

# The Importance of International Transport and Logistics Infrastructure in the Economic Development of the Country: The Case of the EU for Ukraine

Yuliia Atamanenko<sup>1</sup>, Olena Komchatnykh<sup>2</sup>, Sukhomlyn Larysa<sup>3</sup>,  
Didkivskiy Viacheslav<sup>4</sup>, Borys Sulym<sup>5</sup>, Oksana Losheniuk<sup>6</sup>  
[kalushvika18@ukr.net](mailto:kalushvika18@ukr.net)

<sup>1</sup>Donetsk Law Institute, Mariupol, Ukraine

<sup>2</sup>National Transport University, Kyiv, Ukraine

<sup>3</sup>Kremenchuk Mykhailo Ostrohradskiy National University, Kremenchuk, Ukraine

<sup>4</sup>National academy for public administration under the President of Ukraine, Ukraine

<sup>5</sup>Ivan Franko National University of Lviv, Lviv, Ukraine

<sup>6</sup>Chernivtsi Institute of Trade and Economics of Kyiv National University of Trade and Economics, Chernivtsi, Ukraine

## Abstract

For twenty years, in the EU there has been a trend of a lack of maritime infrastructure and a redundancy of the road one, which has a negative impact on the economy. The intermodal transport market structure in the EU has not changed over the past ten years. The stability of transport systems due to the lack of changes in the transport market remains under threat, affecting supply chains and networks through the optimization of warehousing and transportation costs. The research methodology is based on a quantitative assessment of cause-and-effect relations between economic growth and transport and logistics in the EU. A statistical analysis of security indicators, intermodal and modal transport, international trade in goods within the EU and in the world trade in goods, the dynamics of GDP of the EU countries, the level of openness of the EU economy, investment and maintenance costs of different modes of transport and infrastructure has been carried out. The results show that in 2000-2010 there were positive changes in the transport and logistics infrastructure of the EU, which had a positive effect on trade, openness of the economy of the EU, GDP growth. However, at that time, negative effects of environmental impact and the load on road and rail transport were accumulating. Investment in different modes of transport is limited, and technical maintenance and infrastructure maintenance costs form a significant part of GDP of the EU. A slowdown in economic growth leads to budget constraints and infrastructure financing gap. As a result, the freight and passenger intermodal and modal transport market structure remains virtually unchanged. The load on rail and road transport remains stable, despite the reduced level of transport hazards. Transport productivity has declined over the past ten years. Herewith, the intensification of trade and the openness of the EU economies require constant modernization and innovative renewal. The EU policy in this direction remains normative, uncontrolled, which is reflected in investment differences within the EU and maintenance costs.

## Keywords:

*EU Transport System, EU Logistics Efficiency, Intermodal Transport Market, Sustainability of Transport Infrastructure.*

## 1. Introduction

Intensification of international relations and globalization strengthen the role of transport and logistics infrastructure in the economic development of countries. If the intermodal transport market in the EU was actively developing in the late 1990s and early 2000s, since the beginning of 2008, the countries have been limited in financing challenges and problems related to the development of transport and logistics due to the slow pace of economic growth. "Transportation as an economic factor is a measure of economic activity and at the same time transportation is a reflection of economic activity" [1]. As a consequence of cause-and-effect relations, the role of transport and logistics infrastructure in the economic development of the EU countries is declining due to a number of negative trends in both infrastructure development and economic development. This requires examination of the current state of efficiency of transportation, freight and passenger transport, the likely impact on the economy and future challenges for governments of the countries. The goal of the research consists in a comprehensive study of changes in the transport and logistics sector of the EU countries and their relationship with economic development.

## 2. Literature review

In the scientific literature, the effects of transport and logistics infrastructure in the economic development of the country are assessed through increase in productivity, investment or reduction of production costs. Information and communication technologies are considered an integral part of logistics. The economic impact is assessed through

GDP growth, per capita GDP, the transport share in GDP, the share of transport exports or the level of openness of the economy (the trade share in GDP) [2; 3; 4]. New studies examine the positive impact of infrastructure on the efficiency of the logistics sector, as it accounts for an average of 10% of GDP of the EU [5]. "Logistics performance index in terms of 'timeliness' significantly increases GDP per unit of energy use, health expenditures, and per capita income, where as logistics index in terms of 'infrastructure' increases renewable energy source and decreases carbon emissions" [6]. Poor infrastructure leads to higher transportation costs, but the opposite effect is observed due to the trade scale effect [7]. Kovacs & Spens note the transition from a planned to a market economy through the development of transport infrastructure, ensuring the growth of trade and freight transport [8].

The transport system has a positive impact on the dynamics of gross domestic product, with the exception of certain subsystems, which are being displaced due to the emergence of innovative modes of transport. Economic development is stimulated through investment in transport and logistics, which accelerate the movement of goods and improve the quality of transport and logistics services. At the same time, due to the spread of the concept of sustainable economic growth within the EU, transport and logistics infrastructure has a negative impact on sustainability due to environmental impact and pollutant emissions [9], security, land use, congestion at the regional level [10]. Nowakowska-Grunt & Strzelczyk note in their study the growing role of the policy aimed at reducing the negative environmental impact of transport [11]. Islam, Ricci, & Nelldal argue the need to increase rail transport and the share of this mode of transport in freight transportation to 18% within the EU. The EU countries need to ensure better planning, use of ICT systems and an integrated approach to supply chains, integration of rail freight corridors [12]. Similar conclusions were made in the study of Giannopoulos: the EU should focus on improving the intelligence of transport infrastructure and freight operations in the field of urban logistics, methods of optimization and planning of transportation, the formation of an e-business environment [13]. The importance of the intelligent transport system is evidenced by the work of Mandzuka et al. dealing with the problems of modern infrastructure: congestion and rising costs of congestion, pollutants and accidents [14]. Despite the understanding of the need to implement a policy of reorientation to rail transport, there are problems with its implementation in the EU. These problems are caused in part by an incorrect assessment of the market potential of other modes of transport, for example Short Sea Shipping (SSS) [15]. Maritime transport is exposed to known risks related to security, tracing the origin of goods and possible threats of failure of the maritime transport chain [16].

Negative effects of transport infrastructure on the economy can also be observed in the case of shortages of some modes of transport and surplus of others. Such a problem was observed within the EU in 1990-2000 in the process of forming a single market, building the European network economy and an integrated transport system as a priority concept of transport development. These problems have been partially solved through the formation of a policy of using "environmentally friendly transport systems" [10]. The development of intermodal transport in the EU took place through the implementation of modernization measures and infrastructure development, innovative technologies, the creation of logistics centres [17]. The economic effect of intermodal transportation is to increase the efficiency of terminals, reduce the cost of transportation while improving quality [18]. Such a policy of the EU ensures the sustainability of transport systems, changes in the transport market, affecting supply chains and networks through the optimization of warehousing and transportation costs [19]. However, according to Douet & Cappuccilli [15], Islam, Ricci, & Nelldal [12], the implementation of a policy for the development of sustainable transport and logistics infrastructure remains a challenge for the EU countries.

Recent studies have examined the impact of international transport corridors on the economy, the acceleration of trade and international relations on a global scale. The New International Land-Sea Trade Corridor (ILSTC) connects China's western provinces with ASEAN, Central Asia and the EU countries, leading to a change in the structure of freight transport [20]. The change in the structure is associated with increased trade between countries, especially agricultural products, increased demand for freight transport, reducing transportation costs and improving transport services.

A review of the scientific literature demonstrates the lack of comprehensive studies on the role of transport and logistics infrastructure in the economic development of the EU countries. First of all, positive effects of the impact on trade, GDP growth and negative effects of the environmental impact, the load on road and rail transport have been highlighted. There are no studies on the level of cost reduction for the development of transport and logistics infrastructure: investment in different modes of transport and infrastructure, technical maintenance and infrastructure maintenance.

### 3. Methodology

This research examines the effectiveness of the structure of transport and logistics infrastructure and intermodal transport within the EU-27 and the impact on the economies of member countries. The following indicators of the state and structure of the intermodal transportation market were used to study the effects of the impact:

### 4. Results

- Security by modes of transport.
- Intermodal transport usage to study the level of efficiency of the implementation of the EU policy on reducing the cost of congestion due to the load on road transport and infrastructure, accident risk. The structure of intermodal transport is also studied to determine the effectiveness of the transition to rail, maritime transport as an alternative to road transport.
- Transport, volume and modal split to determine the level of impact of freight and passenger transport on GDP [21]. To study the effects of transport and logistics infrastructure, endogenous variables (dependent, effective) have been identified: indicators of international trade in goods within the EU and in the world trade in goods; dynamics of GDP of the EU countries; the level of openness of the EU economy (the share of exports and imports in GDP); investment and maintenance costs of different modes of transport and infrastructure.

The increase in modes of transport and international trade volume within the EU has led to reduced security, which has become a priority of the EU policy. Over the past ten years (2010-2019), the level of security of rail and road transport has decreased within the EU, meanwhile the level of incidents in air and maritime transport has increased (100% and 41% respectively) (Table 1). This demonstrates that the EU policy of creating a secure intermodal transport market is effective, and innovative technologies and modernization have had a positive impact on the transport market. At the same time, there are significant differences in the level of security within the EU (the standard deviation is 99.5 incidents with persons in 2010 and 67.6 incidents with persons in 2019). Significant differences in the level of security are observed in road, air and maritime transport.

**Table 1:** Indicators of intermodal infrastructure security in the EU by mode of transport

European Union - 27 countries (from 2020)	2010	2015	2016	2017	2018	2019	Growth, %
Rail accidents by type of accident (ERA data), total persons in the EU-27	2229,0	1763,0	1742,0	1777,0	1666,0	1516,0	-32%
Average	86,9	65,0	65,6	64,8	63,0	55,7	-36%
Standard deviation	99,5	77,9	75,5	76,5	72,5	67,6	-32%
Persons killed in road accidents, persons	32978,0	24133,0	24358,0	23812,0	23394,0	23339,0	-29%
Average	1121,7	906,3	1032,7	1010,3	1000,9	976,1	-13%
Standard deviation	1421,2	1163,5	1577,6	1540,7	1556,3	1451,3	2%
Air accident victims in commercial air transport	0,0	158,0	7,0	9,0	8,0	16,0	100%
Average	0,1	11,9	0,4	0,3	0,3	0,5	313%
Standard deviation	0,7	46,9	1,2	1,2	1,0	1,7	150%
Maritime accident victims, killed persons	-	49,0	34,0	15,0	25,0	24,0	41%
Average	-	6,1	4,3	1,9	3,1	3,0	24%
Standard deviation	-	5,5	4,1	2,0	2,7	5,1	167%

Rail transport in the EU remains a priority in providing intermodal transport within the EU, the share of which is growing steadily (17.1% in 2017) (Table 2). The use of road transport has not changed in recent years, in the structure of intermodal transport, its share is 6.4%. Instead, the share of maritime transport has decreased to 15.5%, which, on the

one hand, has a positive effect on security as the main risk of this mode of transport, on the other – on reduction of the negative environmental impact. Inland waterway transport increased to 9.2%, which means a reduced load on maritime modes of transport.

**Table 2:** Dynamics of intermodal transport by mode of transport in the EU-27, proportion of each mode of transport % (Unitisation in the different modes of transport – tonne-kilometre for gross weight of goods)

TRA_MODE/TIME	2010	2011	2012	2013	2014	2015	2016	2017	Growth, %
Railways	15,4	15,6	16,8	16,9	16,7	16,5	17,3	17,1	2,9
Roads	6,2	6,4	6,5	6,4	6,5	6,5	6,3	6,4	-1,0
Maritime	16,4	16,5	16,9	17,1	18,2	17,4	17,6	15,5	0,1
Inland waterways	6,8	7,5	7,7	7,7	8,3	8,2	8,7	9,2	2,9

Road infrastructure is the busiest with different types of freight and passenger transport in the EU (Table 3). This means that modal freight/passenger transport in a particular

country is most often carried out using roads. As a consequence, with a reduced level of incidents and a stable load on road infrastructure, the EU policy has proved

effective. The use of rail transport in modal transport remains a problem within different member countries, despite slight growth in transport.

Table 3: Modal split of freight and passenger transport in EU-27, 2010-2018, %

GEO/TIME	2010	2015	2016	2017	2018	Growth, %
Modal split of freight transport						
Railways, inland waterways - sum of available data	25,4	25,8	25,6	24,8	24,7	-0,7
Railways	18,0	18,8	18,9	18,3	18,7	0,7
Roads	74,6	74,2	74,4	75,2	75,3	0,7
Inland waterways	7,4	7,0	6,7	6,5	6,0	-1,4
Modal split of passenger transport						
Trains, motor coaches, buses and trolley buses - sum of available data	16,9	17,5	17,3	17,1	17,1	0,2
Trains	7,1	7,7	7,6	7,8	7,9	0,8
Passenger cars	83,1	82,5	82,7	82,9	82,9	-0,2
Motor coaches, buses and trolley buses	9,8	9,9	9,7	9,2	9,3	-0,5

The index of the ratio of the volume of freight transport relative to GDP decreased from 100 in 2010 to 96.6 in 2018 (the ratio of productivity of all modes of transport to the volume of GDP associated with the supply chain), the index

of the ratio of the volume of passenger transport relative to GDP – to 92.3 in 2018 (Figure 1). This means that the productivity of freight and passenger transport is declining.

Fig.1. Volume of freight transport relative to GDP and Volume of passenger transport relative to GDP in EU-27, Index 2010=100

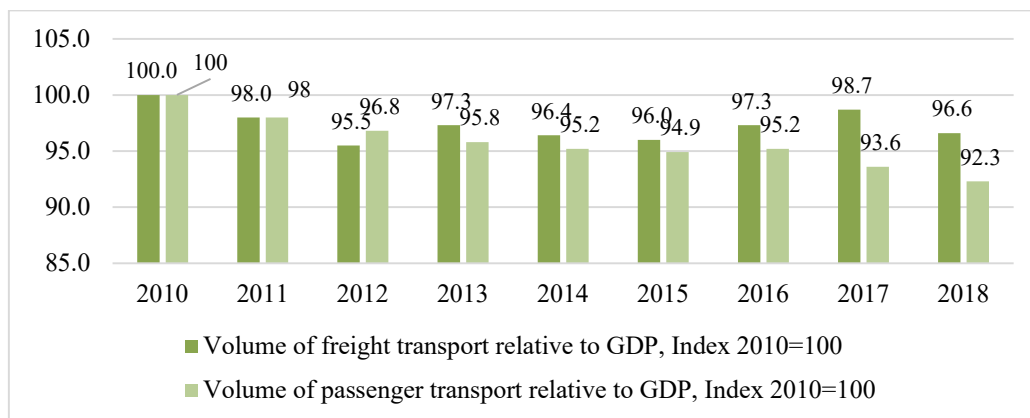


Fig.1. Volume of freight transport relative to GDP and Volume of passenger transport relative to GDP in EU-27, Index 2010=100

After the crisis of 2008, the EU policy was aimed at supporting economic growth and the stability of financial markets. The GDP growth rate in the EU averaged 2.66% in 2011-2019 (Table 4). In combination with the reduction of transport productivity, it can be assumed that the positive effect and role of transport infrastructure in the EU economy will decrease. This is evidenced in particular by indicators of investment and costs for support and maintenance of different types of infrastructure.

For example, the ratio of investment and maintenance costs of railway infrastructure to GDP increased significantly in 2011 and 2017, when the costs of rolling stock of railway undertakings amounted to 2,157,280.52 million euros, and investment in rolling stock amounted to 1,991,326.82 million euros in 2011. In 2017, the volume of costs of rolling stock, investment and maintenance costs amounted to 14,038,779.33 million euros, which significantly exceeded the GDP of all the EU countries.

**Table 4.** Dynamics of growth of GDP, exports and imports, trade balance and openness of the economy of the EU-27 in 2011-2019

GEO/TIME	2011	2015	2016	2017	2018	2019
European Union - 27 countries (from 2020), million euro	11 321 808,8	12 211 542,9	12 550 983,8	13 069 697,9	13 517 885,1	13 963 897,4
Growth rate, %	-	3,65%	2,78%	4,13%	3,43%	3,30%
Trade balance in million euro	-3 858,7	4 950,3	3 876,4	3 260,5	1 616,3	1886,18
Exports in million of ECU/EURO	4 377 687,4	4 859 477,4	4 860 863,8	5 230 034,4	5 486 391,9	5623006,5
Level of openness of the economy (share of exports in GDP), %	38,67%	39,79%	38,73%	40,02%	40,59%	40,27%
Imports in million euro	4 485 731,0	4 720 868,0	4 752 324,5	5 138 741,7	5 441 134,8	5 570 193,4
Level of openness of the economy (share of imports in GDP), %	39,62%	38,66%	37,86%	39,32%	40,25%	39,89%
Investment and maintenance expenditure	44,59%	18,24%	15,05%	3293,97%	3498,00%	5,88%
In principal railway enterprises, % in GDP	41,92%	8,90%	7,65%	107,41%	7,02%	5,86%
Road transport and infrastructure, % in GDP	2,64%	9,32%	7,37%	3186,53%	3490,93%	0
In oil pipeline infrastructure, % in GDP	0,01%	0,01%	0,01%	0,01%	0,04%	0
Inland waterways transport, % in GDP	0,012%	0,016%	0,021%	0,011%	0,011%	0,020%

A similar situation is observed with investments and costs for maintenance, development and modernization of road transport and infrastructure. Therefore, in 2017, road infrastructure costs amounted to 208,226,980.62 million euros, and in 2018 – to 235,945,321.66 million euros. Investments in road infrastructure amounted to 9,666,612.04 million euros in 2017 and 13,807,053.74 million euros in 2018. Road maintenance amounted to 198,547,821.69 million euros in 2017 and 222,124,655.35 million euros in 2018. Despite the positive effects of transport and logistics infrastructure in ensuring the openness of the EU economy, employment, costs and investment significantly reduce such effects. For example, the level of openness of the EU economy was 40.27% in 2019 by the share of exports, but by the share of imports – 39.89%. The EU trade balance in 2018-2019 decreased significantly, although it was positive. Establishing international relations and globalization ensure the exchange of goods of the EU countries, but infrastructure costs borne by member countries cause negative effects and load on budgets. For example, Hungary invested 408,872 million euros in 2017 and 608,087 million euros in 2018, Sweden – 33,300 million euros and 35,716 million euros

respectively, and the Czech Republic – 44,899.5 million euros and 49,138.6 million euros respectively. On the other hand, other countries invested on average 6,884.9 million euros and 4,242.2 million euros. Such an unevenness arises due to the lack of control within the EU on the quality of roads and infrastructure, the financing gap. At the same time, road and infrastructure costs in the EU have remained low for the last twenty years (2000-2020). Active infrastructure reforms in the 1990s were replaced by a period of downtime, while international relations were strengthening, and trade was intensifying. The reason for the financing gap consists in the budget constraints of the EU countries, slow economic growth in 2008-2020. With the context of the openness of the EU economy, the importance of transport and logistics infrastructure is growing, but governments of different countries are facing financing gaps due to the budget constraints. This situation leads to a lack of progress in logistics efficiency (Table 5) [22]. Within the EU, the Logistics performance index remained at the same level within 3.5. Herewith, the share of transport services in the volume of exports and imports of services, commercial exports and imports has declined in 2010-2019. The ICT exports and imports index has also declined.

Table 5. Dynamics of indicators of transport services development in the EU, 2010-2019

Indicator Name	2010	2015	2016	2017	2018	2019	Growth, +/-
Logistics performance index: Overall (1=low to 5=high)	3,443	-	3,593	-	3,519	-	0,076
Transport services (% of commercial service exports)	23,241	20,078	19,270	19,532	19,815	19,576	-3,666
Transport services (% of commercial service imports)	24,184	21,066	20,715	20,904	21,215	20,594	-3,590
Transport services (% of service exports, BoP)	23,023	18,870	17,921	18,235	18,282	17,958	-5,065
Transport services (% of service imports, BoP)	22,477	18,411	17,770	18,018	18,514	17,212	-5,265
ICT goods exports (% of total goods exports)	6,445	5,306	5,328	5,292	5,222	5,318	-1,127
ICT goods imports (% total goods imports)	9,075	7,811	7,765	7,810	7,606	7,733	-1,342

Thus, the role of transport and logistics infrastructure in the economic development of the EU countries is reduced due to a number of negative trends in both infrastructure development and economic development. A slowdown in economic growth leads to budget constraints and infrastructure financing gap. As a result, the structure of intermodal and modal freight and passenger transport market remains virtually unchanged. The load on rail and road transport remains stable, despite the reduced level of transport hazards. Transport productivity has declined over the past ten years, which has affected the reduction of transport services in exports and imports of the EU countries. Herewith, the intensification of trade and the openness of the EU economies require constant modernization and innovative renewal. The EU policy in this direction remains normative, uncontrolled, which is reflected in investment differences within the EU and maintenance costs.

## 5. Discussion

This research proves that the main effects of transport and logistics infrastructure in the economic development of the country are to increase productivity, investment or reduce production costs. Both productivity and infrastructure investment within the EU have declined due to budget deficits. Information and communication technologies as an integral component of logistics cannot provide a positive effect on the economy, as the worn-out transport infrastructure of the EU does not ensure the growth of logistics efficiency. Due to the slow growth of GDP, the EU countries are limited in infrastructure financing, while the share of exports and imports in GDP remains constant and reflects the intensification of international relations [2; 3; 4]. This research contradicts the conclusions made by D'Aleo & Sergi on the positive impact of infrastructure on the efficiency of the logistics sector for reasons identified above [5]. However, our conclusions correlate with those of [7]: transportation costs, in particular those of individuals through taxes, are increasing despite the modernization and low quality of the EU infrastructure. However, the

intensification of trade and the openness of the economies of member countries provide the potential for generating positive effects.

In the EU, slow economic development cannot be compensated by innovative modes of transport due to the long-term payback effects of infrastructure projects. New infrastructure requires significant investment, which in the absence of automation is not always positively reflected in the logistics and quality of transport services.

It is difficult to implement the concept of sustainable economic growth popularized in the EU due to lack of transport and logistics infrastructure financing [9], although the security level has improved, but congestion at the regional level continues to be a problem due to significant road congestion [10]. Therefore, our research also confirms the conclusions made by Nowakowska-Grunt & Strzelczyk on the development of policies aimed at reducing the negative environmental impact of transport [11]. The conclusions of Islam, Ricci, & Nelldal on increasing rail transport and the share of this mode of transport in freight transport to 18% within the EU contradict the conclusions of this research [12]. Though in 2017 the share of intermodal transportation by railways was 17.1%, modal – 18.7% in 2018, the problems of negative environmental impact and accident risk, security still are not solved.

These problems and risks should be managed through the policy of digital transformation and a more careful planning, the use of ICT systems and an integrated approach to supply chains, modernization and creation of new rail freight corridors [12]. It seems that rail and road transport will be the busiest for another 10 years. Therefore, the government's efforts should be aimed at optimizing the management of these modes of transport. An additional reason for this policy is the high level of danger of maritime and air transport with an increasing level of incidents. Like Giannopoulos [13], in this research Mandzuka et al. [14] proposes to increase the level of intelligence of transport infrastructure and freight operations in the field of urban logistics, the introduction of new methods of optimization and planning of transportation, the formation of the e-business environment. Since congestion and increasing maintenance costs form a big part of GDP, digitization and

automation of transport flows are the solution to these problems.

The problem of the policy of reorientation to rail transport in order to reduce the load on road infrastructure is exacerbated by the low market potential of other modes of transport. Waterborne modes of transport within the EU cannot solve complex problems of road congestion [15]. This research also proves the riskiness of maritime transport due to incidents and security [16].

For twenty years, in the EU there has been a trend of a lack of maritime infrastructure and a redundancy of the road one, which has a negative impact on the economy [10]. This problem, identified in the EU in 1990-2000 in the process of forming a single market, can be traced now. The development of the European network economy is slow, the integrated transport system is constantly facing systemic problems in development. The policy of using "environmentally friendly transport systems" does not solve the problems of the load on the road infrastructure [10]. The structure of the intermodal transport market in the EU has not changed over the past ten years, and measures in the late 1990s and early 2000s to modernize and develop infrastructure, innovative technologies and logistics centres are limited by budget deficits [17]. Thus, the sustainability of transport systems due to the lack of changes in the transport market remains under threat, affecting supply chains and networks through the optimization of warehousing and transportation costs [19]. This research proves the conclusions of Douet & Cappuccilli, Islam, Ricci, & Nelldal that the implementation of a policy of sustainable transport and logistics infrastructure remains a challenge for the EU countries [15; 12].

Thus, in 2000-2010 there were positive changes in the transport and logistics infrastructure of the EU, which had a positive effect on trade, openness of the EU economy, GDP growth. However, at that time, negative effects of environmental impact and the load on road and rail transport were accumulating. Investment in different modes of transport is limited, and technical maintenance and infrastructure maintenance costs form a significant part of GDP of the EU.

## 6. Conclusion

For twenty years, in the EU there has been a trend of a lack of maritime infrastructure and a redundancy of the road one, which has a negative impact on the economy. The intermodal transport market structure in the EU has not changed over the past ten years. The stability of transport systems due to the lack of changes in the transport market remains under threat, affecting supply chains and networks through the optimization of warehousing and transportation

costs. In 2000-2010, there were positive changes in the transport and logistics infrastructure of the EU, which had a positive effect on trade, openness of the economy of the EU, GDP growth. However, at that time, negative effects of environmental impact and the load on road and rail transport were accumulating. Investment in different modes of transport is limited, and technical maintenance and infrastructure maintenance costs form a significant part of GDP of the EU. The role of transport and logistics infrastructure in the economic development of the EU countries is reduced due to a number of negative trends in both infrastructure development and economic development. A slowdown in economic growth leads to budget constraints and infrastructure financing gap. As a result, the freight and passenger intermodal and modal transport market structure remains virtually unchanged. The load on rail and road transport remains stable, despite the reduced level of transport hazards. Transport productivity has declined over the past ten years, which has affected the reduction of transport services in exports and imports of the EU countries. Herewith, the intensification of trade and the openness of the EU economies require constant modernization and innovative renewal. The EU policy in this direction remains normative, uncontrolled, which is reflected in investment differences within the EU and maintenance costs.

## References

- [1] Skorobogatova, O., & Kuzmina-Merlino, I. (2017). Transport infrastructure development performance. *Procedia Engineering*, 178, 319-329.
- [2] Mačiulis, A., Vasiliauskas, A. V., & Jakubauskas, G. (2009). The impact of transport on the competitiveness of national economy. *Transport*, 24(2), 93-99.
- [3] Vilko, J., Karandassov, B., & Myller, E. (2011). Logistic infrastructure and its effects on economic development. *China-USA Business Review*, 10(11).
- [4] Skorobogatova, O., & Kuzmina-Merlino, I. (2017). Transport infrastructure development performance. *Procedia Engineering*, 178, 319-329.
- [5] Mačiulis, A., Vasiliauskas, A. V., & Jakubauskas, G. (2009). The impact of transport on the competitiveness of national economy. *Transport*, 24(2), 93-99.
- [6] Vilko, J., Karandassov, B., & Myller, E. (2011). Logistic infrastructure and its effects on economic development. *China-USA Business Review*, 10(11).
- [7] D'Aleo, V., & Sergi, B. S. (2017). Does logistics influence economic growth? The European experience. *Management Decision*. 55 (8), 1613-1628. <https://doi.org/10.1108/MD-10-2016-0670>
- [8] D'Aleo, V., & Sergi, B. S. (2017). Human factor: the competitive advantage driver of the EU's logistics sector. *International journal of production research*, 55(3), 642-655. <https://doi.org/10.1080/00207543.2016.1194540>
- [9] Zaman, K., & Shamsuddin, S. (2017). Green logistics and national scale economic indicators: Evidence from a panel of

- selected European countries. *Journal of cleaner production*, 143, 51-63.
- [10] Martínez-Zarzoso, I., & Suárez-Burguet, C. (2005). Transport costs and trade: empirical evidence for Latin American imports from the European Union. *Journal of International Trade & Economic Development*, 14(3), 353-371. <https://doi.org/10.1080/09638190500212121>
- [11] Kovacs, G., & Spens, K. M. (2006). Transport infrastructure in the Baltic States post-EU succession. *Journal of transport geography*, 14(6), 426-436.
- [12] Gherghina, Ș. C., Onofrei, M., Vintilă, G., & Armeanu, D. Ș. (2018). Empirical evidence from EU-28 countries on resilient transport infrastructure systems and sustainable economic growth. *Sustainability*, 10(8), 2900.
- [13] Janic, M. (2001). Integrated transport systems in the European Union: an overview of some recent developments. *Transport Reviews*, 21(4), 469-497. <https://doi.org/10.1080/01441640110042147>
- [14] Nowakowska-Grunt, J., & Strzelczyk, M. (2019). The current situation and the directions of changes in road freight transport in the European Union. *Transportation Research Procedia*, 39, 350-359
- [15] Islam, D. M. Z., Ricci, S., & Nelldal, B. L. (2016). How to make modal shift from road to rail possible in the European transport market, as aspired to in the EU Transport White Paper 2011. *European transport research review*, 8(3), 1-14.
- [16] Giannopoulos, G. A. (2009). Towards a European ITS for freight transport and logistics: results of current EU funded research and prospects for the future. *European Transport Research Review*, 1(4), 147-161.
- [17] Mandžuka, S., Žura, M., Horvat, B., Bičanić, D., & Mitsakis, E. (2013). Directives of the European Union on Intelligent Transport Systems and their impact on the Republic of Croatia. *Promet-Traffic&Transportation*, 25(3), 273-283.
- [18] Douet, M., & Cappuccilli, J. F. (2011). A review of Short Sea Shipping policy in the European Union. *Journal of Transport Geography*, 19(4), 968-976.
- [19] Papa, P. (2013). US and EU strategies for maritime transport security: A comparative perspective. *Transport policy*, 28, 75-85.
- [20] Šakalys, A., & Palšaitis, R. (2006). Development of intermodal transport in new European Union states. *Transport*, 21(2), 148-153.
- [21] Simina, D., Patrick, S., & Radu, C. (2012). Economic benefits of developing intermodal transport in the European Union. *Annals of Faculty of Economics*, 1(2), 81-87.
- [22] Grzelakowski, A. S. (2011). Internalization of external costs in the EU transport sector as an instrument of rationalization of the logistics supply chains. *Logistics and Transport*, 13(2), 57-67.
- [23] Jiang, Y., Qiao, G., & Lu, J. (2020). Impacts of the new international land-sea trade corridor on the freight transport structure in China, central Asia, the ASEAN countries and the EU. *Research in Transportation Business & Management*, 35, 100419. <https://doi.org/10.1016/j.rtbm.2019.100419>
- [24] Eurostat (2020). Transport. Available at: <https://ec.europa.eu/eurostat/data/database>
- [25] World Bank (2020). European Union Statistics. Available at: <https://data.worldbank.org/region/european-union>