

INSTITUTIONAL PRINCIPLES OF FORMATION OF CROSS-BORDER TRANSPORT AND LOGISTICS CLUSTER IN THE CONDITIONS OF DIGITAL AND SUSTAINABLE DEVELOPMENT

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Abstract. At the present stage, the strategic vector of transformation of transport and logistics systems in the border regions of Ukraine and the Visegrad Four countries is the integration of transport and logistics infrastructure into a transport and logistics cluster. *The purpose of the paper* is to substantiate the institutional basis for the formation of a cross-border transport and logistics cluster as an effective form of cooperation between the border regions of Ukraine (Volyn, Zakarpattya and Lviv regions) and the Visegrad Four (Poland, Slovakia, Hungary). *Methodology.* The theoretical and methodological basis of the study is the provisions of institutional theory, in particular the paradigms of evolutionary development, the theory of clustering, the concepts of strategic and logistical management, enterprise development management. The following general scientific methods were used in the research process: analysis and synthesis, statistical analysis, classification and systems approach, comparison and structural-logical generalization. The article presents the results of analytical assessment of the current state of development of transport and logistics systems of the Visegrad Four. Based on statistical analysis, features, trends, barriers and challenges to the functioning of transport and logistics systems in the border regions of Ukraine have been identified. *Results.* In order to modernize the regional ecosystems of Ukraine and the Visegrad Four countries, the conceptual provisions for the creation of a cross-border transport and logistics cluster are substantiated. It is proved that this cluster structure should include enterprises in the field of transport and logistics, innovation infrastructure (technology parks, business incubators, industrial parks, etc.), state, regional and local authorities, NGOs, research institutions and centers, higher education institutions that are geographically concentrated in cross-border regions. It is established that for the implementation of the conceptual foundations of the formation of cross-border transport and logistics cluster it is necessary to use a set of mechanisms, which include: regulatory, institutional, organizational and economic, financial, social, informational, environmental. *Practical implications.* The results of the study can be used to refine the current legal and regulatory framework, namely in amending the Association Agreement between Ukraine and the EU, the Laws of Ukraine "On Cross-Border Cooperation" and "On Principles of State Regional Policy", the State Development Program cross-border cooperation for 2021–2027, Regional Development Strategies of Volyn, Zakarpattya and Lviv regions until 2027 in terms of creating appropriate institutional conditions for the formation of cross-border transport and logistics cluster and determining the mechanism of financial support for its operation. *Value/originality.* The author's approach to the improvement of legal and institutional support for the development of cross-border cluster structures in Ukraine is formulated, taking into account European practice.

Key words: national economy, regional economy, clustering, cluster policy, cluster approach, transport and logistics cluster, organizational form, cross-border cooperation, European practice, institutional principles, legal support, mechanism, sustainable development, digitalization, transformation, smart specialization.

JEL Classification: F15, F20, L22, P51, R40

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1. Introduction

In the context of global challenges and external threats facing Ukraine, the formation of partnerships and the deepening of cross-border cooperation is particularly important. Ukraine has a European vector of economic development. At the same time, cross-border cooperation in the field of transport and logistics, which is of strategic importance in ensuring balanced sustainable development of the country, is recognized as a key priority of the national economy and an important object of modern regional policy. The main principles of cross-border cooperation of Ukraine with the Visegrad Four countries are defined by Chapter 27 of the Association Agreement, Laws of Ukraine "On Cross-Border Cooperation" and "On Principles of State Regional Policy", Resolutions of the Cabinet of Ministers of Ukraine "On Approval of the State Strategy for Regional Development 2021–2027" and "On approval of the State program for the development of cross-border cooperation for 2021–2027".

Issues of international cooperation in the transport sector, improvement of mutual and transit transport connections, modernization and development of transport networks are regulated by cooperation agreements, namely: "Agreement between Ukraine and the Republic of Poland on good neighbourliness, friendly relations and cooperation", "Agreements between the Government of Ukraine and the Government of the Slovak Republic on trade, economic and scientific-technical cooperation", "Agreements between the Government of Ukraine and the Government of the Republic of Hungary on economic cooperation".

At the present stage, one of the targets of the national transport strategies of Ukraine and the Visegrad Four countries is integration into the European transport space, increasing the volume of exports of transport services and the realization of transit potential in the system of international transport corridors. To achieve this goal it is necessary to implement and develop a cluster approach to traffic management and the formation of transport and logistics systems that promote innovative development, increase competitiveness and modernize the economy of the regions. At the same time, the strategic vector of transformation of transport and logistics systems in the border regions of Ukraine and the Visegrad

Four countries, which correspond to political, socio-economic, technological, environmental realities, is the integration of transport and logistics infrastructure into a transport and logistics cluster (Kwilinski & Trushkina, 2019; Trushkina, 2019a; Trushkina, 2019b; Liashenko, Ivanov, Trushkina, 2021; Trushkina, Dzwigol, Kwilinski, 2021; Pushak & Trushkina, 2021; Liashenko, Osadcha, Trushkina, 2021).

Given this, the purpose of this study is to substantiate the institutional principles for the formation of a cross-border transport and logistics cluster as an effective form of cooperation between the border regions of Ukraine (Volyn, Zakarpattya and Lviv regions) and the Visegrad Four (Poland, Slovakia, Hungary).

2. Analytical assessment of the current state of development transport and logistics systems of the Visegrad Four

According to the United Nations Economic Commission for Europe, rail freight in Poland increased by 26.1% in 2000–2019, and in Hungary by 5.3%. However, the volume of freight transport by rail in Slovakia decreased during this period by 11.6%. Rail freight turnover in Hungary increased by 31.3%, and in Poland – by 1.1%. At the same time, the freight turnover of railway transport in Slovakia decreased by 24.5% (Table 1).

During 2000–2019, the volume of road freight transport in Poland increased by 39.1%. However, the value of this indicator decreased in Hungary by 22.4%, and in Slovakia – by 0.9%. At the same time, it should be noted that the freight turnover in these countries of the Visegrad Four, on the contrary, has increased. Thus, the freight turnover of road transport in Poland increased 4.8 times, in Hungary – 2.8, and in Slovakia – 2.4 times (Table 2).

According to the analysis of the statistical database of the United Nations Economic Commission for Europe, the volume of river freight transport in Slovakia increased 4 times in 2000–2019, and in Hungary – 1.9 times. But the volume of river freight transport in Poland decreased by 73.4%. During the study period, the turnover of river transport in Poland decreased by 92.8%, in Slovakia – by 32.2%. The value of this indicator in Hungary, on the contrary, increased 2.4 times (Table 3).

Table 1

Dynamics of freight volumes and freight turnover of railway transport in the Visegrad Four countries

Years	Cargo transportation, thousand tons			Freight turnover, million tkm		
	Poland	Slovakia	Hungary	Poland	Slovakia	Hungary
2000	185334	54177	49625	54015	11234	8093
2005	269553	49310	48706	49972	9463	8530
2010	216767	44327	45794	48705	8105	8809
2013	232596	48401	49085	50881	8494	9722
2014	227820	50997	50593	50073	8829	10158
2015	224320	47358	50333	50603	8439	10010
2016	222523	50727	50047	50650	9111	10528
2017	239501	47790	52682	54797	8486	11053
2018	249260	50931	52471	59388	8691	10584
2019	233744	47869	52270	54584	8480	10625

Source: compiled on the basis of information materials from the statistical database of the United Nations Economic Commission for Europe

Table 2

Dynamics of freight volumes and freight turnover of road transport in the Visegrad Four countries

Years	Cargo transportation, thousand tons			Freight turnover, million tkm		
	Poland	Slovakia	Hungary	Poland	Slovakia	Hungary
2000	1083071	188901	261019	72842	14340	19123
2005	863396	195405	197727	111826	22550	13243
2010	1216083	143244	199848	202308	27575	33721
2013	1300608	129032	169211	247594	30147	35818
2014	1300382	142608	193112	250931	31358	37517
2015	1264960	147225	198743	260713	33525	38352
2016	1313657	156279	197762	290749	36106	40006
2017	1501811	176790	188259	335220	35362	39687
2018	1390184	177222	206669	315874	35590	37948
2019	1506450	187161	202631	348952	33888	36951

Source: compiled on the basis of information materials from the statistical database of the United Nations Economic Commission for Europe

Table 3

Dynamics of freight volumes and freight turnover of river transport in the Visegrad Four countries

Years	Cargo transportation, thousand tons			Freight turnover, million tkm		
	Poland	Slovakia	Hungary	Poland	Slovakia	Hungary
2000	10433	1607	4422	1173	1383	882
2005	9607	2350	8413	1277	88	2111
2010	2820	10103	9952	130	1189	2393
2013	3185	8107	7857	91	1006	1924
2014	5899	7010	7825	110	905	1811
2015	4907	5721	8163	83	741	1824
2016	3821	6758	8224	105	903	1975
2017	3412	6896	8414	108	933	1992
2018	2988	5567	6926	119	778	1608
2019	2779	6430	8592	84	937	2120

Source: compiled on the basis of information materials from the statistical database of the United Nations Economic Commission for Europe

It should be noted that the increase in river freight transport is due to the main provisions of the Paris Agreement under the UN Framework Convention on Climate Change to regulate measures to reduce global carbon dioxide emissions. In this regard, the UN is considering ways to reduce the negative impact of freight on nature. One of them, according to the UN Economic Commission for Europe, may be the diversification of inland waterway transport. The United Nations is proposing that the countries of the world (Austria, Hungary, Slovakia, France and Croatia, the share of inland waterway freight is less than 10%, in Bulgaria, Germany, Romania and Serbia it exceeds 10%, and in the Netherlands is approaching 40%) attention to the development of water transport as the most profitable from an economic point of view and safer from an environmental point of view. Modernization of port infrastructure, expansion of the network of freight routes will create new jobs, ensure sustainable development of the transport system in the context of the European Green Course.

The volume of export transactions in trade in goods of Ukraine with Poland increased in 2010–2020 by 83.3%, and import – by 49.1%. The balance of export-import operations is negative. At the same time, the ratio of imports and exports decreased: if in 2010 the value of this indicator was 1.56 times, in 2020 – 1.27 times. The share of exports of goods increased by 3.2 percentage points or from 3.5 to 6.7% of world foreign trade in goods, and imports – by 3 percentage points or from 4.6 to 7.6%.

Exports of goods from Hungary increased by 47.5% and imports – by 15.3%. The balance of export-import operations is also negative and decreased by 62%. The ratio of imports to exports decreased: if in 2010 the value of this indicator was 1.42 times, then in 2020 – 1.11 times. The share of exports of goods increased by 0.9 percentage points or from 1.7 to 2.6% of world foreign trade in goods, while imports, by contrast, decreased by 1.7 percentage points or from 2 to 0.3%.

During 2010–2020, the volume of export transactions in trade in goods of Ukraine with Slovakia decreased by 20.8%, and imports – by 161.5%. The balance of export-import operations during this period decreased by 81.8%: in 2010 it amounted to 126.7 million US dollars, and in 2020 – 696.6 million US dollars. At the same time, in 2010 exports exceeded imports

by 1.26 times. And in 2020, imports exceeded exports by 2.56 times. The share of exports of goods decreased by 0.2 percentage points or from 1.1 to 0.9% of world foreign trade in goods, while imports increased by 1.4 percentage points or from 0.7 to 2.1% (Table 4).

During the period under study, there is a growing trend in the volume of import transactions in foreign trade in services with the Visegrad Four. Thus, the volume of exports in the structure of foreign trade in services of Ukraine with Poland increased in 2020 compared to 2010 by 4.6 times. However, the value of this indicator in Hungary, by contrast, decreased by 12.8%, and in Slovakia – by 9.3%. The volume of imports in the structure of foreign trade in services of Ukraine with Poland increased by 34.9%, in Slovakia – by 30.2%, in Hungary – by 15.9%. The balance of export-import operations in Slovakia and Hungary is positive, but decreased by 31.5% and 21.6%, respectively. At the same time, the balance of export-import operations in Poland increased 4.5 times: in 2010 it had a negative value, and in 2020 – already positive (Table 5).

According to the State Statistics Service of Ukraine, the volume of exports of transport services of Ukraine with Poland increased in 2020 compared to 2010 by 2.5 times, and with Slovakia – by 1.3 times. The volume of imports of transport services from these countries of the Visegrad Four increased by 2 and 1.7 times. The balance of export-import operations increased 16.6 and 1.2 times, respectively. At the same time, the volume of exports of transport services of Ukraine with Hungary decreased by 42.1%, imports – by 17.5%, and the balance of export-import operations – by 48.5% (Table 6).

According to statistical analysis, there is a negative trend in financing the economy of the Visegrad Four countries through direct investment from Ukraine. Thus, the share of direct investment from Ukraine in the Polish economy in 2019 was 0.13% of the total volume of these investments (in 2010 – 0.73%), and Hungary – 0.26%. And in the development of the Slovak economy does not receive investment (Table 7).

The share of direct investment from Poland in the economy of Ukraine in 2019 was 2.45% of the European volume of these investments, from Hungary – 1.35%, from Slovakia – 0.24% (Table 8).

Table 4

Geographical structure of foreign trade in goods with the Visegrad Four countries

Years	Exports, million dollars US			Imports, million dollars US		
	Poland	Slovakia	Hungary	Poland	Slovakia	Hungary
2010	1785.6	563.9	857.0	2778.1	437.2	1213.8
2011	2791.8	833.7	1327.9	3164.2	594.3	1279.8
2012	2571.0	665.2	1507.1	3545.3	580.1	1158.6
2013	2547.8	752.8	1556.9	4068.7	663.7	1400.5
2014	2644.7	670.2	1509.9	3070.8	426.9	1463.9
2015	1977.3	468.5	909.7	2324.0	346.3	1608.5
2016	2200.0	471.4	1053.1	2693.3	434.9	802.0
2017	2724.6	656.0	1326.4	3453.8	508.7	1152.3
2018	3257.2	863.9	1646.0	3641.9	525.9	1260.2
2019	3295.8	709.6	1562.8	4109.1	651.8	1251.1
2020	3272.7	446.8	1263.8	4140.9	1143.4	1399.5

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Table 5

Geographical structure of foreign trade in services with the Visegrad Four countries

Years	Exports, million dollars US			Imports, million dollars US		
	Poland	Slovakia	Hungary	Poland	Slovakia	Hungary
2010	90.5	50.6	223.8	141.1	18.2	52.3
2011	132.4	49.4	83.8	142.5	33.6	101.0
2012	140.3	38.0	76.5	175.4	27.6	107.9
2013	217.9	50.0	183.4	167.5	30.8	85.1
2014	202.8	41.4	98.8	148.4	46.0	65.4
2015	181.9	26.8	92.3	98.7	101.8	50.0
2016	220.6	27.1	113.3	138.6	109.2	51.7
2017	296.3	40.9	147.2	150.2	108.3	35.5
2020	417.9	45.9	195.1	190.3	23.7	60.6

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Table 6

Export-import operations for the provision of transport services of Ukraine with the Visegrad Four countries

Country	Exports, thousand dollars US		Imports, thousand dollars US	
	2010	2020	2010	2020
Poland	48072.5	118653.0	46510.3	92784.6
Slovakia	28261.2	36836.0	7773.0	12868.8
Hungary	53623.1	31033.1	11088.5	9147.0

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Thus, in the future it is necessary to pay considerable attention to investing in the development of the economies of Ukraine and the Visegrad Four.

3. Functioning of transport and logistics systems in the border regions of Ukraine: features, trends, barriers and challenges

As a rule, railway and road transport are developed in the border regions of Ukraine.

However, according to the analysis of statistical data, the volume of freight transportation by rail in the Zakarpattya region decreased in 2000–2020 by 66.1%; in Lviv – by 44.7%; in Volyn – by 42.5%. The volumes of road freight transport in Lviv oblast decreased by 15.4%, and in Zakarpattya region – by 6.4%. At the same time, the volume of cargo transportation by road in the Volyn region increased by 63.4% (Table 9).

Table 7

Dynamics of the volume of direct investments from Ukraine in the economy of the Visegrad Four countries, million dollars US

Years	Poland	Slovakia	Hungary
2010	47.0	-	0.1
2011	46.3	-	0.1
2012	52.3	-	4.2
2013	56.4	-	17.3
2014	53.4	-	16.0
2015	50.2	-	14.6
2016	48.7	-	14.9
2017	6.7	-	17.5
2018	6.7	-	16.8
2019	8.1	-	16.1

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Table 8

Dynamics of the volume of direct investments from the Visegrad Four countries in the economy of Ukraine, million dollars US

Years	Poland	Slovakia	Hungary
2010	913.0	62.1	697.6
2011	834.3	71.1	678.5
2012	897.2	70.4	684.3
2013	819.8	99.7	685.9
2014	708.0	74.2	466.4
2015	679.4	72.2	333.7
2016	509.1	71.1	498.1
2017	571.3	74.9	511.1
2018	631.7	66.5	565.1
2019	693.7	69.1	380.7

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Table 9

Dynamics of freight traffic volumes in the border regions of Ukraine

Years	Volyn region		Zakarpattia region		Lviv region	
	railway	road	railway	road	railway	road
2000	1534.7	7581.1	3928.4	10795.2	6168.3	29607.0
2005	1787.5	10332.3	4713.0	13702.2	6487.0	20255.8
2010	1131.1	10106.0	1710.3	11899.2	3826.5	19456.5
2013	1068.9	10358.0	1424.1	9501.3	3223.7	21362.1
2014	1017.8	10122.6	1238.1	8934.3	3551.0	20905.5
2015	1031.5	10555.9	1703.5	9065.5	3840.9	20581.3
2016	985.6	12540.3	1245.6	9236.6	3641.3	21511.2
2017	1063.2	12955.8	1504.8	8747.6	4005.2	23217.9
2018	1124.5	13447.2	1815.8	8751.5	3850.4	25748.9
2019	1052.0	13145.5	1605.0	9778.4	3371.5	24390.2
2020	882.1	12390.0	1332.4	10103.2	3411.4	25038.0

Source: compiled on the basis of information and analytical materials of the Main Department of Statistics in Volyn, Zakarpattia, Lviv regions

During 2000–2020, the freight turnover of road transport in Zakarpattia region increased 10.4 times, in Volyn – 8.9 times, and in Lviv region – 2.9 times (Table 10).

The volume of export transactions in the structure of foreign trade in goods in Lviv region increased in 2010–2020 by 138.4%, in Volyn region – by 47.9%, in Zakarpattia region – by 16.7%. During this period, the volume of imports increased in Volyn region by 130.2%, in Lviv region – by 69.8%, and in Zakarpattia region, on the contrary, decreased by 6.9%. At the same time, the ratio of imports and exports in the Volyn region has increased: if in 2010 the value of this indicator was 1.31 times, in 2020 – 2.05 times.

In the Lviv region there is a tendency to reduce the value of the indicator: in 2010 – 2.08 times, and in 2020 – 1.48 times. In 2010, in the Zakarpattia region, imports exceeded exports by 1.17 times, and in 2020, exports exceeded imports by 1.07 times (Table 11).

If we consider foreign trade in goods (Table 12) and services (Table 13) between the border regions of Ukraine and the Visegrad Four countries, it should be noted that in the Volyn region there is a negative situation in the organization of export-import operations, as the balance is negative value. And in Lviv and Zakarpattia regions in 2020 the situation has improved and the balance of export-import operations will grow.

Table 10

Dynamics of freight turnover of road transport in the border regions of Ukraine, million tkm

Years	Volyn region	Zakarpattia region	Lviv region
2000	321.3	423.5	1748.8
2005	998.3	1755.5	1911.3
2010	1690.5	2754.3	3878.0
2013	1755.2	4149.5	4367.9
2014	1622.7	4410.7	4564.4
2015	1838.4	4676.1	4344.8
2016	2108.6	4862.6	4511.1
2017	2401.7	5285.6	4604.1
2018	2770.3	5073.1	5317.6
2019	2966.5	5002.1	5150.1
2020	2885.5	4410.6	5127.7

Source: compiled on the basis of information and analytical materials of the Main Department of Statistics in Volyn, Zakarpattia, Lviv regions

Table 11

Regional volumes of foreign trade in goods in the border regions of Ukraine

Years	Exports, thousand dollars US			Imports, thousand dollars US		
	Volyn region	Zakarpattia region	Lviv region	Volyn region	Zakarpattia region	Lviv region
2010	434800.0	1156600.0	974400.0	571500.0	1348600.0	2028300.0
2011	646350.7	1397588.5	1201931.1	1059592.7	1997931.9	3202346.9
2012	605783.6	1385087.3	1343535.6	1015138.6	2009084.9	3373475.2
2013	628811.2	1299965.6	1290873.7	1089007.1	2062449.2	2655042.5
2014	685422.1	1382795.9	1305077.7	765457.7	1734557.0	2472001.5
2015	631693.7	1094379.6	1206324.8	622087.5	1011507.0	1447944.9
2016	611874.2	1211902.4	1275566.1	1130757.2	1133380.9	1699411.8
2017	689287.7	1446423.2	1585154.1	1334974.0	1341735.6	2180388.2
2018	719980.9	1658975.7	1895635.5	1368504.4	1515819.8	2707300.7
2019	694002.3	1489957.9	2202053.5	1455943.0	1471227.2	3087739.0
2020	642901.2	1349544.5	2322937.5	1315698.3	1255371.3	3443377.1

Source: compiled on the basis of information and analytical materials of the Main Department of Statistics in Volyn, Zakarpattia, Lviv regions

Table 12

Foreign trade in goods between the border regions of Ukraine and the Visegrad Four countries

Country	Volyn region		Zakarpattia region		Lviv region	
	2010	2020	2010	2020	2010	2020
Exports, thousand dollars US						
Poland	44289.8	110856.8	48241.5	59959.7	175489.2	654772.2
Slovakia	9762.3	13102.5	88612.3	37388.9	20236.5	65502.5
Hungary	43369.6	8467.6	672762.5	808207.8	9860.6	158176.8
Imports, thousand dollars US						
Poland	132880.6	209942.0	27536.3	30770.1	608591.7	766295.7
Slovakia	11510.8	25695.5	43310.6	30025.2	38407.4	52949.7
Hungary	107566.3	127426.1	157451.0	147251.6	45366.6	45424.8
Balance of export-import operations, thousand dollars US						
Poland	-88590.8	-99085.2	20705.2	29189.6	-433102.5	-111523.6
Slovakia	-1748.5	-12593.0	45301.7	7363.7	-18170.9	12552.8
Hungary	-64196.7	-118958.5	515311.5	660956.2	-35506.0	112752.0

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

During 2010–2019, the share of direct investment in the economy of Lviv region increased by 0.5 percentage points or from 2.62 to 3.12% of the total volume of these investments; Volyn – by 0.38 percentage points or from 0.48 to 0.86%; Zakarpattya region – by 0.2 percentage points or from 0.8 to 1% (Table 14).

Statistical analysis shows that from the Lviv region there is an insignificant inflow of investments into the economic development of the world. And from Volyn and Zakarpattya regions no investment resources came to the countries of the world (Table 15).

Thus, ensuring balanced sustainable development of the border regions of Ukraine and the Visegrad Four in the context of intensification

of integration processes requires the search for qualitatively new tools to increase their competitiveness and investment attractiveness, including the cross-border transport and logistics cluster.

The main mechanism for implementing the development strategies of Ukraine, Poland, Slovakia and Hungary is the clustering mechanism, which involves the development of the concept of regional clusters and a system of measures for financial incentives for cluster initiatives. The concept of clustering of economies is a fundamentally new approach to the territorial organization of ecosystems, which focuses on the links between companies, the presence of clusters of interconnected areas of economic activity.

Table 13

Foreign trade in services between the border regions of Ukraine and the Visegrad Four countries

Country	Volyn region		Zakarpattya region		Lviv region	
	2010	2020	2010	2020	2010	2020
Exports, thousand dollars US						
Poland	4593.3	6519.8	843.5	5964.0	11966.7	94047.1
Slovakia	236.6	200.0	3416.5	10331.0	112.8	2264.4
Hungary	-	170.6	7502.0	145523.6	245.0	3115.7
Imports, thousand dollars US						
Poland	8035.7	7899.4	1027.4	1009.1	13591.3	26095.5
Slovakia	541.9	617.3	6743.2	4116.3	726.1	634.8
Hungary	-	17.7	5221.6	4179.5	4775.7	2640.3
Balance of export-import operations, thousand dollars US						
Poland	-3442.4	-1379.6	-183.9	4954.9	-1624.6	67951.6
Slovakia	-305.3	-417.3	-3326.7	6214.7	-613.3	1629.6
Hungary	-	152.9	2280.4	141344.1	-4530.7	475.4

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Table 14

Dynamics of direct investment in the economy of the border regions of Ukraine, million dollars US

Years	Border regions		
	Volyn region	Zakarpattya region	Lviv region
2010	218.6	364.4	1186.8
2011	291.4	348.5	1300.4
2012	380.5	406.4	1315.8
2013	341.3	437.5	1379.5
2014	271.2	334.2	1097.6
2015	247.1	311.8	1032.9
2016	246.1	317.0	833.5
2017	251.3	325.1	930.0
2018	256.7	343.3	947.8
2019	306.6	360.9	1116.3

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

Table 15

Dynamics of the volume of direct investments from the border regions of Ukraine in the economy of the world, million dollars US

Years	Border regions		
	Volyn region	Zakarpattya region	Lviv region
2010	-	-	0.8
2011	-	-	21.0
2012	-	-	27.4
2013	-	-	43.8
2014	-	-	38.1
2015	-	-	34.5
2016	-	-	15.4
2017	-	-	10.2
2018	-	-	8.8
2019	-	-	8.7

Source: compiled on the basis of information and analytical materials of the State Statistics Service of Ukraine

4. Institutional principles of forming a cross-border transport and logistics cluster in the context of cooperation between the border regions of Ukraine and the Visegrad Four

Legal, economic and organizational principles of cross-border cooperation in Ukraine are regulated by the relevant Law of Ukraine "On Cross-Border Cooperation". But, as the analysis shows, this legislation does not say anything about cluster development and cluster initiatives. It does not refer to cross-border transport and logistics clusters (Table 16).

At present, the State Program for the Development of Cross-Border Cooperation for 2021–2027 has been developed and approved. Among the main obstacles to the effectiveness of cross-border cooperation between Ukraine and the Visegrad Four countries are the development of border transport infrastructure, protection and restoration of ecosystems of the regions, low institutional capacity of entities and participants in cross-border cooperation. This is primarily due to insufficient funding for relevant activities and projects from the state budget.

It should be noted that in this State program insufficient attention is paid to the formation and functioning of cross-border transport and logistics clusters. The document does not provide appropriate mechanisms to ensure their creation and development, the implementation of which will help consolidate the efforts and concentration of resources in the field of transport and logistics

to achieve balanced development of border areas and increase the competitiveness of Ukraine.

To date, Regional Development Strategies for 2021–2027 have been developed and Action Plans for their implementation for 2021–2023 have been formed, in which the development of cross-border cooperation is recognized as a strategic priority (Table 17).

In order to intensify cross-border cooperation between the regions of Ukraine and the Visegrad Four, it is advisable to justify and develop a set of conceptual and strategic principles that will contribute to the effective development of cross-border cluster structures.

Among the main stages of developing the Concept of creating a cross-border transport and logistics cluster are the following:

- 1) analysis and diagnosis of appropriate conditions for the formation (marketing research and analysis of the market of transport and logistics services; assessment of the cluster);
- 2) development of a cluster formation mechanism (identification of potential cluster members; determination of cluster functioning principles; determination of cluster organizational and legal form; development of regulations and agreements on joint activities; determination of personnel potential of cluster participants);
- 3) scientific and methodological substantiation and development of the cluster model (formation of the organizational structure of management; determination of the necessary resource provision; development of the mechanism of financial

Table 16

The use of conceptual and categorical apparatus on the clustering of the economy

Legislation	Terminology
Association Agreement between Ukraine and the EU	Cluster development (Article 379 of Chapter 10 "Policy in the field of industry and entrepreneurship"). Intersectional maritime clusters (Article 411)
Law of Ukraine "On Cross-Border Cooperation"	Euroregional cooperation association. European Grouping of Territorial Cooperation. Cross-border association
Law of Ukraine "On Principles of State Regional Policy"	Programs and projects for the development of interregional and cross-border cooperation
State strategy of regional development for 2021–2027	Cross-border clusters. World-class regional, interregional and national clusters. Internationalization of cluster initiatives
State program for the development of cross-border cooperation for 2021–2027	Border transport infrastructure
National transport strategy of Ukraine for the period up to 2030	Network of multimodal transport and logistics clusters. Logistics centres.

Source: compiled on the basis of generalization of the current legislative and regulatory framework

Table 17

Operational development goals by 2027 in part ensuring cross-border cooperation in the regions of Ukraine

Name	Operational goal	Tasks
Development strategy of Volyn region for the period until 2027	Infrastructural support of cross-border cooperation	improving the condition of road transport infrastructure and transport connections of territories; development of border infrastructure; implementation of projects for logistics of cross-border cooperation; development of transit potential
Regional development strategy of Zakarpattia region for the period 2021–2027	Development of cross-border economic relations	creation of multidisciplinary international cross-border clusters; implementation of cluster initiatives with the use of mechanisms such as "cross-border park and logistics centre"
Development strategy of Lviv region for the period 2021–2027	Road transport, logistics, cross-border and information and communication infrastructure	development of cross-border infrastructure (network of logistics centres in border areas; business border infrastructure and cooperation between local and regional communities of neighbouring countries); construction of international checkpoints; implementation of large infrastructure projects

Source: compiled on the basis of the generalization of the Strategies of regional development of Volyn, Zakarpattia and Lviv regions for 2021–2027

support; determination of norms and rules of interaction between cluster participants);

4) assessment of the expected synergetic (economic, social, environmental) effect from the creation of a cross-border transport and logistics cluster.

5. Conclusions

In order to modernize the regional ecosystems of Ukraine and the Visegrad Four countries, it is advisable to develop a Concept for the creation of a cross-border transport and logistics cluster. To implement it, it is necessary to use a set of mechanisms, the key of which is regulatory.

At present, it is expedient to amend the Association Agreement between Ukraine and the EU, the Laws of Ukraine "On Cross-Border Cooperation" and "On Principles of State Regional Policy", the State Program for Cross-Border Cooperation for 2021–2027, Regional Development Strategies of Volyn and Zakarpattia and Lviv regions by 2027 in terms of creating appropriate institutional conditions for the formation and operation of the cross-border transport and logistics cluster. In addition, the Concept of the National Strategy for the Formation and Development of Cross-Border Clusters should be developed and approved. It is necessary to determine the mechanisms of financial support for their operation, namely: venture investment, crowdfunding, crowdsour-

cing, international-private-public partnership based on attracting private investment, credit institutions, foreign investment resources, grants from international financial institutions. The mechanism of international-private-public partnership will allow to successfully plan the development of border transport infrastructure and provide integrated multimodal logistics services; effectively ensure connectivity between different modes of transport and their integration with the territories; to increase the economic potential of transport and logistics infrastructure facilities.

Development and implementation of basic conceptual provisions for the formation of cross-border transport and logistics cluster will create appropriate conditions for increasing the volume and quality of transport and logistics services, gain competitive advantage, strengthen economic partnership, and implement a fundamentally new model of balanced sustainable development of cross-border regions of Ukraine and the Visegrad Four countries, which will meet modern economic requirements.

Further research is planned to summarize the international experience of creation and development of cross-border cluster structures and develop proposals for its application in the regions of Ukraine in terms of economic modernization, smart specialization and digital transformation.

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