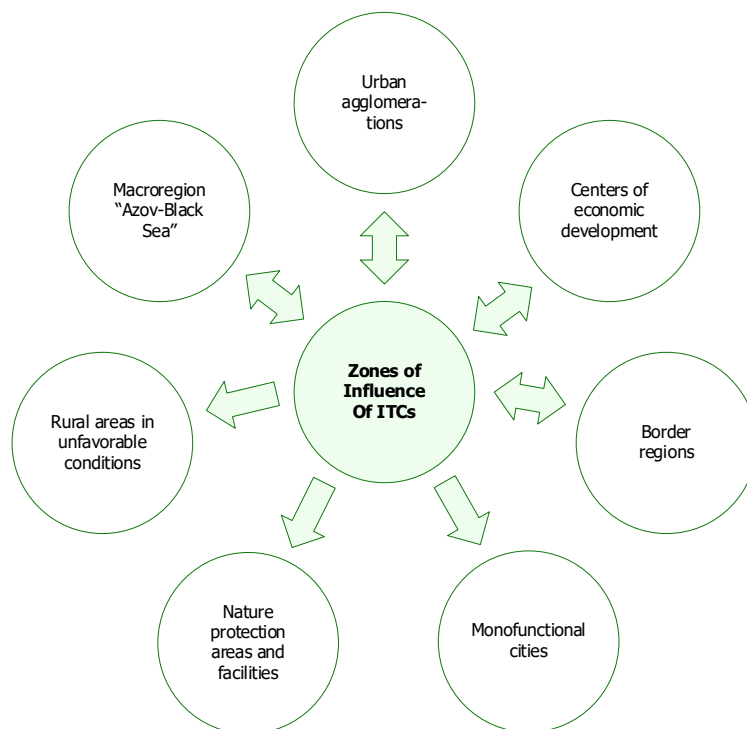


Figure 6. The functional interrelationship of the development of zones of influence of the ITCs and certain functional types of territories of Ukraine.

ITCs strengthen agglomeration processes around the largest cities of Ukraine, which are areas of population concentration, economic activity, and financial resources. The current Strategy has identified the seven largest urban agglomerations, which primarily need state-regulated tools and mechanisms for further development. These are: Kyiv, Kharkiv, Dnipropetrovsk, Kirovohrad, Zaporizhzhia, Odesa and Lviv agglomerations. The development of strategies for the development of agglomerations should be consistent with the development strategies of ITC, which pass through the territory or past the specified urban agglomerations. The greatest loads on urban transport infrastructure and the surrounding cities are inherent in Odesa (6 ITCs pass through the territory of Odesa Oblast), Kyiv, Lviv, and Kirovohrad (three ITCs each pass through the territory of Kyiv, Lviv, and Kirovohrad Oblasts). As of 2021, most of these cities were leading in the ranking of road congestion.

International company TomTom International B.V. calculates the Traffic Index, which evaluates congestion in cities around the world, covering 404 cities in 58 countries on 6 continents (TomTom, 2021). Only four Ukrainian cities made it to this rating: Kyiv, Odesa, Dnipro and Kharkiv. The place of Ukrainian cities in the specified rating is shown in Table 3.

Table 3. The place of Ukrainian cities in the ranking of cities by the Traffic Index 2021.

Rating	City	Time spent in traffic jams during the year, hours	Load level, %
3	Kyiv	128	56
6	Odesa	117	51
12	Kharkiv	105	46
25	Dnipro	92	40

According to the rating of cities during 2019-2021, the level of congestion in Ukrainian cities only increased. This had the effect of increasing travel time costs, increasing fuel costs and emissions. In particular, a report by the Asian Development Bank states that traffic congestion costs countries in the region about 2-5% of GDP each year due to lost time and higher transport costs.

The load on road sections that are shared by several ITCs is increasing. Some of them are listed in Table 4. In the conditions of post-war reconstruction, spatial planning and restoration of the destroyed infrastructure of cities and the transport network should take into account the influence of the ITCs and on the basis of the best practices of sustainable development of transport systems.

Table 4. Separate sections of roads, through which the routes of several ITCs pass.

ITCs	Pan-European Corridor V	Europe-Asia	Eurasian	Baltic - Black Sea
Pan-European Corridor III	Brody - Rivne	Lviv - Rivne - Zhytomyr - Kyiv		
Pan-European Corridor V		BCP Koson-Barabash (Hungary) – Ternopil – Khmelnytskyi - Novokostiantynov		
Pan-European Corridor IX		Vasylkiv - Hlevakha, Kyiv - Boryspil - Brovary - Semi-polky		Odesa- Kryve Ozero Druhe
Baltic - Black Sea		Vinnytsia – Komisarivka – Mykolaiv – Kopany	Kopany - Kherson – AR of Crimea	
BSEC		Kalynivka - Mykolaiv - Zorya	Odesa – Kobleve – Mykolaiv – Posad Pokrovske – Oleshki – Petropavlivka	

There is also a close connection between the zones of influence of the ITCs and the centres of economic development. It is the places of concentration of economic activity that are the determining factors of the routes of the ITCs, and the ITCs, in turn, give an additional impetus to the further development of these territories.

ITCs exert a similar influence on the development of border regions, increasing their connectivity with the rest of the country's regions and foreign markets. ITCs can have a positive impact on the development of monofunctional cities and rural areas in unfavourable conditions, revitalizing economic activity, diversifying the areas of employment and creating new jobs. At the same time, ITCs can affect the occurrence of additional environmental risks in the development of nature conservation areas and objects, increasing the burden on the environment.

The zones of influence of the ITCs of the BSEC and the "Azov-Black Sea" Macroregion practically overlap in the south of Ukraine from Izmail to Mariupol and will develop in close connection with each other in the future. Today they are in the zone of active hostilities.

The nature of the impact of ITCs on the territory of their passage is shown in Figure 7.

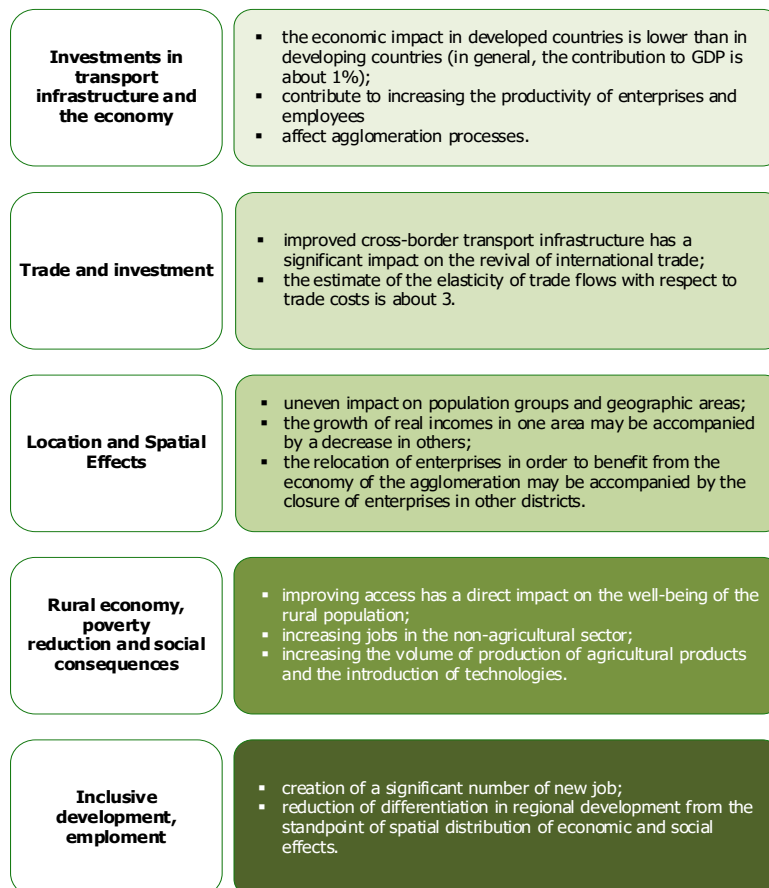


Figure 7. The nature of the ITCs influence on the territory of their passage. (Source: built based on Quium, 2019)

In general, most academics and specialists in transport infrastructure development and transport policy agree that the development of transport infrastructure is vital for economic development and improving people's well-being. This impact is carried out by reducing trade costs and stimulating trade, encouraging investment, increasing the value of land and assets, etc. (Quium, 2019).

The development of TRACECA (Transport Corridor Europe-Caucasus-Asia) will contribute to the realization of Ukraine's transit potential. Separate sections of the national network of ITCs in Ukraine are included in its routes. The development of the corridor plays an important role in stimulating trade and economic cooperation between the EU member states, Eastern European, Caucasus and Central Asian countries. Major traffic flows passing through a corridor formed on the one hand, in Western and Central Europe, and on the other - in Central and South-East Asia. During 1996-2016, Ukraine was involved in the implementation of 33 TRACECA soft and hard infrastructure development projects. Among them are: "Improvement of the Existing Rail Ferry Terminal and Construction of Facilities at Ilyichevsk, Ukraine" (EUR 6,400,000); "Cargo and Container Handling Equipment for the Seaports of Baku (Azerbaijan), Turkmenbashi (Turkmenistan), Poti (Georgia) and Ilyichevsk (Ukraine)" (EUR 5,825,000); "Transport dialogue and interoperability between the EU and its neighbouring countries and Central Asian countries" (EUR 7,000,000); "Ukrainian port strategy development and feasibility" (EUR 1,750,000); "Moldova/Ukraine border crossing" (EUR 1,700,000), etc. (TRACECA). Considering the importance of financing projects within TRACECA and implementing own initiatives, on September 27, 2023, the Working Group started its work on finalizing the documents regulating the status and activities of the TRACECA Fund.

The blockade of Ukrainian ports on the Black Sea, and the severing of trade and economic relations with Russia and Belarus affect supply chains and changes in the routes of ITCs. Before the war, about 75% of Ukraine's foreign trade was carried out through seaports. The processes of increasing the export of goods by land transport with the involvement of river ports significantly increased the intensity of cargo flows through the Ukraine-EU border section.

On December 22, 2023, Ukraine and the European Union signed a High-Level Understanding on the updated indicative maps of the TEN-T (Trans-European Transport Network) - road and railway routes (The Ministry for Communities, Territories and Infrastructure Development of Ukraine, 2023). They will be finally approved by the EU in April 2024 along with the update of the relevant Regulation. The priority sections for the development of rail connections between Ukraine and the EU using European standard track infrastructure have been identified as Lviv – Rava-Ruska – Lublin; Odesa - Berezino - Basarabiaska (on Chisinau and Reni, Republic of Moldova); Zhytomir - Vinnytsia - Yampil (to Rishykany, Republic of Moldova); Chop - Uzhhorod - Sambir - Lviv; Krasnograd - Poltava, Krasnograd Kharkiv, Krasnograd - Dnipro.

On June 21-22, 2023, at the Ukraine Recovery Conference (London, UK), the State Agency for Restoration and Infrastructure Development of Ukraine identified the key areas of financing the export logistics infrastructure: the expansion of 4 TEN-T corridors using EuroRail; reconstruction, construction or modernization of 21 automobile checkpoints on the state border of Ukraine with EU countries and the Republic of Moldova; development of the Danube port cluster (The State Agency for Restoration and Infrastructure Development of Ukraine, 2023). During the war, the ports of "Izmail", "Reni" and "Ust-Dunaisk" tripled their cargo flow. The cluster will remain an important transport corridor for cargo ships, as it provides direct water connections with EU countries.

The inclusion of new Ukrainian routes in the TEN-T will allow for attracting EU funding, in particular grants from the European Commission within the framework of the CEF (Connecting Europe Facility) instrument for the implementation of infrastructure projects aimed at the development of the TEN-T (The Ministry for Communities, Territories and Infrastructure Development of Ukraine, 2023).

Also, in September 2023, an Agreement amending and restating the Loan Agreement dated December 18, 2020 "Development of the Trans-European Transport Network" (Ukraine – Road Corridors) was signed between Ukraine and the European Bank for Reconstruction and Development (EBRD). The amendments allow for a part of the existing EUR 182 million EBRD sovereign loan to be allocated to improve the M-09 Ternopil-Lviv-Rava-Ruska Road, which leads to the Ukrainian border with Poland (Governmental Portal, 2023). The road between Lviv and Rava-Ruska is the main route connecting Lviv to Warsaw and is part of the TEN-T, which has seen a significant increase in traffic since the outbreak of the war.

Socio-economic benefits obtained as a result of the development of transport corridors can be divided into three stages of their formation (AECOM, 2001). The primary effects (or direct benefits) are associated with changes in travel times, reductions in transport costs, increased reliability and the introduction of new services, resulting in lower costs for transport users and transport service providers. Second-order benefits arise from improved transport connectivity, which allows access to larger markets and a wider range of services and resources. The effects of the third order arise in the long term due to structural changes due to the economic dynamic processes activated by the effects of the second order. These

changes ultimately lead to positive impacts on human well-being, including poverty reduction through increased employment, increased output and wages, and higher product prices. However, these changes can also lead to such external effects as a negative impact on the environment.

Improving road capacity can lead to changes in greenhouse gas emissions, air pollution and noise. And while increasing traffic on roads usually leads to increased emissions, reducing congestion can reduce greenhouse gas emissions.

In order to assess the environmental impact of the ITCs on the territory of its passage, the territorial coefficient of ecological load was calculated (the volume of emissions of pollutants and greenhouse gases into the atmosphere from road transport based on km²) (Figure 8).

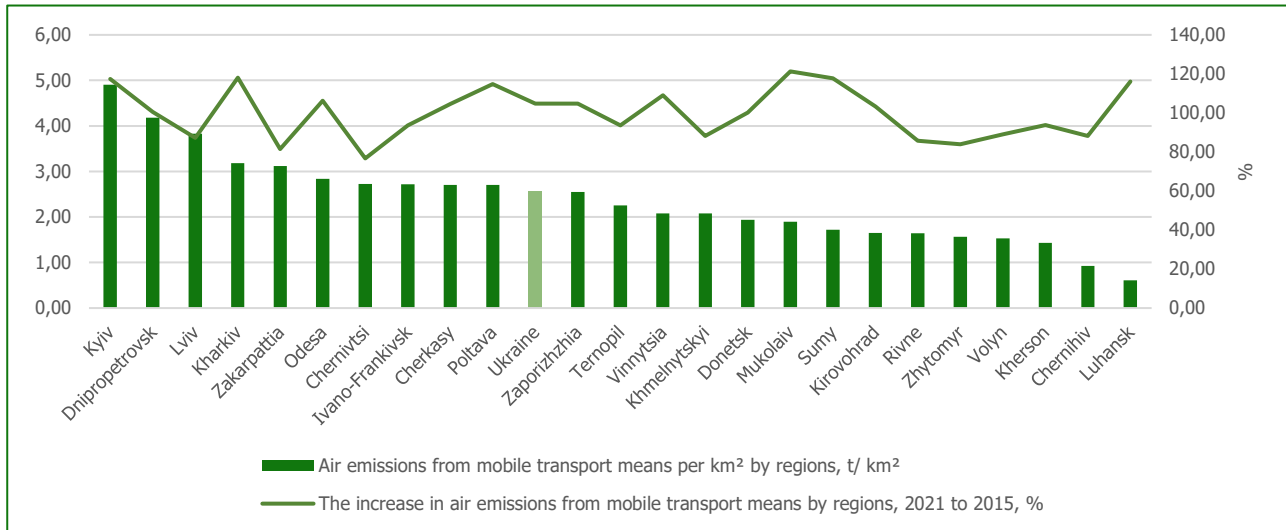


Figure 8. Air emissions from mobile transport means by regions, 2021. (Source: State Statistics Service of Ukraine. Air emissions from mobile transport means by regions. Retrieved from: <https://www.ukrstat.gov.ua/>)

The highest values of the indicator of the territorial coefficient of environmental load in 2021 are observed in the Kyivska and Dnipropetrovsk Oblasts, which are almost twice the average value for Ukraine. It is these regions that are the centres of business and investment activity, which are characterized by a high level of economic development and active foreign economic activity, which affects the intensity of passenger and cargo transportation by road transport.

The lowest values of the studied coefficient are in Chernihivska, Khersonska and Volynska Oblasts. Up to and including 2017, in most regions, and in some regions until 2018-2019, the dynamics of this indicator are positive. Only in Dnipropetrovska, Zaporizhska, Kyivska, Kirovohradska, Mykolaivska, Sumska and Kharkivska Oblasts, the territorial coefficient of environmental load continues to grow in 2020.

The share of the motor transport industry in total environmental pollution is about 55% (State Environmental Inspectorate of Ukraine, 2021). Road transport accounts for 91% of emissions of harmful substances into the atmosphere from mobile sources. The largest share of pollutant emissions into the air from mobile sources of pollution in general in regional terms falls on the city of Kyiv (12.7%), Kyivska (8.8%) and Dnipropetrovsk Oblasts (8.7%). The dynamics of emissions of polluting substances during 2015-2020 show their growth in almost all regions of Ukraine.

DISCUSSION

The conducted study of the features of the ITCs development confirmed their significant impact on the surrounding areas. They act as a catalyst for economic, social and environmental development in the regional, national and global context. The economic development of most countries, regardless of their level of development, is largely determined by the level of development of their logistics and transport infrastructure, which is a physical component of the transport corridor. This is confirmed by the results of most studies, in particular, those conducted by Ng et al. (2017) and Alam et al. (2019).

Investing in the development of ITCs has a greater impact on the deepening of foreign economic relations than on the openness of the economy. Most researchers (Shepherd & Wilson, 2007; Fujimura & Edmonds, 2006; De, 2011) note the positive impact of the modernization of border transport infrastructure along the route of the ITCs on trade volumes, and primarily on export volumes. At the same time, less attention has been paid to their impact on the openness of the

economy. The conducted study proved that the development of the ITCs affects the increase in the openness of the economy of low and middle-income countries. This allows them to integrate more deeply into global value chains and increase their competitiveness. The influence of the ITCs on the openness of the high-income countries is ambiguous and requires further research.

Quium (2019), AECOM (2001) investigated the multi-vector influence of ITCs on the development of adjacent territories. At the same time, their relationship with the development of functional types of territories remains overlooked. These areas have common characteristics and problems and have the potential to act as functional areas. Taking into account and evaluating the mutual influence of ITCs and functional types of territories will allow to develop more effective tools for supporting their development.

CONCLUSIONS

Under the conditions of globalization, the development of the global economy is largely determined by the level of transport accessibility and connectivity. For this purpose, new initiatives are being formed and existing international transport corridors are being developed as a result of the participation of all trading partner countries. The development of the latter determines not only the dynamics of trade and economic cooperation between countries but can also become an internal trigger for the economic growth of countries and their regions.

The effective development of ITC has a positive impact on the level of GDP per capita. The analysis of 121 countries showed a close correlation between LPI scores and GDP per capita (correlation coefficient = 0.77) (Figure 1). The median GDP per capita of countries divided into 4 groups based on their LPI scores (1.9-2.4; 2.5-3.0; 3.1-3.6; 3.7-4.3) made up USD 5.355, USD 13.743, USD 41.738, and USD 59.470, respectively (Figure 2).

The impact of ITC development on the level of economic openness is ambiguous. Despite the absence of a close correlation between the indicators (LPI scores and trade-to-GDP ratio), which is equal to 0.34, the median value in countries with a higher LPI level is increasing. In particular, countries with LPI scores of 1.9-3.6 have median values of 67.8% (1.9-2.4), 78.6% (2.5-3.0), and 124.52% (3.1-3.6), respectively. At the same time, countries with LPI values of 3.7-4.3 have a median of 92.99% (Figure 3). Most countries characterized by a high level of logistics and transport infrastructure development are countries with large economies, and accordingly, the level of openness of their economies is lower.

The development of ITC has a greater impact on the volume of foreign trade per capita. The correlation ratio is equal to 0.64. The median volume of trade per capita by country according to their LPI level is 1.64, 3.02, 19.09, and 30.38, respectively (Figure 4).

ITCs have a significant impact on the development of all functional types of territories through strengthening agglomeration processes around the largest cities of Ukraine, which are areas of high concentration of population, economic activity and financial resources; creating an additional impetus for the further development of economic development centres; improving the connectivity of border regions with the rest of the country and foreign markets; revitalization of economic activity, diversification of labour application areas and creation of new jobs in mono-functional cities and rural areas in unfavourable conditions. At the same time, ITCs contribute to additional environmental risks in the development of protected areas and facilities, increasing the pressure on the environment (Figure 8).

The current ITC routes specified in the Strategy for determining the ITC zones of influence correspond to those ITCs regulated by legal documents of 1996-1997: Resolution of the Cabinet of Ministers of Ukraine No. 1324 dated October 30, 1996 "On the Creation of Transport Corridors in Ukraine and Their Inclusion in the International Transport System"; Resolution of the Cabinet of Ministers of Ukraine No. 1512 dated December 16, 1996 "On Priority Measures for the Creation of a National Network of International Transport Corridors"; Resolution of the Cabinet of Ministers of Ukraine No. 821 dated August 4, 1997 approving the Concept for the Creation and Functioning of a National Network of International Transport Corridors in Ukraine. At the same time, the National Transport Strategy of Ukraine for the period up to 2030 No. 430-r dated May 30, 2018, approved by the Cabinet of Ministers of Ukraine, states that "A number of international transport corridors pass through the territory of Ukraine: Pan-European Corridors No. 3, 5, 7, 9; corridors of the Organization for Co-Operation between Railways No. 3, 4, 5, 7, 8, 10; TEN-T, TRACECA". The issue of clarifying the list of ITCs and their routes should be settled not only from the point of view of bringing all regulatory acts related to the development of ITCs into compliance but also from the point of view of new challenges and opportunities. Updating the list and maps of the ITC list as well as updating the corridor routes and developing new corridor routes is on the agenda. Most of the ITC routes approved by the Strategy have now become irrelevant. For the development of transport corridors that run through Ukraine, it is also important to integrate them into the European and global transport system.

Identifying and approving new ITC routes that will run through Ukraine will require legal regulation and the development of appropriate financing instruments. Each individual corridor will need its own development strategy, management and monitoring system, etc. As of today, this has not been done, and the current national legislation on ITC development has long since lost its relevance. The main regulatory documents were adopted after the second and third Pan-European Transport Conferences in order to implement the main provisions of the declarations adopted at the Pan-European Conferences. Therefore, in the context of Ukraine's reconstruction, it is necessary to update the legislation in the field of ITC development: to adopt new regulations on the development of the national network of international transport corridors as well as on the development of Ukraine's transit potential. Therefore, future studies should concern the definition of a list of ITCs (their routes that pass through the territory of Ukraine) that meet the modern challenges and needs of Ukraine; the study of the world's (primarily European) experience in financing the development of such corridors and the development of effective investment instruments.

ADDITIONAL INFORMATION

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ЕКОНОМІЧНІ ТА ФУНКЦІОНАЛЬНІ ВИМІРИ РОЗВИТКУ МІЖНАРОДНИХ ТРАНСПОРТНИХ КОРИДОРІВ В УМОВАХ ГЛОБАЛІЗАЦІЇ

У сучасних умовах зростаючої взаємозалежності національних економік відбувається трансформація глобальних ланцюгів постачання та переорієнтація торговельних потоків. Динаміку й масштаби цих процесів у значній мірі визначає ефективність функціонування міжнародних транспортних коридорів. Здійснення інвестицій у транспортні коридори має значний мультиплікативний ефект для всієї економіки країни шляхом стимулювання розвитку транспортно-логістичного та супутніх секторів економіки, формування зростаючого попиту на ринках праці, розвитку глобальних ланцюгів вартості, міжнародних виробничих, торговельних і логістичних мереж. Метою роботи є дослідження впливу міжнародних транспортних коридорів на розвиток територій на національному й регіональному рівнях. Використання методів описивної статистики дозволило оцінити вплив міжнародних транспортних коридорів на рівень економічного розвитку, торговельну відкритість та обсяги зовнішньої торгівлі на основі аналізу даних 121-ї країни. Досліджено зв'язки між зонами впливу міжнародних транспортних коридорів та іншими функціональними типами територій в Україні. Розраховано територіальний коефіцієнт екологічного навантаження в розрізі регіонів України. Результати дослідження будуть корисними й для дослідників у царині розвитку логістично-транспортної інфраструктури, і для управлінців у сфері транспортної та економічної політики.

Ключові слова: міжнародні транспортні коридори, зовнішня торгівля, функціональні типи територій, економічний розвиток, глобалізація

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