



Polish-Ukrainian borderland as an area of transformation

SCIENTIFIC EDITORIAL

Andrzej Miszczuk
Oleksandr Shubalyi

Maria Curie-Skłodowska University Press

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Security
Green
Digital
Intellectual

Implemented as part of the project Eurizon ID 829:

“Structural transformation of the economy of the Polish-Ukrainian borderlands as a response to common challenges of security, green, digital and intellectual transition”



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INTRODUCTION

Ukraine's independence in 1991 as a result of the collapse of the Soviet Union and Poland's political and socio-economic transformation two years earlier created conditions for the development of the Polish-Ukrainian borderland. One of these was the opening of new border crossings. The border from a closed, disintegrating one during the Soviet era, took on the character of a partially open (filtering) one, becoming an impulse for undertaking cross-border cooperation. Quite consistent reforms and Poland's implementation of the European integration process, with the lack of simultaneous coherent actions on the Ukrainian side, resulted in the Polish-Ukrainian border becoming an external border of the EU, with new regimes for its crossing, but at the same time opportunities to develop cooperation based on funding from cross-border cooperation programs.

The Polish-Ukrainian borderland has become a subject of research since the 1990s, which was also expressed in publications. Thus, one of the first of its kind was a series of 15 volumes under the common title "Euroregion BUG," containing the results of research by Polish and Ukrainian economists, geographers, ecologists, sociologists, published in 1994–1997, as a result of a grant headed by Prof. Maciej Baltowski. In turn, 2005 saw the publication of a monograph, published in three languages – Polish, English and Ukrainian – by Polish and Ukrainian authors entitled: *Polish-Ukrainian Borderland. Environment-Society-Economy*¹.

Two monographs were published in 2017. One by Routledge Publishing entitled *The EU's New Borderland. Cross-border relations and regional development*, by Andrzej Jakubowski, Andrzej Miszczuk, Bogdan Kawalko, Tomasz Komornicki and Roman Szul, and another in Polish dedicated to the development challenges of the Polish-Ukrainian borderland².

¹ B. Kawalko, A. Miszczuk (red.), *Pogranicze polsko-ukraińskie. Środowisko-społeczeństwo-gospodarka*, Wydawnictwo WSZiA, Zamość 2025, ss. 332.

² A. Miszczuk (red.), *Wyzwania rozwojowe pogranicza polsko-ukraińskiego*, Norbertinum, Lublin 2017, ss. 288.

The monographs listed are exemplary in nature. Many other compact publications and articles have also been produced, not only in the scientific centers of the regions neighboring Ukraine, but also throughout Poland. It is also worth noting the development of cross-border statistics in the Polish-Ukrainian borderland, both in the form of paper and electronic publications³. In addition, the Statistical Office in Rzeszow conducts systematic quarterly surveys at the Polish-Ukrainian border on border traffic and spending by foreigners in Poland and Poles abroad.

The war that broke out in Ukraine in February 2022 became the impetus for the search for a new model of development of the Polish-Ukrainian borderland and new research challenges of the area. Among other things, it has led to a significant shift in regional development priorities in Ukraine from East to West (due to the loss of human capital, civil and industrial infrastructure), and in Poland from West to East (due to real threats to national security from aggressive Russia and Belarus). This also calls for a revision of the principles of cross-border cooperation between the Polish-Ukrainian border regions, as their importance has significantly increased and will continue to increase in the future, especially in the context of the further reconstruction of Ukraine and its European integration and the formation of a new system of European military, food, energy and digital security after the war.

The Republic of Poland is one of the largest partners supporting Ukraine, providing necessary humanitarian, financial, material and military assistance. In particular, from the first days of the full-scale war, it were the Polish border regions bordering Ukraine – the Lubelskie Voivodeship and the Podkarpackie Voivodeship – that took in Ukrainian refugees, provided them with the necessary humanitarian aid and employment. The Polish border regions also became a kind of logistical hub for the flow of military, humanitarian and material aid to support the Ukrainian armed forces and rebuild damaged infrastructure.

Ukraine's regions bordering Poland – Volyn, Lviv and Zakarpattia – also play an important strategic role in future post-war reconstruction from the beginning of the war on a full scale, particularly by preserving human capital, increasing the capacity of the agricultural, forestry, construction, industrial and military sectors of the national economy; generating additional revenue for budgets at all levels, etc.

Therefore, the economy of the Polish-Ukrainian borderland should be taken into account in the new relations between Ukrainian and Polish border regions, aiming to achieve common additional socio-ecological and economic benefits for both countries in a strategic perspective. In this context, it is very important that the development of this cross-border regional entity be carried out in accordance

³ Szerzej na ten temat: A. Jakubowski, A. Miszczuk, *Informacja statystyczna jako czynnik rozwoju pogranicza polsko-ukraińskiego* [w:] A. Miszczuk (red.), *Wyzwania rozwojowe pogranicza polsko-ukraińskiego*, Norbertinum, Lublin 2017, s. 237–258.

with a modern approach to the structural transformation of economic systems towards accelerating green, digital and intellectual transformation, taking into account the current security challenges for both countries. Of course, in terms of a timely response to these challenges, passive and active scenarios for the development of the Polish-Ukrainian borderland will not provide significant benefits at the local, regional and national levels in the long term. On the other hand, the proactive scenario is the most difficult to develop, as it requires a structural transformation of the economies of the border regions, but will be the most promising in terms of maximizing co-benefits.

This important task will require attracting additional foreign investment to create new high-tech industries that meet modern requirements, develop renewable energy, and, above all, develop natural and technical education and science, etc. This will make it possible to spread this new knowledge throughout the territory of the two countries in the post-war period, ensuring development on a modern technological basis. Therefore, further structural transformation of the economy of the regions along the Polish-Ukrainian border will play a very important role, on the one hand, in ensuring the post-war economic recovery of Ukraine and strengthening the security of Poland's borders, and on the other hand, in equalizing economic disparities in the levels of regional development in both countries.

This monograph was written by a team of Polish and Ukrainian scientists within the framework of the international project Eurizon ID 829: "Structural transformation of the economy of the Polish-Ukrainian borderlands as a response to common challenges of security, green, digital and intellectual transition", funded by the European Union program HORIZONT 2020 (grant agreement no. 871072), and is an attempt to identify current problems of development of the Polish-Ukrainian borderland regions from a scientific perspective and to propose ways to solve them in this context.

The monograph is divided into three parts according to the logic of presenting the results of scientific research.

The first part "Determinants of transformation of the Polish-Ukrainian borderland" contains chapters devoted to various factors of development of the Polish-Ukrainian borderland: environmental (W. Kalamucka, P. Telish), geopolitical (W. Baluk), socio-demographic (A. Jakubowski), systemic-economic (P. Kozarzewski), international economic (P. Pasierbiak), institutional-organizational (M. Miszczuk, A. Miszczuk), infrastructural (P. Witkowski), social (I. Shubala, I. Gordiichuk), digital (O. Khilukha), local (M. Khvesyk, M. Ilyina, Y. Shpyliova).

The second part of "Transformation of the Polish-Ukrainian borderland" contains chapters with research results related to the dimensions of regional and cross-border "green" transformation (J. Szafran), climate change and competitiveness (A. Karman, J. Banas, U. Bronisz, A. Miszczuk), human capital development and labor market

(P. Maleszyk), intellectual transformation (A. Gordiichuk), directions of digital transformation (U. Bronish), digitization of business environment (M. Dziamulych), “green” transformation of coal areas (I. Storonińska, K. Patytska, A. Dub, L. Benowska), logistics infrastructure planning (I. Vakhovich, Y. Pohulyayko), intellectual property system, scientific and innovative activities (N. Rud, V. Khomytskyi), stimulation of “green” transformation (P. Kosinskyi), placement of modern businesses (P. Miszczuk) of the Polish-Ukrainian border regions.

The third part “Competitiveness and Resilience of the Polish-Ukrainian borderland” contains chapters that examine the competitiveness and sustainable development of border regions against the background of EU regions (U. Bronisz, A. Jakubowski), common security challenges and measures to increase the resilience of the Polish-Ukrainian borderland economy (M. Khvesyk, G. Obikhod), the directions of development in the light of strategic documents of the Lubelskie (B. Kawalko) and Podkarpackie (P. Wais, A. Kielbasa) voivodeships, Ukrainian border regions (O. Shubalyi), as well as the conceptual assumptions of the new strategy for the development of the Polish-Ukrainian cross-border borderland as a tool for the integration of Ukraine into the EU (A. Miszczuk, O. Shubalyi).

The authors of the monograph hope that through their own conclusions and proposals they will draw additional attention of EU institutions, authorities, business, local community and scientists to the problems and prospects of development of the Polish-Ukrainian borderland in order to use all advantages and opportunities, overcome all threats and weaknesses on the common path of cross-border cooperation with maximum benefit for Poland and Ukraine.

Andrzej Miszczuk, Oleksandr Shubalyi

DETERMINANTS OF TRANSFORMATION
OF THE POLISH-UKRAINIAN
BORDERLAND

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ENVIRONMENTAL CONDITIONS OF THE POLISH-UKRAINIAN BORDERLAND

The Polish-Ukrainian borderland covering the territory of Lubelskie and Podkarpackie Voivodeships on the Polish side and Volyn, Lviv and Zakarpattia Oblasts, on the Ukrainian side is an area of great diversity in the natural environment.

The northeastern part of the area is located in Lubelskie Voivodeship. It covers an area of 25,122 km² and is the third largest voivodeships in the country. It borders Podlaskie, Mazowieckie, Świętokrzyskie, and Podkarpackie Voivodeships, while the border with Belarus in the east is 170 km, and with Ukraine – 296 km. The voivodeship's borders are largely determined by the natural-course boundaries – the valleys of the Vistula (to the west) and the Bug (to the east). The others are rather conventional, shaped by historical divisions or in a way that is completely incompatible with natural and cultural structures (Hrubieszów Basin and Roztocze).

Lubelskie Voivodeship has a unique geographical location. The boundaries of natural structures of continental scale meet in its territory. The border of Eastern and Western Europe is of the highest importance, running southward at the eastern border of the voivodeship. To the north of Lublin there runs the border of European lowlands and highlands, and the southwestern border, which is the edge of Roztocze and Lublin Upland, separates the old Paleozoic structures of Central Europe from the geologically youngest Alpine structures of Southern Europe.

In the relief of the area, there can be distinguished two broad belts: lowlands and highlands, and a small fragment of piedmont depressions. The northern part of Lubelskie Voivodeship is poorly sculpted. In the base of the part belonging to Lublin and Volyn Polesie, there are mainly sands and peats, and in the northeastern part belonging to the South Podlasie and Central Mazovian Lowland there are sands,

clays, and gravels. The lowest point (109 meters above sea level) is located in this part, in the Vistula River valley. The upland part, comprising the Lublin Upland with Roztocze, the Volyn Upland, and the Pobuże Basin, is characterized by a greater variety associated with the loess which is cut by a dense network of ravines near deeply incised river valleys. The greatest denivellations of the terrain can be found in Roztocze, where the highest point is located – Krągły Goraj (388.7 meters above sea level). The southern part lying in the Sandomierska Basin is a fragment of a vast plain sloping gently to the south, covered with sands overlying a thick layer of clay.

The area of Lubelskie Voivodeship is located on the slope of the East European Precambrian platform, on which thick deposits of Paleozoic rocks have been deposited. Of these, Carboniferous sediments containing coal deposits are the most significant. Paleozoic sediments are covered by a continuous series of Mesozoic rocks represented mainly by those of the Jurassic and Cretaceous periods. Cretaceous rocks on the surface are found within the Lublin Upland and Roztocze. Tertiary sediments at lesser depths are preserved in the northern part of the voivodeship. They contain the largest deposits of amber in Poland. In this part of the region, Pleistocene sediments occur on the surface, mainly sands, gravels, boulder clays as well as peats, sands, silts, river muds from the Holocene period – in extensive depressions and river valleys (*Harasimiuk et al.*, 2006).

Lubelskie Voivodeship is characterized by a moderate continental climate. It is shaped mainly by polar-marine air masses (*Kaszewski*, 2008). The average annual air temperature ranges from +7 to +7.6°C. Average precipitation ranges from 600 to 750 mm. The lowest is recorded in Podlasie and the eastern part of the upland belt (550 mm per year). The eastern part of the voivodeship is distinguished for the highest sunshine values in Poland. Climatic conditions are slightly influenced by the relief of the terrain, mainly Roztocze, which rises above 300 meters (*Kaszewski*, 2006). Winds from western directions predominate. Large, often rapid precipitation in the warm season and long periods without precipitation, with droughts in lower-lying areas are characteristic of the territory. The average air temperature is from +8° C in the southwest to +7° C near Tomaszów. The growing season in the western part lasts about 220 days, being 6 to 8 days shorter in the east. The lowest precipitation is in Podlasie and Polesie (520–550 mm) and the highest – in Roztocze (650–750 mm).

Lubelskie Voivodeship lies between the Vistula River and its right tributary – the Bug River. The rivers are allochthonous, carrying water from outside the voivodeship as well. The longest river (303 km) and the largest river basin in terms of area (40.5%) is the Wieprz, located centrally, entirely within the voivodeship. Groundwaters occur at different depths within the voivodeship. The lowest water table can be found in river valleys and the lowland part. In the upland part, due to the high density of chalky rocks, water can be found at more than 80 meters in some places. In these areas, there are the largest water voids in Poland, where distances to surface water

are more than 6 km (Michalczyk, Wilgat 2008). The upland part is characterized by the occurrence of numerous springs, the most abundant of which (with a capacity of over 300 l/s) can be found in Roztocze. The surface water network also includes a complex of more than 60 karst lakes with a specific recharge regime, occurring in the southern part of Polesie. Such a recharge regime makes them unique hydro-graphic objects, occurring in Europe outside the range of the last glaciation.

The diversity of the geological substrate and water conditions has contributed to the existence of a wide variety of soils. The most fertile ones can be found in the upland part and are associated with extensive areas of loess formations and chalky rocks, as well as river sediments (Vistula Valley, Chodelska Basin). The soils of the rest of the voivodeship, formed from post-glacial and organic formations, are characterized by lower use value and are more susceptible to chemical erosion (*Turski et al 2006*). The index of the agricultural quality of productive space in Lubelskie Voivodeship is 74.1 points (66.6 points in the country) and is one of the highest in Poland (after the Opole and Lower Silesian Voivodeships). (*Strategia Rozwoju Województwa Lubelskiego*). Soils in the highest three classes (I–III), both formed from loess formations and river formations, occupy nearly 40% of the voivodeship's soil acreage. These resources are getting more scarce, mainly due to the urbanization of land used for agriculture and afforestation of lands with poor agricultural suitability. The good quality of soils has led to the situation when the voivodeship has retained relatively few forests (23.3%), which puts the voivodeship in 15th place in the country. The southern part of the voivodeship, the Łęczna-Włodawa Lake District, the area around Parczew and Puławy, is characterized by high forest cover. The most deforested, due to good soils, is the Lublin Upland, where in many municipalities forest cover does not even exceed 10%. The structure of forest lands by form of ownership is dominated by the public sector (59.70% of forest land). However, this value is much lower than for the country in general (81.11%).

The location at the junction of natural regions means that diverse and valuable natural habitats have developed in the voivodeship. Many of them are included in the system of protected areas in the Lubelskie Voivodeship, covering 22.7% of the voivodeship's area (Cebrykow et.al 2012). This significantly affects the formation of the regional functional and spatial structure. The system is made up of 2 national parks (18,247.2 ha, i.e. 0.72% of the voivodeship's area), 87 nature reserves (11,862.90 ha, i.e. 0.47% of the voivodeship's area), 17 landscape parks (241,182.0 ha, i.e. 9.6% of the voivodeship's area), 17 protected landscape areas (301,970.8 ha, i.e. 12.02% of the voivodeship's area) and 123 Natura 2000 areas (384,961.98 ha, i.e. 15.3% of the voivodeship's area) (*Strategia Rozwoju Województwa Lubelskiego*).

Exceptional natural values and relatively low-intensity management made it possible to establish two international transboundary biosphere reserves: TBR Polesie Zachodnie (Polish-Belarusian-Ukrainian) and TBR Roztocze (Polish-Ukrainian). In

addition, the Ramsar site status as a wetland of global importance has been granted to Polesie National Park.

Of the natural resources occurring in Lubelskie Voivodeship, of strategic importance, according to the Polish law, are mineral deposits, underground and surface waters, forests with the leading role of state forests, and natural resources of national parks. Of the minerals, energy resources are of the leading importance, mainly bituminous coal the reserves of which account for 18.4% of the national balance resources. Documented resources of conventional natural gas account for only 2.4% of national resources, but more deposits are being systematically documented. Of the carbonate raw materials, limestone, and marl for the cement industry (documented resources reach 27.2% of national resources), and of the clay raw materials – clay raw materials for building ceramics (4.3% of national resources) are of supra-regional rank. (*Strategia Rozwoju Województwa Lubelskiego*). Of the water resources, groundwaters deserve mention, primarily because of their high quality. The use qualities of these waters are among the highest in the country. This is particularly conducive to the development of the food and pharmaceutical industries. Of fundamental importance in meeting the water needs of the region is the chalk basin of the Lublin Trough. Groundwater reservoirs are highly threatened by anthropological pressure (mainly pollution) due to the high permeability of the overburden and lack of legal protection (*Stanicka, 2012b*). Surface water resources are considerably smaller, primarily as a result of the underdeveloped river network over much of the Voivodeship and the variable components of runoff. Their usefulness is diminished by the still persistent excessive level of pollution (*Stanicka, 2012a.; Wojewódzki Inspektorat Ochrony Środowiska w Lublinie*).

The natural resources of the national parks (Polesie National Park and Roztocze National Park) are assessed in comparison with those of other parks in the country as significant, especially with regard to vascular plants. The parks are refuges for the most valuable species and habitats of this part of Poland. The vascular flora of the Roztocze NP includes more than 900 species. These include 70 species that are under strict and partial protection and a similar number of taxa considered rare in the region, with about 20 of them being under the threat of extinction on the national scale. The fauna includes more than 3,630 species. There are more than a thousand species of vascular plants in the Polesie National Park, of which 170 are rare, 75 are under species protection, and another 17 are in the Polish Red Data Book of Plants. In the territory of the Voivodeship also outside the national parks, there are many rare and endangered species of plants, animals, fungi, and natural habitats. In order to protect them, active nature conservation measures are being taken. Protection programs include, among others, the pond turtle, whose Lublin population is the most numerous in the country, the speckled ground squirrel – an extremely endangered species found only in Lubelskie Voivodeship, the capercaillie, listed in the Polish Red

Data Book of Animals, and the swamp ecosystems in the Sobibór Landscape Park. (*Regionalna Dyrekcja Ochrony Środowiska w Lublinie*).

An important potential for the development of the region is medicinal resources (mainly mineral waters with medicinal qualities), which are combined with the healing properties of the climate found in many places in the Voivodeship (mainly in the zone of the Bystra valley and the Tanew valley). They can provide the basis for the development of the resort function. There are significant opportunities for the use of renewable energy sources in the Voivodeship, especially solar energy (almost the entire Lubelskie Voivodeship is located in an area considered privileged in Poland in terms of potentially useful solar energy) and biomass. The projected energy resources of thermal waters are significant but require additional exploration. Wind energy can also be exploited. The best conditions for obtaining wind energy exist in the northwestern and western parts of the Voivodeship. An important natural resource is also the Voivodeship's landscape space, especially open space devoid of development or developed harmoniously. The highest value is that of the near-natural landscapes which have been preserved in the marshy, inaccessible areas of Western Polesie, Sandomierz Basin and Volyn Polesia (*Plan Zagospodarowania Województwa Lubelskiego; Strategia Rozwoju Województwa Lubelskiego*).

The southern part of the frontier area on the Polish side belongs to the Podkarpackie Voivodeship. Podkarpackie Voivodeship covers an area of 17,844 square kilometers, which is 5.6% of Poland's area and positions the 11th in the country. The Voivodeship borders Lubelskie Voivodeship to the north, Małopolskie Voivodeship to the west, and Świętokrzyskie Voivodeship to the northwest. The southern border is the state border between Poland and Slovakia (134 km) and Ukraine (239 km).

The predominant part of the area according to the system of continental geological structures lies within Southern Europe, covering the area of the youngest Alpine folding. The northern part is located within the Sandomierz Basin. Geologically, it is part of the Subcarpathian trough. It is filled with Miocene sediments, on the surface of which younger Quaternary sediments were deposited. In the physical-geographical division, it is referred to as part of the Northern Subcarpathia. The relief here is relatively monotonous, with a series of uplands built of glacial formations, separated from each other by wide river valleys (*Kondracki, 2000*).

The southern part of the Sandomierz Basin contrasts sharply with the Foothills (Pogórze) range which passes into the mountain ranges of the Beskid Niski which is part of the Western Carpathians, and the Bieszczady Mountains included in the Eastern Carpathians. The border between the two parts is the Łupków Pass. A small area located in the northeastern part of the Voivodeship is highland. These are fragments of the Lublin Upland and Roztocze. Denivelations of the terrain in the Voivodeship generally increase in a southern direction. The lowest point is in Chwałowice in the municipality of Radomyśl nad Sanem (138 m above sea level) and the highest point

is at the summit of Tarnica in the Bieszczady Mountains (1,336 m above sea level). The difference in altitude is significantly higher than in the Lubelskie Voivodeship, amounting to nearly 1,200 m.

Soils in the Subcarpathian region are characterized by great diversity. The areas of the Sandomierz Basin have mainly podzolic soils formed from sands, clays, loams, and silty formations. A significant area of the northern part of the Sandomierz Basin is occupied by podzolic soils formed from dune sands, while the eastern part of the basin is made up of podzolic soils formed from silty formations of water origin. In the vicinity of Leżajsk there are flat soils formed from specific sandy-dusty formations of water-glacial origin, and in the Carpathian Foothills there are loess-like dusty formations of varying thickness or on weathered clays formed in situ as a result of the weathering of the Carpathian flysch. In the area of Jarosław, Przemyśl, and Przeworsk there are the best soils in the Voivodeship – black soil formed from loess (*Strategia Rozwoju Województwa Podkarpackiego*).

The mountainous areas, including the Low Beskids and the Bieszczady Mountains, contain mainly brown soils, formed from flysch rocks. Among the brown soils, acidic and leached brown soils predominate, while proper brown soils are less common, the same as flat and precipitous soils. The bottoms of the river valleys are covered by mud and silt soils, while in the higher elevations, there are poorly developed soils. In the valleys of the Vistula, San, Wisłok, and Wisłoka rivers there are fertile muds (Kondracki 2000).

The largest area of agricultural land is made up of soils of the IV, III, and V quality classes, (87.2% of agricultural land). The share of very poor soils (class VI) is 7.4%, while the share of the best soils (class I and II) is 5.4%. A factor that reduces the quality of soils is their significant acidification. About 70–80% of agricultural land requires liming (*Strategia Rozwoju Województwa Podkarpackiego*).

The climate is mainly shaped by warm and humid polar maritime air masses arriving from the west. The frequency of their occurrence during the year is about 65%. Less frequently, the climate is influenced by dry and cool polar-continental masses coming from the east, from Eastern Europe and Asia (their frequency of occurrence is about 20%). Arctic, tropical, and other air masses have a much smaller impact (about 15%).

The warmest part of the region is the Sandomierz Basin. The average annual temperature here is +8 °C; in summer – +18 °C, during winter -3 °C, while the average amount of precipitation here is the smallest in the Voivodeship – from 565 mm near Tarnobrzeg up to 700 mm on the Kolbuszowa Plateau. Days with frost occur for 40–55 days. The duration of snow cover is about 70 days. The winds here are mainly western.

The climate is slightly harsher in the Carpathian Foothills. The average temperature of the year is +7°C, which is determined by lower average winter temperatures

than in the Basin, from -3 to -5°C. The average amount of precipitation is 700–750 mm in the western part and 750–800 mm in the eastern part. Days with frost occur here for about 50 days, and morning frosts – up to 150 days a year. Snow cover persists for about 80 days. The prevailing winds are southwestern.

In the Low Beskid and the Bieszczady Mountains, the average temperature per year is 2 to 3°C, lower than in the northern part of the Voivodeship. The values of average temperatures decrease towards the east and are up to +5°C at the extremities, up to +16°C in summer and -6°C in winter. This part of the Voivodeship is the area with the highest precipitation values in both summer and winter. Annual precipitation for this part ranges from 800 to 1,200 mm. Days with frost occur on average for about 75 days, and in the higher parts of the Bieszczady Mountains even for 100 days. Snow cover remains in the Low Beskids for up to 150 days, in the Bieszczady for up to 200 days, and can reach a thickness of up to 300 cm here. Southern winds dominate.

A characteristic feature of the southern part of the Voivodeship is the occurrence of foehn winds most often from the southern direction, in late autumn and winter (February), early spring, and less often in summer. These are strong winds with speeds above 10 m/s. In addition, the Dukla area is characterized by strong winds blowing from over the Hungarian Lowland, taking advantage of the significant lowering of the Carpathian Mountains in the area of the Dukla Pass – these are the so-called Dukla winds (*Regionalna Dyrekcja Ochrony Środowiska w Rzeszowie*).

In the foothills and mountains there are large local climatic differences, depending on relative altitudes, relief, and slope exposures.

The Polish part of the border region in question, which includes Podkarpackie Voivodeship, is located mainly in the Vistula River basin, encompassing the drainage basins of large rivers such as the Wisłoka, San and its tributary, the Wisłok. A small, northeastern fragment of the Voivodeship is the catchment area of the Rata and Sołokia rivers – tributaries of the Bug and a fragment of the eastern part of the Voivodeship is located in the catchment area of the Black Sea through the Dniester basin, which includes the Strwiąż and Mszanka drainage basins. Surface water resources, which are the main source of water supply, are huge but unevenly distributed. Good-quality waters can be found in the southern part of the Voivodeship, in sparsely populated areas, largely forested and covered by large-scale forms of nature conservation (*Regionalna Dyrekcja Ochrony Środowiska w Rzeszowie*). In other areas of the Voivodeship, especially in urbanized areas, areas threatened by municipal and industrial pollution, and areas used for agricultural purposes, water quality is worse. The Voivodeship has a significant retention potential (about 15% of all water retention in Poland). In its territory there lies the most capacious surface water reservoir in Poland, i.e. Lake Solina, and, in addition, large reservoirs: Myczkowce on the San River and Besko on the Wisłok River. The Voivodeship has

good conditions for locating both large and small retention reservoirs (*Strategia Rozwoju Województwa Podkarpackiego*).

Documented groundwater resources are found mainly in the northern part of the Voivodeship. Compared with the resources of other regions of the country, they are small. The estimated disposable resources of the reservoirs in the part pertaining to Podkarpackie Voivodeship constitute about 1.5% of the resources of all reservoirs in Poland. Groundwaters are mostly characterized by a good chemical condition. Threats to their quality are posed by municipal, industrial and agricultural pollution, especially in areas of shallow water table. Water status is poor in the northwestern part of the Voivodeship, in an area historically associated with mining and sulfur processing industries (*Wojewódzki Inspektorat Ochrony Środowiska w Rzeszowie*).

Podkarpackie Voivodeship has average mineral resources if compared with the rest of the country. There are various raw materials in the Voivodeship, which is due to the varied geological structure. Of greatest economic importance are deposits from the group of energy resources, i.e. deposits of natural gas and oil. Also important in the context of the functioning and development of resort treatment is the occurrence of medicinal waters and peats. In the exploitation and exploration of hydrocarbons, thermal waters have been found, which are fit for exploitation. Also important from the point of view of the size of resources and uniqueness of occurrence are deposits of sulfur.

Mineral waters can be found throughout the Podkarpackie Voivodeship: in the central and southern parts of the Voivodeship these are mainly chloride waters, healing mineral waters and brines, while in the northern part these are sulfide and hydrogen sulfide waters. Based on these resources, four resorts operate in the Podkarpackie Voivodeship. These are: Iwonicz-Zdrój, Rymanów-Zdrój, and Polańczyk – located in the Carpathian Mountains, as well as Horyniec-Zdrój – located in the Subcarpathian trough (*Strategia Rozwoju Województwa Podkarpackiego*).

The forest cover of Podkarpackie Voivodeship is significantly higher than that in Poland. The largest forest complexes have survived in the north of the Voivodeship, in the Sandomierz Basin as remnants of the former Sandomierz Forest, as well as in the Beskids and the Bieszczady Mountains. The forests in the Sandomierz Basin are dominated by pine, and the share of oak, beech, linden, hornbeam, black alder, fir, spruce, and larch is also high. In the Carpathian Foothills, forests are found mainly in the upper elevations and are primarily mixed forests. The lower areas of the Foothills are home to hornbeam, oak, birch, and pine, while the higher elevations are home to fir and beech.

The most diverse and rich vegetation occurs in the southern, mountainous part of the Voivodeship. In the Low Beskids and the Sanok-Turka Mountains, there are two vegetation zones: the foothill zone, reaching up to about 500 m above sea level, and the lower montane zone, and in the Bieszczady Mountains – also the mountain

pasture zone. The upper montane spruce forests are missing from the stratified vegetation system (Kondracki, 2002). The predominant forests in the Bieszczady area are beech and fir. In the lower montane areas, there are fir or mixed forests, in the higher ones – exclusively beech, often with an admixture of sycamore maple.

The geographical location, diverse landscape, resulting diversity of natural habitats, and relatively small environmental transformation have made this an area of great natural value. Protecting plant, animal, and fungus species play a vital role here. In Podkarpacie, among the protected plant species, there are about 50 species listed in the Polish Red Data Book of Plants, including 14 species that have the only natural sites in the Podkarpacie region. The natural wealth also includes diverse fauna, with the Carpathian deer, elk, and bison (the only free mountain population of this species in Poland). The lynx, wildcat, and wolf have their main refuges here, as well as the bear which forms the largest population in Poland. The flagship bird of Podkarpacie is the largest Polish eagle – the golden eagle. Over 50% of the area is covered by legally protected areas, including 2 national parks, 98 nature reserves, 10 landscape parks, 7 Natura 2000 areas – bird sanctuaries, 55 habitat sanctuaries, and 1 sanctuary with bird and habitat status (*Regionalna Dyrekcja Ochrony Środowiska w Rzeszowie*).

Some of the protected areas in the Voivodeship are protected within the framework of global networks of protected areas. These include the Bieszczady National Park and its buffer zone Landscape Parks – Cisna-Wetlina and San Valley, which are part of the trilateral Polish-Slovak-Ukrainian International Biosphere Reserve Eastern Carpathians (Polski Komitet do Spraw UNESCO). A unique resource of the biosphere reserve is the low level of light pollution. The Polish part of the Eastern Carpathians BR is the second largest dark sky protection area in Europe and is known as the Bieszczady Starry-Sky Park. It borders the Dark Sky Park on the Slovak side.

The northeastern part of the Polish-Ukrainian borderland lies within Volyn Oblast. It covers an area of 20.1 thousand km² and is the 20th largest in Ukraine (*Ekologichnyj pasport Volynskoi Oblasti*). Volyn Oblast borders Brest Oblast of Belarus in the north, Rivne Oblast in the east, and Lviv Oblast in the south. The western border of the Oblast is natural for more than 184 km and goes along the valley of the Bug River.

The geographical location of Volyn Oblast is quite favorable. The Oblast belongs to the regions of Ukraine with relatively well-preserved natural conditions, but there are differences in the development in different parts of the Oblast. The landscapes of the southern forest-steppe part of the Oblast are the most transformed.

The borderland area within Volyn is predominantly flat, with an average altitude of 195 metres above sea level. The highest point of the Volyn Oblast surface reaches 292 m above sea level and is located near the village of Buzhany in Lutsk raion, and the lowest point is 139 m above sea level in the valley of the Prypiat River near the place where the Stokhid River flows into it. The territory of the region has low relative

altitudes, especially in the northern Polesia part. In the southern forest-steppe part of the region, it slightly increases above 100 m, especially between rivers and their local watersheds. Although the surface of Volyn Oblast is generally flat, it is divided into several distinct orographic parts: Volyn Loess Upland (average height 215 m), Turiya Denudation Plain (190 m), Volyn Hilly Ridge (175 m), and Upper Prypiat Lowland (155 m) (*Fesiuk, 2016*).

The territory of Volyn Oblast is located within the Volyn-Podilsk margin of the East European Platform, the foundation of which is composed of crystalline Proterozoic sediments. On the surface of this basement there lies a thick layer of Tertiary sedimentary rocks (Proterozoic, Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Jurassic, Cretaceous, Paleogene). In addition to Cretaceous and Paleogene sediments, all of them are covered by Quaternary sediments, which have a very heterogeneous structure and different thicknesses. A characteristic feature of the distribution of Quaternary sediments in Volyn territory is their latitudinal zonation. The Quaternary sediments of the region are composed of continental formations, among which glacial (moraine), water and lake-glacial, aeolian, alluvial, and other sediments prevail (*Pavlovska, 2019*).

The climate of the borderland within Volyn region is humid moderate continental, with mild winters with unstable frosts and frequent thaws, mild summers, significant rainfall throughout the year, and long spring and autumn. There are six weather stations in the region (Luts'k, Liubeshiv, Svitiaz, Manevychi, Kovel, Volodymyr) and 15 meteorological posts that monitor the main weather and climate indicators of the Oblast round the clock. The direction and speed of winds is determined by the seasonal rhythm of the baric centres that develop over the northern part of Eurasia and the Atlantic. Due to the flat nature of the surface, there are no significant contrasts in the air temperature distribution. The coldest month is January, with an average temperature of -5°C . The lowest temperatures occur when the Arctic continental air flows in. The average temperature in July is $+18.6^{\circ}\text{C}$. The highest temperatures occur when warm sea air from the Atlantic or continental air from Asia Minor enters the region. The relative humidity in winter is about 80%, and in summer it drops to 65–70%. The annual precipitation in the region is 550–600 mm, with the highest amount of precipitation falling in June (80–90 mm) and the lowest – in January (24–32 mm) (*Pavlovska, 2019*). In winter, the entire territory of the Oblast is covered with snow, but recently thaws have become much more frequent. This may be a manifestation of the impact of climate change in the region.

Volyn is very rich in surface water: rivers, lakes, and ponds. Most rivers in the Oblast belong to the Prypiat and Bug River basins. The rivers flow through the Oblast mainly from north to south and have a slow flow due to the small height differences. The Prypiat basin includes 59 rivers ranging in length from 10 to 50 km, four rivers – from 50 to 100 km, and four rivers (Prypiat, Turiya, Stokhid, Styr) – over

100 km. The Bug River basin includes 11 rivers ranging in length from 10 to 50 km and the Luha River with a length of more than 50 km. By their regime, the rivers of the Oblast are plain-type rivers with a predominance of snow recharge. The nature of the rivers' nutrition determines their levels of regime and flow (Fesiuk, 2016).

Volyn Oblast has the largest number of lakes among all western regions of Ukraine – about 170 lakes of various origins, ranging in size from 2 to 2,450 hectares. Most of the lakes are karstic, but there are also floodplain lakes, mainly in the Prypiat floodplain. The largest lakes in the Oblast territory are in the Bug River basin (Svitiaz, 24,250 ha, Pulemetske, 16,350 ha, Liutsymer, 4,500 ha, and Lake Bile, 3,500 ha in the Prypiat floodplain (Fesiuk, 2016). All lakes in Volyn Oblast have favourable conditions for the development of recreation, and fish and waterfowl breeding.

The distribution of soils in the borderland within the Volyn Oblast is clearly subject to general geographical patterns. In the Polesie part of the Oblast, azonal hydro-morphic soils associated with lowland relief on sandy and sandy loam deposits prevail – sod-podzolic (*Albic Retisols*), sod (*Arenosols (Ochric)*), meadow (*Gleyic Phaeozems*) and bog (*Haplic Gleysol*) soils as well as peat bogs (*Histosols*). In the south of the Oblast, within the Volyn Upland, grey forest-steppe soils (*Haplic Luvisols*), typical (*Haplic Chernozems*), and podzolic black soils (*Greyzemic Phaeozems*) are common for loess-like loams. In the places where chalk and marls are exposed on the surface, soddy carbonate soils (*Rendzic Leptosols*) have developed.

The natural vegetation of the borderland within Volyn Polesie is relatively young and was formed in the post-glacial period based on different botanical and geographical centres. In terms of vegetation, that is a plain fragmentarily covered with pine, birch, spruce, black alder, and mixed forests, vast swampy plains, and interfluvial meadows. The most common types of forests are pure and mixed pine forests, which differ in terms of moisture conditions, trophic composition, and floristic composition. Large areas of the Oblast are occupied by dry and lowland interfluvial meadows. Floodplain meadows are common in the valleys of the Prypiat, Styr, Stokhid, and Turiya. The coastal and aquatic flora is extremely rich and diverse. The western part of Volyn Polesie is home to relict Pleistocene plant species that are very sensitive to changes in environmental conditions and often disappear as a result of land drainage. In the south of the Oblast, natural mixed oak forests are common on the loess-formed Volyn Upland, with some forest-steppe and steppe species also occurring there (Fesiuk, 2016).

The flora of the borderland within Volyn Oblast includes a significant proportion of plant species protected at the international level (*the European Red List and the Bern Convention*). Some plant cenoses are listed in the Green Book of Ukraine: green moss and blueberry oak forests, bog cenoses, or aquatic cenoses.

Landscape diversity, a complex of forest and marsh ecosystems, a dense distribution of lakes, and favorable climatic conditions contribute to the uniqueness and

richness of the Oblast's fauna. 90% of vertebrates are indigenous, the rest are introduced. The background mammal species of the Oblast are as follows: hedgehog, red squirrel, marten, red fox, grey hare, wild pig, European chamois, elk, and others.

The land stock of the borderland within Volyn amounts to 2,014.4 thousand hectares, of which 52% is occupied by agricultural land, which indicates a high level of agricultural development of the land. The least agriculturally developed are the northern districts of the region, with the share of arable land in their structure not exceeding 20% (*Ekologichnyj pasport Volynskoi oblasti*). This is due to high forest cover and the availability of nature conservation sites.

The total area of Volyn forests is 687.2 thousand hectares. This is about 34% of the total area of the region. In terms of forest cover, Volyn Oblast ranks fifth among the oblasts of Ukraine having the highest forest cover. The Oblast's forest cover increases from south to north. The southern forest-steppe areas are characterized by more intensive forestry development due to significant logging volumes and logging areas. Almost 90% of all forests in the region are state-owned.

A significant number of natural and little-altered habitats have been preserved in the borderland area within Volyn. This made it possible to cover them with the protection regime within the nature reserve fund. Today, the region's protected area rate is 11.7%. Volyn's system of protected areas includes: Cheremsky Nature Reserve (2,976 hectares, 1.26% of the region's protected areas), three national nature parks (121,767 hectares, 52%), and the Botanical Garden in Lutsk (10 hectares, 0.004%), 225 nature reserves (95,344 ha, 40.4%), 131 natural monuments (741.8 ha, 0.31%), 27 protected tracts (15,064.02 ha, 6.38%), 12 parks-monuments of landscape art (110.63 ha, 0.05%) (*Ekologichnyj pasport Volynskoi oblasti*).

Wetlands of international importance from the list of the Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat, 1971) are under special supervision and protection in the region. This list includes the Shatsk Lakes (1995 – 13,039 hectares; in 2002 – expanded to 32,850 hectares), the Prypiat River Floodplain (12,000 hectares), and the Stokhid River Floodplain (10,000 hectares). In 2021, the rare eumesotrophic Cheremsky bog complex, with an absolute protection status, was included in the Ramsar list (*Regionalna dopovid pro stan navkolyshniogo pryrodnogo seredovyshcha u Volynskij oblasti*). The main purpose of the approval of these sites is to preserve the most valuable wetlands in their natural state while conducting sustainable traditional economic activities.

The border area within Volyn Oblast is relatively poor in mineral deposits. The most important industrial minerals here are coal, peat, raw materials for lime, cement and bricks, construction sands and pottery clay. A number of structures have also been discovered here that are promising for the discovery of gas and oil fields. Coal is found in the southwestern part of the region. The Novovolynsk deposit of the Lviv-Volyn basin is located here, with the first mines being founded in 1950.

Peat reserves have been discovered in Volyn's subsoil, mainly associated with the floodplains and the first floodplain terraces of the Prypiat, Stokhid, Turia, Styr, and their tributaries. Cement raw materials and raw materials for lime and brick production are common in the form of Upper Cretaceous chalk-marl rocks. Construction sands are very common for the northern (Polesie) part of the region. Their deposits are associated with water and glacial deposits. Pottery clays occur in the form of low-powered lenses and interlayers among Paleogene sediments in small areas and are not of industrial importance (*Volynska, 2009*).

There are 11 reservoirs in operation in Volyn region, with a total area of 2,170.7 hectares. They are used primarily for wetting drained land in reclamation systems and fish farming. There are 1,252 ponds in the region, with a total area of 5,435.52 hectares, the main sources of water supply being meltwater, flood, rain, and groundwater. The region's surface water reserves are sufficient for various needs (*Regionalna dopovid pro stan navkolyshniogo pryrodного seredovyscha u Volynskij oblasti*).

The natural resources of Volyn's national parks (Shatsk NNP, Kivertsi NNP, and Prypiat-Stokhid NNP) are of great importance for the protection of flora in the northeastern part of the Polish-Ukrainian borderland. The flora of the Shatsk NNP includes more than 807 species of vascular plants, which is about 40% of the entire flora of Ukrainian Polesie. The Red Data Book of Ukraine includes 50 species of plants and fungi found in the park, 21 species are protected at the European level, and 15 species of vascular plants are protected at the regional level. The fauna of the park includes 347 species of vertebrates: 57 species of mammals, 241 species of birds, 7 species of reptiles, 12 species of amphibians, and 30 species of fish. The Red Data Book of Ukraine includes otter, badger, ermine, 37 species of birds, three species of reptiles and amphibians, and three species of fish (*Regionalna dopovid pro stan navkolyshniogo pryrodного seredovyscha u Volynskij oblasti*).

The northeastern part of the borderland has significant prospects for the development of sanatorium and resort treatment based on the use of mineral waters and therapeutic muds (sapropels and peat muds). The territory of the region is located within the Volyn-Podole artesian basin, so mineral waters of various types are widespread within its borders. A total of nine mineral water deposits have been discovered in the region, but only four of them are currently in operation. Calcium bicarbonate, sodium bicarbonate, and calcium chloride mineral waters are common in the area of Ratne, Osnytsia, Tur, and near the *Lisova Pisia* sanatorium. They are suitable for treating diseases of the cardiovascular system, hypertension, nervous system, and other diseases. Near the village of Zhuravychi, sodium chloride waters with mineralization rate of 12–13 mg/l and with impurities of bromine, iodine, and radon are common. These waters are suitable for treating diseases of the cardiovascular, respiratory, and digestive systems as well as atherosclerosis. Near the town of Kovel, there is a deposit of sodium chloride, iodine, and bromine water, which has

no counterparts anywhere else in Ukraine. The operational horizon of these waters reaches 1,300 m. The operational reserves are 90 m³/day and are meant to be used over 25 years. Two wells of iodine-bromine, sodium chloride waters of high mineralisation and low-mineralized ferrous waters that can be used as drinking table and mineral water have been drilled near Lutsk (*Ekologichnyj pasport Volynskoi oblasti*).

Volyn lakes contain significant reserves of sapropel that can be used for medicinal purposes. It is used to treat diseases of the cardiovascular and nervous systems, burns, joint and skin diseases, as well as rheumatism. Proven reserves of sapropel amount to over 270 million tonnes (about 97% of Ukraine's total reserves). However, today it is commercially extracted only in some shallow lakes. In addition to sapropel, 33 deposits of therapeutic peat mud have been surveyed in the region (*Regionalna dopovid pro stan navkolyshniogo pryrodnogo seredovyshcha u Volynskij oblasti*).

The southeastern part of the Polish-Ukrainian borderland lies within Lviv Oblast. It covers an area of 21.8 thousand km², which is about 3.6% of the territory of Ukraine and ranks 17th among the oblasts with the largest area in Ukraine (*Nazaruk, 2018*). Lviv Oblast is located in the far west of Ukraine. It borders Volyn and Rivne Oblasts to the north and northeast, Ternopil and Ivano-Frankivsk Oblasts – to the east and southeast, and Zakarpattia region – to the south. In the west of the Oblast, a part of the state border of Ukraine with Poland extends for more than 258 km. The geographical location of Lviv Oblasts also has the peculiarity that a significant part of the Main European Watershed which separates the rivers of the Baltic and Black Sea basins passes through its territory (*Shabliij, 2012*).

The Polish-Ukrainian borderland within Lviv Oblast is characterized by a wide variety of natural conditions and a wealth of natural resources. The area is home to plains and mountains, as well as Polesie, forest-steppe and forest-meadow landscapes. Its subsoil is rich in various minerals. This diversity of natural conditions and resources is due to its geographical location, geological structure, and surface character.

The geological structure of Lviv Oblast is complex and diverse. The southwestern part of the Oblast is occupied by the Eastern Carpathians and Subcarpathia, while the central and northeastern parts are located within the Volyn-Podillya part of the East European platform. The northern and northeastern part of the Oblast, up to about the Rava-Ruska – Lviv – Zhydachiv line, belongs to the slope of the Ukrainian crystalline shield. Sedimentary rocks here lie on a Precambrian basement consisting of granites and other magmatic and metamorphic rocks. To the south is the Subcarpathian zone the basement of which is formed by Lower Paleozoic and Upper Proterozoic sediments. The crystalline basement is overlain by a thick layer of Jurassic, Cretaceous, and Miocene rocks. Sedimentary flysch strata of Cretaceous and Paleogene age, formed by clay shales, marls, sandstones and other rocks, play a major role in the geological structure of the Skyba zone of the Ukrainian Carpathians. The Pleistocene sediments overlie the older geological rocks in an almost continuous

layer. They have different thicknesses, belong to different genetic types, and differ greatly in their lithological composition (*Ivanov, 2021*).

The position of the southeastern part of the borderland in the Main European Watershed has led to a rather significant elevation of its territory above sea level. It has been estimated that the average altitude of Lviv Oblast reaches 376 m above sea level, which is twice the average altitude of Ukraine (175 m above sea level). The highest peak of the Oblast is Mt. Pikuy (1,405 m above sea level), and the highest point of the plain part of the Oblast is Mt. Kamula (471 m). Lviv Oblast is divided into several distinctive parts by its relief features: the Volyn Upland, Small Polesie, Roztocze, Podole, Subcarpathia, Outer Carpathians and Watershed-Highland Carpathians. Within Lviv Oblast, the Volyn Upland forms a rather distinct Sokal Ridge, which does not exceed 270 m in height. This ridge, which generally belongs to the forest-steppe landscapes in the south, passes into the area of Male Polesie with a distinct ledge. Male Polesie is a fairly large flat area of more than 7,000 km², with some parts having slightly different relief features. To the northwest of Lviv lies a completely different Roztocze region, which is a very rugged hilly upland with some elevations of over 350 m above sea level. The name Roztocze is associated with the fact that many rivers flow from there in different directions: to the south to the Dniester, to the east to the Bug River, to the west to the San. To the southeast of Lviv lies the high and forested Podole with an altitude of over 340 metres. To the southwest of Lviv and Roztocze there is Nadsanie, a low-lying depression with an elevation of 250 m (*Ivanov, 2021*).

To the south of Nadsanie and the Podole Uplands is the Subcarpathian region, an orographic area of specific structure and significant mineral reserves. The southern part of the region belongs to the Carpathian Mountains, which are traditionally divided into the Upper Dniester and Skole Beskydy and the Stryi-San Highland (*Nazaruk, 2018*).

Due to the heterogeneity of the surface, the territory of the southeastern part of the Polish-Ukrainian borderland is characterized by the greatest differences in climatic features. Lviv Oblast is not at all characterized by severe frosts and droughts, but rather by frequent thaws in winter, significant cloud cover and precipitation. There are significant differences in air temperature, precipitation, cloud cover, etc. in different parts of Lviv Oblast, which are caused by atmospheric circulation and absolute altitudes. In the Carpathian part of the borderland, local winds are often formed: mountain-valley winds in summer, and foehn winds in winter and spring. In the mountainous part of the borderland, the Carpathian Mountains receive between 580 and 1,070 mm of precipitation. These are the highest precipitation figures for the entire Polish-Ukrainian borderland (*Ivanov, 2021*).

The southeastern part of the borderland is extremely rich in surface water resources. There are over 8,950 rivers in Lviv Oblast, with a total length of 16,343 km.

Most of the rivers belong to the Dniester and Bug River basins, with only a small part belonging to the San and Prypiat basins. Since the southern part of the borderland on the Ukrainian side is located within a watershed, small rivers predominate here. The speed of their flow varies, with the highest in the mountain rivers and streams in the Beskydy Mountains and the lowest – in the Male Polesia. In addition to rivers, there are small lakes, reservoirs, and ponds in Lviv Oblast (Nazaruk, 2018).

The flat forest-meadow landscapes of the southeastern part of the borderland are dominated by sod-podzolic soils (*Albic Retisols*), among which there are also sod (*Arenosols* (*Ochric*) and bog (*Fluvisols Histic*) soils. In the forest-steppe landscapes, grey forest soils (*Haplic Luvisols*) and black soils (*Haplic Chernozems*) occur on watersheds and slopes, and sod and bog soils also occur in river valleys. In the mountainous areas, brown mountain-forest soils (*Dystric Cambisols*) are prevalent (Ivanov, 2021).

The flora and vegetation of Lviv Oblast was formed during the glacial and post-glacial periods. In pre-agricultural times, most of the borderland was covered with forests. Today, only a third of the area is covered by natural vegetation and is characterized primarily by forest, meadow, and marsh cenoses. In very limited areas, fragments of steppe vegetation have been preserved. Lviv Oblast is considered one of the richest in Ukraine in terms of biodiversity. The region's flora comprises more than 2,000 vascular plant species, which accounts for almost half of the species composition of Ukraine's flora. The Red Data Book of Ukraine includes 176 species of plants and fungi. In addition, there are 281 plant species in the territory of the region that are included in the List of plant species subject to special protection in the region (Nazaruk, 2018). Lviv Oblast has a fairly diverse fauna, including Eastern, Western European, Mediterranean, and mountain species. The vertebrate fauna includes more than 340 species, including 71 species of mammals, 199 species of breeding birds, 47 species of fish, 15 species of amphibians, and 8 species of reptiles. In the mountainous areas of the borderland, brown bear, lynx, fox, wolf, roe deer, deer, and squirrel can be found. In the plains, there are grey hare, red fox, squirrel, roe deer, wild pig, steppe ferret, vole, hedgehog, gopher, and mole. Bison, muskrat, nutria, etc. have also been acclimatized (Ivanov, 2021).

The land stock of the borderland within Lviv Oblast amounts to 2,183.1 thousand hectares, of which about 58% is arable land, which points to a high level of agricultural development of the lands of the southeastern part of the Polish-Ukrainian borderland. The least agriculturally developed areas are the mountainous regions of the Beskydy Mountains, due to high forest cover and the availability of nature protection objects (*Ekologichnyj pasport Lvivskoi oblasti*).

In the southeastern part of the Polish-Ukrainian borderland, significant areas of forest have been preserved. Lviv Oblast is one of the most forested regions in Ukraine. Its forest cover is 28%, while the average for Ukraine is almost half of that (14.3%).

In terms of the total area of forests (694.4 thousand hectares, more than 8% of all forests in Ukraine), Lviv Oblast ranks third after Volyn and Zhytomyr Oblasts. The species composition of Lviv Oblast's forests is quite diverse. There are more than 20 indigenous forest-forming species, among which deciduous trees predominate. The main species are beech, oak, hornbeam, alder, birch, aspen, ash, maple, poplar, linden, while conifers include pine, spruce, fir, and larch. The largest forests are concentrated in the Carpathians and in the north of the region. Spruce, fir, and beech forests dominate in the mountains, while oak, oak-hornbeam, beech, and pine forests are most common in the plains (*Regionalna dopovid pro stan navkolyshniogo pryrodnogo seredovyscha u Lvivskij oblasti*).

In the southeastern part of the borderland within Lviv Oblast, a significant part of natural and little-altered habitats has been preserved. This made it possible to cover them with the protection regime within the nature reserve fund. There are 413 nature reserves in Lviv Oblast, with a total area of 181.86 thousand hectares, which is 8.3% of the total area of the Oblast. The list of nature protection sites includes the Roztocze Nature Reserve with an area of 2,084.5 hectares, five national nature parks with an area of 79,587.5 hectares, five regional landscape parks with an area of 56,540.7 hectares, 78 nature reserves, 205 natural monuments, 37 protected tracts, three botanical gardens with an area of 42.7 hectares, and three dendrological parks with an area of 67.4 hectares (*Ekologichnyj pasport Lvivskoi oblasti*).

The southern part of the Polish-Ukrainian border within Lviv Oblast is quite rich in mineral resources. The most important of these are fuel and energy resources (coal, oil, and natural gas), raw materials for the chemical industry, and construction materials (sands, sandstones, clays, limestones, gypsum, marl, cement raw materials). The Lviv-Volyn coal basin is located in the northern part of Lviv Oblast and is still being developed. There are small deposits of lignite (Maheriv). Peat deposits (wetlands in the valleys of the Dniester, Solokiya, Styr, and Yarychivka) are of great importance in this part of the region (*Regionalna dopovid pro stan navkolyshniogo pryrodnogo seredovyscha u Lvivskij oblasti*).

In the Subcarpathian region, oil and gas-bearing layers are widespread, from which oil, gas, and ozokerite have been extracted for more than a century. Oil fields (Strilbychi, Skhidnytsia, Drohobych, Stynava, Oriv-Ulychne, and others) are concentrated in the inner zone of the Subcarpathian region, closer to the Carpathians. Gas fields (Khidnovychi, Pyniany, Opari, Uhersko, and Dashava) are located mainly in the outer strip of the Subcarpathians. Within the mountainous part of the region, stone for road construction and menilite slate are mined in quarries. Lviv Oblast has long been known for its ozokerite deposits. Some of the largest ozokerite deposits in the world are located here – Boryslav deposit, which has been used since 1856, and Truskavets deposit. A large number of various mineral water sources here (Nemyriv, Soluky, Olesko, Shklo, Liubin Velykyi, Truskavets, Skhidnytsia, Morshyn, Rozluch,

and others) have long been known. They are used for medicinal purposes and food consumption. Famous resorts in Lviv Oblast operate based on these waters. There are also quite significant deposits of medicinal mud (*Regionalna dopovid pro stan navkolyshniogo pryrodnogo seredovysshcha u Lvivskij oblasti*).

As it results from the conducted analysis, the natural environment of the Polish-Ukrainian borderland is characterized by very high diversity and the availability of significant natural resources. A characteristic feature of this area is the continuity of natural structures on both sides. The established border crosses naturally formed physio-geographic regions, creating artificial structures, and thus, as a result of different management methods, affecting changes in the physiognomy of the landscape. However, these changes are minor. The Polish-Ukrainian borderland is an area of exceptionally valuable nature on a European and global scale, as evidenced by the establishment of three international UNESCO biosphere reserves. This situation naturally favors the development of international cooperation. The low level of environmental transformation and the lack of natural barriers predispose this area to transformation toward lasting sustainable development.

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POLISH-UKRAINIAN RELATIONS IN THE CONTEXT OF THE GEOPOLITICS OF CENTRAL AND EASTERN EUROPE IN THE POST-COLD WAR PERIOD⁴

Historically and culturally, Central and Eastern Europe (CEE) should be considered as an autonomous and complementary part of European civilization, while geographically as a bridging area of the so-called Baltic-Adriatic-Black Sea constriction. The geopolitical location of the region at the junction of transportation routes creates both opportunities and threats for the countries of the region. The geostrategic position of the region is influenced by natural conditions and geopolitical positioning, as well as the population, economic and military potential of its states. Historically, CEE has been a field of expansion for regional powers such as Germany and Russia, as well as Sweden, Austria and Turkey. The region is the quintessence of Greco-Roman civilization fused with Christianity, organically combining Latin and Byzantine cultures (*Baluk, 2023*).

Geopolitics plays an important role in the history of the region, as it has very often been treated as a field of rival powers. *Geopolitics* is an approach to politics, pioneered in Germany in the late 19th century, which takes into account the influence of a country's geographic location on its foreign policy (*The Concise Oxford, 2006*). Geopolitics is the theory that a country's domestic and foreign policy is influenced by its geographic location and international environment. Excessive attention to the geographical factor in politics has led to the emergence of "geographic determinism." Proponents of this concept believe that geographic location and terrain (mountains,

⁴ In the paper, the author used excerpts from his own research published, among others, in: W. Baluk, M. Doroszko (eds.), *Polish-Ukrainian relations under hybrid security threats*, Kyiv – Lublin 2019; W. Baluk, J. Makar, M. Doroszko (eds.), *The Legacy of Jozef Pilsudski and Symon Petlura. Past, Present and Future of the Partnership between Poland and Ukraine*, Lublin 2021; M. Pietraś, W. Baluk, H. Perepelycia (eds.), *Strategic Partnership between Poland and Ukraine in the Conditions of Change of the International System*, Lublin 2024.

rivers, climate, access to the sea) are important for a country's politics, development and security. At this stage, geopolitics does not occupy a dominant position in international relations theory. However, the importance of this factor in public policy analysis should not be underestimated (*Lexicon of contemporary*, 2000), especially given the geopolitical determinism in the actions of the Russian Federation.

Contemporary Polish geopolitical concepts

In the post-Cold War period, several interesting concepts appeared in geopolitical thought, which directly or indirectly concern the Polish-Ukrainian partnership. Geographer M. Rościszewski pointed out that after the fall of communism, Poland, as a medium-sized country, had a strategic position in Europe between the East and the West, where traditionally two imperialisms and expansionisms (Russia and Germany) clashed (Rościszewski, 2003). Poland's new geopolitical situation created an opportunity to break the unfavorable trends and allows for the development of not only latitudinal trade and communication routes (West-East), but also routes with a meridional position (North-South). In the first case, these are the Berlin-Warsaw-Minsk-Moscow and Dresden-Wrocław-Cracow-Lviv-Kiev routes. In the second case, he also distinguished two routes: 1) *Via Baltica* – connecting the Baltic States with Western Europe, and 2) *Via Intermare* – located between Gdansk and Odesa (Eberhardt, 2023). According to M. Rościszewski, *Via Intermare* can be the basis for building a Polish-Ukrainian geopolitical alliance. In relations with its eastern neighbors, Poland should follow the principle of pragmatism and realism, but for the sake of its security, support the independence of Lithuania, Belarus and Ukraine. The researcher presented his own geopolitical vision of the vast Baltic-Black Sea belt. He considered Ukraine as an important state of the southern part of this bridge. Russia, deprived of power over Ukraine, has a chance to develop democracy. By subordinating Ukraine, it will be doomed to pursue its traditional imperial policy (Rościszewski, 2003). Russia's war against Ukraine in 2014–2024 confirms the researcher's conjecture.

Leszek Moczulski has a significant place in the study of Polish geopolitics. In his view, Poland's flight was determined by its location between two great European powers (Germany and Russia). However, he is far from geographic determinism, condemning the Polish-Lithuanian-Russian lands to expansion from the East. Geopolitical changes after 1989 and entry into NATO and the EU have protected Poland from expansion from the East, and the German problem has been solved by a common presence in Western structures (Moczulski, 2008). The activist supports the concept of the Inter-Mediterranean, claiming that the part of Europe between the Baltic, Adriatic and Black Seas retains its distinctiveness. The nations of the area must not remain slaves to their own history and should reach an intra-political consensus

on the integration of the Inter-Mediterranean. The historical narratives imposed by Russian-Soviet historiography and propaganda, including the supposedly eternal Polish-Ukrainian antagonism, should be discarded (*Leszek Moczulski, 2020*). For Poland, what happens in Ukraine is of crucial importance. It is in Poland's interest for Ukraine to be in the EU (*Leszek Moczulski: Ukraine in the EU, 2020*). "Without waiting for Brussels' decisions, we are able to integrate with Ukraine to the same extent as between Sweden and Norway" (*Leszek Moczulski on the concept, 2020*).

A different approach was represented by conservative Alexander Hall (*Hall, 2020*), who advocated arranging good relations with Russia and abandoning Poland's involvement in supporting Ukraine and Belarus. "Either we will try to achieve a Polish-Russian settlement, assuming the permanence of our current eastern border and Russia's superpower position, or we give up in advance on working toward a settlement (...)." Poland after the breakthrough period in the CEE should strive for the political and military structures of the West and correct relations with Russia. Poland should not get embroiled in a permanent Russian-Ukrainian conflict (*Engelgard, 2014*). Supporters of the *Russia First* approach in Polish Eastern policy include Leszek Sykulski, Maria Szyszkowska and Witold Modzelewski, as well as the milieu of "Polish Thought" (*Kremlin close, 2023*).

At present, three main currents can be distinguished in Polish geopolitics: 1) European (EU, Weimar Triangle, Rome-Warsaw axis) and Atlantic (USA, NATO); 2) Central European (The Visegrad Group, Trilateral Initiative, Bucharest 9, Lublin Triangle) and the unpopular 3) Panslavism. There were also unexpected proposals to create a "Berlin-Warsaw-Moscow" Kaliningrad Triangle, but these were not reflected in reality.

The geopolitical concepts presented above had a significant impact on the formation of Poland's foreign policy after 1989, including towards the CEE. Being in the orbit of the two fundamental concepts of Jagiellonian (federalist, ULB) and Piast or "incorporation", Poland realized its basic geopolitical goals of entering Western structures (NATO and the EU). In parallel, Poland pursued an active regional policy in the CEE. The relative consensus of the Polish political elite on ULB as part of the CEE area began to be challenged in the early 2000s, not only in leftist and conservative circles oriented toward cooperation with Russia, but also in liberal circles (*Sienkiewicz, 2000*).

Contemporary Ukrainian geopolitical concepts

After Ukraine regained its independence, several interesting and coherent geopolitical concepts emerged. Alexander Dergachev described the problem of Ukraine's "geopolitical self-determination" according to the civilizational para-

digm. He linked Ukraine's geopolitical identity to the Eastern European region and Orthodox civilization. The above space is troubled by conflicts and vulnerable to Russia's imperialist inclinations. Ukraine's geopolitical self-determination should take place in the East European-Eurasian space. He was not in favor of the Baltic-Black Sea alliance, in his view a buffer zone and a cordon sanitaire. He considered Ukraine's membership in NATO to be the best solution. The distant prospect of realizing these plans conditioned the implementation of a strategy of balancing interests rather than a strategy of geopolitical choice (*Dergachev, 1995*) – a de facto strategy of balancing. In 2004, the geopolitical dualism of the Eurasian/East Slavic vector (authoritarianism/paternalism/collectivism) and the European vector (democracy/modern state) took shape in Ukraine. The unfinished process of national and state consolidation in Ukraine hindered the modernization of the state according to the European model (*Dergachev, 2009*).

Within the modernist current of geopolitical thinking, we can mention M. Mychalchenko, who presented a concept of Ukraine's internal and external geopolitics. He believed that the "Ukrainian reality" (political nation) is neither a Western European model of development, nor a Eurasian (Russian) one. Ukraine's geopolitical peculiarity lies in its bridging between East and West, and its primary challenge and threat is being in the buffer zone between NATO and Russia. Ukraine, a Central European country, is influenced by Western European and Eastern European (Russian) civilization. Ukraine should quickly go through a period of consolidation and modernization, overcoming a state of transition in political, economic and cultural terms, joining Central Europe. He spoke as a critic of the balancing policy and advocated making a geopolitical choice (*Mikhalchenko, 2004*).

Geographer M. Dnistrianskyj points out the Europeanness of Ukraine, which he includes in the CEE, a region residing in the process of structuring after the Cold War. Ukraine has elements of both Central and Eastern European political culture. Ukraine's political stability depends on creating a zone of "peaceful coexistence" in the region to prevent and resolve conflicts. He pointed to the need to increase the subjectivity of the region's states and supported a Baltic-Black Sea alliance with the leading participation of Ukraine, Poland and Romania. He pointed to the threat from Russia and the West's lack of willingness to integrate Ukraine. He saw an alternative to a buffer zone for Ukraine in the integration and strengthening of the CEE countries (*Dnistrianskyi, 2014; Dnistrianskyi, 2000*). T. Wozniak held similar views, pointing out the importance for Ukraine of a tactical alliance with Poland on the path to the strategic goal of EU membership (*Wozniak, 2003*).

A supporter of the Black Sea doctrine is, among others, J. Kochubey (*Kochubey, 2021; Vasylevych, 2012*), claiming that historically and nowadays the north-south axis is the most important for Ukraine, since the west-east axis carries the threat of confrontation and domination of the superpowers (*Kochubey, 2015*). The well-

known researcher B. Parachonski considered Ukraine as a European state, located in the south-central part of the continent. He postulated Ukraine's entry into European and Euro-Atlantic structures. He pointed out the importance for Kyiv of the southern – Black Sea vector, since geopolitically Ukraine is located at the interface of European, Eurasian and Muslim space. The above conditioned the possibilities of bridging potentials, among others, transit, but also compounded conflicts and other threats (*Parakhonsky, 1998*). He called for a geopolitical choice in favor of the West, increased activity in the Black Sea region and equal partnership with Poland, Turkey and Russia (*Parakhonsky, 2004*).

Ukraine had lost much of its geopolitical and geo-economic potential at the beginning of the 21st century, A. Kudriachenko believed. He emphasized the lack of strategic thinking of the Ukrainian political class, and considered the Budapest Memorandum as insufficient security guarantees. He described Ukraine's geopolitical identity as typical of a borderland state, influenced by Western (European), Eastern (Russian) and Southern (Byzantine, Ottoman) vectors. He opted for the implementation of a policy of multi-vectorism in such a way that the overlapping vectors (east-west) do not lead to confrontation, but complement each other allowing the potential of a bridging state to be realized (*Kudriachenko, 2001*). S. Vasylenko defines Ukraine's geopolitical position at the junction of one of the "European crossroads" between the CEE and Southeastern Europe. Ukraine's geostrategy should move in the direction of Europeanization, and balancing between East and West should belong to tactics. The southern vector was considered complementary to the European one, giving Ukraine the possibility of an active policy in the CEE (*Vasylenko, 2002*).

F. Rudych, among others, wrote about the importance of the Black Sea paradigm for Ukraine. Ukraine is searching for its geopolitical code and identity, it is between the Euro-Atlantic and Eurasian paradigms. Ukraine is a medium-sized state in the CEE that seeks European and Euro-Atlantic integration, strategic partnership with Russia and partnership with CEE countries. While opting for the Euro-Atlantic choice, he pointed out at the same time the danger for Ukraine of being held hostage in Russia's rivalry with the West. For this reason, he believed that the model of a "dynamic balance of power" between the two geopolitical centers would allow Ukraine to pursue a strategy aimed at integration with the EU, while maintaining strategic cooperation with the US (NATO) and Russia (*Rudych, 2002*).

In Ukraine, a number of scholars, politically associated with the activities of pro-Russian parties (Communists, Progressive Socialists, Party of Regions, Opposition Platform for Life), were supporters of the concept of "Russkiy mir". Among the researchers, we can mention the historian P. Tolochka, who supported the concept of Soviet historiography about the Ruthenian nation giving rise to the Lesser Ruthenian, Greater Ruthenian and Belorussian nationalities (*Tolochko O. & Tolochko P., 1998*). He conceded the absence of a Ukrainian political nation, pointed to the existence of four

separate Ukrainians and advocated federalization of the state. He supported a policy of balancing relations with Russia, the EU and the US. On issues of geopolitical choice, he oscillated toward the unity of the "Ruthenian world", S. Hryniewiecki, an Odesa local government activist, analyzing the geopolitical situation in the Black Sea region, pointed out, among other things, the need for Russia to counter US penetration into the basin and the creation of an anti-Russian Georgia-Romania-Ukraine axis. He criticized Ukrainian-U.S. military cooperation, Ukraine's and Georgia's Euro-Atlantic aspirations, and called GUAM a U.S. "cordon sanitaire".

Among state activists with distinctive geostrategic thinking, we can include V. Horbulin, co-author of Ukraine's geopolitical strategy aimed at integration into the EU and NATO. In 2003 Ukraine for the first time at the statutory level declared its geostrategic priorities – European and Euro-Atlantic integration (*Law of Ukraine on the Fundamentals of National Security*, 2003). 2006 r. W. Horbulin analyzed three models of Ukraine's geopolitical situation: 1) "neutrality according to the European model," 2) "enhanced neutrality," and 3) "non-blockade state." The first two assumed the integration of Ukraine into the European economic space and the use of transit potential, while non-entry into political-military blocs was supposed to insure Ukraine against being drawn into a US/NATO-Russia confrontation. The third model involved Ukraine not joining any political-military alliances and guaranteeing security with its own forces. He found the first two models attractive on the condition that Ukraine be given hard security guarantees (*Horbulin*, 2017). He considered the subjugation of Ukraine crucial to the geopolitics of Russia, which will want to resolve the issue before 2015 (*Horbulin & Lytvynenko*, 2009a.). He saw the security of Ukraine as being in the EU and NATO. He pointed to the formation of a security gray zone in the Baltic-Black Sea (Ukraine, Moldova and potentially Belarus) and Black Sea-Caspian (Georgia, Azerbaijan and potentially Armenia) regions (*Horbulin & Lytvynenko*, 2009b). He wrote about Putin's efforts to destabilize Ukraine as early as 2008–2009 (*Horbulin*, 2016).

State Development Strategy (2002) recommended a gradual transition from a policy of neutrality to a policy of European integration (*Vlasiuk*, 2002). Co-author of the document, Prof. A. Halczynskyj, Director of the National Institute for Strategic Studies (NISS), emphasized Ukraine's borderland location between East and West. Only one direction can be strategic for Ukraine – the EU, and correct relations should be maintained with Russia. He stressed the importance of the country's internal stability in the difficult processes of democratization, economic reform and nation-state consolidation. He pointed out that successful reforms would strengthen Ukraine's geopolitical position. He identified the problems, among others, in the crisis of the Ukrainian elite, which does not demonstrate state and patriotic thinking. This is when the Russian elite acts pragmatically, pursuing a policy of "soft hegemony" in the former USSR. He stressed the importance of cooperation with the CEE

countries, especially in the context of implementing the EU integration strategy. In this regard, he pointed to the importance of strategic partnership with Poland (*Galchynskyi, 2005; Galchynskyi, 2002*).

In conclusion, we can say that the Ukrainian geopolitical strategy was dominated by two basic currents of thought, which we can describe as the strategy of balancing interests and the strategy of geopolitical choice. The first strategy led to the formation of the concept of a multi-vector policy, balancing between Russia and the West, and the emergence of a doctrine of neutrality or an out-of-block state. The second strategy involved making a geopolitical choice between the European and Eurasian/East Slavic vectors. In the first decade of the 21st century, a relative consensus was reached among a significant part of the elite and the public towards the Europeanization strategy. Russia's aggression against Ukraine, on the other hand, also realized the need to pursue a Euro-Atlantic direction to guarantee the security of the state. Eventually, after the Revolution of Dignity, Ukraine introduced a provision in its Basic Law stating European and Euro-Atlantic integration as strategic goals of the state.

Ukraine's political elite was characterized by a low culture of strategic thinking, having failed to develop a coherent geopolitical strategy in the process of becoming an independent state (*Kudryachenko et al., 2004*). Russia's aggression against Ukraine in 2014 accelerated the process of consolidation of the state and nation and the formation of its geostrategy.

Analysis of the contemporary geopolitical situation of Poland and Ukraine

The analyzed cross-border region was ethnically mixed in the past, but after dramatic historical events it consists of two ethnically homogeneous parts: Polish on the Polish side of the border and Ukrainian on the Ukrainian side of the border.

The disintegration of the Warsaw Pact and the Soviet Union at the beginning of the last decade of the 20th century significantly changed the geopolitical situation in Central and Eastern Europe. The end of the Cold War, generating confrontation or rivalry between East and West, also resulted in the collapse of the bipolar world. The decomposition of the Soviet sphere of influence and the empire-state itself (the USSR) fostered the emergence of geopolitical pluralism in Central and Eastern Europe and the opportunity to shape a new model of international relations in the region based on cooperative principles. This was conditioned by the change of the political and economic system in the countries of the region, the appearance on the geopolitical map of an independent Ukraine (a geopolitical pivot) and the transformation of one of the most important geopolitical players in this part of the world – Russia. Therefore, in Poland's foreign policy, not only the western direction became important, but also the eastern direction required a huge commitment (*Baluk, 2024*).

After the end of the Cold War, most of the countries of Central and Eastern Europe made a geopolitical choice in favor of integration with the West, which won the Cold War confrontation with the USSR through unity and solidarity, and the Western model of development and system of democratic values were an important force of attraction. In the 1990s, the countries of Central and Eastern Europe, including Poland, sought a new development model and security guarantees, as the fate of democratic reforms in Russia and the change in imperial policy were uncertain. The above was confirmed in the policy of the Russian Federation during the presidency of Vladimir Putin, who rejected cooperation with the West not only within the framework of the Partnership for Peace (NATO), but also within the framework of the Eastern Partnership (EU) (Baluk, 2024).

The period of geopolitical pluralism in the CEE between 1991 and 2007 was better used by Poland, which quickly made a geopolitical choice by integrating into NATO and the EU. In contrast, Ukraine, balancing between Russia and the West, found itself in a buffer zone between Euro-Atlantic (NATO) and Eurasian (Collective Security Treaty Organization) structures. The Orange Revolution offered the rulers a chance to quickly complete the process of consolidating the state and nation around the idea of Europeanizing Ukraine. However, rivalry and confrontation within the Orange camp prevented the Ukrainian state from achieving its strategic goals on the path of European and Euro-Atlantic integration. In 2008, Germany and France convinced the United States not to grant Ukraine and Georgia a plan for NATO membership. The above decision encouraged Russia's aggression against Georgia and facilitated Moscow's return to its imperial policies. Ukraine's rapprochement with Europe and willingness to sign an Association Agreement with the EU also encountered strong opposition from Russia, which launched a trade and diplomatic war against Ukraine as early as mid-2013. In contrast, the beginning of the following year saw the open aggression and occupation of Crimea and Russia's installation of low-intensity conflicts on the Donbas in the Donetsk and Luhansk regions.

Russia's 2014–2024 war against Ukraine, first in the formula of hybrid and then full-scale aggression, is moving toward Moscow's geopolitical domination of Central and Eastern Europe. The authorities of the Russian Federation ultimately chose confrontation in their relations with NATO and the EU, as they aimed to shatter the unity of Western security structures. The annexation and militarization of Crimea and the excessive concentration of the Russian Armed Forces in the Königsberg (Kaliningrad) region then began to directly threaten the security of the Republic of Poland. On the other hand, Russia's full-scale invasion of Ukraine in 2022 and the nearly three-year war significantly changed the perception of security on the European continent, especially in Central and Eastern Europe. In this situation, one has to give credit to Zbigniew Brzezinski, who called Ukraine a geopolitical pivot, a country important for the security of Poland and the region (Pietras *et al.*,

2024). The Russian Federation's mastery of Ukraine means that Poland will be on the front line of Russia's confrontation with the West. Therefore, the security of Ukraine plays an important role in the context of Poland's security, which determines Polish support for the struggling Ukraine not only in military terms, but also in economic and humanitarian terms.

Russia's aggressive and imperial policy once again indicates the timeliness of the Polish-Ukrainian alliance, the basis of which remains security in the broadest sense. The Polish-Ukrainian tandem of regional leaders is capable of balancing Russian influence in Central and Eastern Europe, while supported by Western structures it has the capacity to resist Russian expansion. The materialization of the formula of strategic partnership between Poland and Ukraine within the framework of the integration of the countries of Central and Eastern Europe will allow strengthening the subjectivity of the countries of the region as a complementary part of the European and Euro-Atlantic space.

Poland made very good use of the period of geopolitical pluralism by joining Western political-military (NATO) and economic (EU) security structures. Poland also forged relations of strategic partnership with the US and leading European countries (including within the framework of the Wajmar Triangle with France and Germany). In addition, it played an active role in the processes of deeper cooperation and integration of the countries of the Central and Eastern European region. In this regard, we can mention the participation of the Republic of Poland in such regional structures as the Visegrad Group, the Council of the Baltic Sea States, the Trilateral Initiative, the Lublin Triangle and the Bucharest 9. Ukraine also tried to play a similar role, initiating the formation of GUAM and showing interest in integration within Central European structures.

Conclusions

Despite significant geopolitical changes at the end of the 20th century, the geopolitical situation in Poland and Ukraine has not changed radically. These countries are still influenced by the East-West geopolitical axis, with Russia and Germany having a significant influence on events in the Central and Eastern European region. On the other hand, the ways and methods of influence of the above-mentioned countries have changed significantly. The Russian Federation has returned to the geopolitical code of the tsarist and Soviet empires, which determined imperial policy using hard power. Undergoing modernization and democratization, post-war Germany became part of Western structures, which fundamentally changed the strategic culture of this state, reaching for soft power tools in its policy. In a complex geopolitical situation, Poland and especially Ukraine must find their own geopolitical code that defines not

only the East-West axis, but also the North-South axis. The challenge for Ukraine remains leaving the buffer zone (security gray zone) and joining the EU and NATO.

Polish geopolitical concepts, taking into account the bridging and location of the country on the borderline of civilizations as a Central European state, were aimed at fully utilizing the potential on the West-East and North-South axes. With its accession to NATO and the EU, Poland realized its basic strategic goals. In a situation of strained Western unity and the rise of international regional politics, Poland has a vested interest in deepening CEE integration to counter new challenges and threats, including Russia's aggressive policies.

Ukrainian geopolitical concepts, similar to Polish ones, took into account the bridging and location of the country on the cultural-civilizational borderland, emphasizing the geostrategic importance of the west-east and north-south axes. Two basic currents of thought dominated Ukrainian geopolitical strategy – the strategy of balancing interests (the policy of balancing or the policy of neutrality/post-balancing) and the strategy of geopolitical choice between East and West. Ukraine's choice of geopolitical orientation in favor of EU and NATO integration was redeemed by Russia's aggression, seeking to annex Crimea, Donbas and the Azov Sea coast. In Ukraine's foreign and security policy, the role and importance of the CEE is growing, including the strategic partnership with Poland.

Poland and Ukraine, as medium-sized European states and the largest CEE countries in terms of size, economic and military potential, are of strategic importance to the region. The Polish-Ukrainian tandem in the form of a strategic partnership can be the foundation of the perceived multidimensional security of CEE and an important geopolitical axis of the region, determining its strength and potential.

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SOCIO-DEMOGRAPHIC DETERMINANTS OF THE TRANSFORMATION OF THE POLISH-UKRAINIAN BORDERLAND

The development potential of any spatial unit remains largely dependent on its social and demographic potential, understood as a set of demographic characteristics (such as the number and structure of the population by sex and age and average life expectancy) and demographic processes (natural movement and migration) that shape its economic potential. It directly affects the size of the labour force, while indirectly it affects its quality (*Flaga et al. 2017*). The dynamic socio-economic transformations taking place in Poland and Ukraine in the 21st century did not omit the border regions either, as confirmed by variables describing the most important phenomena, processes and demographic structures. In each of the analysed parts of the cross-border area, however, the course of demographic processes had a different dynamics and character, translating indirectly into the formation of human and social capital, and thus into the broadly understood socio-economic situation and opportunities for regional development. Thus, knowledge of socio-demographic processes is essential in the context of shaping economic transformation processes under the challenges of the present day.

The issue of the situation and demographic changes in the Polish-Ukrainian borderland has been the subject of numerous studies by both Polish and Ukrainian researchers, with relatively few works devoted to comparative analyses. An attempt at a thorough study of demographic processes in the Ukrainian part of the borderland at the time of economic transformation was made by *Flaga (2006b, 2006a, 2008)*. Social and demographic transformations in the Polish-Ukrainian borderland since the beginning of the political and economic transformation were discussed in a work devoted to the characteristics of the Polish-Ukrainian borderland as the “new EU’s borderland» (*Jakubowski et al. 2017*). A comprehensive monograph on demographic processes in the area of the regions of the Euroregion Bug was devel-

oped by *Jakubowski (2015)*, while the characterisation of demographic processes in the context of regional development became the subject of the works *Jakubowski and Miszczuk (2016)* and *Flaga et al. (2017)*. Demographic changes in the regions of western Ukraine in the context of migration processes and their impact on the regional labour market, became the subject of research by a team of employees of the Institute of Regional Research named after M. Dolishniy of the National Academy of Sciences of Ukraine under the direction of Sadova (*Rehional'nych Doslidžen' Institute 2019*). In turn, current changes in the demographic and social situation in Poland and in the Polish-Ukrainian borderland caused by the Russian aggression against Ukraine have become the subject of research *Wiśniewski et al. (2024)*, *Duszczyk et al. (2022)*, *Duszczyk and Kaczmarczyk (2023)*, *Kubiciel-Lodzińska et al. (2024)* and *Łażniewska et al. (2024, 2025)*.

The aim of this study is to characterise the social and demographic determinants of the transformation of the economies of the Polish-Ukrainian border regions as a response to common challenges of security, green, digital and intellectual transition. The chapter will present an analysis of the population structure and the dynamics and direction of its changes, as well as changes in natural and migratory movements in order to understand the most important barriers and opportunities for demographic development of the study area.

However, it should be borne in mind that Russia's aggression against Ukraine in 2022 has made it very difficult to conduct detailed socio-demographic analyses in the studied cross-border region. The lack of up-to-date statistical data and the information chaos resulting from massive population movements are a serious barrier for researchers. This situation further exacerbates the difficulties in identifying the long-term effects of the war on social and demographic structures. As a result, all analyses have to be based on often incomplete or retrospective data, requiring particular caution in the formulation of conclusions. Given that statistical data on the demographic situation and processes for the Ukrainian part of the border region have not been published since the outbreak of the full-scale war in Ukraine, this chapter will present a picture that does not take into account the far-reaching transformations that have occurred after 2022.

Socio-demographic determinants of regional development

Demographic and social factors play a key role in economic and regional development processes, as confirmed by numerous theories and scientific studies. These analyses indicate that human resources and social structure have a decisive impact on economic growth opportunities, innovation and the adaptation of regions to changing economic conditions.

In theoretical reflections on the role of demographic factors in regional development, the theory of endogenous development is of great importance (*Lucas, 1988; Romer, 1990*). According to this theory, the development of an area depends primarily on internal development potentials originating from local conditions, while external development impulses play a lesser role. The key issue in this theory is the mobilisation of the local environment in order to make the best possible use of internal assets, while these can be considered at the level of the country, region or local community (*Dziaduch, Jakubowski 2015*). The theory of endogenous development emphasises the importance of human capital as a key factor in economic growth. Human capital, measured in terms of educational attainment, skills and innovation, is the basis for value creation and technological progress. Empirical studies indicate that regions characterised by high levels of education and professional competence of their inhabitants achieve higher economic growth rates (*Barro, 2001*).

The theory of cumulative causality (*Myrdal, 1957*) points out that the demographic structure of the population has a direct impact on the development potential of regions. Population ageing, youth migration and demographic inequality are key determinants of economic change in regions. Areas with dynamic population growth and an influx of young people have greater opportunities to develop new economic sectors and attract investment, in contrast to depopulating regions. The role of migration processes is also highlighted by *R. Florida (2002)*. Migration, both internal and international, is an important factor in regional transformation. The inflow of highly skilled labour to so-called “creative regions” contributes to their competitiveness and innovation. In contrast, regions with low levels of external migration often face difficulties in accelerating economic development. Social capital theory (*Putnam, 1993*), emphasises the role of social relationships, trust and cooperative norms in stimulating economic development. Research has shown that regions with high levels of social capital are more resilient to economic crises and show a greater capacity to innovate (*Fukuyama, 1995*).

The literature also highlights the role of social factors. Societies with a strongly developed value system, oriented towards education, entrepreneurship and cooperation, are more likely to develop economically and regionally. Porter (1990), in his theory of the competitiveness of nations, noted that social factors such as a culture of innovation and the ability to cooperate within economic clusters are crucial to the economic success of regions. At the same time, demographic and social inequalities, such as access to education, income disparities or disparities in access to infrastructure, can act as barriers to development. In summary, the research literature points to the fundamental importance of human and social resources for economic and regional development. Key theories such as endogenous development theory, social capital theory or cumulative causality theory provide an analytical framework for the study of the impact of demographic and social factors on development.

Population status and distribution

The Polish-Ukrainian cross-border area has a population of 7623.7 thousand, of which Lviv Oblast has 2478.1 thousand (32.7% of the total area population), Podkarpacie Voivodeship – 2071.7 thousand (27.3%), Lubelskie Voivodeship – 2011.0 thousand (26.5%), and Volyn Oblast – 1021.4 thousand (13.5%) (Table 1).

The high diversity of population distribution is evidenced by the population density indicator, ranging from 51 persons/km² for Volyn oblast, 80 persons/km² for Lubelskie Voivodeship, 114 persons/km² for Lviv oblast to 116 persons/km² for Podkarpacie Voivodeship, with an average of 89 persons/km² for the entire analysed area (Tab. 1). The southern part of the border region, comprising Podkarpacie Voivodeship and Lviv Oblast, has a much higher population density than the relatively sparsely populated northern part, especially the north-eastern part (Volyn Oblast). Of all the regions included in the analysed cross-border area, only Lviv Oblast had a higher population density than the national average. For the other territorial units, it is lower or significantly lower than the national average.

One of the most important conditions favouring economic transformation is the presence of large urban centres and a correspondingly high share of the urban population. Indeed, cities are not only the most important element in the settlement network of countries and regions and their socio-economic systems, but also play a key role in creating development conditions. Due to the benefits of agglomeration, they are important economic drivers, places of concentration of human resources, capital and creativity and innovation, and the most important centres of services provided not only to their inhabitants, but also to surrounding areas. Due to the concentration of various potentials and functions, covering almost all manifestations of socio-economic activity (including administrative, political, industrial, service, transport, religious, educational, scientific and cultural ones), cities are a kind of “growth poles” influencing the surrounding areas, and the social and economic processes taking place in them are of particular importance for development at the national and regional level.

Table 1. A demographic profile of the Polish-Ukrainian borderland

Specification	Lubelskie Voivodeship	Podkarpacie Voivodeship	Lviv Oblast	Volyn Oblast
Population (in thous.)	2011.0	2071.7	2478.1	1021.4
per 1 km ²	80	116	114	51
males (in thous.)			1165.0	480.9
females (in thous.)			1294.8	537.7
per 100 males				
Urban areas (in thous.)	926.9	849.2	1516.4	533.5
in % of total population	46.1	41.0	61.2	52.2

Specification	Lubelskie Voivodeship	Podkarpackie Voivodeship	Lviv Oblast	Volyn Oblast
Rural areas (in thous.)	1084.2	1222.5	961.8	487.9
in % of total population	53.9	59.0	38.8	47.8
At age: (in % of total population)	-	-	-	-
0–14	14.5	15.3	16.1	19.3
15–64	64.5	65.7	68.6	67.3
65 and more	21.0	19.0	15.2	13.5
Live births	13492	14877	19440	9852
per 1000 population	6.7	7.2	7.8	9.6
Deaths**	22910	19705	39890	15493
per 1000 population**	11.4	9.5	16.0	15.1
Natural increase	-9418	-4828	-20450	-5641
per 1000 population	-4.7	-2.3	-8.2	-5.5
Immigration	19768	19475	27940	11487
Emigration	24236	21807	27107	11887
Net migration	-4468	-2332	833	-400
per 1000 population	-2.2	-1.1	3.3	-3.9
Actual increase/decrease	-13886	-7160	-19617	-6041
per 1000 population	-6.9	-3.5	-8.0	-5.9
Total fertility rate	1,123	1,137	1,169	1,135
Life expectancy at birth (years)	-	-	70.7	71.5
male	74.3	76.1	65.6	66.9
female	82.7	83.6	75.9	76.3

Source: Own study on the basis of Central Statistical Office of Poland and State Statistics Service of Ukraine data.

* Data for the Polish part as of 31 December 2023, data for the Ukrainian part as of 1 January 2022.

** High values are due to the COVID-19 pandemic.

At the same time, the issue of the directions and dynamics of development of urban centres is of particular importance in the case of poorly urbanised regions of the Polish-Ukrainian borderland, characterised by a relatively low level of economic development. The development of entrepreneurship and the supply of new jobs requires adequate human resources, which can have a positive impact on the socio-economic processes taking place in the entire area (*Jakubowski 2022*).

The urbanisation rate for the cross-border area analysed was 50.5%. The Lviv oblast had the highest percentage of urban population (61.2%), while in the case of the Volyn oblast, the share of urban population was only slightly higher than rural population (52.2%). In the Lubelskie Voivodeship, the share of the rural population slightly predominated (the urbanisation rate was 46.1% there), while in the Podkarpackie Voivodeship the predominance of the rural population was already much more pronounced (the urbanisation rate was 41.0%). It is worth noting that in the case of each of the analysed regions, the value of the urbanisation rate was clearly lower than in the reference country.

The urban centres of the analysed Polish-Ukrainian-Belarusian border region are quite unevenly distributed. Its south-western part (i.e. the Podkarpackie voivodeship,

part of the Lubelskie Voivodeship and Lviv Oblast) has a significantly higher density of cities than its northern and especially north-eastern part (i.e. Volyn Oblast), which is the result of historical settlement processes and urbanisation diffusion, running from west to east. Out of a total of just under 160 towns in the analysed cross-border area, almost three out of four are small towns (less than 20,000 inhabitants), most of which are very small with a population of less than 10,000. In the group of large cities, i.e. with more than 100 thousand inhabitants, there is one large centre with metropolitan status – Lviv, with 753.8 thousand inhabitants, one city with more than 300 thousand inhabitants (Lublin – 329.6 thousand in 2023), one with more than 200 thousand inhabitants (Łuck – 216.1) and one with less than 200 thousand inhabitants (Rzeszów – 197.3 thousand). The Polish-Ukrainian border area is characterised by unfavourable demographic changes. Their direct effect is a decrease in the number of inhabitants (Fig. 1), which between 2015 and 2021 amounted to 215.0 thousand people (from 7838.7 thousand to 7623.7 thousand people), as a consequence of negative natural growth and negative migration balance.

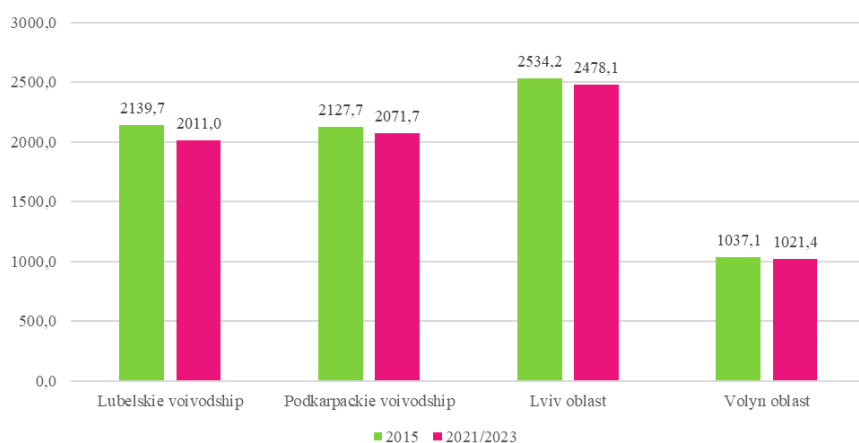


Fig. 1. Population change by Voivodeship and region in 2015 2021/2023 (in thousands)

Source: Own study on the basis of Central Statistical Office of Poland and State Statistics Service of Ukraine data.

* Data for the Polish part as of 31 December 2015 and 2023, data for the Ukrainian part as of 1 January 2016 and 2022.

The decrease in population was most pronounced in Lubelskie Voivodeship (101.4 thousand fewer persons, i.e. 4.7%), Lviv Oblast (56.1 thousand fewer persons, 2.2%) and Podkarpackie Voivodeship (41.8 thousand fewer persons, 2.0%), and to a lesser extent in Volyn Oblast (15.7 thousand fewer persons, 1.5%).

Between 2015 and 2023, the urban population in the Polish part of the border area decreased by 89.6 thousand people, while in the Ukrainian part of the border area (in the period 2015–2021) – by 32.1 thousand people. In the case of the Polish

part, the decrease in the urban population was primarily a consequence of suburbanisation processes, particularly evident in the case of the city of Lublin. The rural population also decreased in the same period – by 95.0 thousand in the Polish part and by 39.5 thousand in the Ukrainian part of the border region. A phenomenon common in the entire Polish-Ukrainian border area is therefore primarily the depopulation of peripheral rural areas and the concentration of the population in larger urban centres or in their immediate vicinity (urban functional areas, metropolitan areas). These processes take place within three consecutive phases (Węclawowicz *et al.* 2006): depopulation of peripheral rural areas, concentration in metropolitan areas, and deconcentration within (inside) metropolitan areas.

Population structure

The structure of the population by sex and age largely determines the formation of future trends in fertility and mortality and thus determines a certain level of natural movement. It also makes it possible to identify a number of important consequences of a social and economic nature. The first characteristic by which the population structure can be studied is gender. The structure of the population by sex influences the intensity of marriages and births and thus the dynamics of population change. In the analysed area, there is a clear predominance of women (3928.0 thousand) over men (3633.2 thousand). The feminisation coefficient in 2023 was 105 in the Polish part and 111 in the Ukrainian part in 2021. The significant surplus of women in the Ukrainian area has at least several reasons, partly of a historical nature (Flaga 2006a). At present, however, the main reason for this deformation is the high intensity of the phenomenon of over-mortality of men of working age. In rural areas, on the other hand, the surplus of men of maturing age (i.e. 20–34) remains a significant problem. This is mainly influenced by migration processes leading to the over-representation of women in towns. In almost most rural gminas in Lubelskie Voivodeship and a significant number of gminas in Podkarpackie Voivodeship, the feminisation rate in this age group is below 90%. A similar phenomenon is also observed in Western Ukraine, where the ratio of women to men in urban areas has been steadily increasing since the mid-1990s, while it has been decreasing in rural areas.

The basic characteristics of the population structure by age are measures showing the share of the population by specific age groups in the total population. Given the differences in economic age groups across national systems, for the purposes of the international comparisons made in this study, a classification in line with *International Labour Organisation* (ILO) methodology will be used, covering the biological population groups of 0–14 years (pre-working age), 15–64 years (working age) and 65 years and over (post-working age). The highest percentage of the population in

the pre-productive age group (0–14 years) in 2021 was recorded in Volyn Oblast (19.3%), while the lowest (in 2023) was in Lubelskie Voivodeship (14.5%). The situation was different in the group of people in the post-working age group (65 and over). The highest proportion of people in this age category was in the Polish part of the analysed area (21.0% in Lubelskie Voivodeship and 19.0% in Podkarpackie Voivodeship), while the lowest was in Volyn Oblast (13.5%). On the other hand, the highest percentage of people aged 15–64, i.e. in the economically crucial working age, was recorded in Lviv Oblast (68.6%) and Lubelskie Voivodeship (69.7%) (Fig. 2).

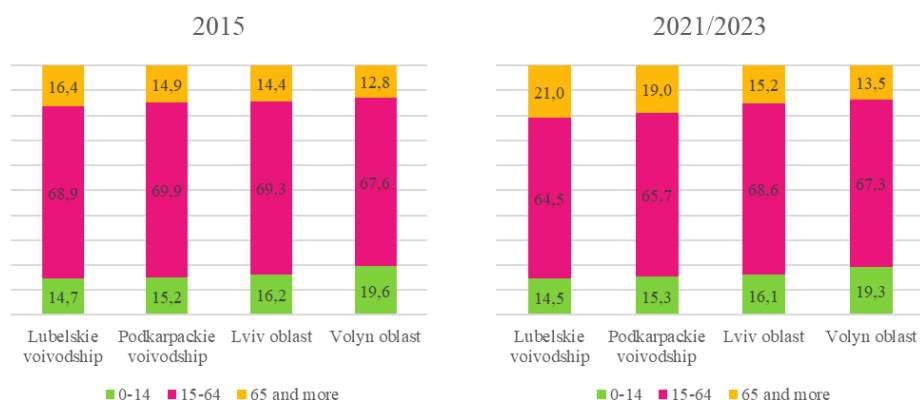


Fig. 2. Population structure by economic age groups (in %)

Source: Own study on the basis of Central Statistical Office of Poland and State Statistics Service of Ukraine data.

* Data for the Polish part as at 31 December 2015 and 2023, data for the Ukrainian part as at 1 January 2016 and 2022.

At the same time, the analysed cross-border area was characterised by clear differences in terms of population structure by age groups and place of residence. Generally, in all regions covered by the study, the share of the urban population in the pre-productive and post-productive age was lower than in the rural areas, while the share of population in the productive age was significantly higher.

A particularly important research problem is the process of population ageing, which involves changes in the age structure of the population, resulting in a decreasing share of younger people and an increasing share of older people. It should be noted that this is a trend common throughout Europe, which, however, acquires certain characteristics in areas of depopulation, which include the analysed region. The process of population ageing is mainly a consequence of increasing life expectancy, improving living conditions, improving the quality of medical services, as well as a decline in fertility as a result of the so-called second demographic transition, characterised by a change in the family model and its goals, late marriage, delaying the typical age of procreation and the disappearance of polygamy (Celińska-Janowicz *et al.* 2010), and

migration processes involving mostly young people. Although the share of people in the pre-productive age group decreased only slightly between 2015 and 2023, the share of people in the working age group (especially in the Polish part of the borderland) was significantly reduced, which, with the overall decrease in population, means a progressive decrease in available labour resources. At the same time, the share of people in the post-working age has increased significantly – especially in the Polish part of the border region. Taking into account the process of shifting of subsequent cohorts towards the post-working age, in the coming years we will observe a progressive ageing of the population in all regions of the Polish-Ukrainian borderland, which will be facilitated by the process of extending the average life expectancy. At present, it ranges from 65.6 years (Lviv Oblast) to 76.1 years (Podkarpackie Voivodeship) for men and from 75.9 years (Lviv Oblast) to 83.6 years (Podkarpackie Voivodeship) for women. It is worth mentioning that the average life expectancy in Podkarpackie Voivodeship is one of the highest in the country. In this respect, significant progress has also been recorded in the Ukrainian part of the border region in recent years. Although average life expectancy in Ukraine is one of the lowest among European countries, it was higher in Lviv and Volyn Oblasts than the national average.

Natural and migratory movement

Natural movement, including marriages, births and deaths, significantly determines changes in the size and structure of the population by sex, age and marital status. In the analysis of natural movement, the analysis of births and deaths, which are the factors determining the value of the natural increase rate, is of key importance.

Over the last quarter of a century, both Poland and Ukraine have experienced a series of negative trends in demography, leading to a progressive decline in population and an increasing ageing process. Although foreign migration undoubtedly had a significant impact on the phenomena described above, the decrease in the populations of both countries was mainly due to falling birth rates and – initially only in the case of Ukraine, and since the outbreak of the COVID-19 pandemic also in Poland – an increase in mortality, so that for a long time both countries recorded negative values of natural increase. The trends outlined above were and are also observed in the border regions of the above countries, i.e. the Polish-Ukrainian border area, although to a different extent and on a different scale.

In recent years, all regions of the border region have seen a decline in the value of the birth rate, which, together with an increase in the death rate, has led to a worsening natural decline. The total number of live births in the Ukrainian part of the border region in 2021 was 29.3 thousand, almost a third lower than in 2015. Similarly, in the border regions on the Polish side of the border, the number of live births in

the period 2015–2023 decreased by 27.8%, i.e. by more than a quarter. At the same time, there was an increase in the number of deaths in the border area, especially in the Lubelskie Voivodeship and Lviv Oblast.

Assessing the birth rate, it is also necessary to use the total fertility rate. This measure synthetically characterises the reproduction process of the population and its value of approximately 2.1 guarantees the simple replacement of generations. Low fertility is said to occur when the cross-sectional total fertility rate is in the p-value range between 1.35 and 1.5, and very low when it does not exceed 1.35 (*Kotowska & Chłoń-Domińczak 2012*). In this respect, the situation in the Polish-Ukrainian border area is particularly unfavourable, even alarming. Both in the Polish part of the borderland and in the Ukrainian part, the value of the fertility rate is much below the lowest threshold indicated above. In the Lubelskie Voivodeship in 2023, the value of this coefficient was 1.12, while in the Podkarpackie Voivodeship it was 1.14, just as it was in the Volyn Oblast in 2021. In the same year, the value of the total fertility rate in Lviv Oblast was 1.17.

The population situation of the border region is also significantly influenced by migration processes, directly influencing changes in the number and structure of the population and indirectly influencing the natural movement. They depend on a number of “pull” factors, i.e. the broadly defined attractiveness of the area in question, and “push” factors, mainly related to difficulties on the labour market. Inflow areas are dominated by large urban centres and their surroundings, while outflow areas are peripheral and economically backward. However, when analysing data on the migratory movement of the population, one should be aware that they do not refer to actual flows, but to registered data reflecting the number of notifications of change of place of residence, and this applies to both Polish and Ukrainian data.

The Lubelskie and Podkarpackie Voivodeships have for years been among those regions characterised by the largest outflow of population. Between 2016 and 2023, 203.0 thousand people left the Lubelskie Voivodeship for other Polish Voivodeships (primarily the Mazovian Voivodeship) or abroad for permanent residence, and the migration balance was -38.3 thousand people. The scale of migration in the Podkarpackie Voivodeship was slightly lower, although even here a negative balance of -17.4 thousand persons was recorded in recent years. In the light of official statistics, both Ukrainian border regions were characterised by a slightly more balanced scale of migration processes, with Lviv Oblast even recording a positive balance in 2021. However, the regions comprising the Polish-Ukrainian cross-border area are generally outward-looking, leading to a deepening population loss. Importantly, the statistics presented do not reflect the actual emigration outflow. According to the results of the National Population and Housing Census 2021, 87.8 thousand permanent residents of the Lubelskie Voivodeship stayed abroad for more than 3 months (*Statistical Office in Lublin, 2024*), while in the case of the Podkarpackie

Voivodeship it was as many as 134.4 thousand people (*Statistical Office in Rzeszów, 2024*). The lack of analogous data for the Ukrainian part of the border region does not allow for a full assessment of the phenomenon of economic emigration for the entire analysed area, nevertheless the number of emigrants from the border regions of Western Ukraine even before the outbreak of the war in Ukraine was most likely at an even higher level than in the case of the border Voivodeships of Eastern Poland. However, it should be emphasised that emigration from the analysed area also has a positive dimension. In many cases, financial transfers generated by economic emigrants from Poland and Ukraine constituted an important source of livelihood for households remaining in the country of origin, although in the case of Poland their volume is steadily decreasing (*Chmielewska, 2015*), which is influenced by the relocation of entire families to the country of emigration and the gradual weakening of relations with the country of origin.

Labour force participation

One of the main determinants of the outflow of population from the Polish-Ukrainian border area is the situation on the local labour market. In 2023, the number of economically active people in the Polish part of the borderland amounted to 1785.0 thousand and was lower by 135.0 thousand people compared to 2015. In the period 2015–2021, the size of the analogous group of people in the Ukrainian part decreased from 1575.0 thousand to 1527.0 thousand. The value of the employment rate, measured as the ratio of the employed to the population of people of working age in the Lubelskie Voivodeship was 54.3%, while in the Podkarpackie Voivodeship it was even lower at 51.4%. Values lower than the average in Ukraine, although higher than in the Polish part of the borderland, this indicator reached in both regions of Western Ukraine. An improvement in the labour markets of the eastern Polish border Voivodeships is indicated by the decreasing unemployment rate (according to the methodology of the International Labour Organisation). In Lubelskie Voivodeship, it decreased from 9.5% to only 3.9% between 2015 and 2023. In the Podkarpackie Voivodeship, the decrease was even higher, with the share of unemployed people changing from 12.7% to 4.3% over the period indicated. In total, the number of unemployed people in the Polish part of the cross-border region decreased from 209 to 73,000. A slight improvement in the 2015–2021 period in the unemployment sphere was observed in the Lviv Obslast (decrease from 8.2% to 7.7%), while in the Volyn Obslast – as the only region of the cross-border area – the unemployment rate increased from 9.8% to 12.7%. The fall in unemployment is undoubtedly a positive development, but it is taking place at the same time as a simultaneous, albeit so far insignificant, fall in the number of people in work. This may indicate a potential

shortage of workers, which, given the high demand for labour, may hinder economic transition processes, although this shortage can and is partly being met by an influx of immigrants and refugees from Ukraine in the case of the Polish part and internal refugees in the case of the Ukrainian part. A relatively high percentage of economically inactive people (43.5% in the Lubelskie Voivodeship and 46.3% in the Podkarpackie Voivodeship) also remains a major problem on both sides of the border, although one should note a certain progress in this respect in recent years (the number of economically inactive people in the Polish part of the border region decreased from 1742.0 thousand to 1454.0 thousand, i.e. by 16.5%).

In the structure of the employed population by economic sector in Volyn Oblast, Lubelskie Voivodeship and Lviv Oblast, the share of the agricultural sector, in which approximately 20% of the population worked in 2023 (2021 for the Ukrainian part), is marked. At the same time, it is important to be aware that agriculture in the analysed area is characterised by relatively low productivity, which translates into particularly low added value generated by this sector of the economy. The share of the population working in industry and construction ranged from 16.2% in Volyn oblast to 33.5% in Podkarpackie Voivodeship, while in Lubelskie Voivodeship and Lviv Oblast it was at a similar level of over 22%. Also characteristic of the entire area is the relatively low (much lower than in Western European countries) share of services, varying from 57.0% in the Lubelskie Voivodeship to 63.1% in the Volyn Oblast (Fig. 3).

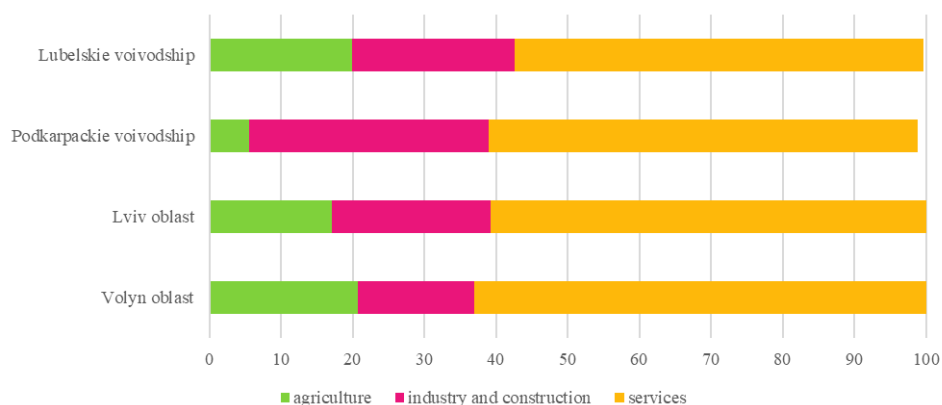


Fig. 3. Structure of employment by economic sectors

Source: Own study on the basis of Central Statistical Office of Poland and State Statistics Service of Ukraine data.

* Data for the Polish part as at 31 December 2015 and 2023, data for the Ukrainian part as at 1 January 2016 and 2022.

Impact of Russian aggression on the socio-demographic situation of the border region

The Russian aggression against Ukraine, which began in 2014 and intensified in February 2022, has had a significant impact on the demographic and social situation of western Ukraine and, indirectly, on the situation in the border provinces of eastern Poland. Above all, the region has become a place of refuge for people fleeing the hostilities. According to a study by Ukrainian demographers, western Ukraine already experienced a significant influx of internally displaced persons (IDPs) from conflict areas after 2014 (*Malynovska, 2020*), and their numbers multiplied after the outbreak of full-scale war in 2022. The number of internally displaced persons in Ukraine in 2022 was around 7 million. The oblasts of western Ukraine, particularly Lviv, have received a significant proportion of this population. It is estimated that the Lviv Oblast alone received more than 500,000 refugees in the first months of the war, while the Volyn Oblast, as of mid-2023, sheltered more than 80,000 people. At the same time, the Lviv Oblast became a major transit point for refugees heading abroad, mainly to Poland. As a result of these dynamic processes, the population of Lviv Oblast increased from around 2.5 million to over 3 million, an increase of over 20% in just a few months (*Łaźniewska et al. 2025*). The influx of IDPs, among whom women and children predominate, has changed the demographic structure of western Ukraine. However, the number of people of working age has also increased, which may have a positive impact on the local labour market, especially in the context that the high dynamics of migration of Ukrainian citizens abroad have led to depopulation and a deepening deformation of the age and gender structure of the population (*Bazhenova, 2023*). However, a major challenge for the region remains the increased burden on social infrastructure, especially in the education and healthcare sectors (*Łaźniewska et al. 2025*).

The influx of refugees from the eastern and southern regions of Ukraine was also not without impact on regional labour markets. In the Lviv Oblast, unemployment among IDPs remained at over 50% in the first months after the outbreak of the war. Although the Volyn Oblast was characterised by a lower absorption of refugees in the labour market. At the same time, 80% of refugees in the region remained dependent on humanitarian or social assistance in 2022. At the same time, the influx of refugees has increased the supply of labour in less demanding sectors such as hospitality and catering. In addition, there is a significant level of irregular employment in the labour market in the border regions – many vacancies were offered without registration, such as part-time work, etc. (*Łaźniewska et al. 2024*).

In the case of the Polish part of the border region, the impact of the influx of refugees, although significant in the first days after the outbreak of war, turned out to be less than expected. The Polish border regions were primarily a transit point

for Ukrainian refugees rather than a destination (*Łażniewska et al. 2024*). The influx of refugees from Ukraine to the border Voivodeships of Eastern Poland therefore had a limited impact on the local demographic situation. In Lubelskie Voivodeship, there were higher concentrations of refugees in the vicinity of larger cities, such as Lublin, and in suburban areas where cheaper accommodation is available. In Podkarpackie Voivodeship, refugees were mainly concentrated in tourist areas, such as Bieszczady, and in Rzeszów, which offered better employment and infrastructure conditions. In general, the eastern regions of Poland, despite their potential to accommodate more refugees, did not see a significant impact in terms of compensating for local depopulation processes. Many refugees chose larger cities and regions with a more developed labour market, skipping peripheral areas. This spatial distribution is also related to pre-existing migration networks and opportunities to find work in larger urban centres. The long-term effects of refugee migration on the demographic structure of these provinces therefore remain uncertain. Many people who received a PESEL number chose to migrate further, both to other parts of Poland and abroad. Thus, the influx of refugees cannot be expected to significantly slow down the processes of population ageing and depopulation of the eastern regions of Poland (*Wiśniewski et al. 2024*).

Conclusions

The analysis of the demographic and social situation of the Polish-Ukrainian border area allows for several general conclusions to be drawn in the context of the processes of transformation of the economy as a response to common challenges of security, green, digital and intellectual transition. First of all, the Polish-Ukrainian border area is characterised by significant differences in terms of population density and population structure. The highest population concentration is found in the southern parts of the region, such as Podkarpackie Voivodeship and Lviv Oblast. In the northern regions, especially in Volyn Oblast, the population density remains significantly lower, which is the result of both historical settlement processes and contemporary migration trends. In addition, the urbanisation structure indicates a clear predominance of small towns in the analysed region, which may hinder economic development and improvement of the quality of life of the inhabitants.

The border area is experiencing negative demographic changes, such as population decline and a progressive ageing of the population. According to official statistics, the population decline is particularly evident in the Polish part of the region, where this trend is influenced by both a low birth rate and high emigration. The process of population ageing is more advanced in the Polish part, where the proportion of people in post-working age is higher than in the Ukrainian part of the border region.

These demographic changes may in the future increase the burden on health and social care systems and affect the availability of labour force. At the same time, it should be borne in mind that the picture presented of the western regions of Ukraine is not entirely true, as it would appear from official data. In reality, the scale of emigration processes is much higher, and population ageing processes are also more advanced.

The Polish-Ukrainian cross-border area is characterised by a negative migration balance. Labour emigration, both in Poland and Ukraine, leads to an outflow of young economically active people, which further aggravates demographic problems. Despite a decrease in unemployment in recent years, the border area still faces a high proportion of economically inactive people, which points to the need to strengthen local labour markets and improve employment conditions. Low productivity rates in agriculture and limited development of the service sector suggest the need to intensify the region's economic diversification efforts.

The Russian aggression against Ukraine and the resulting massive influx of internally displaced persons (IDPs) has significantly affected the demographic and social situation in western Ukraine, particularly in the Lviv and Volyn Oblasts, which have seen significant population growth, benefiting the local labour market on the one hand and increasing the burden on social infrastructure on the other. The Lviv Oblast has also become a key transit point for refugees heading to Poland. Poland's eastern voivodeships, although they saw temporary concentrations of refugees in cities such as Lublin and Rzeszów, did not experience permanent demographic changes, as most refugees migrated to larger urban centres or abroad. The long-term impact of migration on both regions remains uncertain, especially in the context of local demographic challenges such as population ageing and depopulation.

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SYSTEMIC AND ECONOMIC DETERMINANTS OF THE TRANSFORMATION OF THE POLISH-UKRAINIAN BORDERLAND

Introduction

The transformation of border regions has always been a pivotal aspect of broader economic and systemic shifts, as these areas serve as dynamic spaces of interaction, convergence, and divergence between neighboring states. In the context of the Polish-Ukrainian borderland, this transformation is particularly significant due to its historical complexities, geopolitical sensitivity, and strategic importance in fostering cooperation and integration within Central and Eastern Europe. This chapter examines the systemic and economic determinants essential for the evolution and development of this borderland, with a particular focus on the interplay of trajectories of post-communist transitions, and current economic systems and their performance.

The Polish-Ukrainian borderland holds a peculiar position in the landscape of Europe. On one hand, Poland represents a success story of post-communist transition, having implemented comprehensive political and economic reforms, culminating in its accession to the European Union in 2004. On the other hand, Ukraine's transition has been marked by slower progress, ongoing political instability, and the significant influence of external actors, resulting in a complex and uneven trajectory. Despite still lagging behind the most developed countries of "Old Europe", the Polish economy is one of the soundest and fastest-developing ones on the continent; even before the full-scale war, Ukraine was, at best, a mediocre economic performer with many development problems. Russia's aggression against Ukraine has only exacerbated that country's economic and social problems.

Section 2 of this chapter discusses the paths of post-communist transition in these countries, the common elements and differences that influenced the specificity of

capitalist systems formed in Poland and Ukraine, and their performance, which are discussed in Section 3. Section 4 is a concluding part which sums up the analysis, considering the challenges that both Polish and Ukrainian societies face.

Communist legacy and post-communist transition

Legacy and challenges

Both Poland and Ukraine are post-communist countries that, at the turn of the eighties and nineties, together with other countries of the Eastern Bloc, started systemic reforms which addressed the deep and all-encompassing crisis of the decaying administrative economic system and authoritarian political regime. The main challenges and both short- and long-term goals of the transition (overcoming the crisis and building an efficient economic system fostering long-term development, respectively) were common for all these countries. Despite all the similarities, all the countries had their peculiarities in the economic, political and institutional areas, which influenced both the trajectory and the effects of the post-communist transition.

The communist economic system was to address real and imaginary failures of capitalism of the early 20th century, such as high income inequalities, monopolization, cyclic crises, inadequate production of public goods, as well as alleged exploitation of the working class by capitalists, “the contradiction between socialized production and capitalistic appropriation”, and anarchizing character of market impact on production (*Engels 2010, pp. 259, 261*). A new system was to be created not only based on social justice, but also superior to market economy in ensuring long-term sustainable social and economic development. This system was based on two pillars. The first was all-encompassing state interventionism: the state was to fully, or almost entirely, replace the market as a regulator of economic processes, substituting for the missing interests, information and economic mechanisms (*Staniszakis, 1992*).

It was realized through strict centralization of all economic processes, especially decision-making and control, within a so-called central planning system. Such planning was carried out based on material balances, which indicated how many of what goods should be produced to ensure the achievement of social and economic development goals in the short and medium term. It also included the entire allocation of financial, material and human resources, price formation, procurement and distribution. The central planning system could not operate without concentrating in the hands of the state the rights to dispose of productive assets. Thus, the second pillar of the communist economy was state ownership of almost all economic entities. Soviet lawyer *Anatoly Venediktov (1952)* formulated it as a principle of the unity

of state power in performing the function of regulator and owner of the means of production. In a sense, state-owned enterprises (SOEs) were not businesses, but branches of state administration and the state authorities could freely dispose of their assets (*Baltowski 2009, p. 178*). In the USSR, private property of the means of production was banned entirely.

First, this system was introduced in a large part of the former Russian Empire after the 1917 Bolshevik revolution – including Ukraine at first as a quasi-independent state and after 1922 – as the Ukrainian Soviet Socialist Republic within the USSR. After World War II, Poland (as well as other countries of Central and Eastern Europe – CEE) became a satellite state of the USSR and was forced to introduce economic and political solutions modelled on the Soviet regime. It should be noted, however, that in Poland, private property has survived through the whole communist period, providing for more than 70% of sales in agriculture and about 19% of sales in other sectors at the end of the 1980s (*Kozarzewski 2021, p. 47*). Initially, after stabilizing the principles and tools of the command economy, it proved to be effective in strengthening the power of the ruling communist parties by eliminating political competition and establishing its base in the form of the large-scale industrial working class. Due to administrative mobilization and use of resources of the agricultural sector, extensive modernization of the economies through industrialization with a priority on the development of capital goods production was carried out. A civilizational leap forward was made in several areas, such as a radical improvement in the health of society and the creation of social lifts for the lower classes.

At the same time, in the long run, the command system proved incapable of intensive growth and being competitive with market economies. After mobilization opportunities and generally the potential for extensive economic were depleted, it turned out that this system was very unflexible. The bureaucratic regulation system made it incapable of efficiently adapting to changing economic and social realities, motivating enterprises to improve their productivity and introducing innovations. Even more, this system promoted a decrease in efficiency at the micro level, motivating enterprises to maximize the resources received from the authorities and cutting their production plans. It created a specific “bargaining culture” in which SOEs and bureaucrats were involved, which contributed to a further reduction in the effectiveness of the state’s regulatory capabilities.

Both in the USSR and in Poland, there were numerous attempts to introduce reforms that would address the low effectiveness of the command economy. In the USSR, the most radical was the “perestroika” policy launched in the second half of the 1980s. In 1987–1988, several laws were passed that increased the autonomy of enterprises and introduced elements of employee self-management. Small businesses in the non-state sector were allowed to be created without officially legalizing private property, and partial ownership transformation was made possible by leasing

SOEs' assets to their employees. At the same time, Soviet leadership tried at every price to retain the general paradigm of the communist system both in economic and political areas, as well as to prevent the disintegration of the USSR. Most Soviet republics, including Ukraine, could embark upon systemic reforms only after the USSR collapsed in December 1991.

By the end of the communist era, the Polish economy was probably the most reformed in the Eastern Bloc. In 1982, the directive character of central planning was effectively abolished for most SOEs by granting them a significant degree of autonomy based on the "3S principle": self-reliance, self-financing and self-management. SOEs got the right to decide on their finances and production independently and independently appoint top management. The government retained only tools of indirect control over enterprises through access to resources, public procurement, regulation of prices, etc. However, this reform and further deregulation measures (albeit much more cautious) proved to be not incapable of stopping the economic decline of the Polish economy; in the second half of the 1980s, the communist leadership became aware of systemic failures of the command system and started introducing more radical changes, first of all in the regulatory area, which effectively meant gradual abandonment of the principles of the communist economy. During the last year of the communist rule, a series of laws were adopted, introducing, among others, the basic principles of a market economy: all market players have equal rights, and everything is allowed that is not forbidden by law. The Soviet-type monobank system was abolished, and a two-tier system of the central bank and commercial banks was introduced. The economy became more open to foreign direct investments (FDI), and most consumer prices were liberalized. The government started talks with the "Solidarity" opposition on directions and conditions of political and economic systemic transformation, ultimately leading to the end of communism in Poland.

Despite Poland and Ukraine having similar challenges created by an inefficient communist system and similar goals of transition to a capitalist system based on democratic rules and market economy, significant differences existed both in initial conditions and in the course and effects of post-communist reforms in these countries. They entered the transition period with different levels of reforming their economies and the role of market relations in them; besides, macroeconomic and structural disparities and challenges in Ukraine (mainly inherited from the USSR) were much more severe than in Poland. The dominance of heavy industry, primarily defence sectors, was much more severe; the levels of concentration and monopolization were much higher; spatial localization of production was much more policy-driven and created more economic and social problems (e.g., so-called city-forming enterprises – huge entities being the main employer in the region on which the well-being of the population depended). Specific post-Soviet problems, which

came from the centralized character of the Soviet state, should be added: centralization of control over industries at a supra-republican level in central resorts and lack of horizontal ties between enterprises. Centralized structures often covered several republics, so the dissolution of the USSR and the uncoordinated economic policies of the newly independent states led to broken supply chains. A massive challenge for the future independent state was also a common monetary system after the collapse of the USSR called the “ruble zone”.

There were differences of social and political kind as well. This is not a complete catalogue of them, but probably an account of the most important ones. In the communist times, Poland had – compared to other countries in the Eastern Bloc – the least repressing regime, allowing a significant degree of personal liberties, which led to the formation of elements of civil society and, since the mid-1970s, the most active opposition (with the momentous event of the creation of the “Solidarity” movement in 1980). It also allowed for the development of the national intellectual potential, which in Poland was probably the strongest among communist countries. Since 1956, after de-Stalinization started, independent political and economic thought existed, with unofficial or semi-official discussions on the situation in the Polish state regarding the reforms that had to address existing problems. Additionally, Polish intellectuals, unlike their Soviet counterparts, were not isolated from the world economic and political debate and had access to relevant literature, more possibilities of visiting Western academic centers, etc. The whole Polish society was also much more exposed to knowledge about life in capitalist countries (having much more possibilities to travel abroad than Soviet citizens and having a large Polish diaspora in developed countries in the West). The Polish society had a much stronger national identification. It was also much less contaminated with “Soviet mentality” because quite visible private entrepreneurship still existed, as well as a memory of the capitalist past before World War 2. The communist regime was regarded by many as something imposed on Poles by external forces – the Soviet Union. Also, despite the Polish society had no experience in functioning in a modern, efficient state and major political forces on the verge of the transition – communists and the oppositionists – “had a tradition of state abuse and the other of state negation” (*Kochanowicz et al. 2005, p. 23*), and limited sovereignty of the country, Poland had experience of running state institutions and conducting social and economic policy.

In its turn, Ukrainian society was affected very much by Ukraine being a part of the USSR for almost 70 years and adopting a lot not only from soviet mentality and behavior, but also that of the Russian Empire. One of such “legacies” was a peculiar “mobilization culture” imposed by the state and which was based on informality. Authorities avoided setting any rigid regulations in order to preserve freedom of action. And the existing regulations were notoriously violated – presumably “for the common good” (*Dubrovskiy et al. 2003*). Authoritarian rule, informality, and

peculiarities of the historical experience of Soviet citizens just led to severe erosion of this “common good”. The society was atomized (everyone looking out for their own interest), and there was a widespread lack of respect for the law and official institutions (“nothing can be done without breaking the law”). At the same time, the state promoted passivity (active society was regarded as a threat to communist rulers), counting on state paternalism. Omnipresent anti-capitalist propaganda (with a lack of possibility to verify its claims) created a common negative attitude towards private property and entrepreneurship (Kozarzewski, 2006b, p. 39). Unlike Poland, Ukraine also had no experience in statehood, as Soviet Ukraine’s state institutions had virtually no autonomy being steered from Moscow.

The problem of Ukrainian national identity was also one of the challenges. While the emergence in the 19th century of modern Ukrainian literature and cultural movements played a pivotal role in fostering national consciousness, it was to an important extent “diluted” by the imperial policy of the Soviet leadership and Soviet institutional setup. Besides, while Poland is culturally more homogenous, Ukrainian society is much more diversified (culturally, linguistically, etc.), which is deeply rooted in Ukraine’s complex history of foreign dominations, shifting borders, and diverse ethnic compositions. It posed challenges to national unity and political cohesion. Consolidation of Ukrainians’ national identity accelerated only in the 21st century due to political events, such as the Orange Revolution (2004) and the Revolution of Dignity (2013–2014), and the stages of Russian aggression against Ukraine (2014, 2022) (Veira-Ramos & Liubyva?=?, 2020; Wilson, 2022).

Transition in Poland

Poland was the first country of the Eastern Bloc to start radical systemic reforms. In the political area, it was abolishing authoritarianism and introducing democratic institutions, civil liberties and pluralism; in the economy, it was building efficient market mechanisms. The latter was implemented generally in line with Washington Consensus recipes, which at the turn of the 1990s were regarded as a universal set of efficient solutions for economies in a deep crisis. They included a triad of reforms: stabilization of the economy, liberalization of the economy, and privatization (Williamson, 2000). This approach was fine-tuned to the context of post-communist economies, particularly the Polish economy, by the Polish reformers headed by Leszek Balcerowicz. The short-term governmental plan of the reforms, commonly known as “Balcerowicz’s Plan” (*Rada Ministrów*, 1989) envisaged a fast introduction of stabilization and liberalization reforms which would address the nearly catastrophic state of the Polish economy and create conditions for the development of market relationships, thus creating ground for building stable capitalist system with high development capacity.

Liberalization included price liberalization, abolition of the state-controlled distribution system, liberalization of foreign trade, the introduction of the internal convertibility of the zloty, and complete liberalization of starting a business. Stabilization measures consisted of, among others, balancing the state budget, introducing a restrictive monetary policy, restricting wage growth, introducing an exchange rate anchor of the zloty to the dollar, and agreement with foreign creditors on temporary suspending of debt payments.

The plan also included first steps in introducing institutional reforms, such as demonopolization of the enterprise sector, “small” privatization in trade and services and preparation of the legal framework and organizational structures for privatization of large and medium-sized SOEs (that was to take place later); continuation of the banking reform and creating the main institutions of the non-bank financial market (capital market, investment funds, brokerage, etc.); preparing to introduce the new tax system (PIT, CIT, and VAT). Last but not least, local self-government reform started creating a system of public administration according to the principle of subsidiarity and unleashing grassroots activity of the society.

Apart from the need to stop the economic disaster and to create conditions for further reform processes, such a set and an order of reforms were also based on political considerations. The reformers made use of a unique window of opportunity which made it possible to conduct “extraordinary policy”, when the government was not a subject of external pressure, was in a “splendid isolation”, and thus was able to introduce reforms that otherwise would have been hard or impossible to implement – in the conditions of a “normal” policy, affected by political struggle and the need for compromises that take into account various interests. This window was created, among others, by the high credit of trust of the population to the first post-communist government, political support of “Solidarity”, and lack of powerful interest groups: those existing under the previous regime were scattered, and new ones have not formed yet (*Balcerowicz 1995, pp. 160–163*). This very short period (a few months) allowed Balcerowicz’s team, among others, to introduce measures bearing high social costs and violating the interests of several interest groups, first of all in the area of stabilization (*Kochanowicz et al. 2005*).

These “first-generation reforms” (*Loayza & Soto, 2004*) created the ground for perhaps the most sophisticated politically, technically and institutionally reform: privatization of large and medium-sized SOEs. Other areas of privatization have been completed fast and without much trouble: “small privatization” and so-called greenfield privatization – grassroots creation of new private market entrants, which flourished after the appropriate deregulation measures were introduced (*Baltowski & Kozarzewski 2014, pp. 284–292*). Apart from the systemic goal of making private ownership dominant in the Polish economy, the privatization of SOEs also aimed at improving the performance of enterprises and meeting other goals – political

(creation of a political base for the reforms), fiscal (among others, as an additional source of proceedings to the state budget), social (e.g., reduction of social costs of the transition), support for financial markets, etc. (Kozarzewski, 2006a). One of the key problems in “large” privatization was finding an efficient private owner that would bring to the enterprise investments, be able to conduct deep restructuring, and find a market niche in the rapidly changing economic reality. In Poland at that time, there was no domestic capital – private businesses were very small, and the population was poor, with inflation “eating” its already very modest savings. In many other post-communist countries (including Ukraine), in line with the ideas of Western advisors, there were attempts to resolve the problem of lack of capital through mass privatization schemes transferring property rights for free or almost free to the population. It was unacceptable for the Polish government because it did not address the problem of lack of financial and other resources in privatized SOEs. Instead, the privatization of, first of all, large enterprises was conducted with the participation of FDIs, which indeed, in the vast majority of cases, proved to be a very efficient solution because foreign owners provided privatized enterprises with capital, new technologies, new management methods, access to markets (which among others helped in the reorientation of Polish economy to Western markets), etc. These privatization deals, together with numerous green field FDIs, made foreign ownership a large part of the private sector, and FDIs became one of the major factors of Poland’s economic development. Later, such type of development of post-communist economies (typical for most CEE countries) started being called FDI-led development (Szanyi, 2016).

However, at the beginning of the 21st century, Polish authorities became increasingly reluctant to privatize the remaining state property. It led to declining dynamics of ownership change, and in the mid-2010s, privatization was officially stopped. A series of nationalizations took place as well. It left quite an extensive state-controlled sector in Poland, especially among the largest enterprises and in certain branches, e.g. extractive industry, infrastructure, municipal services and financial sector. The official reason was the changing paradigm of economic policy towards state interventionism: the state was to become a major player in the market and the main driving force of economic development (Kozarzewski & Bałtowski, 2017). However, there are reasons to believe that a hidden goal also existed in the form of rent-seeking interests within the political elite. Privatization in Poland was generally conducted transparently, transferring property to efficient entities; since then, the market has become the main regulator of their activity. It is worth noting that privatization in Poland, unlike in many other post-communist countries, did not lead to the formation of an oligarchy (oligarchs being a narrow group of private businessmen powerful enough to influence decision-making in the state). In this situation, the remaining SOEs became the source of rents of various kinds, including

the seats on the boards of SOEs that were treated as a bounty of election winners, the use of SOE's resources for political aims, etc. Continuation of privatization would mean further depletion of this source of rent (*Kozarzewski 2021, p. 222*).

The picture of the Polish post-communist transition would not be complete without mentioning the withdrawal of the country from communist international structures such as the Warsaw Pact and Committee for Mutual Economic Assistance and embarking upon integration with the Western world. In the Polish society, there was a broad consensus in this respect. In 1999, Poland joined NATO, which increased security for this country – it became more apparent in later years in the light of the increasingly aggressive policy of Russia towards its neighbors; also, it helped modernize Polish armed forces and increased the importance of the country in the international arena. In 2004, Poland (together with other CEE countries) joined the European Union (EU). There is a widespread opinion that this event marked the end of the post-communist transition in Poland. However, one can argue that remnants of the communist system and some institutions of the transition period still exist in the Polish economy (e.g., the extensive role of the state in the enterprise sector – *Kozarzewski 2021, p. 3*). In any case, the EU accession was one of the key factors that contributed to the generally successful post-communist transition in Poland, creating a strong incentive to introduce reforms otherwise blocked by interest groups (e.g. demonopolization), opening developed European markets, and becoming the leading recipient of EU funds. This substantial financial support has been instrumental in modernizing the country's infrastructure, boosting economic growth, and enhancing overall social and economic development. Last but not least, the accession created a strong EU anchor against violating the rule of law and democratic division of power (*Pech et al. 2021*).

Transition in Ukraine

The post-communist transition in Ukraine was a much more complicated and inconsistent process, encountering many more political, economic, and institutional obstacles.

The first official document devoted to economic reforms in Ukraine ("The main directions of economic policy in the conditions of independence") was adopted by the Ukrainian parliament in October 1991, two months before the official dissolution of the USSR. This document, together with a few more adopted in 1992, was to create legal and program foundations for market reforms based on the Washington Consensus approach. However, their implementation was erratic and inconsistent (e.g., partial price liberalization was not followed by stabilization measures), which led to hyperinflation and widespread financial instability. Initial attempts at privatization and restructuring were launched but suffered from poor execution. Non-monetary

transactions, including barter systems, were pervasive; corruption was widespread. Unlike in Poland, in Ukrainian society, no consensus on the ways of overcoming the crisis of the decaying stage of the communist economy was achieved; there was no strong will of the leading social forces to integrate into the structures of the developed world. Powerful anti-reform forces existed, including so-called “red directors” – CEOs of large state-owned enterprises who were interested in keeping support from the state. Therefore, there was no place for “extraordinary policy” to give the government room for unhampered decision-making. Social unrest grew as governance faltered, culminating in presidential and parliamentary elections in 1994. Leonid Kuchma won them, who declared embarking upon comprehensive reforms developed in cooperation with international financial institutions such as the International Monetary Fund and the World Bank. Key policies included price liberalization, exiting the “ruble zone”, introducing the hryvnia as the national currency, and mass privatization program. Unlike in Poland, privatization was conducted in a non-efficient and non-transparent way. It did not bring capital and other valuable resources to privatized SOEs, which would make their efficient restructuring and increasing capabilities possible to adapt to the market. Instead, it facilitated taking over of them by their directors and other cronies, giving birth to oligarchy. While some stabilization was achieved, GDP continued to decline, and corruption persisted, particularly in energy-intensive industries. The 1998 financial crisis ignited by Russia’s default exposed the fragility of these reforms, highlighting the need for more robust institutional changes.

In 1999, Ukraine entered a phase of crisis and recovery. The government led by Prime Minister Viktor Yushchenko addressed fiscal imbalances, non-monetary payment systems, and inefficiencies in the agricultural sector. Significant reforms in deregulation, privatization (which entered its cash stage), and taxation were implemented. This period marked the beginning of economic recovery, with GDP growth resuming in the early 2000s. However, political instability, corruption and entrenched oligarchic interests continued to impede progress. Reforms were often reactive, driven more by crisis management than strategic planning, limiting their long-term impact. Public discontent with the fraud of the 2004 presidential elections and corruption led to the democratic awakening that culminated in the Orange Revolution. Efforts to align with European standards gained momentum, with judicial and administrative reforms and a fight against corruption (which, among others, led to a temporary moratorium on privatization and attempts to revise several privatization deals) taking centre stage. However, economic reforms during this period were inconsistent, influenced by alternating administrations and shifting political priorities. The struggle between pro-European and pro-Russian factions significantly shaped domestic and foreign policies, underscoring Ukraine’s geopolitical challenges.

The Euromaidan protests of 2013–2014 and the subsequent Revolution of Dignity led to increased efforts by Ukraine to overcome institutional dysfunctions, distance

itself from its Soviet past, and accelerate integration with European and Euro-Atlantic international structures. The government signed the EU-Ukraine Association Agreement, and legal and institutional reforms gained momentum, but the efficiency of the new policy was hindered by political instability, vested interests threatened by the change, and Russian imperialist policy. Russian authorities regarded post-Euro-maidan developments in Ukraine as very unfavorable for geopolitical reasons: Russia perceived NATO's eastward expansion and the EU's growing influence in Eastern Europe as a direct challenge to Russia's strategic interests. Besides, Russian authorities feared that Euromaidan could be a potential model for anti-authoritarian uprisings within Russia (Wilson 2014). Russia's response was the annexation of Crimea and the initiation of separatist riots in Eastern Ukraine. Instead of subordination, the external threat galvanized Ukraine's efforts to consolidate sovereignty and to continue a pro-European course, which Russia failed to stop by starting full-scale aggression in Ukraine in 2022. Recent years have seen a relaunch of privatization processes that have to be more transparent and competitive. Large-scale auctions have aimed to reduce corruption and broaden access to privatized assets (Grigorenko, 2023).

Effects of the transition

A comparative analysis of the post-communist transition of these countries highlights critical differences in their trajectories. Poland's early political consensus, decisive economic reforms, and success in introducing democratic institutions laid the foundation for its success and is the reason why Polish and Ukrainian paths are so different (Kupfer, 2018). However, not inclusive enough Polish institutional setup (Acemoğlu & Robinson, 2012) did not prevent the emergence of powerful interest groups that affected the reforms' progress, especially in the role of the state in the enterprise sector. But institutional dysfunctions of various kinds were characteristic of virtually all post-communist countries, and Poland still was among the best performers in systemic transition. By contrast, Ukraine, to a large extent, failed to create strong inclusive institutions, integrate the nation and pursue a coherent policy of post-communist reforms, which is reflected in much more inferior effects of the transition than in Poland. Ukraine's experience reflects both significant achievements and persistent challenges. Corruption, political instability, and economic inequality remain pressing issues, but the resilience demonstrated in recent years offers hope for continued progress.

The lack of a coherent approach to reforms in Ukraine negatively affected the stabilization of its economy, both from short- and long-term perspectives. High inflation, inevitable at the beginning of the transition as the first effect of restoring market equilibrium, was higher in Ukraine than in any other transition economy, reaching as high as 4735% in 1993 (in Poland, the highest transitional inflation was in 1990:

568%).¹ During the whole period of the transition, the macroeconomic stability of the Ukrainian economy measured by inflation was much lower than in Poland and was much more exposed to external shocks like the crises of 1998 and 2008–2009.

According to the European Bank for Reconstruction and Development (EBRD) data, progress in liberalization and institutional reforms in Ukraine was also more modest not only compared to Poland and other CEE countries, but also the average indicators for the whole former Eastern Bloc – with some catching up visible only since the mid-2000s (Fig. 1).

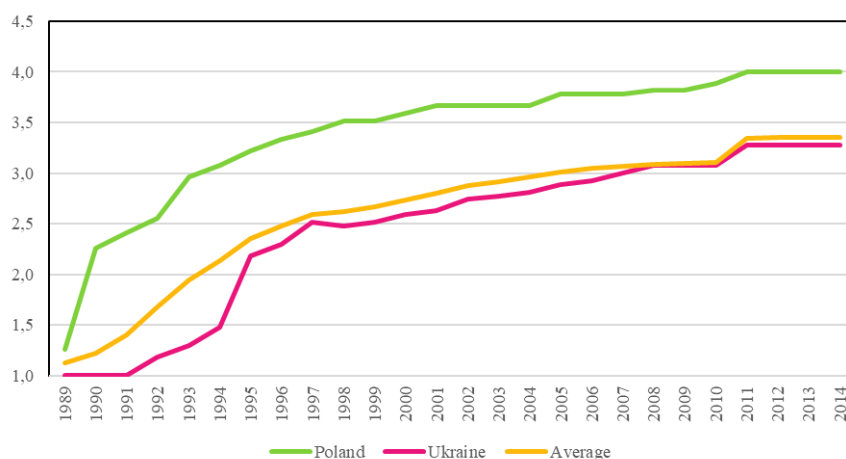


Fig. 1. The overall progress of transition

Note: Possible values are within the range of 1.0–4.3, where 1.0 means lack of market reforms and 4.3 is a situation similar to that of developed market economies. The last available data is for 2014, but there has been no significant progress in transition since then.

Source: European Bank of Reconstruction and Development database, own calculations.

Poland was an absolute leader in transition during its first years, and in 2014 (the last year of EBRD's estimations), it occupied the 2nd place after Estonia. The worse transition performance of Ukraine meant a much more delayed return to the path of economic growth (extremely moderate, additionally being unstable through the years, when there were periods of recession as well), while Poland was the first country to achieve this, also being the first country to achieve the pre-transition level of GDP – which Ukraine failed to do till nowadays. Figure 2 shows the striking difference between long-term economic growth trends: while Poland embarked upon the path of economic growth, the Ukrainian economy keeps stagnating.

¹ Worldwide Development Indicators.

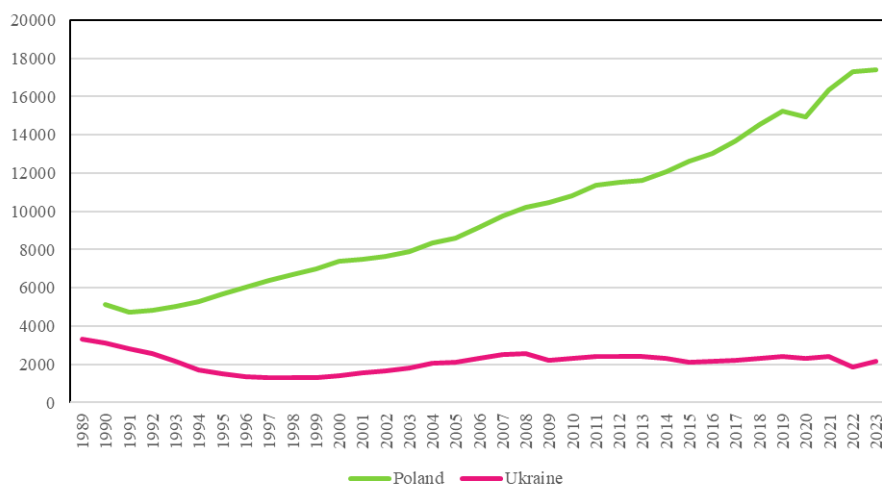


Fig. 2. GDP per capita in constant 2015 US dollars

Source: World Development Indicators, The World Bank.

What economic system has been built?

Some characteristics of the system²

According to the character of regulation and ownership structure, both economies can be considered capitalist ones, although with some more minor or more significant deficiencies. An Index of Economic Freedom estimated by the Heritage Foundation,³ which measures freedom of national economies in terms of rule of law, government size, regulatory efficiency, and market openness, placed Poland in quite high 39th place (out of 182 economies) for 2022 and the ninth among post-communist countries. Poland scores lower in government spending, judicial effectiveness, government integrity (impartial decision-making), and labor freedom, but higher in everything else: all other types of capitalist freedoms (business, monetary, trade, investment, and finance), property rights protection, tax burden, and fiscal health. Ukraine occupied a very low 130th place, fourth from the bottom among former countries of the Eastern Bloc, ahead only of Belarus, Tajikistan and Turkmenistan, and far beyond the “worst” EU economy (Greece – 77th place). Like Poland, Ukraine scores lower for judicial effectiveness and government integrity (although it gets

² In this section, the most recent data used is for 2021, so indicators are not distorted by Russia's full-scale invasion. It allows to concentrate on more long-term and systemic issues.

³ Index of Economic Freedom, <https://www.heritage.org/index/>.

lower scores than Poland), but also in property rights, investment, and financial freedoms. In other areas, the scores are quite high, sometimes even higher than in Poland (tax burden and labor freedom). Ukraine's low place in the global ranking comes not so much from high interventionism and lack of economic freedoms (except for the financial area), but rather from poor protection of market relations.

Looking at another pillar of the capitalist economy, the prevalence of private property, according to the Center for International Private Enterprise (CIPE 2023) estimations, just before the full-scale Russian invasion, the private sector produced 60–70% of the country's GDP. No sound estimates exist on the private sector's share in Poland's GDP, but in the enterprise sector, it was estimated at about 85% of gross output in 2018 (*Kozarzewski 2021, p. 187*). From this perspective, both countries can be assessed as capitalist as well, albeit with a substantial public property sector.

The notion that one of the biggest problems of Ukraine's capitalism is institutions, is corroborated by data from the Worldwide Governance Indicators project implemented by the World Bank. It assesses the state of governance according to six groups of indicators depicting the public's control over authorities and the quality of their work, political stability, quality of regulations, rule of law, and level of corruption and state capture by interest groups. While according to 2021 data, Poland was far from being the best performer in the world (occupying 77th place according to average score in these areas) and even among CEE countries, Ukraine was placed much further – at 151st place, albeit scoring considerably better than such countries as Russia and Belarus. The indicators show the situation in Ukraine as politically unstable, with a high degree of corruption and state capture, weak rule of law, and inefficient government. At the same time, public control over authorities and regulatory quality were assessed as relatively favorable. Poland scored much better in all six areas than Ukraine; relatively the most problematic was the situation with political stability, public control over authorities and the quality of their work⁴.

Efficient economy, economic growth and economic development are not an end in itself, but a way to ensure the well-being of society. They are key factors determining living conditions, but not the only ones; they do not cause an automatic effect on the population. *Amartya Sen (1980)* introduced the concept of capability, which focuses on positive freedom, a person's actual ability to be or do something. It is not enough to have a right; it is necessary to have appropriate resources to act out of personal choice. Therefore, provision of them must be one of the key tasks of the state, and governments should be measured against the concrete capabilities of their citizens. This approach gave birth to studies on human development, since 1990 conducted by the United Nations Development Programme (UNDP), i.e. on the process of

⁴ Worldwide Development Indicators, <https://databank.worldbank.org/source/worldwide-governance-indicators>.

enlarging people's capabilities – to live a long and healthy life, to be educated and to have access to resources that ensure a decent standard of living (*UNDP, 1990, p. 1*). A Human Development Index was elaborated that included indicators on life expectancy at birth, years of education, and gross national income (GNI) per capita. In 2010, a modified measure was created – Inequality Adjusted Human Development Index (IHDI), that takes into account losses in human development caused by inequalities in these measures.

In 2022, Poland ranked 36th according to the HDI index and found itself in the group of countries with the highest human development being the fourth best post-communist country. Ukraine was at 100th place, in a group with high human development, but among post-communist countries, the worst performer was only Uzbekistan. The largest difference that contributed to such a wide gap between Ukraine and Poland was the fact that Ukraine was much poorer, with GNI per capita three times lower than that of Poland. But other indicators were also less favorable: eight years shorter life expectancy (despite war losses were not taken into account yet), and almost five years shorter total length of schooling. In the IHDI, Poland moved one place down losing 9.5% of points due to the fact that some countries were characterized by lower inequalities, but still remained in the club of countries with the highest level of human development. Ukraine advanced to 69th place by losing 7.9% of points – being concerning inequalities much better performer than many other countries, including those with the highest level of human development⁵. While Poland is a country with quite a low level of income inequalities (even a bit lower than the EU average) with a Gini coefficient of 28.56 in 2021, Ukraine's Gini coefficient was as low as 25.63, placing it ninth among countries with the most equal income distribution⁶.

Types of post-communist capitalism

Different paths of post-communist transition also resulted in differences in economic systems built in Poland and Ukraine. Analysis of economic systems is not an easy task. One of the key problems is finding the proper taxonomy that would reflect the most important features of the studied economies and show differences between them. In the case of developed market economies the most popular approaches are based on the role of the state in the economy (dividing them into neoliberal economies, social market economies and socio-democratic economies or using similar terms – see e.g. *Esping-Andersen, 1990*) or in the way how firms coordinate with each

⁵ Human Development Reports, <https://hdr.undp.org/>.

⁶ World Income Inequality Database, <https://www.wider.unu.edu/project/world-income-inequality-database-wiid>.

other and other actors. The latter is called a Varieties of Capitalism (VoC) approach, which became popular at the beginning of the new century (*Hall & Soskice, 2001*).

Attempts to include post-communist countries in the approaches used for studies on the developed capitalist world so far did not allow for proper identification of the specificity of transition economies, especially if they had to be attributed to the already existing categories. Therefore, additional categories were created, and additional features, e.g. the role of FDIs, were taken into account. *Nölke & Vliegenthart (2009)* added a category of dependent market economies (meaning the key role of FDIs in coordination mechanisms) within the VoC approach. It included only four CEE countries: Poland, Hungary, the Czech Republic, and Slovakia and did not take into account another important feature of post-communist economies (being both common to them and diversified in its manifestations): the role of the state in the economy, especially in the enterprise sector. The same shortcomings (limited geographical coverage, which makes broader comparative analysis impossible and not paying attention to the state's role) are characteristic of other attempts. Studying post-communist EU member states, *Beáta Farkas (2016)* introduced the categories of "stable East Central Europe" (which included Poland) and "unstable Eastern and South-Eastern Europe". Analyzing the same set of countries, *Juliusz Gardawski and Ryszard Rapacki (2021)* put forward a concept of patchwork capitalism, which is characterized by a lack of coherent and enduring institutional structures that could define the foundations of the socio-economic order and a variety of organizational and institutional forms coexist.

So far, most studies on post-communist economic systems have been, to a large extent, separated from studies on those of developed Western-type capitalism. For many years, starting in the early 1990s, the geographical approach applied by international financial organizations, e.g., the EBRD, dominated. It divided the post-communist world into the most successfully transformed Central and Eastern Europe (CEE, sometimes called Central-Eastern Europe and Baltics – CEEB), mediocre South-Eastern Europe (SEE), and the former USSR republics without the Baltic states (often mistakenly called Commonwealth of Independent States – CIS despite not all these countries, including Ukraine, belonged to this organization) – which lagged behind the first two groups. This classification indeed showed significant differences between the regions, although the latter category was too diversified. It included three clearly different categories of countries: best performers within the group (including Ukraine; they were at a somewhat similar level with the SEE group), mediocre performers, and reform outliers like Belarus and Turkmenistan (*Kozarzewski 2006b, pp. 145–152*). However, this type of classification reflected the progress of the transition towards some ideal model of market economy, not distinguishing between possible different models of capitalism built in these countries.

Since the early 2000s, there have been numerous attempts to create a taxonomy of post-communist capitalism without directly referencing capitalism models in devel-

oped countries. For example, *Lawrence King and Iván Szelényi (2005)* distinguished three models of such capitalism according to the ways it had shaped: “capitalism from below”, where small and medium-sized private businesses started to appear spontaneously with large enterprises remaining state-owned and coordinated by a central planning system (like in China and Vietnam – although one can argue to what extent such economies can be classified as capitalist); “capitalism from above”, where transition, especially privatization, was supported by the party nomenklatura and directors of large SOEs (as in Russia and Ukraine); and “capitalism from without” with key involvement of international corporations that have invested in the restructuring and renovation of enterprises integrating those economies into international value chains (as in many CEE countries, including Poland).

David Lane (2005) proposed a taxonomy of three groups based on the level of transformation of post-communist economies: state-led continental market capitalism (with a most advanced version in the Visegrad Group countries, including Poland); hybrid state/market uncoordinated capitalism, observed in the former USSR republics (including Ukraine) that lag behind the first group in terms of the development of market institutions and integration with the global economy; statist economies that have made little progress in privatization and market liberalization (Belarus, Uzbekistan, and Turkmenistan).

Martin Myant and Jan Drahekoupil (2015) identified five types of capitalism in post-communist countries according to the degree and nature of their integration into global economic processes. Later this taxonomy was updated by Anna Grosman, Piotr Kozarzewski and Ilya Okhmatovskiy (*Grosman et al. 2025*) by adding the sixth type:

1. FDI-based market economies are the strongest and are characterized by democratic political systems, EU integration, and export structures that increasingly rely on goods produced by foreign multinational corporations – these are CEE countries, including Poland.
2. Peripheral market economies (mostly SEE countries) have democratic political systems and basic legal and institutional conditions for business, but rely on less stable exports of manufactured goods and have a less favorable investment climate.
3. Order states (e.g. Belarus) have undergone the most limited reforms and the state keeps the command heights; it is questionable whether they can even be called capitalist. International integration is very weak.
4. Oligarchic or clientelistic capitalism (e.g. Russia) is characterized by relatively authoritarian political systems and a close connection between business and politics. Generally, these economies are not attractive to FDIs, and their international integration is based mostly on commodities export.
5. Remittance and aid-based economies are low-income countries (e.g. Kosovo and Tajikistan) dependent on this type of transfers.

6. Peripheral market economies with a high level (above 9% of GDP) of aid and remittances (they are high but are not the country's only economic pillar) – the type added by Grosman et al. (2025), and it includes Ukraine. It is worth noting that Myant and Drahokoupil put this country in the oligarchic and clientelistic capitalism group. However, the authors of the later study thought that despite the important role of oligarchs, other characteristics were more important as a basis of classification.

State capitalism

The term “state capitalism” has gained in popularity, although different authors put different meanings into it (*Bałtowski et al. 2022*). For some of them, this is a separate type of capitalism, an economic system in which the scale of government interference in the economy is incomparably more significant than in developed market economies; the role of the private sector and basic institutions of the market economy is largely controlled in an arbitrary and ad hoc manner by the government. For others, state capitalism is just a set of tools of state interference in the economy – mainly through ownership or quasi-ownership tools rather than regulatory ones. It allows for arbitrary rather than rule-based decision-making. According to studies conducted by Maciej Bałtowski, Piotr Kozarzewski, and Tomasz Mickiewicz (*Kozarzewski, 2021; Bałtowski et al. 2022*), state capitalism in both senses in post-communist countries has seven specific features (with a specific set of beneficiaries) which make it different from that of in other economies:

1. Treating SOEs as a key tool of economic development – here, the set of beneficiaries depends on the degree of state capture by interest groups.
2. Politicization of SOEs: the government and political elites use them as a source of rent.
3. Politicization of SOEs *à rebours*: the state-controlled enterprise sector (employees, management, trade unions) is itself the main rent seeker.
4. Cronyism: private entities that enjoy special treatment from the state in terms of access to governmental contracts, restricting competition from third parties, etc. Cronies may provide some services to the political elite in return but, unlike oligarchs, they do not influence economic policy.
5. Oligarchy: a small circle of powerful businessmen has a very significant influence on economic policy.
6. Economic populism (clientelism): a patronage system in which the political elite transfers goods to clients from selected social groups, expecting their political support in return.
7. Economic nationalism: the state exerts influence on the economy with the declared aim of increasing, in the long term, the political potential, military

power, or international significance of the state. The state itself can be treated here as the main beneficiary.

The importance of different forms of post-communist state capitalism varies across the region. So far, the studies covered a limited number of countries (including Poland), and Ukraine is not one of them. However, using this approach, Ukrainian state capitalism may be described as a peculiar mixture of cronyism, oligarchy, economic nationalism and using SOEs as a tool of economic development. In the second half of the 1990s, a dense network of cronies formed in this country, closely “cooperating” with public authorities at regional and central levels. Some of them have more features of oligarchs, e.g., owners of the biggest businesses who may successfully lobby for favorable decisions of the parliament and the government. Nevertheless, they depend on the authorities as well, so the power in the economy is shared between the big business and the political class, and these relationships are replicated at the regional level as well (*Lough, 2021*). This kind of semi-oligarchic arrangement proved to be very stable and able to adapt to the political disruptions of two Ukrainian “revolutions”.

Another area of state capitalism activity in Ukraine is the nationalization of selected private companies. In the 2010s, a discussion took place about the necessity to revise some privatization deals as being carried out in violation of the law, but in fact, there was only one nationalization – of the PrivatBank in 2016, the largest commercial bank of Ukraine, because of its growing financial problems. After the full-scale aggression of Russia in Ukraine, several nationalization deals were conducted, for two purposes. The first was the expropriation of assets belonging to Russian entities involved in the aggression (in industrial and banking sectors). The second one is the temporary nationalization of companies that produce military equipment and supplies and pass them under the control of the Defense Ministry (among others, aircraft engine manufacturer Motor Sich and two energy companies). Unlike in Poland, these nationalizations seem not to be a part of a general process of increasing state interventionism (although it could have been understandable in times of war), which is corroborated by the announcement in 2024 of an ambitious program of transparent “large” privatization.

As mentioned before, Polish capitalism is characterized by a lack of oligarchs, although cronyism is expanding, based mostly on state property. SOEs and government investments play multiple roles here: as a vehicle of economic development, a tool for meeting social goals, and a source of rent.

Since the mid-210s, according to the new paradigm of the role of the state in the economy based on the ideas of developmental and entrepreneurial state, the government declared a number of huge state investment projects devoted to, to name but few, the creation of a “national electric car” (with the ultimate volume of production of one million vehicles); the construction of the colossal Central Communication

Port – an airport connected with the whole country by high-speed rail network; the development of a gigantic state-owned food holding company, which would incorporate all stages of food processing, from agricultural businesses to retail. Most of such projects remained on paper only, and the new coalition that took power in 2023 seems willing to put down the most gigantomaniac and economically unviable ones. State capitalist involvement in the enterprise sector also took the form of nationalizations: both rescue ones (to keep afloat branches, like coal mining or some individual enterprises) and based on the assumption that the state owner would perform better in strategically important areas (banking and energy sector, military industry, etc.). In sectors already dominated by SOEs (e.g. in the petrochemical industry), concentration and monopolization took place.

Social functions of SOEs were not limited to preserving employment; SOEs are also used to sponsor cultural and sports events and objects, being, in fact, one of the tools of the government's social policy.

Expansion of the state also performed the role of securing sources of multiple political rents of financial and non-financial kinds. The nexus of rent-seeking relationships is broad and sophisticated; quite often, both sides of a transaction extract rent of some kind (Kozarzewski 2021, pp. 210–220; Sękowski 2024, pp. 141–169). What distinguishes Polish SOEs, compared with other countries, is that SOEs are not only the source rents and other resources used by the government and cronies, but also may be rent-seekers themselves. It is also worth noting that pro-development and pro-social goals of state interventionism may coexist with rent-seeking ones, as those projects and policies can be used as sources of rent as well and apparently, at least some of them were launched for this very purpose; socially important goals being used as a smoke screen.

Such an important role of SOEs in economic policy motivates the government to apply formal and informal tools aimed at supporting them (Grosman et al. 2025). A large number of tools are used from direct support of selected enterprises through (often carefully hidden) preferences in public procurement and various sectoral preferences (for those dominated by state-controlled companies) that limit the competition from the private sector. While losses for the private sector in this case are just “collateral damage”, the government also used regulatory restrictions aimed directly at private businesses. For example, in the mid-2010s, two notable laws were passed. One allows the government to block takeovers (even of wholly private companies) operating in strategic sectors of the economy (and this law was used for re-nationalizations). Another radically tightened the requirements for wind farms, making the development of wind power virtually impossible (the hidden goal was to eliminate competition to mostly state-controlled coal-based energy sector and save coal mines).

Conclusions

The post-communist transitions of Poland and Ukraine were rooted in similar historical contexts, although with crucial differences that, to a large extent, contributed to markedly divergent trajectories of transition, resulting in different economic systems and societal outcomes. Poland's comprehensive and decisive reforms ensured stable economic development, culminating in EU accession and integration into Western economic and security structures. Ukraine, in contrast, has faced a more turbulent and inconsistent trajectory, hampered by systemic corruption, political instability, and a delayed reform process.

Regarding national challenges, Poland must address lingering inefficiencies within its state-capitalist model, including the politicization of state-owned enterprises and the risk of rent-seeking behavior. Simultaneously, there is a need to support private-sector dynamism and innovation, particularly in areas with strong potential for international competitiveness. For Ukraine, the priority lies in deepening institutional reforms, ensuring transparency in governance, and sustaining efforts to combat corruption and oligarchic influence. The recent shifts toward more transparent privatization processes and integration with European frameworks signal progress, but these efforts must be sustained and reinforced.

The integration of Ukraine into Western economic and security systems represents a historic opportunity for both countries. Poland's role in the EU and NATO offers a framework for supporting Ukraine's transition, while Ukraine's eventual economic stabilization and growth could contribute significantly to regional stability and prosperity. The Polish-Ukrainian borderlands embody both the challenges and opportunities inherent in their broader national transformations. Their sustainable development, underpinned by bilateral cooperation and aligned with national and global strategies, is key to a more integrated, resilient, and prosperous Central and Eastern Europe.

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EVOLUTION OF UKRAINE'S INTERNATIONAL ECONOMIC TIES IN THE 21ST CENTURY

Since gaining independence in 1991, Ukraine has been involved in the international division of labor, participating in international trade and global capital flows. As a result, the degree of its involvement in the global economy has changed, and the country's relatively high economic potential has provided grounds for optimistic forecasts. Since the beginning of the 21st century, the conditions for the functioning of national economies have become highly complex and highly variable. This was particularly true for Ukraine, which has been struggling with internal and external challenges.

The study's main objective is to describe the evolution of Ukraine's international economic ties after 2000 and indicate the most critical determinants of its development. To achieve the aim of the study, several research methods were used, including a critical analysis of the subject literature, the method of inference based on statistical data, and the analytical-descriptive method. The time scope of the study covers the years 2000–2023, and the subject covers foreign trade and capital flows in the form of foreign direct investment.

The analysis of the development of Ukraine's international economic ties conducted in this study gives a rather pessimistic picture of the situation. In the analyzed areas, i.e., international trade and foreign direct investment flows, the Ukrainian economy is experiencing unfavorable changes.

1. Introduction

The gaining of independence by Ukraine in 1991 was a turning point in its political and economic development. The expressed desire to integrate with the world economy and to join the international division of labor provided a basis for formulating optimistic forecasts regarding the position that Ukraine could achieve in

the world economy. Nevertheless, the beginning of the 21st century was a period of significant variability in the conditions in which national economies function. This translates into economic results and, therefore, the role those national economies play in the world economy. This is particularly true for Ukraine, which in the 21st century is struggling with many internal and external challenges that affect the country's external economic ties. These issues are the subject of this study.

The study's main objective is to describe the evolution of Ukraine's international economic ties after 2000 and indicate the most critical determinants of its development. The structure of the study is subordinated to this formulated goal. After the introduction, the second section covers the development of Ukraine's foreign trade regarding value, dynamics, and structure. The third section presents Ukraine's share, and the importance of this country in international FDI flows. The fourth section indicates and analyzes selected determinants of developing the country's international economic ties. The chapter ends with a synthetic summary.

To achieve the aim of the study, several research methods were used, including a critical analysis of the subject literature, the method of inference based on statistical data, and the analytical-descriptive method. The time scope of the study covers the years 2000–2023, and the subject covers foreign trade and capital flows in the form of foreign direct investment.

2. Foreign trade development in Ukraine

2.1. Analysis of value and dynamics

The value of Ukraine's trade in the analyzed period of 2000–2023 was subject to significant fluctuations (See Fig. 1 and 2). In 2000, exports amounted to USD 14.6 billion, almost as much as imports (USD 14 billion). In the following years (until 2008), exports and imports grew dynamically. From 2005, the value of imports began to exceed the value of exports, which meant that Ukraine began to record a deficit in the trade balance. In 2008, the highest value of imports in the analyzed period was recorded (USD 85.4 billion) and close to the maximum value of exports (USD 67 billion). In 2009, along with the global economic crisis, the value of exports and imports collapsed, falling by more than 40%.

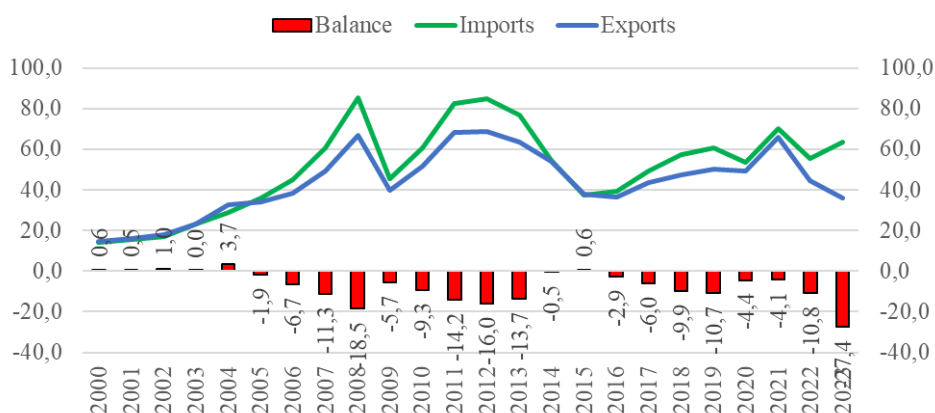


Fig. 1. Merchandise trade of Ukraine between 2000 and 2023, USD billion

Source: Own preparations based on (UNCTAD, 2024a).

In 2010, the trade situation improved, but since 2013, the value of trade flows began to decrease, and in 2015, exports and imports amounted to about USD 37–38 billion, a result similar to 2005. The following years, after 2016, brought an improvement in the situation, but since 2022, the beginning of Russia's military aggression, exports and imports have decreased. In 2023, exports amounted to USD 36.2 billion and imports to USD 63.6 billion, which meant a deficit of USD 27.4 billion.

The above analysis indicates a relatively high variability of trade flows performed by Ukraine after 2000.



Fig. 2. Dynamics of Ukrainian merchandise trade, 2000–2023, %

Source: Own preparations based on (UNCTAD, 2024a).

Although Ukraine is not a very significant global exporter or importer, foreign trade plays a vital role in the country's economic development, which means that trade is an essential source of financing for the economy in the conditions of the war. In the analyzed period, the highest share of this country in world exports was 0.4% (2008), while in 2023 it fell to 0.15%. In imports, the corresponding shares were 0.45% (2012) and 0.26% (2023).

2.2. Product breakdown

When analyzing the product structure of exports, it is worth emphasizing that it has undergone quite a significant evolution (See Fig. 3).

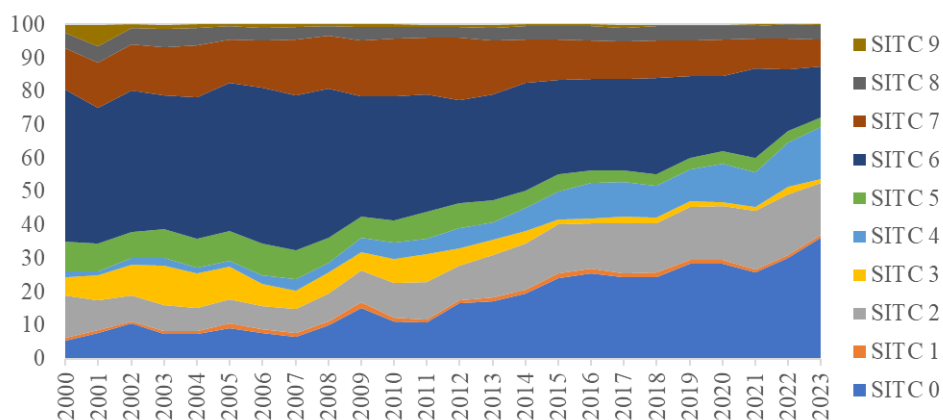


Fig. 3. Product breakdown of Ukrainian merchandise exports, 2000–2023, %

SITC 1: Food and live animals, 2: Beverages and tobacco, 3: Crude materials, inedible, except fuels, 4: Animal and vegetable oils, fats and waxes, 5: Chemicals and related products, n.e.s., 6: Manufactured goods, 7: Machinery and transport equipment, 8: Miscellaneous manufactured articles, 9: Commodities and transactions, n.e.s.

Source: Own preparations based on (UNCTAD, 2024a).

Initially, the dominant group was *Manufactured goods* (SITC 6), which had a 45.6% share in 2000. By 2023, and significantly since the global economic crisis, this share systematically decreased to only 15.2% in 2023. At the same time, there is a noticeable increase in the share of the SITC 0 group (*Food and live animals*) in exports, which increased its share from 5.5% to 36.3% in the same period and is currently the leading group of goods exported by Ukraine. Apart from it, *Animal and vegetable oils, fats, and waxes* (SITC 4) are also essential – 15.6%; *Crude materials, inedible, except fuels* (SITC 2) – 15.4%, and the aforementioned *Manufactured goods* (SITC 6) – 15.2%.

The commodity structure of Ukraine's imports is different (See Fig. 4). In 2000, the leading group was the *Mineral fuels, lubricants and related materials* (SITC3), with a share of 43%, while by 2023, the share had fallen to 16.3%. This is understandable, as Ukraine was largely dependent on imports of energy resources from Russia, which, after the growing tension between the two countries, the annexation of Crimea, and the outbreak of war, had to end with a drastic reduction in Ukraine's imports from Russia.

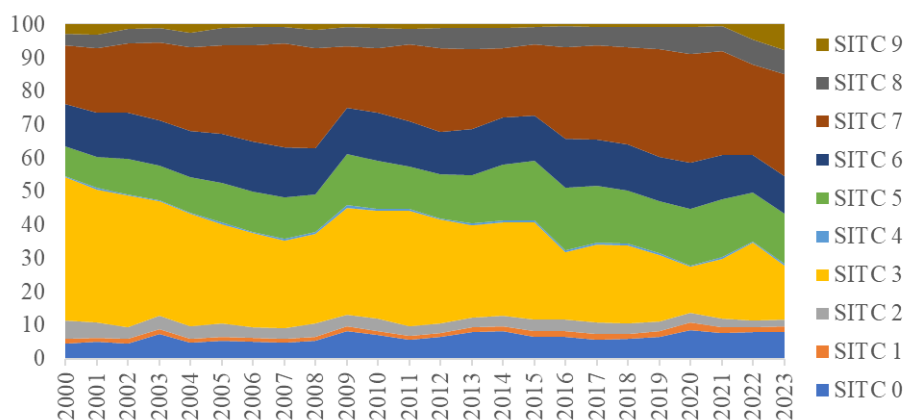


Fig. 4. Product breakdown of Ukrainian merchandise imports, 2000–2023, %

Attention: SITC groups as in Fig. 3.

Source: Own preparations based on (UNCTAD, 2024a).

The second most crucial commodity group was the *Machinery and transport equipment* (SITC 7), with its share increasing from 17.5% to 30.3%. *Chemicals and related products, n.e.s.* (SITC 5) – 15.1% in 2023 and *Manufactured goods* (SITC 6) – 11.3% are also essential. The remaining groups had a relatively small share, amounting to several points, in the commodity structure of Ukrainian imports.

2.3. Geographical structure

When analyzing the geographical structure of Ukraine's trade in goods, it should be noted that it has changed profoundly in the analyzed period. Initially, in 2000, the most important export partners were Russia (24%), Turkey (6%), the United States (4.9%), Germany (4.9%), and Italy (4.4%) (See Tabl. 1). The importance of Russia as a sales market was noticeable, but the dominance of this country as a source of supply for Ukraine was much more visible. In 2000, as much as 41.7% of the value of Ukrainian imports came from this country. Germany came in second with a result of 'only' 7.7%.

Table 1. Five most important export and import markets for Ukraine, 2000, 2010, 2023, %

2000		2010		2023	
Exports					
Russia	24.0	Russia	26.1	Poland	13.2
Turkey	6.0	Turkey	5.9	Romania	10.4
United States	4.9	Italy	4.7	China	6.7
Germany	4.9	Belarus	3.7	Turkey	6.6
Italy	4.4	Poland	3.5	Germany	5.6
Imports					
Russia	41.7	Russia	36.6	China	16.4
Germany	7.7	China	7.7	Poland	10.4
Turkmenistan	6.8	Germany	7.6	Germany	8.0
Belarus	4.3	Poland	4.6	Turkey	7.4
Kazakhstan	3.0	Belarus	4.2	United States	4.5

Source: Own calculations based on (UNCTAD, 2024a).

By 2023, the structure of Ukraine's most important trading partners had changed entirely. In terms of exports, Poland became the most significant sales market (13.2%), followed by Romania (10.4%), China (6.7%), Turkey (6.6%) and Germany (5.6%). In terms of imports, the primary source of supply was China (16.4%), Poland (10.4%), Germany (8%), and Turkey (7.4%). Russia almost wholly disappeared from the statistics. According to UNCTAD (2024a), 1.11% of Ukraine's total exports were sent to Russia in 2022, while 0.01% of total imports were imported in 2023. Such a sharp decline in Russia's importance affected the change in the position of Ukraine's other trading partners.

Analyzing the data from Table 1, it can be seen that the role of China, as an individual country, has increased, but the most significant increase in importance occurred in the case of the European Union. In 2000, Ukraine sold 29.9% of its exports on this grouping's market, importing 26.8% of total imports. These relatively large shares have significantly increased by 2023: the share of the EU27 in Ukraine's total exports this year was as much as 64.6%, and in imports, 51.1%. Such changes are the result of the country's need to switch to Western spheres of cooperation in the conditions of the full-scale war that Ukraine is waging with Russia and of the European Union's policy towards Ukraine. Analyzing the importance of individual EU27 countries, in 2000, the most significant export market in the EU for Ukraine was Germany, with a share of 16.3%, followed by Italy (14.7%), Poland (9.6%), and Bulgaria (8.8%). By 2023, the situation had changed, and the most essential markets became (See Fig. 5): Poland (20.3%), Romania (16.1%), Spain (8.6%), and Germany (8.6%).

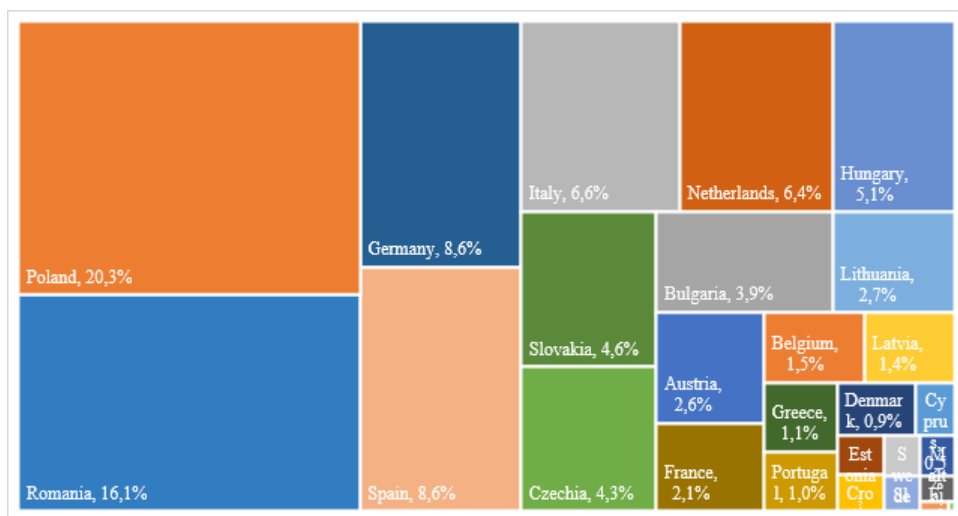


Fig. 5. The primary export market for Ukraine in the EU in 2023, %

Source: Own calculations based on (UNCTAD, 2024a).

Poland also increased its importance as an EU import market for Ukraine, from 8.3% (2000) to 20.2% (2023). The importance of Germany decreased (from 28.6% to 15.6%), although it is still the second most crucial import market in the EU27. Among the EU countries with a share above five percentage points, it is worth mentioning: Italy (7%), Bulgaria (6.8%), the Czech Republic (5.5%), France (5.4%) and Slovakia (5.2%). The remaining countries had relatively little importance for Ukrainian imports from the EU27.

Ukraine also participates in international trade in services (UNCTAD, 2024b). It is lower in value than trade in goods, but it is a relatively important element of the country's economic relations. In 2005, Ukraine exported services worth USD 10.4 billion, 0.39% of the world flow. By 2012, the share had increased to 0.48%, but since then, it has declined, reaching 0.21% in 2023 with a value of USD 16.4 billion. As for imports, in 2005, the value was USD 7.5 billion, which gave a 0.29% share in the world flow. By 2023, imports had increased to 25.4 billion, and the share to 0.35%. The initial surplus that the country recorded has turned into a reasonably large deficit.

When assessing Ukraine's share in world trade, it should be admitted that it is not high, considering its size, population, and available resources. Nevertheless, it is worth emphasizing that the country's situation is very complex, complicating the conditions for smooth economic development. The data from Figure 6 clearly show that Ukraine achieved the highest shares in trade before the outbreak of the global financial crisis (GFC) of 2008–2009, and until then, its share in both goods and services trade was growing.

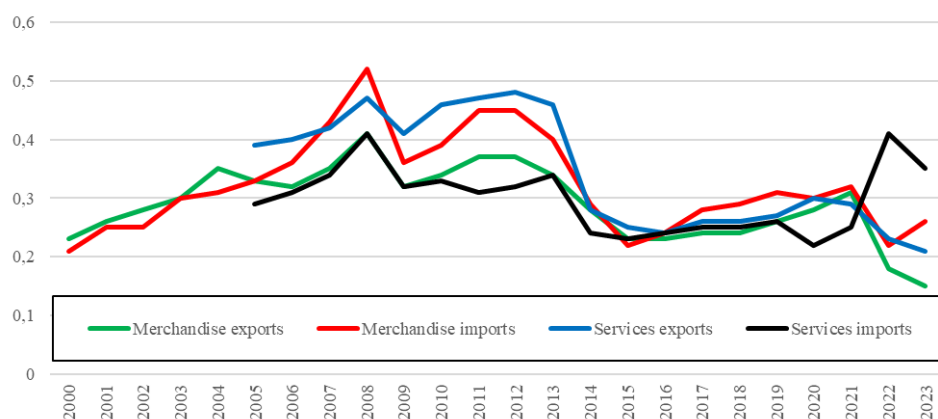


Fig. 6. Share of Ukraine in world flows of merchandise and service trade, 2000–2023, %

Source: Own calculations based on (UNCTAD, 2024a, 2024b).

After 2010, the situation began to improve, but 2014 saw a sharp decline in the country's share in global flows, resulting from the economic consequences of Russia's takeover of Crimea. Since then, the country's shares have remained low. In the last two years, there has been an apparent decline in exports and an increase in imports. The gears of the war economy do not favor the possibility of improving the negative trade balance. This has a similarly negative effect on the country's involvement in international capital flows.

3. Participation of Ukraine in Foreign Direct Investments

After gaining independence in the early 1990s, Ukraine became an increasingly attractive market for foreign investors. At the same time, since it was a country with a relatively low level of development, Ukraine did not invest funds abroad because the available capital was used mainly at home.

Analyzing the data from Figure 7, one can observe the changes in Ukraine's share in FDI flows after 2000. Since the beginning of the 21st century, the value of incoming FDI has been growing, reaching almost USD 11 billion in the record year 2008. At the same time, this meant an increase in the cumulative value of investments in Ukraine, which grew until 2013, reaching USD 67 billion.

While the outflow was relatively small in almost the entire period, it was the highest in 2007–2014, affecting the value of accumulated Ukrainian FDI abroad. At the same time, a downward trend in the inflow of FDI to Ukraine began, although there were quite large fluctuations. In 2015, even divestments were recorded (USD –331 million). With the growing geopolitical tensions, Ukraine became an increas-

ingly risky place for international investors. While this country was never the most important global market receiving FDI, its share in the accumulated global FDI inflow has fallen to 0.002% in recent years. In the case of outflow, it is even lower.

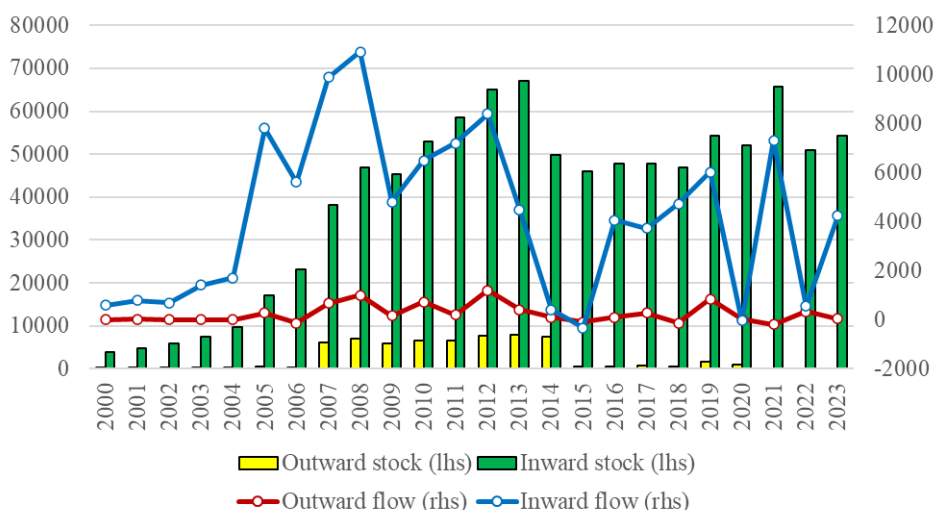


Fig. 7. Participation of Ukraine in world FDIs, 2000–2023, USD million

Source: Own preparations based on (UNCTAD, 2025).

4. Main determinants for the development of Ukraine's economic ties after 2000

Looking at the country's economic, demographic, and resource potential, Ukraine should play a more significant role in the global economy than it currently does. Nevertheless, the complex environment in which Ukraine operates means that this country's fundamental role and significance in international economic relations differs from what is potentially achievable, as illustrated by the data presented in the first part of the study. The factors most significant for developing Ukraine's external economic relations are the country's domestic economic situation, the conjuncture in the global economy, the COVID-19 pandemic, and Russia's military aggression against Ukraine. The development of Ukraine's relations with the European Union, its most important economic partner, deserves separate treatment.

Analyzing the **economic situation in Ukraine** after 2000, one can point to a general negative trend observed in the dynamics of economic growth (See Fig. 8). While in the years 2000–2007, Ukraine showed a higher rate of economic growth than the world average, the crises that came in the following years caused a sharp decline in

the dynamics of development. In 2009, when the global financial crisis occurred, Ukraine's GDP fell by 15.1%, while the world's GDP fell by 'only' 1.3%. In 2014–2015, after the annexation of Crimea by Russia, GDP fell by 10.1 (2014) and 9.8% (2015), but the world recorded an increase of 3.1% in both years.

The COVID-19 pandemic brought about a GDP collapse (-3.8 % in 2020), but the worst period for Ukraine was in 2022, when Russia began a full-scale war fought mainly on the territory of Ukraine. Ukraine's GDP fell by 28.8% this year, while the global GDP growth was positive (3.2%). Thus, the country's economic development slowed in the analyzed period, reflected in a generally negative GDP growth trend (See Fig. 8).

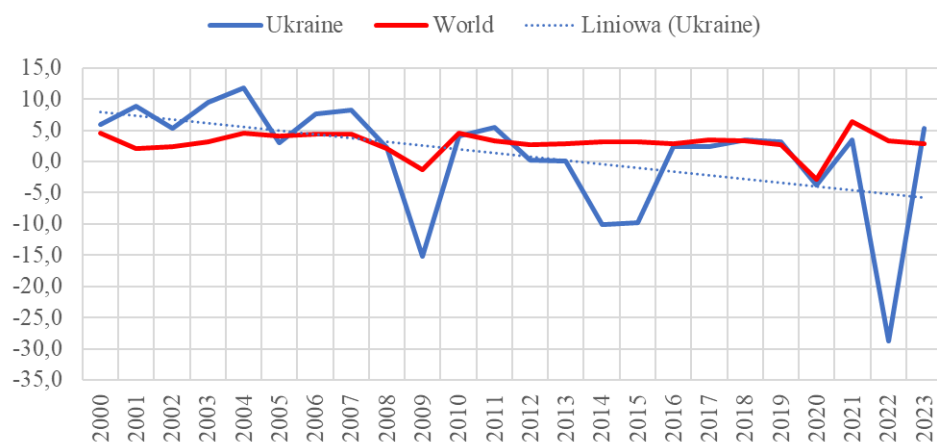


Fig. 8. GDP growth in Ukraine and World, 2000–2023, %

Source: Own calculations based on (World Bank, 2025b).

Other macroeconomic indicators were also not encouraging. Table 2 presents data on selected socio-economic indicators for Ukraine after 2000.

Table 2. Selected social and economic indicators for Ukraine in 2000 and 2023

	2000	2023
Population (million)	49.6	37.7
Net migration (thousand)	-67.9	-299.9
GDP (current USD billion)	32.4	178.8
GDP per capita (current USD)	653.3	5 069.7
Unemployment (%)	11.7	9.8 ^a
Inflation (%)	28.2	12.8
Central government debt (% of GDP)	43.7	58.7 ^b

Attention: ^a year 2021; ^b year 2020.

Source: Own calculations based on (World Bank, 2025a).

The presented data paint a rather pessimistic picture of Ukraine's economic situation's development. One of the most critical problems is the systematic loss of human resources. In 2000–2023, the population decreased by almost 12 million people, and net migration in 2023 alone amounted to nearly 300 thousand people. This is a bad prognosis for the future – without a pool of workers, it will be difficult to increase production, export, and develop the economy. From the point of view of unemployment, the situation improved from 2000 to 2007, when the unemployment rate dropped from 11.7% to 6.4%. Since then, a clear upward trend has been observed with periodic fluctuations. In 2021, the unemployment rate was 9.8%. High inflation also remains a problem. While in the first years of the 21st century, there was a significant decline from 28.2 (2000) to 0.8% (2022); since then, we have observed significant fluctuations in the indicator: 25.2% in 2008, -0.2% in 2013, as much as 48.7% in 2015, and 2.7% in 2020. Another increase in the inflation level has been seen in recent years, which is 12.8% in 2023. The last indicator in Table 2 is the central government debt, which increased in the analyzed period to 58.7% of GDP in 2020. The value of this indicator is not excessively high. Still, it can be expected that it will increase with the need to increase expenditure related to neutralizing the long-term impact of the war on the country's society and economy.

Looking from the perspective of the impact of the internal economic situation on Ukraine's links with the world economy, it can be said that they are unfavorable, especially in the area of export and investment. The weakened economy cannot smoothly produce goods that could find foreign markets. Especially in the conditions of the occupation by Russians of areas of Ukraine rich in natural resources and arable land, destroyed infrastructure, and lack of free access to seaports, the development of exports is difficult. The lack of economic stability also discourages foreign investors from being interested in the Ukrainian market.

An essential factor in the development of Ukraine's economic ties is the **general situation in the world economy**. The period after 2000 saw a significant change in the world economy. There were alternating periods of economic prosperity, as well as periods of crises and collapses. After the dot.com crisis at the beginning of the century, we had years of good economic conditions, which ended with the outbreak of the global economic crisis in 2008–2009. The world economy entered a period of so-called slowbalization, in which economic ties did not develop as quickly as in the previous period (*Białowś & Twarowska-Mól, 2024, p. 115*). In the following years, the situation varied depending on the geographical area. In Europe, there was a secular stagnation, i.e., a prolonged period of economic stagnation. From a global perspective, the growth rate remained relatively stable between 2012 and 2019 (see Fig. 9).

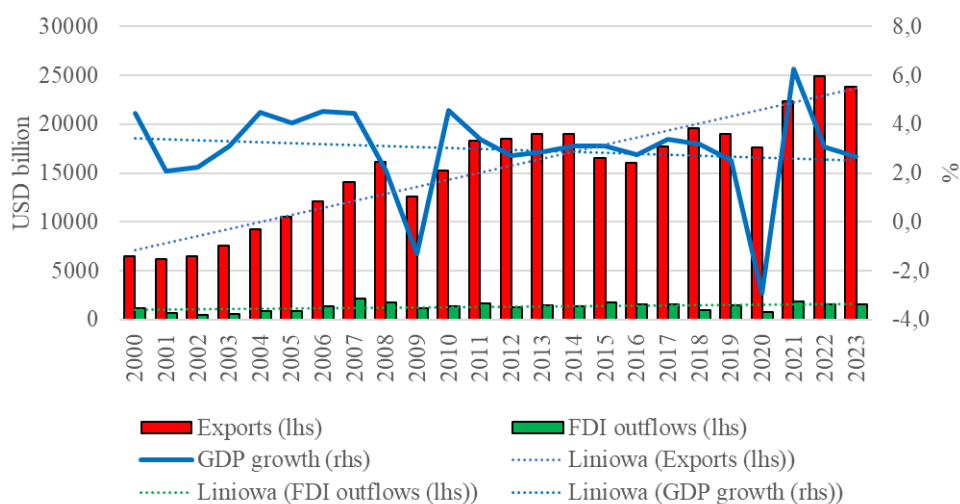


Fig. 9. GDP growth, export value, and FDI outflow in the world, 2000–2023, USD billion and %

Source: Own calculations based on (UNCTAD, 2025).

The generally uncertain economic situation in terms of trade was due to, among others, the economic slowdown in China, the economic recession in Brazil, falling prices of oil and other natural resources, and changes in the exchange rate of the US dollar (WTO, 2016).

In the following years, more significant tensions began in the economic relations between the United States and China in the fight for economic primacy in the world (Bown, 2021; Wu et al., 2021). The intensifying trade conflict did not favor the development of trade and investment globally.

The year 2020 was the beginning of the COVID-19 pandemic. Global GDP fell by 2.9%, global exports by 7.1%, and direct investments by as much as 46%. The shock of the pandemic and the generally pessimistic approach to economic activity limited cross-border activities. Instruments were introduced to stop the spread of the virus, but they hurt enterprises. From the supply area, the crisis spread to the demand area, with a decline in consumer spending and a rapid decline in economic activity. Many countries were experiencing a multidimensional crisis (IMF, 2020). When the situation in the global economy began to stabilize in 2022, Russia started its military aggression in Ukraine. The dynamic of global GDP growth this year fell to 3.1%, i.e., by half compared to the previous year (6.2%), and direct investments also fell. In 2023, all indicators presented in Figure 9 recorded a decline.

Thus, the situation in the world economy of the last quarter of a century was not conducive to the stable development of cross-border economic ties. Intertwining periods of growth and decline, growing geopolitical and geoeconomic threats,

trade conflicts, and increasing protectionism created challenging conditions for the functioning of companies whose area of activity is international markets. This also, and perhaps above all, concerned Ukraine.

Another critical factor affecting the possibility of developing economic ties in Ukraine in the 21st century is the **COVID-19 pandemic** caused by the SARS-CoV-2 coronavirus. The pandemic shock in March 2020 was initially associated with a supply crisis. The restrictions introduced caused significant problems in logistics, supply chains, and the availability of workers. The crisis then spread to the demand side. The decline in consumer spending affected economic activity. Countries experienced polycrises, including a shock in health care, internal economic disruptions, sharply falling external demand, disruptions in capital flows, and falling prices of raw materials (IMF, 2020). The sectors most affected by the pandemic were those whose functioning is based on social interactions, i.e., transport, tourism, entertainment, and hospitality (services sector). The need to maintain social distance introduced quarantines, and regional lockdowns did not facilitate economic activity and the development of international trade and investment links. Disruptions within national economies spilled over to partner countries. In conditions of high economic openness, trade and capital interdependence, and functioning within international value chains, the adverse effects in these areas contributed to the deepening of the crisis. Isolating economies reduced their involvement in global trade, international production, and international capital flows. The impact of the COVID-19 pandemic on Ukraine's external economic relations was similar. The data presented in Figure 1 show a decrease in the country's trade turnover, especially in the case of exports. Nevertheless, due to the specific structure of Ukraine's foreign trade and the focus on exporting raw materials, the decrease in the volume of turnover was relatively small.

Ukraine's economic problems resulting from the development of the pandemic were multiplied by **Russia's military aggression** on its eastern neighbor. It is one of the most important external factors shaping Ukraine's involvement in international economic relations. Relations between Ukraine and Russia have been tense since the beginning of Ukraine's independence in the early 1990s. Ukraine's turn toward the West, represented by the European Union (Labuda, 2020), caused dissatisfaction in Russia and, at the same time, attempted to slow down or reverse the integration process. In 2014, amid a major political crisis in Ukraine, Russia annexed Crimea. The rapidly deteriorating relations between the two countries led to the outbreak of a full-scale war when, in February 2022, Russia attacked Ukraine, initiating a military invasion.

From an economic point of view, the outbreak of war caused rapid changes in the world economy, international trade, and Ukraine's trade. The presented estimates indicate a very high cost for the world economy – equivalent to 1% of world GDP, i.e., about USD 1.5 trillion (Liadze et al., 2023). Global supplies of raw materials,

particularly oil and gas, aluminum, and steel, were disrupted, necessitating a rapid change of supply sources for almost all recipients worldwide (WTO, 2023).

From the Ukrainian perspective, export opportunities for the most critical product groups have decreased. The occupation of Donbas limits the export of coal and heavy industry products. In addition, the production and export of agricultural raw materials is becoming more complicated. For example, about 95% of grain exported from Ukraine was traditionally transported by sea, using the ports of Odesa, Mariupol, and Kherson (Chaerul Ardan *et al.*, 2023, p. 55). However, due to the war and the destruction of infrastructure, these traditional distribution channels had to change. Currently, road and rail transport are used to a greater extent, transferring grain through countries such as Poland and Romania. The war operations restrict Ukrainian farmers from freely carrying out fieldwork, which, combined with the limited availability of fertilizers, causes decreased agricultural production in Ukraine. As a result, one of the main groups of products exported by Ukraine does not generate as high a turnover as before the war. The unstable economic situation causes a decrease in interest in Ukraine as a destination for foreign investments. High risk causes the deterioration of Ukraine's economic relations with other countries. Transaction costs, such as insurance, logistics, and financial security, are increasing, negatively affecting Ukrainian enterprises' competitiveness in international markets. In addition, the need to finance war operations causes a lack of investment in the country's civilian production areas, weakening production and export possibilities.

When analyzing the development factors of economic ties between Ukraine in the 21st century, the **country's relations with the European Union** require special treatment. The proximity of both entities determines the need to establish mutual economic ties. At the same time, the war caused by Russia affects the geographical direction of Ukraine's cooperation – Western markets have replaced Eastern markets (especially Russia), and the European Union has become the most crucial supply and sales market for Ukraine. More than half of Ukraine's exports and imports are carried out with partners from the European Union (See analysis in section 2.3). On the other hand, Ukraine is high, 16th in the ranking of the most important EU trading partners (European Commission, 2025), a vital supply market for the EU, especially in natural resources and agricultural products.

Almost from the beginning of Ukraine's independence (1991), the country declared its rapprochement with the European Union. Official relations were established in December 1991, with the Dutch Minister of Foreign Affairs recognizing Ukraine's sovereignty. Relations between the EU and Ukraine were regulated by the Partnership and Cooperation Agreement between the European Communities and their Member States and Ukraine, signed in 1994, which did not enter into force until 1988 (Stankiewicz, 2013, p. 28). The agreement aimed to create a free trade area. At the same time, in 1998, Ukraine expressed its desire to obtain the status of

an associated country with the EU. In 2000, the EU summit in Nice acknowledged that Ukraine's membership in the EU was desirable. After the enlargement of the European Union in 2004, the concept of the European Neighborhood Policy was created, supplemented by the concept of Neighborhood Programs and a financial instrument in the form of the European Neighborhood and Partnership Instrument (ENPI). In 2008, the Partnership and Cooperation Agreement expired, and in connection with this, work began creating a new agreement with Ukraine even in 2007. Nevertheless, it was not until 2012 that negotiators from both sides signed the Association Agreement (*Stankiewicz, 2013, p. 31*). Relations between the partners also developed in the form of the so-called Eastern Partnership, which was prepared by Sweden and Poland and has been in force since 2008 (*Szeptycki, 2012, p. 82*).

The political part of the Association Agreement between the European Union and Ukraine was signed on 21 March 2014, and the economic part on 27 June 2014. The Association Agreement was formally entered into force on 1 September 2017, while the trade part – Deep and Comprehensive Free Trade Area (DCFTA) – has been in force provisionally since 1 January 2016. The agreement in the economic area is supposed to lead to increased trade in goods and services between the parties, mainly through a gradual reduction of customs duties and approximation of Ukrainian regulations to EU regulations in selected industrial and agricultural sectors (*European Commission, 2025*). Greater integration of Ukraine with the EU market is also to be the result of approximation of regulations in the field of competition, technical barriers to trade (TBT), sanitary and phytosanitary (SPS), customs and trade facilitation, protection of intellectual property rights, public procurement.

The outbreak of war in Ukraine prompted the European Union to grant the country full trade liberalization, consisting of a temporary suspension of import tariffs, quotas, and other internal market protection instruments (Autonomous Trade Measures Regulation). This instrument entered into force on June 4, 2022, and was renewed in subsequent years. The current one is valid until June 5, 2025. Using this tool, the European Union supports Ukrainian producers and exporters, granting them special treatment in trade relations.

Ukraine's pro-European orientation is obvious – a few days after the attack by Russian troops, on February 28, 2022, Ukraine formally submitted a membership application. Since then, the process of this country's accession to the structures of the European Union has been underway and Ukraine is officially a candidate country (*Rada Europejska/Rada Unii Europejskiej, 2025*).

Conclusion

The analysis of the development of Ukraine's international economic ties conducted in this study gives a rather pessimistic picture of the situation. In the analyzed areas, i.e., international trade and foreign direct investment flows, the Ukrainian economy is experiencing unfavorable changes. This is the result of the existence of a complex environment that does not favor improving Ukraine's position in the world economy. Based on the research, several detailed conclusions can be drawn.

First, until 2008, Ukraine's export and import values had grown quite rapidly, but there have been quite significant fluctuations since then. In 2023, Ukraine's exports remained at the level reached almost two decades before.

Second, Ukraine is experiencing a growing deficit in its trade balance, which means that declining exports do not compensate for the country's growing import needs.

Third, the commodity structure of Ukraine's trade is undergoing an unfavorable change, especially in exports: the SITC 0 group (*Food and live animals*) has moved up to the first place, while the *Manufactured goods* (SITC 6) has lost its primacy.

Fourth, the geographical structure of trade has undergone profound changes. The European Union has become the main supply and sales market, while Russia has almost disappeared as Ukraine's trading partner. In turn, within the European Union, Poland has become Ukraine's most important trading partner, and other essential markets were Romania and Germany in exports and Germany and Italy in imports.

Fifth, the inflow of foreign investments to Ukraine increased until 2008, but there were more profound fluctuations afterward. The investment climate resulting from the lack of political and economic stability discourages investors from being interested in this market.

The changes described above took place in the context of factors that had a somewhat negative impact on the development of Ukrainian foreign trade and Ukraine's share in foreign direct investment flows: the instability of the situation in the global economy, the instability of the domestic situation, and the COVID-19 pandemic. Russian military aggression played a key role in this respect – from the takeover of Crimea in 2014 to the full-scale war that began in 2022. The ongoing conflict directly affects producers and exporters but also affects the outflow of people from the country – the essential factor of production. This is a grave threat to the results of foreign trade or capital flows and, above all, an existential threat to the country's survival and economic development. It is, therefore, necessary to end the warfare, which will make it possible to rebuild the country. Ukraine's support from its partners and the development of integration processes with the European Union should be treated as positive factors, key to the reconstruction process and increasing the country's economic potential.

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INSTITUTIONAL AND ORGANISATIONAL DETERMINANTS

One of the most important determinants of borderland development and cross-border cooperation are legal-institutional-organisational conditions, which are manifested in the form of neighbouring states, understood as a constitutionally defined way of organising political and social life, which consists of (*Wojtaszczyk, 2003, p. 252*):

- principles of organisation of the state apparatus,
- political regime,
- territorial and administrative structure.

The principles of organisation of the state apparatus determine who performs the function of the head of state (the monarch in the case of an absolute, constitutional or parliamentary monarchy, and a person or group of persons elected for a specified period of time by universal suffrage or by special electoral colleges in the case of a republic) and what the relations between the organs of the state are, which may be based on the principle of cooperation between the authorities (parliamentary-cabinet system) or the separation of the legislative, executive and judicial powers (classical presidential system).

A political regime refers to a style of governance, comprising all the methods used by the state apparatus to influence the behaviour of large social groups (*Wojtaszczyk, 2003, pp. 267–271*). From this point of view, states can be distinguished:

- totalitarian, in which the authorities have full control over the citizens, a cult of the individual develops, only the right ideology is in force, terror is used against citizens, and the media are subordinated to the propagation of the binding ideology,

- authoritarian, in which most of the regulators of social behaviour (ideology, law, market) are ineffective and play a secondary role, society is characterised by passivity and apathy, and its participation in political life is ritualistic and takes place under strict control,
- democratic, which is a state under the rule of law implementing the principles of: sovereignty of the people, political pluralism and separation of powers.

In the case of democratic states, they can be further divided into (*Wojtaszczyk, 2003, p. 268*):

- states with consolidated democracy, which means: free elections, competition of political parties, guaranteed political rights and freedoms, widespread acceptance of political institutions and democratic rules of the game, competition between political parties, guarantee of political rights and freedoms, but lack of consensus among political elites on the democratic order,
- states with limited democracy, characterised by the narrowing of political participation to social groups of higher material status,
- pseudo-democratic states in which political competition is limited and elections are held under conditions of public intimidation.

The vast majority of European states are consolidated democracies. In the case of some post-communist countries, however, attempts are being made to return to unconsolidated democracy, which can be seen in the weakening of the independence of state institutions (especially the courts or constitutional courts) by making them party-based, and in the production of propaganda that portrays the democratic system as chaos, which can be controlled by a single 'good host', i.e. a party leader who does not respect democratic principles. Such a process was observed in Poland between 2015 and 2023, i.e. during the rule of the so-called 'united right'. However, it was interrupted as a result of the elections on 15 October 2023. Another more advanced and ongoing example of a shift away from consolidated democracy is Hungary under the leadership of Victor Orbán. In the case of Ukraine, we are faced with yet another situation. Here – despite 33 years of independence – the state of consolidated democracy has not yet been achieved. This was to a large extent the result of the hostile actions of Russia, interfering initially in the process of presidential and parliamentary elections and then annexing part of Ukrainian territory (2014) and finally launching a full-scale war against Ukraine, which has already lasted for almost three years (since 24 February 2022).

From the point of view of the decision-making procedure, four models of democracy can be distinguished today (Table 1). These are:

- competitive democracy, which operates on the basis of a pendulum between the two main parties, which win over their opponent by a majority vote of their representatives (parliamentarians, councillors, etc.), resulting in a 'winner takes all' victory,

- consensus democracy, which is based on the search for a broad consensus between the representatives of the winning parties and the minority party,
- voter democracy, which is based on decisions taken directly by the electorate on a majority basis in the form of, among other things, a referendum,
- participatory democracy, in which citizens participate in the elaboration of decisions that affect them by seeking consensus among different social groups (not only those constituting a majority).

Table 1 Contemporary models of democracy

Specification	Majority	Deliberative
Indirect	Competitive democracy	Consensus democracy
Direct	Electoral democracy	Participatory democracy

Source: J. Loughlin, F. Hendriks, and A. Lidström (2010, p. 16).

The target models of democracy should be those classified as deliberative democracy, i.e. consensual and participatory. Building civil society is also served by voter democracy. However, in most European post-communist countries (including Poland and Ukraine) a contested democracy is in place. Table 1 indicates the above-mentioned models taking into account their nature (indirect or direct).

At the central level, indirect democracy generally prevails, which means that citizens elect their representatives (including parliamentarians), who are entrusted with making decisions on state-wide matters. The appropriate – more mature – direction for this type of democracy is to move from ‘majority dictate’ to consensual democracy. At the regional and local level, on the other hand, direct democracy can be used to a greater extent, and not only in the form of voter democracy, but also through various innovative forms of participatory democracy. This, however, requires a transformation of the traditional understanding of local government (*government*), in which it is linked to a few institutions, has a hierarchical and consolidated organisational structure, participates in close horizontal and few international networks, pursues routinised policies under the direct control of central government and is based on collegial leadership, into a new approach (*governance*), in which there is a link to numerous institutions, the organisational structure is decentralised, horizontal networks, including international networks, are extensive, the policies pursued are innovative, learning, the supervision of central authorities is decentralised and the leadership is single-minded, charismatic (*John, 2001, pp. 167–168*).

From the point of view of the analysed conditions, what is important – besides the principles of organisation of the state apparatus and the political regime – is the territorial-administrative structure of the state, within which one can distinguish: complex and unitary states. The contemporary form of a composite state is the

federation¹. It has the character of a federal state, whose constituent parts have legal and – to a certain extent – political autonomy. The constituent parts of the federation (autonomous regions) share in the sovereignty of the state, which follows the genesis of this type of state as an effect of the integration of smaller states (now regions). The specificity of a federation lies in the fact that (*Wojtaszczyk, 2003, pp. 263–264*):

- the territory of a federated state politically and administratively is not a homogeneous whole, which has, among other consequences, consequences in the heterogeneity of local self-government solutions²,
- the union parliament is bicameral, with the first chamber representing the interests of the union as a whole and the second chamber representing the interests of its constituent parts,
- central to the functioning of the union is the division of powers between the federation and its constituent parts, which may be on an exclusive, competitive or joint competence basis.

On the basis of the features cited above, it can be concluded that federal states are characterised by a high degree of decentralisation of the regional level as a result of its (limited) sovereignty.

The situation is more diverse in the unitary (unitary) states prevalent today. Administrative-territorial units there are subordinated to central authorities and identically organised. There is a unitary legal system, a unitary system of judicial, legislative and executive bodies and a unitary citizenship (*Wojtaszczyk, 2003, p.260*). Depending on the way in which competences are distributed, one can speak of centralised and decentralised states. In favour of decentralisation in unitary states is (*Machelski, 2015, pp. 39–40*):

- increasing opportunities for citizen participation in decision-making,
- bringing the decision-making entity closer to the matter being dealt with, and greater efficiency in responding to the needs of local and regional communities,

¹ The historical forms of composite states were personal union, real union and confederation. The latter form is still encountered in Switzerland.

² In the Federal Republic of Germany, for example, four models of municipal government can be mentioned, i.e. the magistratic (Prussian), mayoral (Rhine, French), North German (English) and South German models. In the magistratic model, there are two collegiate bodies: the council elected by the citizens and the magistrate – as the executive body under the leadership of a directly elected mayor (super-mayor). The professional and social members of the magistrate, on the other hand, are elected by the council. In the mayor model, the council is elected by the citizens and the mayor by the council. The mayor serves simultaneously as the executive and presides over the decision-making body. In the North German model, on the other hand, the mayor is only the president of the council, elected by the council. The council is elected by universal suffrage, while the executive body is headed by the municipal director. In the South German model, both the council as the decision-making body and the mayor as the executive body are elected by the residents of the municipality. The mayor also chairs the council. As a result of reforms in the 1990s, there are now two models of municipality in Germany, i.e. the magistratic and the southern German model. Cf. A. Lipska-Sondecka, (2010, 154–168).

- increased transparency and minimisation of corruption risks,
- increased sense of responsibility for decisions taken.

It is assumed that as a result – decentralisation will contribute to more efficient management of the state, and in financial terms will bring benefits in the form of lower costs of providing public services. Decentralisation can concern both the political-administrative and the economic-financial levels. To be truly effective, both these planes should be consistent with each other. Decentralisation can take the form of (*Machelski, 2015, pp. 34–36*):

- deconcentration, i.e. the dispersal of responsibility by the central government to regional and local units,
- delegation, which involves the local and regional level performing tasks on behalf of the central government,
- devolution, i.e. the taking over of tasks from the central government by the local and regional level.

Decentralisation can also be conditioned by the national-ethnic structure of the population, especially when national and ethnic minorities live in compact areas within the national territory and would like to have a say in local and regional governance (the so-called regional question), which fosters the formation of local (localism) and regional identity (regionalism), and when the national territory consists of parts isolated from each other (e.g. the so-called overseas territories of some European countries).

It is worth noting that the traditional understanding of decentralisation refers to the transfer of central government competences to lower levels of public administration: regional and local. In decentralised and federal states, centralisation of competences at the regional level at the expense of local governments can also be found. *J. Loughlin (2004, p. 14)* – based on the experience of EU members – proposed a division of states by territorial-administrative structure into federal states (Austria, Belgium, Germany), regional unitaries (France, Spain, UK, Italy), decentralised unitaries (Denmark, Finland, the Netherlands, Sweden) and centralised unitaries (Greece, Ireland, Luxembourg, Portugal)³. Regional authorities in federal states come from elections, have co-determination of national policy, a limited right to conclude international treaties and exercise political/legal control over local units. In regional unitary states, on the other hand, regional authorities also come from elections, but only have the right to consult on national policy, cannot conclude international treaties, and may (but need not) have political/legal control over sub-regional units. In decentralised states, the regional level comes from elections but has no right to

³ J. Loughlin did not take into account the so-called new member states that joined the EU in 2004 and later, including Poland, but Polish administrative regions can be described as self-governing since 1999.

participate in national policy making, concluding conclusion of international treaties and – as a rule – lacks political/legal control over sub-regional units, whereas in centralised unitary states, regions have only a statist-planning character, meaning that they have none of the characteristics of such units in federal states. Regional units in federal and decentralised unitary states are referred to as autonomous regions, in decentralised unitary states as self-governing regions and in centralised unitary states as administrative-functional regions.

The ultimate functioning of the state, whether at central, regional or local level, is also influenced by the traditions of statehood developed on the European continent. Four models can be distinguished in this respect, viz:

- Anglo-Saxon, represented by the United Kingdom and Ireland,
- German, found in: Germany, Austria, the Netherlands, Belgium,
- French, typical of France, Italy, Portugal, Greece
- Scandinavian, which, in addition to Sweden, is also found in Denmark and Norway.

A summary of the detailed features of the mentioned models is provided in Table 2.

Table 2 European models of state tradition

Features	Models of state tradition			
	Anglo-Saxon	German	French	Scandinavian
Is there a legal basis for the state	no	yes	yes	yes
State-society relations	pluralist	integral	antagonistic	integral
Form of political organisation	union/limited federation	integral federation	Jacobin 'one and indivisible'	decentralised unitarianism
Basis of political style	gradual overcoming of difficulties	legal corporatist	legal technocratic	consensual
Form of decentralisation	devolution/local government	cooperative federalism	regionalised unitary state	strong local autonomy

Source: J. Loughlin,, F. Hendriks, and A. Lidström (2010, pp. 11–12).

Complementary to the one presented in Table 2, there is in turn a typology developed by *P. Swianiewicz (2014)* for Eastern European countries where the local and regional level is only self-governing (Table 3).

Table 3. Typology of local government systems in Eastern European countries

Specification	Typ I	Typ II	Typ III	Typ IV	Typ V
Number of elected levels of local government	2–3	1–2	1–2	1–2	1
Territorial fragmentation of municipalities	diverse	small municipalities	medium	very large municipalities	small municipalities
Functional decentralisation (share of local government expenditure in GDP in %)	wide range of functions (10.5% of GDP)	wide range of functions (10.5% of GDP)	medium (6.6% of GDP)	medium (6.3% of GDP)	narrow range of functions (0.9% of GDP)
Financial decentralisation (share of local government taxes and charges collected in % of GDP)	significant (3.1%)	minor (0.7%)	minor (0.8%)	significant (3.1%)	negligible (0.1%)
Allocation of financial transfers	based on a mathematical formula	based on a mathematical formula	partially based on a mathematical formula	differentiated	mainly based on arbitrary central decisions
Local government debt (% of GDP)	2,3	2,8	0,4	0,6	0
Position of mayor/type of leadership	strong position of the mayor direct elections	collective leadership	strong position of the mayor direct elections	collective leadership	diverse
Council election system	majority in small municipalities, proportional in large municipalities	proportional	proportional	proportional	majority

Source: P. Swianiewicz (2014, p. 304).

Type I is represented by three countries, viz: Hungary, Poland and Slovakia, which can be described as leaders in decentralisation, Type II – Czech Republic, Estonia and Latvia – relatively decentralised, Type III (Balkan) – Albania, Bulgaria, Croatia, Macedonia, Moldova, Romania, Slovenia and Ukraine, Type IV- Georgia, Lithuania, Serbia – with a high degree of territorial consolidation and Type V – Armenia, Azerbaijan – strong functional and financial centralisation and high territorial fragmentation. Comparing Table 1 and Table 2, one can conclude (Swianiewicz, 2014, pp. 3030–308): there is no Scandinavian model in Eastern Europe, there are no centralised states like Type V in Western Europe.

While at the regional level there may be entities that are subjects of executive, legislative and judicial power (autonomous regions), only executive (self-governing regions) or without any competences (administrative-functional regions), at the local

level it is common to have local self-government, which, according to the European Charter of Local Self-Government (*EKSL, 1994*), ratified, inter alia, by the Republic of Poland. The local self-government, which, according to the European Charter of Local Self-Government (*EKSL, 1994*, ratified, inter alia, by the Republic of Poland – means the right and capacity of local communities, within the limits set by law, to manage and administer an essential part of public affairs on their own responsibility and in the interests of their residents (art.3 paragraph 1 of the ECSL). This right is exercised by councils or assemblies with members elected by free, secret, equal, direct and universal suffrage, which may have executive bodies subordinate to them. This does not exclude recourse to citizens' assemblies, referendum or other forms of direct democracy (Article 3(2)). The basic competences of local communities should be defined in the Constitution or in the relevant laws. Their scope should in principle be total and exclusive. They may be challenged or limited by another authority (central or regional) only to the extent provided for by law (Art. 4(1) and (2) ECSL). Local communities have the right to have sufficient financial resources of their own, which they can freely dispose of in the exercise of their powers (paragraph 1). The amount of resources should be tailored to the entitlements and at least part of them should come from local levies and taxes, the amount of which the communities have the right to determine (paragraphs 2 and 3). The financial systems on which the resources at the disposal of local communities are based should be sufficiently diversified and flexible to respond, as far as possible, to real changes in the level of costs associated with the exercise of powers (paragraph 4). The protection of the financially weaker local communities requires the application of compensatory procedures or balancing measures to correct the effects of the unequal distribution of potential sources of revenue as well as of the expenses which these communities incur, with the proviso that, as far as possible, subsidies granted to local communities should not be used to finance specific projects, as this may jeopardise the fundamental freedom of the local community to pursue its own policy freely in respect of the powers conferred (paragraphs 5 and 7). For the financing of capital expenditure, local communities should have access to the national capital market (para. 8).

Local government can arise both as an effect (*Izdebski, 2006, pp. 43–50*):

- non-centralisation of public power (less common, as it applies to countries that have not gone through the absolute monarchy stage and have retained a tradition of strong self-government, operating in historically shaped territorial subdivisions – e.g. England, Sweden),
- decentralisation of public authority (in the vast majority of European countries).

The competences of the local government largely depend on its size, and this on the adopted structure of public administration. There is a relationship between the size of a municipality and the demographic-social and economic-financial potential

it represents, which affect its competitiveness, and the scope of its competences. It can be expected that the greater the potential, the greater the scope of competences and the possibilities for their effective implementation. This is not fully confirmed by the research carried out as part of the Local Autonomy Index project. Table 4 shows the relationship between functional decentralisation, measured by the scope of responsibility for public services (education, health care, social assistance, housing, spatial planning, security, public transport), as expressed in the so-called *policy scope* index, and the freedom to exercise them (so-called *policy discretion* index), and the size of the municipality as expressed by its population.

Table 4. Relationship between the average size of the municipality and the extent of functional decentralisation

Specification		Extent of functional decentralisation (combined indicator: policy scope and policy discretion)*	
		Narrow (index up to 4)	Wide (index above 5)
Average number of inhabitants in the municipality	Small (up to 6,000 people)	Cyprus, Liechtenstein, Moldova, Spain	France, Iceland
	Medium (6,000 to 30,000 persons)	Albania, Malta	Bulgaria, Finland, Latvia, Germany, Norway, Poland, Romania
	Large (more than 30,000 people)	Greece, Georgia, Ireland, Turkey, United Kingdom	Denmark, Lithuania, Serbia, Sweden

* The combined index: policy scope and policy discretion can take values ranging from 0 to 8

Source: P.Swianiewicz, A.Gendźwill, J.Lukomska, A.Kurniewicz (2016, p. 35).

The cited studies show that both small municipalities may have a large remit and large municipalities a small one. The lack of clarity in this respect is also due to the influence of other factors, primarily of a political nature. On the other hand, however, it is also worth noting the correlation that the larger the local government unit, the weaker is its social cohesion and the identity of its inhabitants, expressed, among other things, in a lower turnout in local elections, which is a spectacular manifestation of a lack of interest in municipal affairs (*Rysavy & Bernard, 2013, pp. 833–852*).

The dilemma: a small unitary municipality (i.e. a municipality comprising a single locality) or a large collective municipality (comprising several to a dozen localities) becomes apparent in the typology of E.Page and M.Goldsmith, modified by P. John (2001, pp. 26–36). It shows that two basic models of local and regional government can be distinguished in Western Europe, i.e.: Northern European and Southern European. The criteria for this division are the range of functions performed, the freedom of decision-making and the intensity of contacts with central government. In the Northern European model (represented e.g. by Denmark, Finland, the Netherlands, Ireland, Norway, Sweden and the United Kingdom), there is a wide range of functions, a high degree of freedom of decision-making, low intensity of contacts

with the central government, fewer levels of local government, fewer local authorities and larger local authorities. Sweden, for example, has 290 municipalities. The average Swedish municipality has a population of 34526 people and an area of 1551.6 km². Type I (to which Poland, among others, belongs) and Type II within the typology of local government systems in Table 3 show some similarities to the Northern European model.

In contrast, the Southern European model (e.g. Belgium, France, Spain, Portugal, Italy) is characterised by: a relatively narrow range of functions, little freedom of decision-making, high intensity of contacts with the central government, a relatively large number of local government levels, a large number of local government units and small size. In France, for example, there are 36763 municipalities with an average size of 1,828 people and an area of 17.5 km². There are some similarities to this model in the Balkan type (Type III in Table 3), which included Ukraine before it made radical reforms at the local level. The least represented is the intermediate model, which combines elements of the Northern and Southern European models. Germany, among others, can be included in this model.

The main argument for merging small municipalities is to achieve economies of scale in the provision of public services. Indeed, it may turn out that municipalities are too small a market for the provision of certain municipal services. There may also be a concern about the thinness of local government staff or their low qualifications in the case of small municipalities. Sharing these concerns to some extent, reforms were carried out between 2008 and 2017 to reduce the number of municipalities in 15 European countries (including Albania, Finland, Greece, the Netherlands, the German Länder and the Swiss cantons). It is noteworthy, however, that in most of the listed countries and their regional units, these reforms are still continuing (*Swianiewicz, 2018, pp. 2–3*). Reducing the number of municipalities and thus increasing their size can take place through top-down decisions at the central or regional level, or bottom-up – with various types of incentives, including financial ones.

An interesting case is Ukraine, which carried out a radical decentralisation reform at the local level in 2014–2021 (*Hohol & Tsybulska, 2022, pp. 11–38*). In place of the dynamically increasing number of local self-government units with a rather complex structure (including cities of regional importance, other cities, villages, settlements, urban-type settlements), about 12,000 in number in 2014, about 1,460 municipalities (hromads) were established. On the other hand, the number of districts (counties) was reduced from more than 600 to 136. The reform in the first stage envisaged voluntary amalgamation, while in its second stage local units not showing a desire to amalgamate were forcibly amalgamated. Importantly, the hromads were given new competences in, among other things, education and health care, and were provided with new sources of funding, including increased shares of personal income tax revenues, as well as subventions distributed according to an algorithm, instead

of the hitherto predominant subsidies from the central level. The reform was interrupted by the war, triggered by Russia. A new status in connection with the reform at the level of municipalities (hromads) is required by the regions (*Swianiewicz, 2022, pp. 9–15*). However, what has already been done at the local level – in a fairly common opinion – releasing the energy of local communities under conditions of new opportunities – has strengthened the resilience of Ukrainian society against Russian aggression.

Turning to the typology of institutional-organisational conditions (competence distances) of cooperation of border regions, four – previously indicated – model solutions were adopted for the systemic position of the administrative region in democratic states, i.e. autonomous region in a federal state (AF), autonomous region in a regional unitary state (AU), self-governing region in a decentralised unitary state (SU), administrative-functional region in a centralised unitary state (FU). The first two are part of the executive and the legislature, the self-governing region only the executive, and the administrative-functional region neither the executive nor the legislature. This has specific consequences for border regions. While regions located inside a country generally operate in a fairly coherent territorial and organisational environment, border regions may have an incoherent territorial and organisational environment, as some regions (located on the other side of the border) may have too much or too little competence, necessitating the intervention of central institutions to alleviate institutional and organisational distances. The possible types of such distance (or lack thereof) for example countries A and B, are presented in Table 5.

Table 5. Institutional-organisational distances between border administrative regions of neighbouring countries A and B

Type of border administrative region:		Designation distance	Nature of distance A→B	Consequences for the border region of country A
country A	country B			
Autonomous in a federal state	Autonomous in a federal state	AF-AF	no	coherent cross-border environment
Autonomous in a federal state	Autonomous in a regional unitary state	AF-AU	small	fairly coherent cross-border environment, with minor constraints on the side of the border region of country B
Autonomous in a federal state	Local government in a decentralised unitary state	AF-SU	large	cross-border environment not very coherent, support of central institutions of country B required
Autonomous in a federal state	Administrative-functional in a unitary centralised state	AF-FU	very large	dysfunctional cross-border environment
Autonomous in a regional unitary state	Autonomous in a federal state	AU-AF	small	fairly coherent cross-border environment, with more opportunities on the border region side of country B

Type of border administrative region:		Designation distance	Nature of distance A→B	Consequences for the border region of country A
country A	country B			
Autonomous in a regional unitary state	Autonomous in a regional unitary state	AU-AU	no	coherent cross-border environment
Autonomous in a regional unitary state	Local government in a decentralised unitary state	AU-SU	large	cross-border environment not very coherent, support of central state institutions necessary B
Autonomous in a regional unitary state	Administrative-functional in a unitary centralised state	AU-FU	very large	dysfunctional cross-border environment
Local government in a decentralised unitary state	Autonomous in a federal state	SU-AF	large	cross-border environment not very coherent, with clearly greater opportunities on the side of the border region of country B, for which the support of the central institutions of country A is necessary
Local government in a decentralised unitary state	Autonomous in a regional unitary state	SU-AU	large	cross-border environment not very coherent, with more opportunities on the border region side of country B, needing support from central institutions of country A to exploit them
Local government in a decentralised unitary state	Local government in a decentralised unitary state	SU-SU	no	coherent cross-border environment
Local government in a decentralised unitary state	Administrative-functional in a unitary centralised state	SU-FU	large	inconsistent cross-border environment
Administrative-functional in a unitary centralised state	Autonomous in a federal state	FU-AF	very large	the cross-border environment is very incoherent, with very high capacities on the part of the border region of country B, in respect of which only the central institutions of country A may be partners
Administrative-functional in a unitary centralised state	Autonomous in a regional unitary state	FU-AU	very large	the cross-border environment is very incoherent, with very high capacities on the part of the border region of country B, in respect of which only the central institutions of country A may be partners
Administrative-functional in a unitary centralised state	Local government in a decentralised unitary state	FU-SU	large	incoherent cross-border environment, with more opportunities on the side of the border region of country B, to which the central and branch institutions of country A may be a partner
Administrative-functional in a unitary centralised state	Administrative-functional in a unitary centralised state	FU-FU	no	dysfunctional cross-border environment

Source: A. Miszczuk (2013, pp. 93–95).

On the basis of Table 5, a typology can be made according to which the institutional and organisational distance of the border region from the cross-border environment can:

- represent a threat to development (increase peripherality), due to a shortage of competencies of the environment (AF-AU, AF-SU, AF-FU, AU-SU, AU-FU, SU-FU),
- provide opportunities (stimulate development), as the environment is characterised by a surplus of competences (AU-AF, SU-AF, SU-AU, FU-AF, FU-AU, FU-SU),
- be indifferent (AF-AF, AU-AU, SU-SU, FU-FU).

The cooperation of regions in the Polish-Ukrainian border region is described by the SU-SU type, which means a coherent cross-border environment. Obviously, there are some differences in the self-governing character of Polish and Ukrainian regions. In Poland, there are direct elections of councillors to voivodship assemblies⁴, while in Ukraine, regional councils are made up of representatives of local authorities (hromads and regions). Polish and Ukrainian regions are the main actors in intra-regional policy, while Polish regions have greater financial and investment opportunities due to the availability of EU funds, typical for an EU member state with a medium level of socio-economic development. Following the recent decentralisation reform in Ukraine, there are also no significant competence gaps between Polish and Ukrainian municipalities, as both are based on the European Charter of Local Self-Government (1994). However, cooperation between Polish districts and Ukrainian regions remains an open issue. This is because it is necessary to redefine the competences and tasks of the districts in Ukraine, in connection with the extension of the competences of the hromads. This topic will certainly return after the end of the war in Ukraine.

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⁴ In Poland, it is postulated that in addition to the sejmiks of the voivodships, voivodship senates should be set up, which would be composed of representatives of local self-governments. Cf. M. Kisilowski, A. Wojciuk (2023, 122–124).

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TRANSPORT AND BORDER INFRASTRUCTURE IN THE PROCESS OF HARMONISATION OF CROSS-BORDER MOVEMENT OF PEOPLE AND GOODS ON THE EXAMPLE OF THE POLISH-UKRAINIAN BORDER IN 2019–2023

Modern communication and border infrastructure solutions are one of the basic elements ensuring efficient and effective state border management. The process of this management is largely dictated by the practical implementation of the passenger and goods border service paradigm. It is particularly concerned with ensuring border protection and security and the smooth and harmonious movement of people and goods.

The model for the management of the EU's external borders constitutes a coherent whole, based on the mutual correlation of the legal and organisational solutions in force in the European Union as a whole and those implemented at the level of the Member States, in particular those with an external border. According to the accepted view, this system is the consequence of two processes, the first being deeper European integration, which in this respect takes the form of free movement of goods and persons between Member States, leading to the transfer of border controls to the external border, and the second being the unfortunately recurring, on an increasing scale, immigration crises (*Trubalska* 2017).

In the current military-political and socio-economic conditions it is of particular importance to ensure a safe and harmonious flow of people and goods in Polish-Ukrainian cross-border relations. With a view to analysing this issue, the author's aim is to indicate the importance of transport and border infrastructure in the implementation of this task. To this end, a review of transport and border solutions and a study of the scale of the flow of persons (foreigners and Polish citizens) through border crossings located in the Lubelskie Voivodeship in the years 2019–2023 were carried out. The study also covered the means of road and rail transport moving across the Polish-Ukrainian border in those years.

It can be hypothesised that the harmoniousness of border crossings depends to a large extent on the level of development of the transport and border infrastructure and increasingly on the stability or rather lack thereof in regional and global relations. Unfortunately, the latter element is clearly visible in the cross-border movement of people and goods on the Polish – Ukrainian border. This applies to the dramatic perturbations as a consequence of Russia's aggression in Ukraine and, earlier, the global Covid-19 pandemic.

The subject matter proposed in the article covers a broad and multifaceted spectrum of issues concerning transboundary Polish-Ukrainian relations; therefore, the author is aware of its general character and many generalisations which should be further developed. At the same time, he assumes that this topic may be the subject of separate, much broader and deeper research contributing to the diagnosis of the current state and development in this scope of conditions for functioning of Polish-Ukrainian cross-border relations.

Regulations governing the movement of persons and goods at the's external borders

The Treaty on the Functioning of the European Union, with regard to policies on border control, asylum and immigration, identifies the need for the gradual introduction of an integrated management system for external borders (*Treaty on European Union, 2012*). In implementation practice, the principle was introduced that border control is in the interest not only of the Member State at whose external borders it is carried out, but of all Member States which have abolished border control at internal borders. Border control should help to combat illegal immigration and trafficking in human beings and to prevent any threat to the internal security, public order, public health and international relations of the Member States (*Code on the rules governing, 2016*).

The borders of a state have always been one of the most important symbols of its sovereignty and integrity. The Constitution of the Republic of Poland, referring to the necessity to ensure the indivisibility of the territory and the security and inviolability of its borders, gives priority to this duty (*Stańczuk, 2022*). This task is fulfilled in order to ensure the freedom and rights of man and citizen and the security of citizens, guard the national heritage and ensure the protection of the environment, guided by the principle of sustainable development (*Constitution of the Republic of Poland, 1997*). The practical implementation of this principle is inextricably linked to the protection of the state border. This obligation in the reality of the external border correlates with the protection of other Member States and the European Union as a whole (*Witkowski, 2016*).

The codification provisions on border issues in the European Union and Polish national law formulate a legal definition of the EU external border and the state

border. In the case of the former, it has been defined as land borders, including river and lake borders, and maritime borders of the EU Member States, as well as their airports, river ports, seaports and lake ports, provided that they do not constitute internal borders. In the case of the Polish state border, it is indicated that it is the vertical surface passing through the border line, separating the territory of the Polish state from the territories of other states and from the high seas¹.

The current military-political and socio-economic situation has made the eastern border of the Republic of Poland the most sensitive external land border in the European Union. As a result of Russia's aggression in Ukraine on 24 February 2022 and its consequences, a significant part of the border section with Russia and Belarus is managed in a command-and-control manner through mutually imposed sanctions contingent on the possibility of transporting goods as well as limiting passenger traffic, inter alia by reducing the number of border crossings serving both types of border traffic.

Border service – clearance of persons and goods is, according to the well-established view in doctrine, a series of procedures and activities carried out at border crossings in order to ensure compliance with the applicable legal regulations, in particular with regard to border protection and to ensure, as far as possible, the smooth and harmonious movement of persons and goods (*Witkowski, 2018*). In the European Union regulations, the provisions of the Schengen Borders Code (KGS) are fundamental in this respect, shaping a comprehensive compendium of organisational, technological and surveillance and control instruments necessary in the practical implementation of border services. Among other things, it defines the principles of operation of border services of Member States, specifies the notion of border surveillance², border checks³ and border control⁴ and indicates the infrastructural conditions of land border crossing points⁵. It is worth bearing in mind

¹ On land sections and in places where the state border crosses standing waters or flowing waters, passing to the other side – according to the straight line running from one border marker to the other, Art. 5 (1) pt. 1 Act of 12 October 1990 *on state border protection*, Dz. U. 1990 No. 78, item 461 as amended.

² Border surveillance means surveillance of borders between border crossing points and surveillance of border crossing points outside established opening hours to prevent and discourage persons from evading border checks, Art. 2 para. 12 KGS

³ Border checks means the control operations carried out at border crossing points to ensure that persons, including their means of transport and objects in their possession, may be authorised to enter or may be authorised to leave the territory of the Member States, Art. 2 para. 11 KGS

⁴ Border control means action taken at the border in accordance with this Regulation and for the purposes set out therein, solely in response to an intention to cross that border or to the act of crossing it, regardless of any other circumstances, consisting of border checks and border surveillance, Art. 2 para. 10 KGS

⁵ Border crossing point” means any border crossing point designated by the competent authorities for the crossing of external borders, Art. 2 para. 8 KGS

that the provisions of the Code are applicable both to the handling of persons, goods and means of transport moving across borders⁶.

The management of the European Union's external borders requires action at joint level by institutions and agencies carrying out monitoring and analytical operations with regard to, inter alia, surveillance, volume of border traffic and cross-border organised crime. These are, inter alia, the priorities of the Frontex Agency, in place since 2005 and responsible for operational cooperation at the external borders of the EU Member States, currently called the European Border and Coast Guard Agency (FRONTEX)⁷. Subject to constant modernisation and updating, the Agency's tasks include the development and implementation of a technical and operational strategy for European integrated border management and the coordination of the development of national strategies prepared by individual Member States. In particular, these undertakings should take into account constantly evolving migration risks. In this respect, the Agency is, inter alia, optimising activities aimed at improving the effectiveness of border control at the external borders and risk mapping and assessment in the field of migration threats, as well as practical support for countries affected by crisis situations through, for example, technical and operational assistance⁸. Despite EU-wide projects and their actual implementation, it should be borne in mind that ensuring surveillance and security at the external borders is still the primary responsibility of the Member States that directly manage the EU's external border⁹.

In Poland, the issue of the management of the EU external border and the Polish state border in terms of protection and border services has been regulated to a large extent in the provisions of the Border Protection Act¹⁰ and the Border Guard Act¹¹, while the issue of the control of the movement of goods in the regulations of the Cus-

⁶ The management of trade in goods between European Union Member States and third countries, including the border handling of the movement of goods, is regulated by the Union Customs Code. Regulation (EU) No 952/2013 of the European Parliament and of the Council of 9 October 2013 *laying down the Union Customs Code*, Official Journal 2013, L 269, p. 1 as amended.

⁷ Frontex originally established by Council Regulation (EC) No 2007/2004 of 26 October 2004 establishing a European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union, Official Journal 2004, L 349/1 with amendments, subsequently recast (current Regulation) by Regulation (EU) 2019/1896 of the European Parliament and of the Council of 13 November 2019 *on the European Border and Coast Guard and repealing Regulations (EU) No 1052/2013 and (EU) 2016/1624*, Official Journal 2016, L 295/1 with amendments.

⁸ Article 8(4) of Regulation (EU) 2019/1896 COM(2022) 303 final, <https://www.gov.pl/web/mswia/zarzadzanie-granicami-zewnetrznymi>, 18.12.2024.

⁹ <https://www.gov.pl/web/mswia/zarzadzanie-granicami-zewnetrznymi>, 18.12.2024.

¹⁰ Act of 12 October 1990 *on the protection of the state border*, Journal of Laws. 2016 item 1947 as amended

¹¹ Act of 12 October 1990 *on the Border Guard*, i.e. Dz. U. of 2024, item 915.

toms Law¹² and the Act introducing the Customs Law¹³ and the Act on the National Fiscal Administration¹⁴.

Transport infrastructure in the Polish-Ukrainian border area in the region

The Republic of Poland manages the longest section of the eastern external border of the European Union, having it with Russia – 209.83 km, with Belarus – 418.24 km and 535.18 km with Ukraine¹⁵. When considering the issue of ensuring border protection and the harmoniousness of border checks, a very important element is the transport infrastructure and the infrastructure of border crossings, as well as the facilities of logistical bases in the immediate border area. In the case of Ukraine, we currently have 15 border crossing points, including 9 road border crossing points and 6 rail border crossing points (*Wawrzusiszyn, 2020*).

In presenting the Polish-Ukrainian transport and border infrastructure, the author decided to base his analysis on the solutions currently in place and planned in the Lubelskie Voivodeship. This is due, among other things, to the modification of the European Union's concept on the development of the European Union's trans-European transport network (*Union guidelines for the development, 2024*) and the potential increase in the service of cross-border goods traffic realised with the use of border crossings in this particular voivodeship.

Adequate transport infrastructure is of vital importance for efficient and harmonious cross-border traffic between Poland and Ukraine. A huge step forward in this respect is the modification of the Trans-European Transport Network (TEN-T)¹⁶. Currently, as a result of the 2024 modifications, the North Sea-Baltic Sea corridor extends from North Sea ports in Belgium, the Netherlands and Germany to Poland. Further north, the corridor runs through Lithuania, Latvia and Estonia to Helsinki and Oulu in Finland and Lulea in Sweden. In the south, the corridor extends from Warsaw via Lublin to Kyiv and from Katowice via Lviv to Kyiv and Mariupol in

¹² Act of 19 March 2004. *Customs Law*, consolidated text Dz. U. of 2021, item 1856.

¹³ Act of 19 March 2004. *Provisions introducing the Act – Customs Law*, Dz.U. of 2004, No. 68, item 623.

¹⁴ Act of 16 November 2016 *on the National Fiscal Administration* Journal of Laws. 2016 item 1947, as amended.

¹⁵ <https://www.strazgraniczna.pl/pl/granica/granice-rp/1910,Granice-RP.html>, 18.12.2024.

¹⁶ The Trans-European Transport Network (TEN-T) is a network of major transport links within the European Union, including road, rail, air, sea and river routes, as well as multimodal platforms and urban nodes, <https://www.gov.pl/web/infrastruktura/transeuropejska-siec-transportowa--ten-t>, 18.12.2024.

Ukraine. This corridor includes railways, roads, airports, ports, multimodal freight terminals, inland waterways and links to the European maritime transport area¹⁷.

In the Lubelskie Voivodship, the transformation in the design and construction of the North Sea-Baltic Sea Corridor of the Trans-European Transport Network (TEN-T) will lead to the establishment of a communal link via Lublin-Chełm to the border crossing at Dorohusk-Jagodzin. The importance of this border crossing, which can handle road and rail traffic, as well as the long stretch of wide track running to Zawadówka, must be taken into account. This creates a real opportunity to locate a significant multimodal logistics centre of international significance here (Fig. 1).

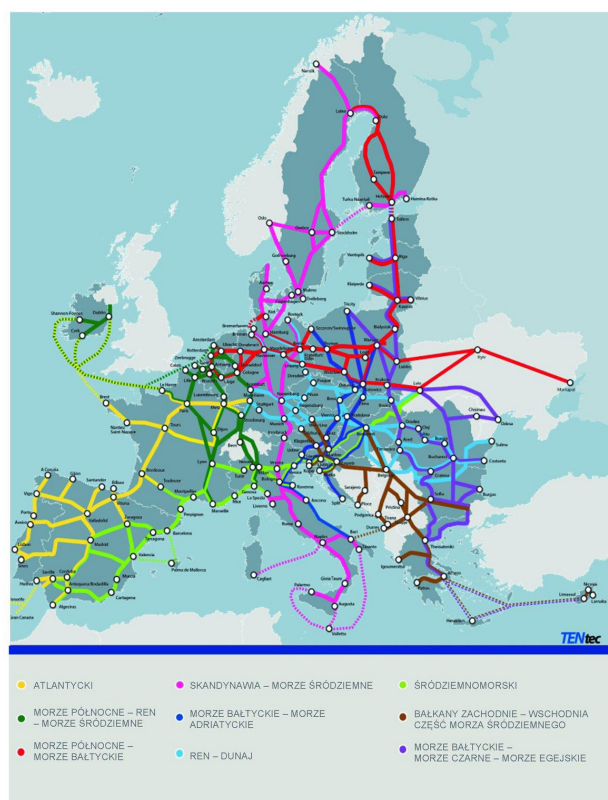


Fig. 1. Trans-European Transport Networks TEN-T

Source: <https://www.gov.pl/web/infrastruktura/transeuropejska-siec-transportowa--ten-t>, accessed 27.12.2024.

¹⁷ In the previous variant, the route of the North Sea-Baltic Sea Corridor with its eastern branch ran through the south of the Lubelskie Voivodship along a motorway/expressway to the Kukuryki/Kozłowicze border crossing with a car terminal in Koroszczyn. On the territory of Belarus, it ran through Minsk towards Moscow.

Taking into account the proper dislocation of the road infrastructure in relation to the communication needs of the state and the voivodeship, as well as, what needs to be emphasised, the road border crossings, the Lubelskie Voivodeship can be defined as one large construction site of strategic importance. Due to the subject of this publication I would like to draw your attention to the solutions constituting direct transport facilities of road and rail border crossings.

A strategic section of the Via Carpatia (S-19), part of the Trans-European Transport Network in the Baltic – Adriatic Sea Corridor linking the north and south of Europe, is in the final stages of construction. This route provides Poland with beneficial connectivity to the Baltic States and the Balkans. The two-lane expressway will connect the border of the Lubelskie and Mazowieckie Voivodeships with Lublin (*Truskolaski & Bugowski, 2018*)¹⁸.

The construction of the S12 expressway – leading from Piaski to the Dorohusk-Jagodzín border crossing – is a priority for the realisation of the new section of the North Sea – Baltic Sea corridor. Almost 70 km of this road is under construction and an additional 5.7 km is in the preparatory phase (*Czowalla, 2024*). Another section aimed at channelling cross-border traffic with Ukraine is the S 17 expressway. This connects Piaski with the Hrebennie-Rawa Ruska border crossing and covers some 125 km. Sections of bypasses in Krasnystaw and Zamość and a section leading to the truck clearance terminal in Hrebennie are in the preparatory stage¹⁹. It is also worth noting the modernisation and extension of national road No. 74, totalling over 40 km (with four bypasses). The implementation of this project will improve communication between the S19 expressway in Janów Lubelski and the border crossing Zosin-Ustług²⁰. (Fig. 2).

A key initiative for solving the issue of Polish-Ukrainian cross-border rail freight transport in the Lubelskie Voivodeship is the creation of the PKP Chelm Broad Gauge Railway Line and the infrastructural, in terms of the rail network, linking it with the PKP Broad Gauge Metallurgical Line. According to the assumptions, the railway crossings in Dorohusk and Hrubieszów on the eastern border of Poland and the external border of the European Union are of great importance for the creation of new cargo streams in railway transport, using the potential of the broad-gauge infrastructure (*Ciemonczułowski, 2019*) (Fig. 3).

¹⁸ A key infrastructure investment in the eastern part of the EU is the Via Carpatia international road, which has been laid out across the territory of seven Member States, namely Lithuania, Poland, Slovakia, Hungary, Romania, Bulgaria and Greece. The international road corridor will connect northern Europe with ports on the Black Sea and the Mediterranean Sea, and in the future will also be an important element in the network of road connections with countries to the east of the Community.

¹⁹ <https://www.gov.pl/web/gddkia-lublin/umowa-na-kolejny-odcinek-s17>, 18.12.2024.

²⁰ <https://www.gov.pl/web/gddkia-lublin/znamy-przebieg-obwodnicy-janowa-lubelskiego>, 18.12.2024



Fig. 2. Road infrastructure in the Lubelskie Voivodeship

Source: <https://investmap.pl/kolejny-krok-do-budowy-dwoch-odcinkow-drogi-ekspresowej-s17-w-województwie-lubelskim.a307105>, accessed 23.12.2024.



Fig. 3. Interconnection of railway infrastructure of PKP Chelmska Wide Line and PKP Broad Gauge Metallurgical Line in the Lubelskie

Source: <https://www.dziennikwschodni.pl/zamosc/kolej-bierze-sie-za-dwie-linie-w-woj-lubelskim-dzieki-inwestycji-pociagi-pojada-szybciej,n1000208216.html>, accessed 23.12.2024.

Planned and implemented transport investments in the Lubelskie Voivodeship open up the possibility of rational use of the logistical potential associated with the handling of cross-border passenger and especially freight traffic between Poland and the Ukraine. What needs to be emphasised is the coherence of infrastructural solutions in multimodal transport hubs which enable unloading and loading operations with a simultaneous change of transport mode, for example from rail to road. This creates the possibility of actually increasing the cross-border movement of bulk goods by rail and their further distribution by road.

Infrastructure of border crossings on the Polish-Ukrainian border in the Voivodeship

The Polish-Ukrainian border in terms of local jurisdiction is located within the Lubelskie and Podkarpackie Voivodeships. In the jurisdiction of the former there are 4 road and 4 railway²¹ crossings, while in the Podkarpackie Voivodeship there are 5 road and 2 railway²² crossings. When analysing border crossings in Lubelskie Voivodeship located on the border section of 296 km, it seems necessary to discuss the largest of the road border crossings first. This is the Dorohusk-Jagodzin crossing. It handles the greatest number of vehicles crossing the Polish-Ukrainian border annually. It is located on an area of almost 15 hectares with the possibility to perform border activities in the area of passenger and cargo traffic as well as veterinary, phytosanitary, sanitary, commercial quality of agricultural and food products control (Witkowski, 2021).

In the years 2019–2023, in terms of handling passenger traffic, we are dealing with a clear variation in the number of foreigners and Polish citizens moving using the Dorohusk/Jagodzin road crossing. The highest number of foreigners and Poles both arriving and departing was found in 2019, the next two years with a reduced number of people moving in the personal cross-border traffic should be attributed to the Covid 19 pandemic, while the evident increase in 2022, especially in the field of arriving foreigners is the effect of Russia's aggression in Ukraine, in 2023 a noticeable return to the period of 2020–21 (Table 1).

²¹ Road border crossing points – Dorohusk-Jagodzin, Dolhobyczów-Uhryniów, Hrebenne-Rawa Ruska, Zosin Ustilug. Railway border crossing points – Dorohusk-Jagodzin, Hrebenne-Rawa Ruska, Hrubieszów-Włodzimierz Wołyński

²² <https://www.lzopg.bip.mbnet.pl/>, 18.12.2024.

Table 1. Handling of passenger traffic at road border crossing point Dorohusk-Jagodzin in the period 2019–2023

Years	Foreigners		Poles	
	entry	trip	entry	Trip
2019	1279587	1479955	71522	68268
2020	619860	786080	10446	10107
2021	696226	880918	40590	38317
2022	921670	741100	21206	20228
2023	680108	675002	10668	11250
Total	4197451	4563043	154432	148170

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

The system of border crossings currently follows a form referred to as a flow. This solution generates almost permanent queues of vehicles waiting in front of the crossing, for both passenger and goods vehicles. In accordance with the organisational requirements of border crossings under the Schengen Code, entry and exit directions have been separated and are handled using a large number of lanes – 14 inbound and 11 outbound. However, it should be borne in mind that it is necessary to separate the individual lanes serving the movement of heavy goods vehicles and passenger vehicles, with a further division of the latter into, for example, those for EU and EEA citizens and third countries. Without going into the details of this separation, it should be noted that currently 8 lanes are allocated for goods vehicles in the inbound direction and 5 in the outbound direction, which naturally slows down the time required for border processing of goods traffic²³.

In the analysis of means of transport moving across the border using the road border crossing of Dorohusk-Jagodzin in the years 2019 – 2023, buses, cars and trucks were taken into account. In these years, despite the Covid 19 pandemic and Russia's aggression in Ukraine, it is not possible, apart from incidental cases, to find significant variations in the handling of means of transport entering and leaving Poland. These deviations concern bus traffic with an apparent decrease in 2020 in both directions of service and an increase in the entry and exit of lorries in 2022 and 2023, while passenger car traffic remained basically at a similar level (this can be justified by the organisational reduction of this traffic in 2022 and especially in 2023) (Table 2).

²³ <http://www.nadbuzanski.strazgraniczna.pl/nos/placowki/psg-dorohusk/10975,PSG-Dorohusk.html>, 20.12.2024

Table 2. Handling of means of transport at road border crossing point Dorohusk–Jagodzin in the period 2019–2023

Years	Movement of means of transport					
	Buses		Passenger cars		Heavy goods vehicles	
	Entry	trip	entry	trip	entry	Trip
2019	13154	14534	279626	355845	141443	179809
2020	10339	10372	105780	177966	160121	177467
2021	14788	14608	158236	253607	152520	173159
2022	13170	11968	100 041	122 288	181373	189378
2023	14506	14506	808	772	181373	208257
Total	656899	65988	644491	910478	806363	928070

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm> 18.12.2024.

In 2024, an agreement was signed on the reconstruction of the border crossing and the inclusion of a car terminal in this area in the village of Okopy, as well as the separation of passenger traffic (implemented using the old bridge) and freight traffic (based on the new bridge) (*Pomykała W. (2021)*). This solution will, in a large generalisation, lead to the separation of two types of border clearance for natural persons and passport (drivers) and customs and freight (if necessary combined with phytosanitary, veterinary and sanitary clearance, commercial quality of agricultural and food products).

In terms of importance and volume of border clearance, the second road border crossing in the jurisdiction of Lubelskie Voivodeship is the road border crossing Hrebenne-Rawa Ruska. In terms of border clearance, full passport-customs, veterinary, phytosanitary, sanitary, trade quality control of agricultural and food products is possible. At the Hrebenne-Rawa Ruska road border crossing in the years 2019–2023, two trends characterising this period in terms of passenger border traffic load are very clear. It can be assumed that the normal number of foreigners and Polish citizens arriving and departing from Poland is 2019, decreasing values are noticeable in the years of the Covid 19 pandemic i.e. 2020–21 and after Russia's aggression in Ukraine a sharp increase, this applies to foreigners i.e. 2022–23 (this occurs in both directions of border traffic) (Table 3).

Border crossing point located on 13.74 hectares, where border checks are carried out in a flow system, using 16 lanes, 8 of which are intended for exit and 8 for entry into the European Union. These are divided into lanes for the clearance of passenger vehicles and buses, 5 lanes each in both directions, and lorries, 3 lanes each in one direction. In terms of border clearance, there is a full passport and customs service, veterinary, phytosanitary, sanitary, commercial quality control of agricultural and food products.

Table 3. Handling of passenger traffic at road border crossing point Hrebenne-Rawa Ruska in the period 2019–2023

Years	Foreigners		Poles	
	entry	Trip	entry	Trip
2019	1 236 569	1 380 326	121 885	129 512
2020	506 890	564 088	45 267	42 548
2021	624 204	648 108	42 719	40 485
2022	1 363 310	1 139 443	37 511	38 542
2023	1 260 832	1 360 408	30 081	35 256
Total	4 991 805	5 092 373	264 825	286 343

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

In accordance with the principles of construction of the border crossing provided for in the Schengen Code, entry and exit traffic flows are separated and control posts are located, and there are also parking spaces for trucks in front of the buildings where customs clearance of goods is carried out – 33 (including 3 for vehicles with hazardous materials) on the import direction and 18 on the export direction (including 3 for vehicles with hazardous materials) (Tabl. 4)²⁴.

Table 4. Handling of means of transport at road border crossing point Hrebenne-Rawa Ruska in the period 2019–2023

Movement of the means of transport						
Years	Buses		Passenger cars		Heavy goods vehicles	
	entry	trip	entry	trip	entry	Trip
2019	13 457	14 848	309 828	323 428	79 820	81 415
2020	7 808	8 699	107 803	127 742	80 188	73 788
2021	8 559	10 601	171 035	177 160	102 331	88 642
2022	16 701	17 922	207 816	204 349	99 121	111 121
2023	18 589	20 110	208 894	219 554	75 687	109 759
Total	65 114	72 180	1 005 376	1 052 233	437 147	464 725

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

Another third road border crossing is Zosin–Ustiug handles passenger traffic, including bus traffic. Due to the increase in freight traffic in 2022, it also handles truck traffic. In the handling of passenger traffic at the road border crossing of Zosin–Ustiug, the previously observed trend in its variation between 2019 and 2023 can be confirmed. The year 2019 reflects the optics of normal Polish-Ukrainian relations in terms of the movement of foreigners and Polish citizens. The Covid 19 pandemic and Russia's ag-

²⁴ <https://www.lzopg.bip.mbnet.pl/index.php/charakterystyka-przejsc-granicznych/8-harakterystyka-hrebenne>, accessed 22.12.2024.

gression in Ukraine causes firstly a decrease in its intensity and then a clear increase. It is worth noting that these trends are particularly noticeable among foreigners (Tabl. 5).

Table 5. Handling of passenger traffic at road border crossing point Zosin-Uściług in the period 2019–2023

Years	Foreigners		Poles	
	entry	trip	entry	Trip
2019	888 994	836 947	39 253	43 038
2020	180 594	184 598	6 500	6 707
2021	92 463	119 179	8 033	8 332
2022	722 137	680 217	12 739	12 739
2023	679 011	796 932	19 667	18 853
Total	2 563 199	2 617 873	86 192	89 669

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024

The Zosin-Uściług road border crossing is located on an area of 8.27 ha, border clearance is carried out on 9 lanes, 5 exit lanes and 4 entry lanes, currently stream border clearance.

Given the infrastructural conditions of the border crossing point, Polish and Ukrainian border clearance of persons and vehicles entering Poland takes place on the territory of the Republic of Poland, while exit control from Poland and entry control in Ukraine is performed by each service on the territory of its country²⁵.

In the area of handling of means of transport at the road border crossing Zosin-Uściług in the period 2019–2023, it is possible to conclude the conformity of the general trend of cross-border traffic load at this crossing. The last year in the studied period 2019 is the last period of normality, in cross-border Polish-Ukrainian relations, Covid 19 in 2020–21 a decrease in the entry/exit volume of buses and passenger cars handled at the crossing and a visible increase after the aggression of Russia in Ukraine 2022–2023, very importantly it also includes border clearance of trucks in significant volumes in these years, especially in 2023 (Tabl. 6).

Table 6. Handling of means of transport at road border crossing point Zosin-Uściług in the period 2019–2023

Years	Movement of means of transport					
	Buses		Passenger cars		Heavy goods vehicles	
	entry	trip	Entry	trip	entry	Trip
2019	6 612	6 537	190 008	194 020	0	0
2020	1 638	1 650	35 818	42 474	0	0

²⁵ <https://www.lzopg.bip.mbnet.pl/index.php/charakterystyka-przejsc-granicznych/7-charakterystyka-zosin>, accessed 22.12.2024.

Movement of means of transport						
Years	Buses		Passenger cars		Heavy goods vehicles	
	entry	trip	Entry	trip	entry	Trip
2021	1 768	1 825	30 050	35 836	0	0
2022	7 548	8 142	132 828	168 719	31 671	22 280
2023	8 052	8 182	122 305	158 964	80 759	64 629
Total	25 618	26 336	511 009	600 0131	112 430	86 909

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

At the road border crossing of Zosin-Uściług, an extension is being carried out, including an increase in the number of entry and exit lanes, which will make it fully operational for handling cargo traffic, as well as the modernisation of border check-points and the renovation of the bridge over the Bug River.

It is due to be completed in 2025, which, together with the modernisation of the transport infrastructure, will contribute to the full use of this crossing for cross-border passenger and freight traffic. The newest road border crossing, opened in 2014, located in the Lubelskie Voivodeship is the Dołhobyczów-Uhrynów crossing. It serves, in a stream organisation, passenger traffic, including coach traffic and currently traffic.

In the personal border checks carried out at the Dołhobyczów-Uhrynów crossing, we see similar trends to those at the two previously discussed road border crossings. A high level of entry and exit of foreigners and citizens of the Republic of Poland in 2019, a noticeable decrease in its volume in covid-19 years, i.e. 2022–2021, and a very clear increase, this border crossing in 2022 and 2023 of the war in Ukraine (Tabl. 7).

Table 7. Handling of passenger traffic at road border crossing point Dołhobyczów-Uhrynów in the period 2019–2023

Years	Foreigners		Poles	
	entry	trip	entry	Trip
2019	545 621	526 900	50 110	40 383
2020	116 422	74 632	7 449	5 551
2021	38 608	41 347	5 954	5 471
2022	675 956	358 938	11 270	10 076
2023	624 199	472 009	13 738	10 800
Total	2 000 806	1 473 826	88 521	72 281

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

The road border crossing of Dołhobyczów-Uhrynów is located on the territory of 13.233 ha. Polish and Ukrainian border clearance of persons and vehicles entering and leaving Poland takes place on the territory of the Republic of Poland. 16 lanes, 8 each in the outbound and inbound direction (Tabl. 8)²⁶.

²⁶ Developments following Russia's aggression in Ukraine

In view of its importance, especially in the current military-political and socio-economic situation, rail transport is of particular significance. This is due to the characteristics of this branch of transport, i.e. universality and massiveness, as well as reliability. In the Lubelskie Voivodeship we have two important railway transport nodes, which also meet the standards of multimodal transport providing reloading possibilities in relation to road transport.

An important element of the communication and border infrastructure in the cross-border transport node on the Chelm-Kowel line is the railway border crossing Dorohusk-Jagodzin (Witkowski, 2017). It fully serves passenger transport in terms of passport and customs clearance.

Table 8. Handling of means of transport at road border crossing point Dolhobyczów-Uhrynów in the period 2019–2023

Years	Movement of means of transport					
	Buses		Passenger cars		Heavy goods vehicles	
	entry	trip	Entry	trip	Entry	Trip
2019	4 157	2 483	123 220	130 341	0	0
2020	712	437	27 521	23 414	1	0
2021	306	383	17 577	16 922	5	3
2022	3 710	2 393	110 105	93 996	99 121	111 121
2023	4 786	3 893	115 795	94 172	30 560	48 458
Total	13 671	9 589	394218	358 845	129 687	159 582

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

The handling of passenger traffic in the analysed period was clearly variable from the point of view of the number of travellers served. This can be ascertained in 2019 before the outbreak of the Covid 19 pandemic and particularly in 2022 and 2023 due to Russian aggression in Ukraine and ongoing hostilities (Tabl. 9).

Table 9. Handling of passenger traffic at the railway border crossing of Dorohusk-Jagodzin 2019–2023

Years	Foreigners		Poles	
	entry	trip	entry	Trip
2019	57 233	35137	3968	3905
2020	10 386	6449	1275	1220
2021	3 384	2904	1151	1179
2022	226 491	120 427	4175	4062
2023	353 806	308 955	5088	5071
Total	651 300	470 968	15 657	15 437

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

Border clearance service for goods traffic includes customs and veterinary (only plant and mineral feeds), phytosanitary, sanitary, trade quality control of agricultural and food products. The organisation of the service of the crossing is related to the location of the railway infrastructure, i.e. from the state border to the border station in Dorohusk there are 2 railway tracks with clearances: 1435 mm (normal track) and 1520 mm (wide track, which leads to the fuel depot in Zawadowka). At the Dorohusk railway station, there are 4 tracks with a clearance of 1520 mm and 7 with a clearance of 1435 mm, a siding with a ramp for unloading goods imported from Poland and the European Union, as well as 2 platforms intended for railway communication in domestic and international passenger traffic, made available for border clearance. In the case of border, passport and customs clearance in passenger-passenger traffic is carried out by Polish services during the train stop at the station, while clearance in freight traffic is carried out on sidings – in recognised places for rail freight operators.

In the years 2019–2023, the Dorohusk-Jagodzin railway crossing observes a non-uniform range of passenger train and goods train services, with a clear predominance of the latter. The period distinguished by the increased number of vehicles handled is the years 2022–23, which is noticeable in both types of trains cleared at the presented border railway crossing (Tabl. 10).

Table 10. Train service at the railway border crossing Dorohusk-Jagodzin in the period 2019–2023

Years	Passenger trains		Goods trains	
	entry	trip	entry	Trip
2019	522	519	488	500
2020	73	73	435	441
2021	59	62	517	511
2022	865	871	1 389	1 389
2023	1 425	1 385	2 047	3 197
Total	2944	2910	4876	6038

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

A railway infrastructure solution of trans-European significance is the Broad Gauge Metallurgical Line starting on the territory of our country and voivodship at the Hrubieszów-Włodzimierz Wołyński border crossing. It is the longest broad-gauge connection within the territory of Poland and the European Union, and terminates at the Sławków terminal in the Śląskie Voivodeship. It handles freight and passenger traffic²⁷. Border clearance is carried out in the field of passport, customs and veterinary, phytosanitary, sanitary, trade quality control of agricultural and food products.

²⁷ currently there are no passenger trains running

In terms of passenger traffic, significant variations can be found, in particular in terms of the passage and departure of foreigners and Polish citizens in 2022; in other years in which the analysis was conducted, the number of foreigners moving across the border was similar, while the number of Poles arriving and departing at this border crossing was significantly lower (Tabl. 11).

Table 11. Handling of passenger traffic at the railway border crossing Hrubieszów-Włodzimierz Wołyński in the period 2019–2023

Years	Foreigners		Poles	
	entry	trip	entry	Trip
2019	9156	9151	6	6
2020	7255	7237	0	0
2021	5663	5659	1883	1889
2022	32 237	8529	14 239	12 739
2023	8 569	8577	0	0
together	62880	39153	16128	14634

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

Railway border clearance at the Hrubieszów-Włodzimierz Wołyński crossing is dictated by the specifics of railway traffic, the crossing being exclusively broad-gauge (1520 mm). The clearance area in Hrubieszów counts 14 tracks enabling the realisation of train services in import and export traffic.

Between 2019 and 2023, the organisation and handling of trains travelling through the Hrubieszów-Włodzimierz Wołyński border crossing varied. This is particularly the case with the introduction of passenger train services in 2022, with regard to goods trains, similar volumes were maintained in 2019, 2021, 2022, while there is a noticeable reduction of around a thousand trains in both imports and exports (Tabl. 12).

Table 12. Train service at railway border crossing point Hrubieszów-Włodzimierz Wołyński in the period 2019–2023

	Passenger trains		Goods trains	
	entry	trip	entry	Trip
2019	0	0	3 302	3 297
2020	0	0	2 486	2 480
2021	0	0	3 024	3 002
2022	17	16	3 221	3 197
2023	0	0	2 678	2 677
Total	17	16	14 711	14653

Source: own compilation based on <https://nadbuzanski.strazgraniczna.pl/nos/komenda/granice/statystyki/statystyki-zbiorcze/15885,Statystyki-zbiorcze.htm>, 18.12.2024.

The third railway border crossing point operating as of 2023 in the Lubelskie Voivodeship is the Hrebenne-Rawa Ruska crossing point; it handles passenger traffic in terms of border clearance – passport and customs. In that year, 14,444 foreigners and 469 Polish citizens entered Poland, while 11,009 foreigners and 435 citizens left. 88 trains entering and 85 trains leaving Poland were handled during that year. In terms of the organisation of border checks, as at the other railway border crossings analysed, the organisation of service is a consequence of the infrastructure considerations adopted for rail transport. The Hrebenne railway station has one platform with two tracks (European gauge – 1435 mm), on which domestic and international passenger train traffic can pass.

Summary

Analysing the situation of cross-border movement of people and goods in Polish-Ukrainian relations, especially in the years 2019–2023, it can be compared to the Chinese proverb *may you live in interesting times*. The time we are living in now is a very stressful, heavy time and causing many people to start feeling its emotional and psychological effects²⁸. This period is the time of the Covid-19 pandemic affecting sanitary restrictions especially on the movement of people due to health and life risks and the era of full-scale war in Ukraine initiated by Russian aggression on 22 February 2022 associated with completely unknown dramas and dangers in cross-border relations and border clearance of people and goods.

The contemporary political and legal paradigm for handling international passenger and freight traffic is, on the one hand, to protect and secure it and, on the other hand, to harmonise, simplify and facilitate it. This paradigm is intended to lead to a maximum minimisation of risks and an increase in the capacity of border crossings, especially those serving passenger and freight traffic.

The practical implementation of this paradigm in correlation to the Chinese mischief in the complex and certainly non-traditional period of 2019–2023 in Polish-Ukrainian cross-border relations appears to be an exceedingly difficult and multifaceted phenomenon, not to say unfeasible. In the undiagnosed and often unpredictable circumstances, organisational and management measures for border checks, which could be carried out on the basis of the available transport infrastructure and the infrastructure of border crossings, were of colossal importance for the handling of passenger and goods traffic.

Three phases can be distinguished in the analysed period. The year 2019 is, so to speak, the last time of normal conditions for handling passenger and freight traffic, the

²⁸ <https://www.katarzynapodleska.pl/obys-zyl-w-ciekawych-czasach/>, accessed 23.12.2024.

years 2020–2021 is a clear decline especially in terms of the number of people, both foreigners and Polish citizens crossing the Polish-Ukrainian border, this naturally has its reference to the level of border crossings by means of passenger transport, especially buses and cars. The time of Russian aggression and war in Ukraine has seen a sharp increase in the arrival of foreigners, especially Ukrainian citizens, to Poland. This can be ascertained mainly in 2022, also through the increased traffic of means of transport allowing passenger transport, including passenger trains. In the case of freight traffic, it is important to be aware that Poland has become the primary corridor for Ukrainian export goods after the blockade of the Black Sea ports by Russian aggressors. This is accompanied by an increased number of goods trains, whose cargo susceptibility is of paramount importance for the carriage of bulk cargo. This corresponds with an increase in road freight traffic and the introduction of important organisational decisions to open the Zosin-Ustiug and Dolhobyczov-Uhryniv crossings for this traffic.

Anticipating in the current international situation a return to normality in cross-border relations and border crossings in Polish-Ukrainian relations, especially in the aspect of the war in Ukraine, is extremely complex and multifaceted. Hoping, however, that like in the words of Romuald Lipka's song – *And after night comes day, and after storm peace...* things change and nothing lasts forever²⁹, and that normal times, unlike in China, can also be very interesting.

The prospect of favourable changes in the handling of border traffic carried out at road and rail border crossings in the Lubelskie Voivodeship is a vision for the expansion and construction of new crossings, as well as for the reconstruction of transport infrastructure, particularly in relation to the new Trans-European Transport Network TEN-T corridor leading through the Lubelskie Voivodeship to Ukraine via the Dorohusk-Jagodzin road-rail transport node.

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²⁹ https://rockgaweda.pl/historia/Budka_Suflera/Jest_taki_samotny_dom, 22.12.2024

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A COMPARATIVE ASSESSMENT OF SOCIAL DEVELOPMENT IN THE REGIONS OF THE POLISH-UKRAINIAN BORDERLAND

Even before the full-scale war, labor migration processes from the border regions of Ukraine to Poland and other EU countries were already observed. Given the mental and cultural proximity of the countries, a significant portion of Ukrainian migrants remained temporarily or permanently in the border regions – the Lubelskie and Podkarpackie Voivodeships. This was primarily due to the relatively higher wages and standard of living in Poland. The war in Ukraine only accelerated the labor migration processes, increasing the flow of Ukrainian refugees to EU countries not only from the border regions but also from almost all regions, especially those that suffered from the destruction of civilian infrastructure.

Given the differences in development levels between Poland and Ukraine, it is important to compare key indicators that characterize social development, particularly in the Polish-Ukrainian border regions. Therefore, the object of further research consists of the border regions – the Lubelskie and Podkarpackie Voivodeships (on the Polish side), as well as the Volyn, Lviv, and Zakarpattia Oblasts (on the Ukrainian side). Social development is a complex economic category. Thus, for the purpose of conducting a comprehensive comparative analysis and assessing the level of social development of countries or regions, it is not enough to rely solely on one or a few indicators; it is necessary to develop a system of criteria and indicators that correspond to them. Accordingly, the aim of the research is to conduct a comprehensive comparative assessment of the level of social development of the Polish-Ukrainian border regions based on a set of criteria and indicators that reflect different aspects of this process.

The issue of assessing social development of regions has been studied by many scholars from different countries over the past few years. Chinese scholars (*Liu et al., 2022*) studied the regional gap in social development and regional coordinated development in Chinese regions using mixed methods. In the book edited by Nitya Mohan Khemka and Suraj Kumar (*Social Development, 2020*) a comparative assessment of social development in South Asian countries was made in the context of the Sustainable Development Goals. Turkish scholars (*Başar & Eren, 2022*) studied interregional differences in social development and regional determinants of social development in Turkey. On the other hand, some Indian scholars (*Kumar & Rani, 2019*) focused on assessing regional differences in social development in the states and union territories of India, while other scholars (*Kallingal & Mohammed Firoz, 2023*) focused on assessing regional differences in social development in specific districts in Kerala. In the framework of a study (*Devender & Kumar, 2022*) a Social Development Index (SDI) was constructed for the Indian region of Haryana, based on 33 key indicators over four time periods. Romanian scholars (*Mitrică et al., 2020*) in their study identified patterns of social development and its territorial inequality in rural areas of the country by assessing social development levels based on the Social Deprivation Index (SDI). Polish scholars (*Barska et al., 2020*) conducted a multidimensional assessment of social development in EU countries in the context of implementing the sustainable development concept. Efforts to assess social development have also been undertaken by international institutions (*World Bank Group, 2010*) and (*OECD, 2020*).

When forming a system of indicators to assess the level of social development of the Polish-Ukrainian border regions, it should be taken into account that this is a complex and multifaceted concept that encompasses not only quantitative and qualitative characteristics of the employed and unemployed populations but also directly depends on the demographic situation in the regions, the state of minimum social guarantees for citizens, the level of income and expenditure of the population and their structure, and must also consider the degree of provision of education, healthcare, and cultural services to the population, as well as the status of workers, their social protection and health, the provision of social assistance to socially vulnerable groups, and so on.

This broad understanding of the essence of social development in the Polish-Ukrainian border regions allowed for the identification of seven main components or criteria that should be considered and used for a comprehensive assessment, which are presented in Figure 1.

Each of the defined criteria (components) for assessing the level of social development in the Polish-Ukrainian border regions should be characterized by a system of key indicators that reveal its content and determine the level of development of specific social groups or the degree of provision of specific types of social services to the population of the respective country.

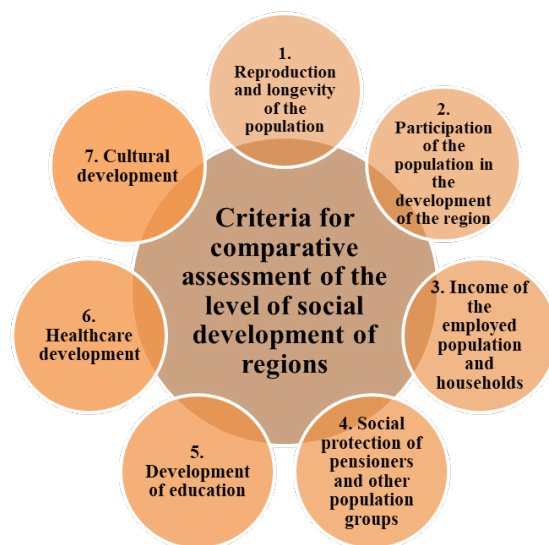


Fig. 1. Criteria (components) for a comprehensive assessment of the level of social development of the regions of the Polish-Ukrainian borderland

Source: compiled by the authors.

Thus, for the purposes of a generalized assessment of the level of social development in the Polish-Ukrainian border regions, the identified components should be considered as partial criteria for evaluation. At the same time, each criterion should be matched with an equal number of indicators, ensuring the proportionality of the subsequent comprehensive assessment of the level of social development for each component.

Unfortunately, due to the ongoing war in Ukraine, official statistical data on the economic and social development of the regions have remained classified and inaccessible since 2022. A review of available statistical sources, including the BDL of the Statistics Poland and the official websites of the State Statistics Service of Ukraine, as well as the Main Statistical Offices in the Volyn, Lviv, and Zakarpattia Oblasts, allowed the identification of periods for assessment during which comparable statistical data were available: 2010, 2015, 2020, and 2021. Based on the available comparable statistical data, a consolidated table of criteria and indicators for the comprehensive assessment of the level of social development in the Polish-Ukrainian border regions was developed (Table 1).

In the presented table, the direction of each indicator is defined. That is, whether it is a stimulant (its increase is considered positive) or a deterrent (its decrease is considered positive). Given that these indicators have different units of measurement and directions, for the purpose of conducting a comprehensive assessment, it is appropriate to transform them into dimensionless quantities – indices. This will allow for the generalization of the level of social development in the country both

for individual components and overall for all components over the specific years of the analyzed period.

There is a need to develop a methodological approach for conducting a comprehensive comparative assessment of the level of social development in the country. Currently, approaches to conducting a comprehensive assessment based on the comparative analysis of indicators in a regional breakdown are widely developed. However, the specificity of this assessment does not foresee comparisons of indicators by administrative-territorial units of Ukraine. Therefore, among the approaches, it is advisable to choose one that involves comparing the values of indicators with their maximum, minimum, or average level, which was achieved over the entire analyzed period. Given that the level of social development is a variable value, and the achieved maximum or minimum value of an indicator, which characterizes its particular aspect, does not always reflect its real level, it is advisable to use the average level of the corresponding indicator for the entire analyzed period as a baseline for comparison.

Based on the outlined information, we believe that for the development of a methodological approach to assess the level of social development in a region, it is advisable to consider the methodological developments of individual Ukrainian researchers, such as (*Poburko, 2004*) and (*Shubalyi, 2016*).

Tabl. 1. A system of indicators for multi-criteria assessment of the level of social development of the regions of the Polish-Ukrainian borderland

Criteria (Components) for Assessment	System of Indicators for Assessment by Criteria	Indicator Characterization: Stimulant (+), Detractor (-)
1. Population Reproduction and Longevity	Average life expectancy at birth, years	+
	Total fertility rate (average per woman)	+
	Demographic dependency ratio (persons aged 0–14 and 65+ per 1000 persons aged 15–64)	-
2. Population Participation in Regional Development	Gross regional product per capita (purchasing power parity), USD	+
	Share of the working-age population, %	+
	Employment rate (ILO definition), %	+
3. Income of the Employed Population and Households	Average monthly wage (purchasing power parity), USD	+
	Total household resources per capita per month, EUR	+
	Concentration coefficient (Gini index)	-
4. Social Protection of Pensioners and Other Population Groups	Average monthly pension amount, EUR	+
	Ratio of average pension to average monthly wage, %	+
	Average monthly disability pension, EUR	+
5. Education Development	Students in higher education institutions per 10,000 population	+
	Coverage of children by preschool institutions, % of children of relevant age	+
	Capital investments in education per capita (purchasing power parity), USD	+

Criteria (Components) for Assessment	System of Indicators for Assessment by Criteria	Indicator Characterization: Stimulant (+), Detractor (-)
6. Health Care Development	Doctors per 10,000 population	+
	Hospital beds per 10,000 population	+
	Capital investments in healthcare and social assistance per capita (purchasing power parity), USD	+
7. Cultural Development	Number of club institutions per 10,000 population	+
	Number of libraries per 10,000 population	+

Source: compiled by the authors.

At the initial stage of the assessment, it is appropriate to determine partial levels of social development for individual components. For this, it is necessary to calculate the indices of each indicator that corresponds to a specific component for a particular year of the analyzed period. The taxonomic method is frequently used to determine the indices of primary indicators. In particular, the methodology for its use is detailed in the official methodological approaches applied in Ukraine for conducting interregional comparisons (*State Statistics Committee of Ukraine, 2003*) and (*Cabinet of Ministers of Ukraine, 2015*).

At the next stage, a group index of the social development level for the regions will be determined for each of the seven components for each year of the analyzed period separately. Based on the chosen approach, this indicator should be determined as the simple arithmetic average of the index values of the indicators corresponding to the given component. Subsequently, the integral index of the social development level of the region as a whole for all seven components will need to be determined for each year of the analyzed period separately. This indicator should also be defined as the simple arithmetic average of the group indices of the social development level for the region based on the individual component.

Thus, the values of group and integral indices of social development will range from 0 to 1. Accordingly, a higher index value approaching one will characterize a higher level of social development. Conversely, if the index value approaches zero, it will indicate a low level of social development in the region.

Therefore, the proposed methodology will allow a comprehensive comparative assessment of the social development level of the Polish-Ukrainian border regions both as a whole and in terms of individual criteria (components) that characterize it for each year of the analyzed period. Ultimately, this will enable a general conclusion to be made about whether the social development level of the Polish-Ukrainian border regions can be considered high or low, depending on the values of the indices.

The results of the assessment of the social development level for Criterion 1 «Population Reproduction and Longevity» for 2010–2021 are presented in Figure 2.

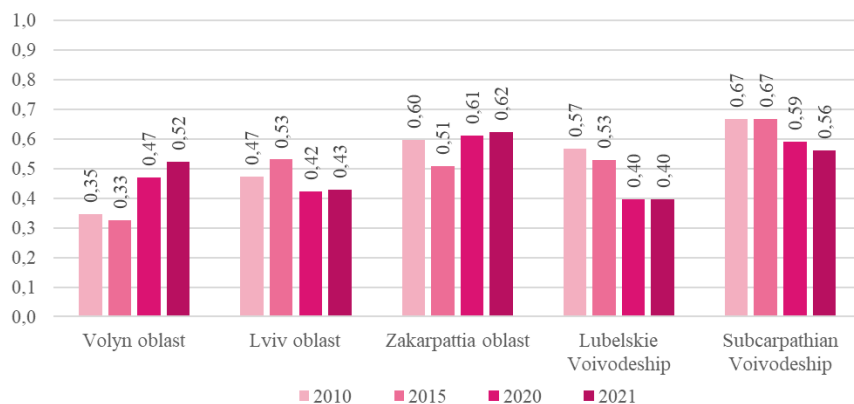


Fig. 2. The results of the comparative assessment of social development of the regions of the Polish-Ukrainian borderland according to Criterion 1: “Reproduction and longevity of the population” for 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

According to this criterion, all Polish border regions showed a negative downward trend in this index. While the Ukrainian Volyn and Zakarpattia Oblasts mostly showed positive dynamics in the Reproduction and Longevity of the Population criterion, Lviv Oblast showed negative dynamics. In 2021, Zakarpattia Oblast was characterized by the highest level of social development by this criterion among all regions, and Lubelskie Voivodeship by the lowest.

The results of the assessment of the level of social development according to Criterion 2 “Participation of the population in the development of the region” for 2010–2021 are presented in Figure 3.

The figure shows that the lowest level of public participation in the development of the region was observed in Volyn Oblast throughout the entire period. Zakarpattia Oblast also showed negative dynamics in this indicator. While Lviv Oblast and Polish border regions showed mostly positive dynamics in this criterion. At the same time, the level of public participation in regional development in the Polish regions in 2021 was over 0.8, i.e., at a high level, while in the Lviv Oblast this indicator remained at an average level of 0.55. Accordingly, Volyn and Zakarpattia Oblasts dropped to a low level for this indicator in 2021.

The results of the assessment of the level of social development under Criterion 3 “Income of the employed population and households” for 2010–2021 are presented in Figure 4.

It is evident that the Polish border regions provided significantly higher and increasing income levels for the employed population and households throughout the entire period compared to the Ukrainian regions. Meanwhile, once again, the

Volyn and Zakarpattia Oblasts demonstrated much lower indicator levels for this criterion. In contrast, the Lviv Oblast only reached the average income level for the employed population and households in 2021, which had already been typical for the Polish border regions back in 2015. Special attention should be given to stimulating the increase of income levels for the employed population and households in Volyn Oblast, where it reached its lowest value in 2021 – 0.07.

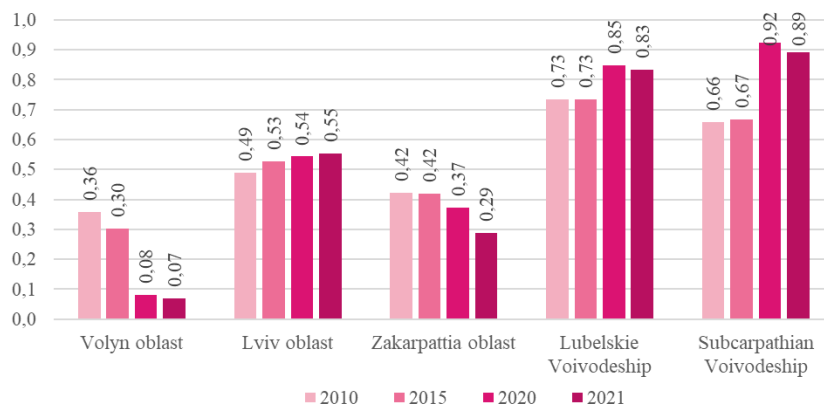


Fig. 3. The results of the comparative assessment of social development of the regions of the Polish-Ukrainian borderland according to Criterion 2: “Participation of the population in the development of the region” for 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

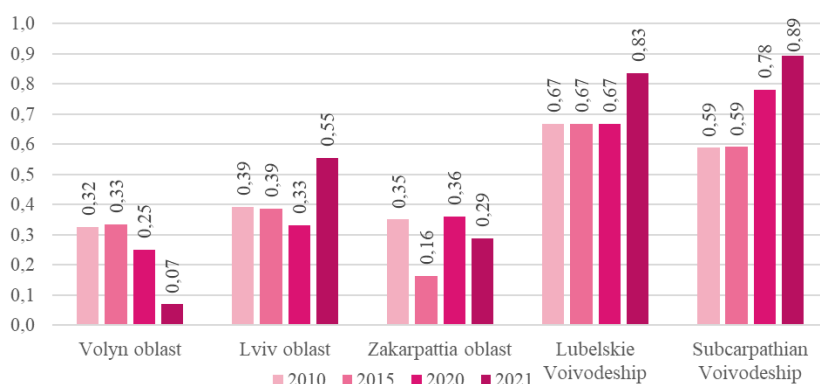


Fig. 4. Results of the comparative assessment of the social development of the regions of the Polish-Ukrainian borderland according to Criterion 3 “Income of the employed population and households” for 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

The results of the assessment of the social development level for Criterion 4 “Social Protection of Pensioners and Other Population Groups” for 2010–2021 are presented in Figure 5.

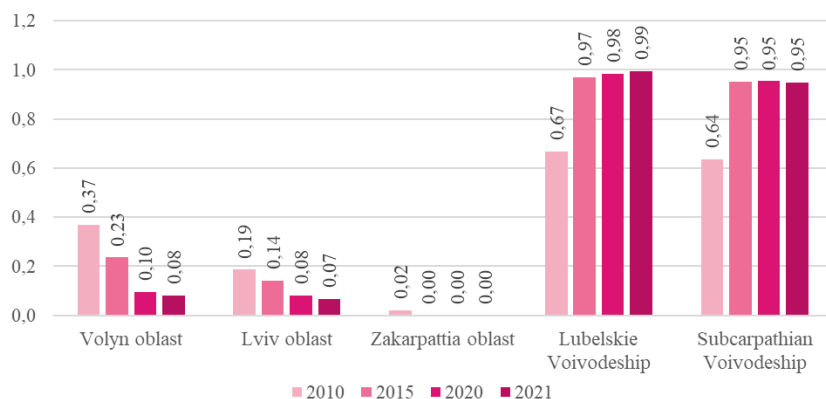


Fig. 5. Results of the comparative assessment of social development of the regions of the Polish-Ukrainian borderland according to Criterion 4 “Social protection of pensioners and other population groups” for 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

The data from the figure clearly confirm the significant gap between the social protection levels of pensioners and other population groups in the Polish and Ukrainian border regions, to the detriment of the latter. The situation was particularly critical throughout the entire analyzed period for this indicator in the Zakarpattia Oblast, while low and declining levels of social protection for pensioners and other population groups were characteristic of the Volyn (0.08) and Lviv (0.08) Oblasts. On the other hand, the Polish border regions provided the highest levels (over 0.95) of social development for this criterion during the last three periods. The continued existence of such a significant gap between the Polish and Ukrainian regions will be an additional negative factor contributing to the growth of interstate labor migration.

The results of the assessment of the level of social development under Criterion 5 “Development of Education” for 2010–2021 are presented in Figure 6.

The figure shows that for Criterion 5 “Education Development,” significant fluctuations were observed in the Volyn, Lviv, and Zakarpattia Oblasts in 2010 and 2021. Specifically, the lowest index during this period was recorded in Zakarpattia Oblast (0.02 and 0.04, respectively). The main reasons for this low level are the mountainous terrain and the dispersed settlement patterns, which significantly complicate access to quality education, especially in remote villages. It is also worth noting that this region has a presence of multiple languages spoken by the population, which further

complicates the learning process, as some students do not speak the state language. A negative influence on the index dynamics for this criterion is insufficient funding for schools in rural areas, often leading to the deterioration of buildings and the lack of modern equipment, textbooks, and stable internet access.

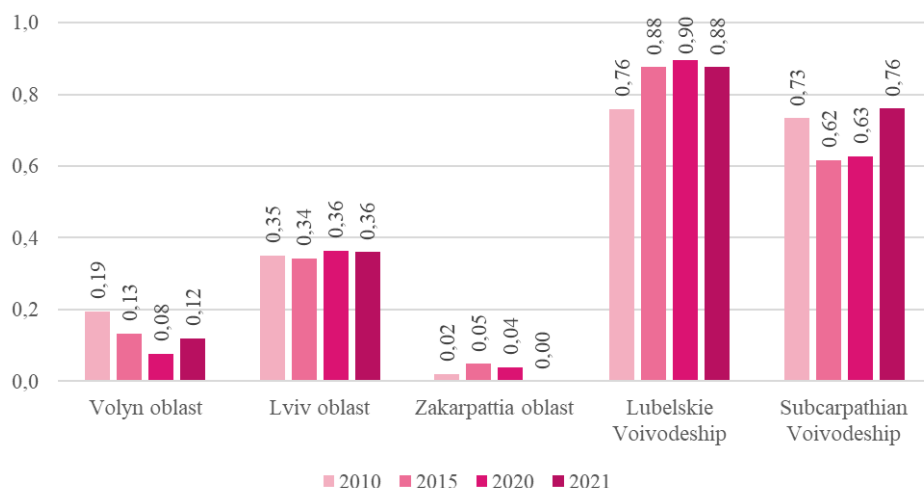


Fig. 6. The results of the comparative assessment of social development of the regions of the Polish-Ukrainian borderland according to Criterion 5 "Development of Education" for 2010–2021
Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024)

The situation for this criterion is significantly better in the Volyn and Lviv Oblasts, where the indicator in 2021 was 0.12 and 0.36, respectively. In recent years, modern programs have been introduced into the educational process, contributing to the increase in the literacy level of the population, while modern information technologies are widely used in education, meeting the demands of contemporary societal development. It should also be noted that, unfortunately, the issue of a shortage of qualified teachers is currently acute, as the low wage levels do not encourage the popularization of the teaching profession. Additionally, since Volyn and Lviv Oblasts are border regions, the migration factor also negatively affects the further development of the education sector. Currently, Ukraine is facing a demographic crisis, as the death rate significantly exceeds the birth rate, which negatively impacts education development, particularly in rural areas. The sharp decline in birth rates leads to a reduction in the number of educational institutions. At the same time, it is important to note that over the period from 2010 to 2021, these regions have demonstrated stable development in higher education. Universities place significant emphasis on not only theoretical knowledge but also practical skills through

the development of dual education and semester-long studies at leading European institutions.

Looking at the Polish Lubelskie and Podkarpackie Voivodeships, it is important to note that their level of education development is significantly higher compared to the Ukrainian border regions. In both voivodeships, the level of education meets European standards. This is primarily facilitated by strict state control over the quality of education and the constant improvement of educational programs. Educational institutions work closely with businesses, ensuring that the education process is practice-oriented and facilitating the quick integration of graduates into the labor market. It is also worth noting that universities in both voivodeships actively collaborate with foreign partners, which strengthens international ties, and students can participate in exchanges and internships, significantly enhancing their qualifications.

The results of the social development assessment for Criterion 6 «Healthcare Development» for 2010–2021 are presented in Figure 7.

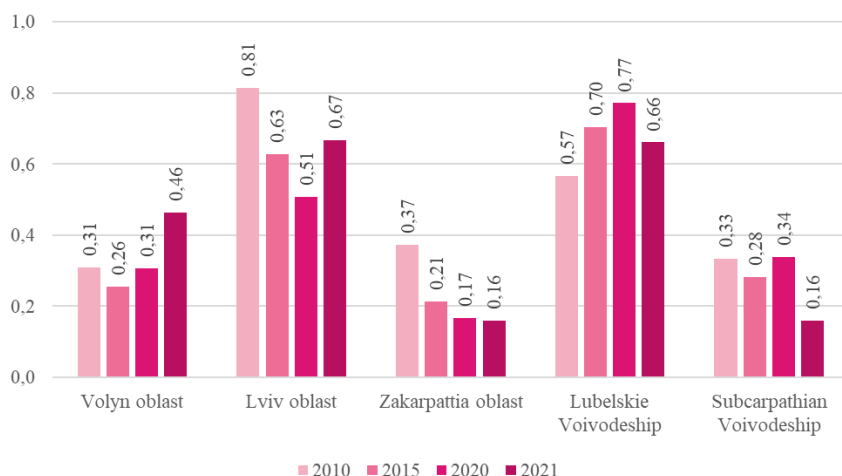


Fig. 7. The results of the comparative assessment of social development of the regions of the Polish-Ukrainian borderland according to Criterion 6 “Healthcare Development” for 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

For Criterion 6 “Healthcare Development,” negative trends are observed in the Zakarpattia Oblast – in 2021, the index was 0.16, which is significantly lower compared to the Volyn and Lviv Oblasts. This may be attributed to the mountainous terrain, the remoteness of some settlements, which complicates access to quality medical care. It is also important to note that social instability negatively impacts public health and the ability to finance the healthcare system. Many hospitals are equipped with outdated

medical equipment, which hampers diagnosis and treatment. The region is also experiencing an acute shortage of specialized doctors, particularly family doctors, which further worsens the healthcare system. The Volyn and Lviv Oblasts are in a much better position – in 2021, their group indices for Criterion 6 “Healthcare Development” were 0.46 and 0.67, respectively, meaning they were at an average to above-average level.

These regions have been affected by nationwide healthcare reforms due to decentralization, the implementation of family medicine, and changes in the funding system. It is also worth noting that Lviv Oblast traditionally has a better material and technical base in hospitals and a more developed network of medical facilities, which is connected to the network of large cities and the relatively higher economic development of the region.

On the other hand, in the Lubelskie Voivodeship, the most stable situation is observed among the Polish border regions for this criterion over the last three periods. In 2020, the “Healthcare Development” index reached its highest level at 0.77, but in 2021 it decreased to 0.66, which indicates that, in general, the healthcare sector in Lubelskie Voivodeship maintains a sufficiently high level of development but requires additional measures to stabilize the situation. In contrast, the Podkarpackie Voivodeship has consistently demonstrated a comparatively low level of healthcare development throughout the entire analyzed period, which was comparable to the level of Zakarpattia Oblast and also requires urgent measures to accelerate its development.

The results of the social development assessment for Criterion 7 “Cultural Development” for 2010–2021 are presented in Figure 8.

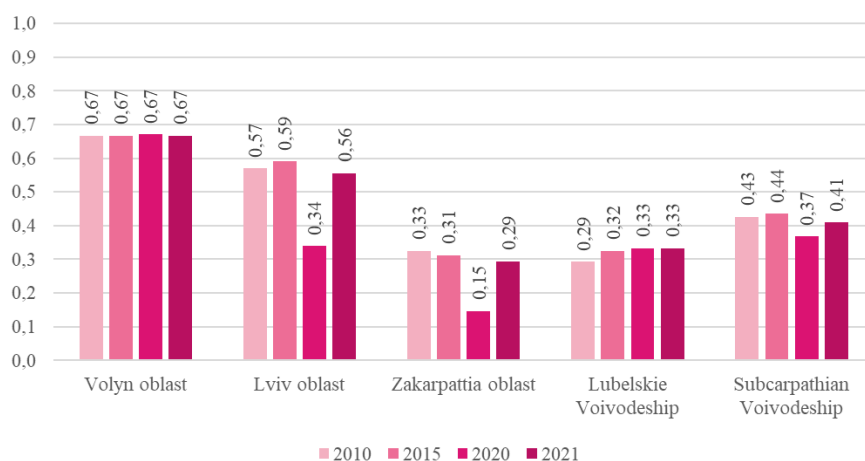


Fig. 8. The results of the comparative assessment of social development of the regions of the Polish-Ukrainian borderland according to Criterion 7 “Development of Culture” for 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

Considering Criterion 7, “Development of Culture,” it is worth noting that Volyn and Lviv Oblasts are rich in historical and cultural heritage. Both Oblasts have preserved unique traditions, but their cultural development has had different paths due to historical, geographical, and socio-cultural factors. Today, the culture of Volyn and Lviv Oblasts is developing quite actively. Traditions are being revived, new cultural centers are emerging, and art, literature, and music are developing. However, there are also certain problems, such as insufficient funding for culture, lack of young talent, and the risk of losing cultural heritage due to the negative effects of the war. Instead, we can see that the indicator “Development of culture” in Zakarpattia Oblast remained quite low throughout the period.

The lowest value was in 2020 and amounted to 0.15. Although the culture of Zakarpattia Oblast is unique and deserves attention and further development. At the same time, there are slight fluctuations in the Polish border regions according to this criterion, but in general, the level of cultural development remained relatively lower than in the Ukrainian Volyn and Lviv Oblasts.

The results of the integrated assessment of the level of social development by all criteria for 2010–2021 are presented in Figure 9.

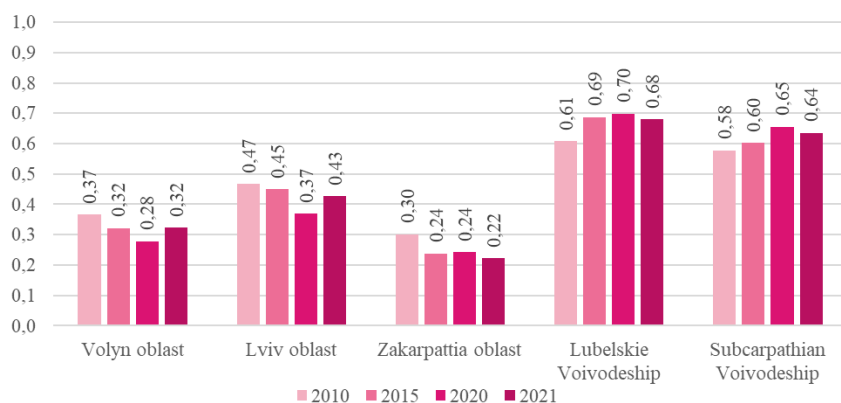


Fig. 9. Results of the integrated assessment of social development of the regions of the Polish-Ukrainian borderland in 2010–2021

Source: based on data from (Statistics Poland, 2024), (State Statistics Service of Ukraine, 2024), (State Statistics Office in Volyn Oblast, 2024), (State Statistics Office in Lviv Oblast, 2024), (State Statistics Office in Zakarpattia Oblast, 2024).

The social development of the regions of the Polish-Ukrainian borderland is a multifaceted and complex process determined by a number of factors, including historical, geographical, economic and political. Regions on both sides of the border are characterized by significant unevenness of social development. As we can see, the border regions of Poland have higher development indicators by a number of criteria

than Ukrainian ones. It is also worth noting that Poland's accession to the European Union has had a significant impact on the social development of the border regions, contributing to the modernization of infrastructure, improving the quality of life and expanding opportunities for cooperation. It is also worth noting that population migration, especially in the border regions of Ukraine to Poland, affects the demographic situation, labor market, and social structure of these border regions.

At the final stage of the study, we will compare in more detail the integral indices of social development in certain regions of the Polish-Ukrainian borderland in 2021 (Fig. 10).

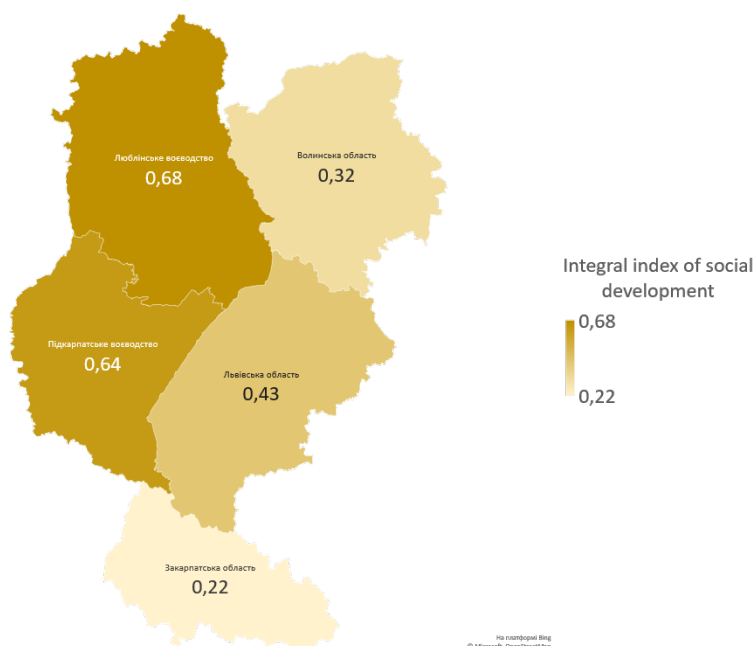


Fig. 10. Comparison of integral indices of social development of the regions of the Polish-Ukrainian borderland in 2021

Source: compiled by the authors.

The figure shows that the highest values of the integral social development index among the regions of the Polish-Ukrainian border in 2021 were observed in the Lubelskie (0.68) and Podkarpackie (0.64) Voivodeships, indicating the achievement of an above-average standard of living, welfare, and quality of life, primarily in the Polish border regions. The border location with developed EU countries contributes to investments and the transfer of technologies.

In contrast, Lviv and Volyn Oblasts are at a lower-than-average level of social development – 0.43 and 0.32, respectively. These levels of social development sug-

gest that these Ukrainian border regions are on the path to improving social living standards. However, for further development, it is necessary to take measures to address existing problems and realize their potential depending on the specific characteristics and challenges of each region. The lowest integral social development index in 2021 was observed in Zakarpattia Oblast (0.22), indicating significant issues in the social sphere in this region, as it has demonstrated a relatively low level of social development throughout the entire period. Therefore, to improve the quality of life for the population, comprehensive measures should be taken to develop the regional economy, social sphere, and infrastructure.

Based on the results of the conducted research, a number of key conclusions can be summarized:

1. The developed methodology for multi-criteria assessment allows for the exploration of social development in border regions from different perspectives based on available statistical data.

2. Polish border regions provide a comparatively higher level of social development according to most of the seven assessment criteria.

3. Ukrainian regions demonstrated a higher or comparable level of social development only for Criterion 1 «Reproduction and longevity of the population» and Criterion 7 «Development of Culture».

4. The results of the multi-criteria assessment can further serve as a foundation for justifying priorities in regional policy and strategies aimed at improving the level of social development in the Polish-Ukrainian border regions.

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STATE AND PROSPECTS FOR THE DEVELOPMENT OF TERRITORIAL COMMUNITIES IN THE UKRAINIAN-POLISH BORDERLAND

The importance of further socio-economic development and strengthening the financial capacity of territorial communities for Ukraine's transformation into a true European state is confirmed by the short but rather successful period after the decentralization reform. The community has become the main primary unit for self-organization of citizens' lives; it has turned out that the effectiveness of community activities depends not only on the available resources and assets, but also on the values, principles, and norms shared by community members. Capable communities are the foundation of a strong country, because it is at the local level that the main economic capital is created and state budget revenues are generated, including for defense needs. Thanks to decentralization, territorial communities have become a full-fledged management entity capable of solving urgent current problems and formulating strategies for further development. The martial law imposed on the territory of the country did not reduce the importance or power of local government instruments, but it significantly changed socio-economic priorities. At the same time, the shift in the focus of community activities to ensuring the safety of their residents and internally displaced persons, protecting vulnerable segments of the population, and organizing many current issues that were not previously inherent in civilian entities has made communities even more united and aware of the challenges facing the state for its survival and preservation.

Theoretical and applied aspects of researching the development issues of territorial communities are a focal point for Ukrainian scholars. Decentralization processes and community development prospects have been addressed in the works of H. Voznyak, Ya. Zhalilo, S. Ishchuk, L. Pronko, T. Kolesnyk, V. Kravtsiv, I. Storonyanska, O. Shevchenko, and others. Efforts to build a sustainable development model for communities, taking into account their inherent natural-resource limitations and potential ecological and social conflicts, are undertaken by I. Bystryakov, V. Holian, and V. Mykytenko. Significant contributions to the theoretical foundations of cross-border and interregional cooperation, as well as the effective functioning of the Ukrainian-Polish borderland, have been made by domestic scholars such as V. Borshchevskiy, Z. Varnalii, M. Dolishniy, I. Zhurba, O. Kopyliuk, A. Maksymenko, I. Tymeckho, V. Pyla, K. Prytula, P. Yansen, and others.

However, given the challenges Ukraine faces due to armed aggression against the state, there is a need to further improve and adapt the theoretical foundations for studying the development prospects of territorial communities in the Ukrainian-Polish borderland. Currently, most domestic research focuses on addressing the socio-economic problems of the border region. Nevertheless, issues related to organizing the livelihoods of territorial communities under the specific conditions of enhanced cross-border cooperation remain unresolved. Ignoring the potentially significant impact of this geographic factor on community development may substantially constrain their future growth.

The relevance of researching the state and prospects of the Ukrainian-Polish borderland development stems from the need to create a new conceptual foundation for the economic development of territorial communities in the context of intensified cross-border cooperation on the one hand and growing threats on the other. These threats include the mass outflow of labor resources, insufficient financial support, misalignment of stakeholders' interests, and the undervaluation of cross-border cooperation potential as a tool for territorial development.

The purpose of this work is to identify the main trends and prospects for the development of territorial communities in the Ukrainian-Polish borderland. Achieving this goal involves the study of the current regulatory framework governing or influencing the livelihoods and development of border communities, an examination of the socio-economic state of these communities, an analysis of key indicators of local budgets and their differentiation, as well as the justification of recommendations and proposals for the further development of territories in the Ukrainian-Polish border region.

The informational basis for this research includes official data from the State Statistics Service of Ukraine, regional state administrations, legislative acts of the Verkhovna Rada of Ukraine, resolutions of the Cabinet of Ministers of Ukraine, documents from the Ministry of Economy of Ukraine and the Ministry of Com-

munities, Territories, and Infrastructure Development of Ukraine, as well as modern studies by domestic and foreign scholars, analytical reviews, and official information portals of territorial communities.

According to the State Regional Development Strategy for 2021–2027, border regions are defined as those directly adjacent to the state border (*State Strategy for Regional Development*, 2024). Border territories are described as spaces of coexistence for various cultures, long-standing neighborly relations, economic ties, and socio-cultural contacts. The formation of border regions is influenced by political, historical, natural, and geographical factors. The military actions in Ukraine have emphasized the importance of studying border regions (communities, territories), which are particularly sensitive to external influences and often remote from decision-making centers.

These regions have taken on the role of a kind of economic rear for other parts of the country. New challenges for border communities in western Ukraine include hosting relocated enterprises and internally displaced persons (IDPs), reorienting the local economy, and ensuring social protection for veterans and displaced populations. Since the onset of the full-scale invasion, Ukraine's land border with the EU (especially its Polish section) has become the primary route for citizen migration and the movement of goods, including arms.

The state border between Ukraine and the Republic of Poland is 535 km long. Ukraine's border regions include Volyn Oblast (bordering Lubelskie Voivodeship in the west), Lviv Oblast (bordering Lubelskie and Podkarpackie Voivodeships), and Zakarpattia Oblast. Border communities are located in seven administrative districts across these three regions (Tabl. 1).

Table 1. General information about the border communities of Ukraine as of 2022

Community	Area, km ²	The number of available population, people			Number of settlements, units				Border crossing points units.
		of all	urban	rural	of all	city	village	settle- ment	
Volyn Oblast									
Velymchenska Rural	110,9	3 744	-	3 744	4	-	4	-	-
Rivnenska Rural	333,5	5 475	-	5 475	17	-	17	-	1
Lviv Oblast									
Belzka Urban	464,5	14 466	3 130	11 336	24	2	22	-	-
Borynska Settlement	638,0	23 141	1 375	21 766	33	-	32	1	-
Dobromylska Urban	293,9	19 618	5 836	13 782	37	1	35	1	1
Mostyska Urban	436,6	31 700	9 103	22 597	63	1	62	-	-
Rava-Ruska Urban	318,6	25 536	8 494	17 042	46	1	45	-	3
Sokal Urban	676,5	51 397	23 985	27 412	60	1	58	1	1
Staryi Sambir Urban	335,8	20 931	7 514	13 417	26	1	24	1	-
Strilkivska Rural	320,4	14 202	-	14 202	21	-	21	-	-

Community	Area, km ²	The number of available population, people			Number of settlements, units				Border crossing points units.
		of all	urban	rural	of all	city	village	settle-ment	
Turka Urban	398,8	22 328	6 925	15 403	25	1	24	-	-
Khyriv Urban	218,0	15 067	4 104	10 963	25	1	24	-	2
Shehynivska Rural	265,2	10 649	-	10 649	30	-	30	-	1
Yavoriv Urban	834,7	51 698	15 892	35 806	82	1	79	2	2
Zakarpattia									
Stavne Rural	299,5	7 002	-	7 002	12	-	12	-	1

Source: compiled by (Profiles of communities and rayons, 2024).

One of the problems of the Ukrainian-Polish border, which has been relevant even before the war, is its insufficient capacity. Even with existing checkpoints, issues remain regarding the organization of international control. In June 2023, the European Commission announced a call for project proposals aimed at improving cross-border infrastructure, including between Ukraine and Poland, Slovakia, Hungary, and Romania. All six projects proposed by Ukraine received approval.

The projects include the modernization of road and rail checkpoints, access roads, truck parking areas, and the procurement of equipment for customs and border control at seven checkpoints, including three on the Polish side (Yahodyn-Dorohusk, Krakivets-Korchowa, and the Mostyska II-Medyka railway checkpoint).

Given the need, Ukraine is also exploring the possibility of opening seven additional checkpoints on the border with Poland: Adamchuky-Zberezhe in Volyn Oblast, and Lopushanka-Mikhnovets, Boberka-Smolnyk, Mshanets-Bandruv, Varyazh-Usmez, Belz-Budynin, and Uhnyv-Dyniska in Lviv Oblast (*Kravchuk, 2023*).

Sociological surveys demonstrate that residents of border communities are aware of the full range of economic advantages of their geographical location, such as the possibility of permanent employment in Poland, the purchase and sale of goods, and even cultural events and tourism. This ignores the opportunities that the proximity of the border provides for the territorial communities themselves for their own development (*Minich, 2019*). The fact that a large proportion of the working-age population in the border areas works abroad significantly reduces the financial capacity of the communities, as the bulk of their budget revenues come from personal income tax. Due to their geographical remoteness from the central regions of the country, where most investment and economic activity is usually concentrated, the border regions of Ukraine (as well as other EU member states) have significantly worse socioeconomic indicators. The main challenges for these territories are increased competition with European goods and services, economic vulnerability of the population, migration, and problems of ethnic minorities (*Territorial Communities, 2020, p.165*). Local budgets of communities are characterized by a high level of subsidization, a higher than average dependence of communities on transfers from

the state budget, low volumes of own revenues and, as a result, an excessive share of community management costs.

The purpose of the empirical part of the study is to determine whether the prospects for socio-economic development of a border community depend on its location – namely, on the presence of international border crossing points and border control on its territory. Accordingly, a scientific hypothesis has been formed according to which the presence of state border crossing points on the territory of a community has a positive impact on its economic condition, financial capacity and further development prospects.

To achieve the research goal, the border communities were divided into transit communities (those that have checkpoints and border control) and isolated communities (those that are remote, peripheral, and do not have such checkpoints). According to the scientific hypothesis, transit communities are more economically developed, as the population is constantly migrating through their territory, transport networks are actively used, and logistics centers for the transit of goods and the provision of relevant services have been formed. If the border areas do not have state border crossing points, they are likely to become depressed, as migration of people, goods, and services is minimal in such communities. Due to their location, these communities are essentially on the margins of the region's active socio-economic life, and only local residents drive economic processes.

To prove (or disprove) the scientific hypothesis, a list of key socio-economic indicators of the state and development prospects of transit and isolated border communities has been identified. To enable comparative analysis, the indicators were converted into relative values. These indicators primarily include data on local community budgets, specifically:

- total budget expenditures per capita (UAH);
- budget subsidy level (%);
- own revenues of communities per capita (UAH);
- capital expenditures per capita (UAH);
- share of capital expenditures in the total volume of local budget expenditures (%);
- share of payroll expenditures in the total volume of expenditures (%);
- expenditures on administrative staff per resident (UAH);
- share of administrative staff expenditures in relation to tax and fee revenues (%).

For further empirical analysis, the border territorial communities of Lviv Oblast were selected. Using the local statistics portal (*Profiles of communities, 2024*) it was determined that out of 79 communities in Lviv Oblast, 12 are border communities: Belzka Urban, Borynska Settlement, Dobromylska Urban, Mostyska Urban, Rava-Ruska Urban, Sokal Urban, Saryi Sambir Urban, Strilkivska Rural, Turka Urban,

Khyriv Urban, Shehynivska Rural, and Yavoriv Urban. It is worth noting that regardless of whether the community is urban or rural, rural populations predominate numerically in all of them (Table 1). In total, there are 10 state border checkpoints between Lviv Oblast and Poland, but they are located in only 6 of the 12 border communities in this region: Dobromylska (Nyzankovychi checkpoint), Rava-Ruska (3 checkpoints), Sokal (Uhryniv), Khyriv (Khyriv and Smilnytsia), Shehynivska (Shehyni), and Yavoriv (Hrushiv and Krakivets checkpoints).

An analysis of local budget indicators for the border territorial communities of Lviv Oblast shows a certain dependency of their financial capacity on the type of community. For instance, the highest total local budget expenditures per capita were observed in the transit communities of Yavoriv (29.8 thousand UAH) and Shehynivska (14.7 thousand UAH). These same communities also demonstrated the best performance in terms of own revenues, capital expenditures, the share of administrative costs in total expenditures, and budget subsidy levels compared to the other communities analyzed. Conversely, the worst budget subsidy level and own revenue indicators were found in the isolated Strilkivska community, with a subsidy rate of 62.1% and own revenues of 2,074 UAH per capita. Detailed specific and relative indicators of local budgets are summarized in Table 2.

Table 2: Indicators of local budgets of the border territorial communities of the Lviv Oblast as of the end of 2023.

Community	Total expenditures per capita, UAH	Level of subsidization, %	Own revenues of communities per capita, UAH	Capital expenditures per capita, UAH	Share of capital expenditures in total expenditures	Share of wages in total expenditures, %	Management expenses per 1 employee, UAH	Share of management expenses in taxes and fees, %
Belzka	10 322	14,7	5 864	1 845	0,179	61,62	1 156	20,54
Borinska	9 627	42,3	3 170	1 392	0,145	68,66	1 170	43,83
Dobromylska	7 925	49,6	2 832	965	0,122	64,29	776	29,20
Mostiska	11 436	23,5	5 546	1 244	0,109	62,32	1 108	21,71
Rava-Ruska	11 058	22,2	5 974	687	0,062	68,21	1 052	21,00
Sokalska	9 893	12,1	5 873	582	0,059	62,37	4 258	10,78
Starosambirska	11 811	22,9	5 922	1 814	0,154	63,01	1 361	23,58
Strelkivska	9 148	62,1	2 074	1 282	0,140	65,72	1 013	36,01
Turkivska	12 717	33,1	4 301	1 652	0,130	58,84	1 059	28,34
Khyrivska	9 365	47,2	2 980	681	0,073	74,79	1 107	38,50
Shehynivska	14 706	6,9	13 742	2 741	0,186	54,49	2 006	15,65
Yavorivska	29 839	-29,2	23 383	13 745	0,461	23,34	1 045	5,00

Source: calculated by the authors based on (Profiles of communities, 2024).

At the same time, there is no clear correlation between the financial capacity of communities and the presence of international checkpoints on their territory – at least

not for every indicator analyzed. For example, the transit community of Khyriv has the smallest share of wages in total expenditures (74.8%), with only UAH 9.4 thousand of total expenditures and UAH 2.9 thousand of own community revenues per capita. The level of subsidization of this community's budget is also one of the highest (47.2%). A comparative analysis of the average values of financial indicators for different types of communities proves the validity of the presented scientific hypothesis.

Thus, the group averages of total local budget expenditures for transit and isolated communities deviate from the overall average by 12%, own community revenues by 34%, capital expenditures by 36%, and management expenditures by 20% (Tabl. 3).

Table 3: Average values of group indicators of local budgets of border territorial communities of Lviv Oblast and deviations from the average for the aggregate

Indicator	Isolated	Transit	Total	Deviation from Average
Total expenditures per capita, UAH	10 844	1 3797	12 320	1477
Subsidy level, %	33,1	18,1	25,6	8
Own revenues of communities per capita, UAH	4 480	9 131	6 805	2326
Capital expenditures per capita, UAH	1 538	3 234	2 386	848
Share of capital expenditures in total expenditures	0,143	0,161	0,152	0,009
Share of wages in total expenditures, %	63,36	57,92	60,64	3
Administrative expenditures per capita, UAH	1 144	1 707	1 426	281
Share of administrative expenditures in tax and fee volumes, %	29	20,02	24,51	4

Source: calculated by the authors based on (Profiles of communities, 2024).

Since the specific (relative) indicators of local budgets were chosen for the analysis, the average values are less representative than the ordinal values. Therefore, we additionally calculated the ranks of the border territorial communities of the Lviv Oblast by local budget indicators (Tabl. 4).

Table 4. Ranking of border territorial communities in Lviv Oblast by local budget indicators

Community	Total expenditures per capita, UAH	Subsidy level, %	Own revenues of communities per capita, UAH	Capital expenditures per capita, UAH	Share of capital expenditures in total expenditures	Share of wages in total expenditures, %	Administrative expenditures per capita, UAH	Share of administrative expenditures in tax and fee volumes, %
Transit Communities								
Dobromyl	XII	XI	XI	IX	VIII	VIII	I	IX
Rava-Ruska	VI	V	III	X	XI	X	IV	V
Sokal	VIII	III	V	XII	XII	VI	XII	II
Khyriv	X	X	X	XI	X	XII	VI	XI
Shehynivka	II	II	II	II	II	II	XI	III
Yavoriv	I	I	I	I	I	I	III	I

Community	Total expenditures per capita, UAH	Subsidy level, %	Own revenues of communities per capita, UAH	Capital expenditures per capita, UAH	Share of capital expenditures in total expenditures	Share of wages in total expenditures, %	Administrative expenditures per capita, UAH	Share of administrative expenditures in tax and fee volumes, %
Isolated Communities								
Belz	VII	IV	VI	III	III	IV	VIII	IV
Borynia	IX	IX	IX	VI	V	XI	IX	XII
Mostyska	V	VII	VII	VIII	IX	V	VII	VI
Starosambir	IV	VI	IV	IV	IV	VII	X	VII
Strilkivska	XI	XII	XII	VII	VI	IX	II	X
Turkivska	III	VIII	VIII	V	VII	III	V	VIII

Source: calculated and compiled by the authors on the basis of data (Profiles of communities, 2024).

Based on the ranking, a total score has been calculated for each community, where the minimum (best) score is 10, and the maximum (worst) score is 80 points. The ranking of communities from best to worst based on the total score allows us to determine that the transit geographic location of a community does indeed contribute to its financial capacity, although to a minor extent. Excluding certain financial indicators from the analysis – namely capital expenditures per capita and the share of capital expenditures in total expenditures – significantly improves the validity of the scientific hypothesis (Tabl. 5).

Table 5. Ranking Results of Communities Depending on the Inclusion or Exclusion of Capital Expenditure Indicators from the Analysis

Rank	With capital expenditures indicators			Without capital expenditures		
	Community	Total rating	Type of community	Community	Total rating	Type of community
1	Yavoriv	10	Transit	Yavoriv	10	Transit
2	Shehynivka	26	Transit	Shehynivka	30	Transit
3	Belz	39	Isolated	Belz	44	Isolated
4	Starosambir	46	Isolated	Starosambir	46	Transit
5	Turkivska	47	Isolated	Turkivska	48	Isolated
6	Rava-Ruska	54	Transit	Rava-Ruska	51	Isolated
7	Mostyska	54	Isolated	Mostyska	51	Isolated
8	Sokal	60	Transit	Sokal	56	Transit
9	Dobromyl	69	Transit	Dobromyl	71	Transit
10	Strilkivska	69	Isolated	Strilkivska	77	Isolated
11	Borynia	70	Isolated	Borynia	78	Isolated
12	Khiviv	80	Transit	Khiviv	80	Transit

Source: calculated and compiled by the authors on the basis of data (Profiles of communities, 2024).

It should be noted that the aggregate community rating calculated after removing capital expenditure indicators from the analysis was brought to the previous

conditions, according to which the highest community rating was 10 points, and the lowest was 80 points. For this purpose, the formula of the canonical straight line equation was applied:

$$\frac{x-x_a}{x_b-x_a} = \frac{y-y_a}{y_b-y_a} \quad (1)$$

Substituting the actual data into equation (1) ($x_a=8$, $y_a=10$, $x_b=49$, $y_b=80$), we get the equation of the line with the slope coefficient:

$$y = (1,7x - 3,66) \quad (2)$$

For further assessment of the development prospects of border communities, it is important to first analyze the current conditions of their economic activities – specifically, the number of legal entities operating within the communities, as well as the potential for tourism and recreation development. The latter is considered one of the most effective directions for the development of rural areas in general (Khvesyk *et al.*, 2019) and in the context of post-war recovery (Ilyina & Shpylyova, 2023). To assess the prospects for tourism and recreation development, indicators such as the area of protected natural areas and the number of cultural heritage sites have been chosen.

As of the end of 2023, there were significantly more legal entities operating in the territory of transit border communities in Lviv Oblast compared to isolated communities (2,866 entities vs. 1,985 entities, respectively). Similarly, the territory of transit communities includes a substantially larger number of cultural heritage sites compared to isolated communities (289 vs. 166, respectively). This indicates significantly greater prospects for further economic and tourism development in transit border communities compared to border communities without international control points on their territory (Tabl. 6).

At the same time, we should note the significant disparity between communities in terms of the area of protected natural areas. An exceptional case in this regard is the Borynia settlement community, more than half of whose territory is designated as a protected area (National Nature Park «Boykivshchyna,» Regional Landscape Park «Nadsyansky»). Furthermore, the development of the recreation industry is supported by the presence of various mineral springs in the community's territory («Naftusia,» «Yessentuki,» etc.). The rest of the border communities, grouped into transit and isolated communities, have approximately the same average indicators for the area of protected natural areas.

Table 6. Socio-Economic Conditions of Communities in Lviv Oblast as of the End of 2023

Territorial Community	Number of Legal Entities	Area of Protected Natural Areas (ha)	Number of Cultural Heritage Sites per 1,000 People	Number of Cultural Heritage Sites
Belz	222	153,8	1,7	38
Borynia	218	33 985,52	0,3	17
Dobromyl	291	366,82	1	46
Mostyska	686	14,32	0,3	37
Rava-Ruska	387	7 810,6	0,8	57
Sokal	892	3 097,1	0,3	93
Starosambir	418	6 092,4	0,5	24
Strilkivska	146	10 209,05	1	23
Turkivska	295	572,94	0,5	27
Khiriv	177	2 626,53	0,8	22
Shehynivka	212	25,3	1,1	13
Yavoriv	874	2 659,55	0,2	58

Source: calculated by the authors based on (Profiles of communities, 2024).

The development of territorial communities can be defined as a purposeful change in the economic, environmental, demographic, social, cultural, household, and institutional conditions of their functioning with the aim of improving the level and quality of life for residents. However, under current conditions, community development in Ukraine should be understood as the creation of the foundations and the formation of strategic (long-term) capacity for communities to independently overcome current challenges, fully utilize available economic opportunities, and improve social living conditions.

It should be noted that any, even the poorest and most remote border community, has certain resources and assets. These may include land, forests, rivers or lakes, enterprises, roads, capital buildings, cultural and historical heritage, young and mobile populations, etc. The mere presence of these resources does not automatically guarantee the prosperity of a community; the key factors are the ability, capacity, and orientation towards attracting, utilizing, preserving, and reproducing these assets. We will define the key parameters of community management to ensure their development:

- a shared vision of how to utilize available resources. For example, a community may view the construction of an industrial enterprise on its territory as an opportunity to improve the economic situation of its residents, create jobs, and increase revenue to the local budget. On the other hand, the community may assess the prospects of building an industrial facility negatively – as a source of environmental pollution and depletion of natural resources. The same applies to the creation of new border crossing points, which may not only stimulate the activation of community life but also lead to increased crime rates, migration of ethnic groups, and the destruction of the local transport network. Therefore, the implementation of any

community development measures requires the prior formation of a shared vision of the community's future among most of its members;

- the administrative powers should include the ability to manage the community's resources and assets (land, capital, infrastructure), as well as the capacity to collaborate with various organizations and institutions – health care and educational institutions, private entities, non-profit organizations, etc.;

- established communication channels within the community enable effective public discussions, which help to consider various viewpoints, conduct a comprehensive analysis of issues, make compromise decisions, and timely adjust local development strategies.

Thus, community development includes the following stages:

- 1) accumulation of capital and assets that enhance the community's capacity, as well as their evaluation;
- 2) identification of the active core of the community (local government bodies, informal leaders) and mobilization of the remaining residents around it;
- 3) formation of a shared vision for the future of the community;
- 4) development of a community development strategy and action plan;
- 5) implementation of the strategy (action plan, programs, projects, measures), monitoring, evaluation of results, and adjustment of the strategy (if necessary) (Khvesyk et al, 2019).

It is clear that in practice, community development is a much more complex and less predictable process; in the case of border communities, planning their development is complicated by numerous challenges and unpredictable external influences. Modeling the development of border communities under current domestic conditions is a promising area for further scientific research. At present, it should be noted that a significant advantage for communities in the Ukrainian-Polish border region is access to certain resources and assets (transport and logistics network, goods, active migration of population, including labor migration), as well as the opportunity to participate in programs funded by the European Union under the neighborhood policy. Some territorial communities in Ukraine are already implementing projects under such cross-border cooperation programs. These projects are mostly focused on improving community governance, healthcare, road infrastructure development, environmental security, tourism, recreation, and culture. The projects are usually co-financed by local, regional, and state budgets.

The Law of Ukraine «On International Territorial Cooperation of Ukraine» (*On international territorial cooperation, 2024*) states that the purpose of such cooperation is to form and deepen neighborly, mutually beneficial relations that will contribute to the joint resolution of local, regional, and national development tasks. The subjects of cooperation are local executive authorities and local self-government bodies of Ukraine, which interact with the corresponding authorities of foreign states in accor-

dance with an agreement on international territorial cooperation. According to this law, territorial communities are the main subjects of cooperation; their powers include:

- concluding agreements on international territorial (interterritorial, cross-border, transnational) cooperation and ensuring their implementation;
- preparation, implementation, and coordination of projects and programs for international territorial cooperation;
- establishment of bodies for international territorial cooperation;
- approval of decisions regarding the financing of the activities of territorial cooperation bodies, allocation of funds from local budgets for the development of international territorial cooperation;
- approval of decisions regarding membership in relevant international associations and other organizations;
- making proposals for organizing cross-border trade.

The adoption of this law has created conditions for the effective solution of many local and regional development tasks of the subjects of inter-territorial and cross-border cooperation, including territorial communities. The development of such cooperation will eventually make it possible to overcome the negative trends inherent in the territorial communities of the Ukrainian-Polish borderland. These trends include underestimation of the importance of the territorial community as a subject of cross-border cooperation, inefficient use of mechanisms and instruments of cross-border cooperation, conflicts of interest within communities, and the ongoing outflow of human resources.

According to the State Strategy for Regional Development for 2021–2027 (*State Strategy for Regional Development, 2024*) the national priorities for the development of Ukraine's territories include strengthening social, humanitarian, economic, and spatial cohesion, increasing the level of security and well-being of citizens through the restoration of infrastructure and modernization of the community economy, effective use of the internal potential of the territories, and the development of democratic, decentralized, and multi-level governance. The priorities of regional development are human capital development, restoration of entrepreneurial activity, involvement of the internal potential of territories and regional specializations, building partnerships, inter-municipal, interregional and cross-border cooperation, attracting investments, and restoring the social service delivery system.

Considering the above, one of the important priorities for the communities in the Ukrainian-Polish border region could be the diversification of the rural economy (creation of agricultural production, support for other types of activities) and improving energy efficiency, including for individual households. A particular challenge will be that the improvement of living standards will occur simultaneously with the optimization of the network of educational and cultural institutions, healthcare centers, and administrative service centers. Another task is to balance the structure of the

local economy – the number and capacity of wholesale, retail trade establishments, and industrial enterprises. The restoration of transport infrastructure will enable the creation of new border crossing points, including pedestrian ones. The construction of large logistics centers not only in the transit communities, near crossing points, but also in adjacent isolated communities, will, in turn, lead to the creation of transport and transport-repair enterprises. When building logistics centers, it is advisable to provide for the creation of modern warehouse infrastructure, dry ventilated rooms, refrigeration systems, and grain storage facilities. Networks of small enterprises for primary processing of products, their packaging, labeling, etc., can be created based on these warehouses. Such projects can partially reduce the economic disparity between transit and isolated border communities and contribute to the further development of cross-border cooperation and cooperation between communities.

The current domestic regulatory and legal framework offers territorial communities in general, and border communities in particular, sufficient tools and mechanisms to improve their socio-economic conditions. Legislation has been adopted that regulates cross-border cooperation and cooperation between communities. However, given the number of challenges facing the state and society, Ukraine's border communities are developing unevenly, not fully utilizing their available resources, assets, and geographic advantages. These communities more often face issues such as uncontrolled population outflows, loss of human capital, and low local budget revenues, which are formed from taxes paid by individuals working within their territories.

The empirical analysis of the local budgets of border territorial communities in the Lviv Oblast allowed for the differentiation of communities into transit and isolated ones, based on the presence of international crossing and control points within their territory. It was concluded that transit communities have better local budget indicators due to more active economic activity and a better-developed transport and logistics infrastructure. However, neither transit nor isolated border communities fully utilize their development potential. Promising areas for their further development include more active participation in cross-border cooperation programs, implementation of cooperation projects between communities, development of transport and logistics infrastructure, and diversification of economic activities—particularly in the areas of agricultural production and manufacturing industry.

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THE STATE OF DIGITALIZATION OF THE ECONOMY IN THE REGIONS OF THE POLISH-UKRAINIAN BORDERLAND

The Polish-Ukrainian border is an important economic and transport corridor for both countries and the European Union. Digital transformation can significantly improve cross-border trade by reducing customs clearance time, implementing automated control systems, and enhancing logistics processes. Digital technologies, such as monitoring systems, biometric data, and artificial intelligence, can help ensure better border control. This is especially important in the context of the increasing flows of migrants and threats of cross-border crime, such as smuggling and illegal migration.

Due to the war in Ukraine, the Polish-Ukrainian border has become a crucial humanitarian and logistics route for delivering aid. Digital solutions can contribute to more efficient management of humanitarian assistance, as well as provide transparency and real-time coordination between countries.

Digitizing administrative services at the border can make life much easier for citizens of both countries. For example, electronic queues at border crossings, digital visas, or ID cards can reduce waiting times and bureaucratic difficulties. Digital transformation fosters innovation and the development of the IT sector in border areas. This creates new opportunities for business development, investment, and job creation, particularly in the fields of IT and technology.

The development of digital infrastructure at the border is an important step in Ukraine's European integration process. It brings Ukraine closer to European standards in the fields of digital services, transport, and security. Poland, as an EU member, can become a key partner in this process, supporting Ukraine in implementing advanced technologies and standards. Digitalization also allows for the implementation of «green» technologies at the border, reducing the environmental impact of transport and infrastructure. This promotes sustainable regional development and supports EU environmental policies.

The introduction of digital technologies into Ukraine's economy is highlighted in the works of V. P. Vyshnevskyi, O. M. Harkushenko, S. I. Knyaziev, D. V. Lypnytskyi, and V. D. Chekin, where they explored information and communication technologies and their role in the development of the digital economy (*Digitalization of Ukraine's economy*, 2020). The issues of digitalization have also been addressed by leading scientists such as O. I. Amosha and O. V. Pankova, who examined the digitalization of Ukraine's socio-labor sphere as a way to ensure sustainable development (*Amosha & Pankova*, 2020). Digital transformation has been studied by Polish scholars such as Adamus-Matuszyńska A., Rydzak W., and Tworzidło D., who explored integrated marketing communications and public relations in the era of digitalization (*Adamus-Matuszyńska et al.*, 2023). Dusz-Prieto, E. analyzed the use of modern technologies in sustainable marketing (*Duś-Prieto*, 2024).

Despite the significant contributions of these authors, the issue of digital transformation of the Polish-Ukrainian border region requires further study, as it is essential for the successful implementation of digital projects, improving border processes, enhancing security, as well as supporting humanitarian aid and economic integration. These studies will help identify current problems and develop strategies for their resolution.

The aim of the research is to study the state of digitalization of the economy in the Polish-Ukrainian border regions based on available information sources.

The Ministry of Digital Transformation of Ukraine has developed a digitalization index, which determines the level of digital transformation of Ukrainian society (*Ministry of Digital Transformation*, 2024). This index includes five indicators: the digital economy of territorial communities, the development of digital skills among the population, digital infrastructure, digitalization of public services, and digital transformation of local government bodies.

The model for calculating the digitalization index includes:

1. Calculation of indicators. At this stage, baseline data for each indicator are collected. Indicators can represent different aspects that need to be assessed.
2. Normalization of indicators. Since different indicators may have different units of measurement, it is necessary to bring them to a common scale. Common normalization methods are used for this purpose.
3. Convert the value to a 100-point scale. After normalization, convert the values of the indicators to a 100-point scale for a better understanding of the results by multiplying the normalized value by 100.
4. Weighting of indicators and calculation of subgroups. To calculate the total values of a group of indicators, we apply weighting, as different indicators may have different levels of importance.
5. Calculating the group. After each indicator or subgroup of indicators is calculated and weighted, we calculate the arithmetic mean.

6. Group weighting and calculation of the Index. The value of the group is multiplied by the group's weighting factor and added.

The indicator of the digital economy of territorial communities analyzes the ability of a territorial community to support the development of the information technology sector and reflects the community's capacity to create favorable conditions for the growth of the IT sector and the establishment of modern digital infrastructure. This includes the availability of resources, policies, and strategies that support the development of the IT industry at the local level.

The main aspects of such capacity are the development of human capital, which includes the training of IT specialists at local educational institutions (universities, technical schools, courses), support for young professionals and startups through grants, competitions, or other forms of support, cooperation with IT companies for internships and training programs, the development of the entrepreneurial environment, support programs for the development of small and medium-sized IT businesses, simplified administrative procedures for opening businesses and obtaining permits, and opportunities to attract investments (including foreign investments).

Digital governance aims to use e-services and digital platforms to simplify the interaction between citizens, businesses, and local authorities, the opening of data, and the opportunities to analyze and use such data in creating new IT solutions.

The indicator of digitalization of the economy of territorial communities also includes the creation of IT communities, organizing hackathons, technical forums, conferences, supporting startups and innovative projects, and fostering collaboration between the community, educational institutions, and private companies to develop the IT ecosystem. The formation of a developed IT ecosystem means creating an environment where various participants (educational institutions, enterprises, investors, government) actively collaborate to develop innovations and implement new technologies, ensuring economic growth and attracting specialists.

Now, let us examine the development of this index in the territory of the Ukrainian border regions (Fig. 1).

The analysis of the data presented in Figure 1 shows that the highest digitalization index of the territorial community economy in the Ukrainian border regions in 2023 is observed in Lviv Oblast, with a score of 2.65 points, while the figure for Volyn Oblast is 0.96 points. The lowest score is recorded in Zakarpattia Oblast, with only 0.66 points.

The next indicator that determines the level of digital transformation of Ukrainian society is the development of digital skills of the population. This involves creating conditions and opportunities for citizens of the territorial community to actively use digital technologies in their daily lives, work, and education. It also includes providing support for those who wish to develop in the IT field and improve their digital literacy.

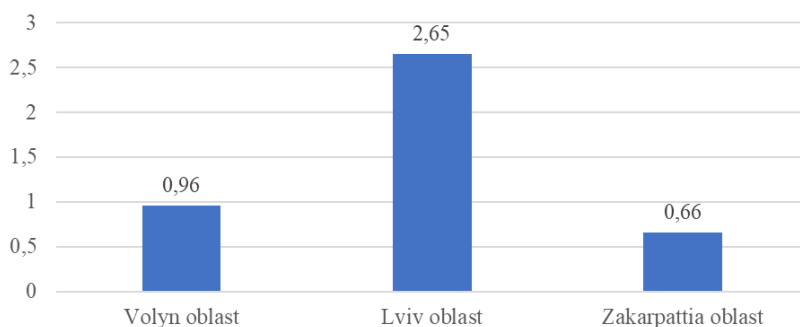


Fig. 1. Comparison of the index of digitalization of the economy of territorial communities in the regions of the Ukrainian border in 2023

Source: compiled by the author based on (Index of Digital Transformation of Territorial Communities, 2024).

The main aspects of this process are the improvement of digital literacy, which includes creating educational programs, organizing courses, training sessions, and webinars for various categories of the population to help them acquire both basic and advanced digital skills, such as working with computers, the internet, electronic documents, and online payments.

Education for different age groups: special attention is given to young people, elderly citizens, and vulnerable groups of the population to ensure they can effectively use modern technologies in everyday life.

The development of digital skills of the population also takes into account digital security, that is, teaching citizens the rules of safe behavior online, protecting personal data, and maintaining privacy. The improvement of digital skills involves active support for citizens who want to develop in the IT field. IT training programs are being created, courses and programs are being introduced for those who want to gain knowledge and skills in programming, web design, data analytics, cybersecurity, and other IT specializations.

Improving digital skills includes periodic internships and gaining practical experience: providing opportunities for internships in local IT companies or through joint projects with educational institutions helps people acquire knowledge in digitalization. Organizing mentorship programs allows creating communities where experienced IT professionals help newcomers develop their skills and advance in their careers. Furthermore, support for entrepreneurship and innovation is promoted by establishing incubators and accelerators, creating platforms for supporting startups and new IT businesses, where citizens can obtain funding, consultations, and technical support. Grants and financing programs are provided, offering financial assistance to people who want to start their own IT business or develop their ideas. Technical support is ensured to provide access to resources such as computers, software, and the internet for those who cannot afford to purchase them independently.

Digital services for citizens are implemented, such as e-services, which involve creating online platforms for providing state and municipal services (for example, submitting documents, obtaining permits), which will ease citizens' access to administrative procedures. Platforms for learning and self-development are being formed, and digital platforms for distance education are being developed, where citizens can gain new knowledge and certifications in various fields, including IT.

Thus, supporting citizens in the field of digitalization involves creating conditions for the development of their digital skills, promoting employment in the IT sector, and providing access to modern technologies and resources. This enhances the competitiveness of the community and promotes economic growth through human capital development. The change in the index of the development of digital skills of the population in the Ukrainian border regions is shown in Figure 2.

The analysis of the data presented in Figure 2 shows that the development of digital skills of the population in the Ukrainian border regions in 2023 reached 3.75 points in Lviv Oblast. Lower indicators were observed in Volyn and Zakarpattia Oblasts, with scores of 2.86 and 2.05 points, respectively.

The next indicator, which characterizes the level of digitalization in the Ukrainian border regions, is the index of digital infrastructure development. This involves the creation of physical and digital resources that support the implementation of digital technologies in the community and ensure the security of using these technologies. This infrastructure enables citizens to actively use digital services while maintaining their security and privacy.

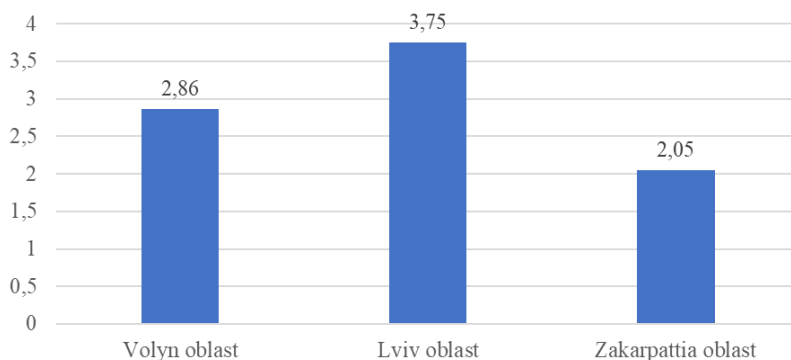


Fig. 2. Comparison of the index of digital skills development in the regions of the Ukrainian borderland in 2023

Source: compiled by the author based on (Index of Digital Transformation of Territorial Communities, 2024).

The main components of such infrastructure include physical infrastructure, which involves access to the internet: ensuring reliable and high-speed internet for

citizens, especially in remote and rural areas. This may include setting up Wi-Fi zones in public places (parks, libraries, schools).

The formation of digital service centers involves the creation of access points to digital technologies (for example, in libraries or community centers), where residents can access computers, the internet, and receive assistance in using digital services.

The creation of co-working spaces and hubs implies the organization of workspaces for freelancers, startups, and IT professionals, which helps to support the development of the digital economy at the local level.

Digital infrastructure includes electronic platforms for providing services through the implementation of online platforms for interaction between citizens and authorities (e-government), and for obtaining administrative services such as document registration, tax payments, or utility bill payments.

The implementation of technologies for data protection, personal information security, and ensuring user privacy, such as data encryption, secure payment systems, and authentication systems, is also a key aspect of digital infrastructure.

Digital education centers are formed, meaning places where citizens can learn to use digital technologies, take IT qualification enhancement courses, or receive consultations on using digital services. Digital literacy programs are licensed. Regular training sessions and seminars on digital security and the use of online resources are organized for different age and social groups, including elderly people and children.

The reliability of the cybersecurity system is ensured to prevent hacking attacks, data breaches, and cybercrime. This may include installing software to detect threats and ensure cybersecurity at the community level. Policies for protecting citizens' personal data are implemented to avoid illegal use or leakage of personal information online. The security of electronic transactions is supported by creating secure systems for conducting online payments and other financial operations.

Digital infrastructure is very important as it expands access to technologies and provides every community member with the opportunity to access digital tools and services, even if they do not have their own technical resources. Thus, the infrastructure for digitalization is a key element in building a modern, secure, and technologically advanced society that is prepared for the challenges of the digital age.

Let us now analyze the change in the index of digital infrastructure on the territory of the Ukrainian border regions in 2023, as shown in Figure 3.

The analysis of the data presented in Figure 3 demonstrates that the highest digital infrastructure index in the Ukrainian border regions in 2023 is observed in the Zakarpattia Oblast, with a score of 5.83 points. In comparison, the Volyn Oblast recorded 5.79 points, and the Lviv Oblast scored 5.6 points.

Next, we will characterize the digitalization of public services in the Ukrainian border regions. As a result of this digitalization, community residents can receive various administrative, social, and other services online through internet platforms,

mobile applications, or other digital tools. This makes the process of interacting with authorities and organizations more accessible, efficient, and secure.

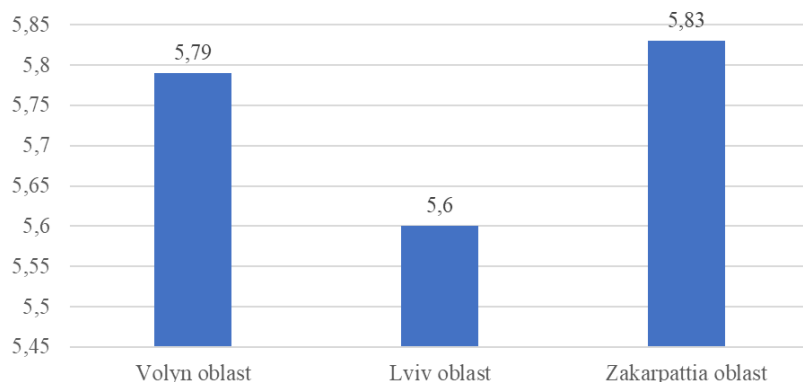


Fig. 3. Comparison of the Digital Infrastructure Index in the Ukrainian border regions in 2023

Source: compiled by the author based on (Index of Digital Transformation of Territorial Communities, 2024).

The key elements of such a system include the accessibility of services 24 hours a day, seven days a week. Citizens can use digital services at any convenient time, without the need to visit community offices physically. They can access services through mobile apps or from any internet-connected device, allowing people to perform operations on the go.

An essential element for digitalizing public services is the availability of a single portal or platform where all necessary community services are gathered, allowing citizens to solve all issues in one place without needing to approach various institutions. Platforms should be designed in a way that is easy to use, even for those with low levels of digital skills. This includes clear instructions, user-friendly menus, and a simple navigation process. Users should be able to perform the necessary operations with minimal steps, filling out only required data and receiving services as quickly as possible. Some processes, such as document verification or receiving results, may be automated, allowing citizens to obtain necessary outcomes faster.

All digital services should be developed in line with high cybersecurity standards. Personal data of citizens must be protected from unauthorized access, use, or leakage. If services include payments (e.g., tax or utility payments), secure payment systems with reliable authentication methods and data encryption should be used. For accessing certain services, multi-factor authentication (e.g., through an SMS code or digital signature) may be implemented, further enhancing user account protection. Citizens can have personal accounts on the platform, where their history of interaction with services is stored, simplifying access to previous information and reducing the need to re-enter data. The system can automatically send notifications (via SMS,

email, or apps) about important events, such as deadlines for document submission, tax payments, or obtaining certificates.

The use of digital technologies allows significantly reducing the time required to process applications, verify documents, and obtain services, compared to traditional offline procedures. Users can track the status of their applications or requests online, which increases trust in the system and reduces the risk of corruption or delays.

Examples of digital services that can be accessed through such channels include registering a place of residence or obtaining a certificate, submitting applications for subsidies, social assistance, or other social services, paying utility bills, taxes, fines, registering a business, obtaining permits or licenses, submitting petitions or appeals to local authorities. Digital channels for accessing services provide convenient, fast, and secure access to government and municipal services. This contributes to improving the quality of service, enhancing interaction between authorities and citizens, and creating more transparent and efficient management at the community level.

Let us now analyze the change in the index of digitalization of public services in the Ukrainian border regions in 2023 (Fig. 4).

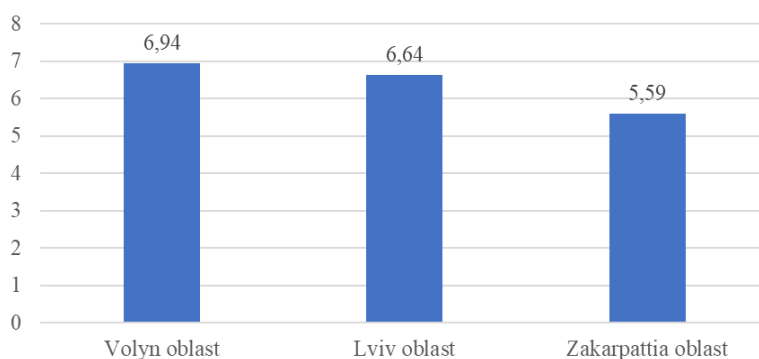


Fig. 4. Comparison of the index of digitalization of public services in the regions of the Ukrainian border in 2023

Source: compiled by the author based on (Index of Digital Transformation of Territorial Communities, 2024).

The analysis of the data in Figure 4 shows that the indicator for the digitalization of public services in 2023 in the Volyn Oblast was 6.94 points, in the Lviv Oblast it was 6.64 points, and in the Zakarpattia Oblast, it was 5.59 points.

Another indicator that characterizes the digitalization of the Ukrainian border regions is the digital transformation of local government authorities. It allows for the implementation of digital solutions and tools to improve the functioning of local government bodies and provides citizens with opportunities to directly influ-

ence local government decisions. This contributes to more effective management, transparency, and greater citizen involvement in decision-making processes at the local level.

The electronic petition system allows citizens to submit petitions online through special platforms. If a petition gathers enough signatures, it is considered by local authorities.

Public discussions and voting involve the creation of digital platforms where residents can discuss key community issues, express their opinions, and vote on various initiatives, projects, or changes (e.g., regarding landscaping, budgeting, new projects).

Participatory budgeting allows citizens to submit proposals for the use of part of the local budget for specific projects (e.g., park construction, infrastructure repair). Through online voting, residents decide which of these projects will be implemented.

The digitalization of internal processes within local government authorities improves the efficiency of administrative bodies, makes their activities more transparent, and facilitates interaction between various departments.

The introduction of systems for exchanging and storing documents electronically within local government authorities accelerates decision-making processes, ensures document security, and prevents the loss of paper copies.

Digital personnel management systems enable the tracking of working hours, employee performance evaluation, work planning, and communication between departments. Online platforms for internal meetings allow for the use of video conferences, online chats, and collaboration platforms among different departments of local government bodies. This is especially important for optimizing management in the context of remote work or large territorial communities.

The implementation of digital platforms for the integration of various departments and services of local government authorities helps improve coordination and information exchange. This could include city infrastructure management systems, processing citizen requests, budget planning, and more. The automation of financial, resource, and infrastructure management processes through specialized programs or platforms includes cost control, resource usage efficiency analysis, and project planning. The introduction of the open data principle allows citizens to access various data about the activities of local government authorities (budgets, expenditures, decisions made, projects). This contributes to increased trust in local authorities and greater public engagement in decision-making processes.

Live streaming of meetings allows residents to follow local council sessions online, which increases transparency in decision-making. Digital tools make citizen participation in local self-government easier and more accessible, which enhances the level of democracy.

The digitalization of internal processes helps local government authorities work faster, more efficiently, and avoid bureaucratic delays. The use of digital tools increases trust in local government bodies, makes their activities more open to the public, and reduces the risks of corruption.

As a result, these measures create a more effective, transparent, and democratic local government, which contributes to community development and improving the quality of life for its residents.

The change in the index of digital transformation of local government authorities is analyzed in Figure 5.

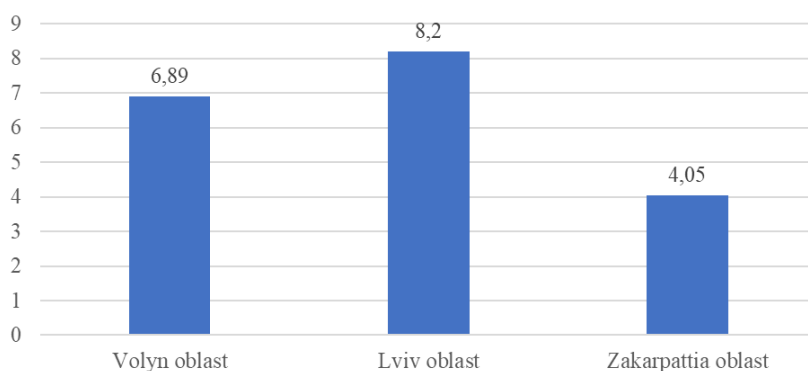


Fig. 5. Comparison of the index of digital transformation of local governments in the regions of the Ukrainian border in 2023

Source: compiled by the author based on (*Index of Digital Transformation of Territorial Communities*, 2024).

The analysis of Figure 5 shows that the digital transformation of local governments on the Ukrainian border regions in 2023 was the highest in the Lviv Oblast and amounted to 8.2 points. In the Volyn Oblast, it amounted to 6.89. In the Zakarpattia Oblast, this figure was 4.05 points, respectively.

Based on the above indicators, we will form an integral index of digitalization of the Ukrainian border regions in 2023 (Fig. 6).

This index is a composite indicator used to assess the level of digitalization of countries, regions or sectors of the economy and is defined as the sum of all the above indices. An analysis of the data in Figure 6 allows us to draw the following conclusions. The highest level of digitalization is in Lviv Oblast and amounts to 26.83 points. In Volyn Oblast, this indicator is 23.44 points. In Zakarpattia Oblast, this figure is 18.18 points, respectively. The introduction of digital technologies on the Polish-Ukrainian borderlands contributes not only to the modernization of border processes, but also to improving security, trade efficiency and humanitarian aid. This is of great importance for the development of bilateral relations between the countries

and maintaining stability in the region. According to DataReportal Poland, as of the beginning of 2024, the population of Poland was 40.57 million. Let us examine the state of digital technologies in the Polish border regions at the beginning of 2024, based on DataReportal Poland (*Global Digital Reports Poland, 2024*).

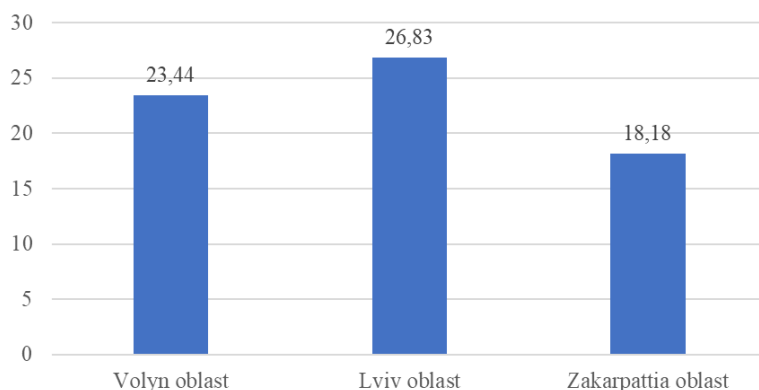


Fig. 6. Integral index of digitalization of Ukrainian border regions in 2023

Source: compiled by the author based on (Index of Digital Transformation of Territorial Communities, 2024).

At the beginning of 2024, 88.1% of the population in the Polish border regions were internet users. In January 2024, 68.8% of the population in the Polish border regions were social media users.

At the beginning of 2024, there were 130.8% active mobile connections in the Polish border regions, compared to the total population of these regions. According to DataReportal Ukraine, as of the beginning of 2024, the population of Ukraine was 37.42 million. Let us analyze the state of digital technologies in the Ukrainian border regions in 2024, based on DataReportal Ukraine (*Global Digital Reports Ukraine, 2024*). At the beginning of 2024, 79.2% of the population in the Ukrainian border regions were internet users. In January 2024, 64.9% of the population in the Ukrainian border regions were social media users.

In the regions of the Ukrainian border, at the beginning of 2024, there were 148.7% active mobile connections, compared to the total population of the Ukrainian border regions (Figure 7).

According to an analysis by Kepios (*Kepios, 2024*), the number of internet users in the Polish border regions decreased by 2.2% between January 2023 and January 2024. In comparison, this data indicates that 11.9% of the population in the Polish border regions remained offline at the beginning of the year.

On the other hand, the number of internet users in the Ukrainian border regions increased by 3.7% between January 2023 and January 2024. In comparison, this data

indicates that 20.8% of the population in the Ukrainian border regions remained offline at the beginning of the year.

Data published by Ookla (*Ookla, 2024*) indicate that in early 2024, Internet users in the Polish borderland could expect the following Internet connection speeds:

- median speed of mobile Internet via cellular networks: 42.12 Mbps
- median speed of the fixed Internet: 139.28 Mbps.

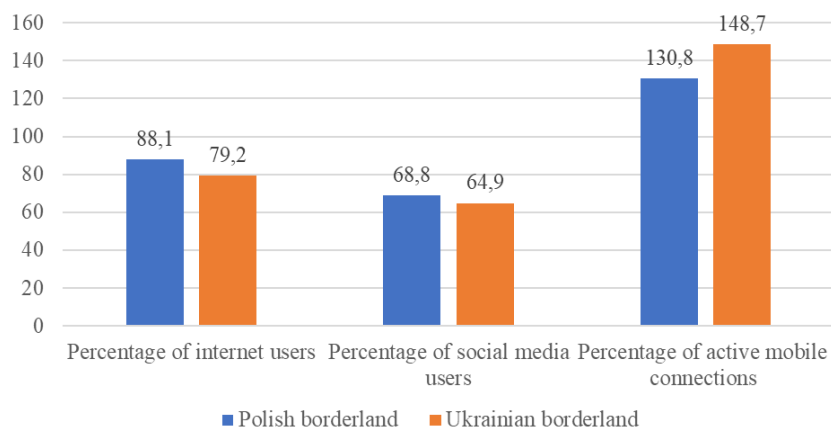


Fig. 7. Comparison of the levels of digital technology use in the regions of the Polish and Ukrainian borderland as of the beginning of 2024, %.

Source: compiled by the author based on (Global Digital Reports Poland, 2024; Global Digital Reports Ukraine, 2024).

Accordingly, the median mobile Internet speed at the Polish border increased by 1.20 Mbps (+2.9%) in the 12 months to the beginning of 2024. At the same time, Ookla data shows that fixed internet speeds in the Polish borderland increased by 43.11 Mbps (+44.8%) over the same period. On the other hand, data from Ookla [10] indicate that in early 2024, internet users on the Ukrainian border could expect the following internet connection speeds

- median speed of mobile Internet via cellular networks: 24.83 Mbps
- median speed of the fixed Internet: 73.68 Mbps.

Thus, the median mobile Internet speed at the Ukrainian border increased by 13.60 Mbps (+121%) in the 12 months to the beginning of 2024. At the same time, Ookla's data shows that fixed-line internet speeds in Ukraine increased by 13.51 Mbps (+22.5%) over the same period.

A comparison of the median mobile and fixed internet speeds in the regions of the Polish and Ukrainian borderland at the beginning of 2024 is shown in Figure 8.

For clarity, the Kepios analysis shows that the number of social media users in the Polish border region increased by 1.5% between the beginning of 2023 and the

beginning of 2024. The number of social media users in the Polish border region at the beginning of 2024 was 68.8% of the total population of the Polish border region.

Meanwhile, data published in the advertising planning tools of leading social media platforms indicate that at the beginning of 2024, 74.7% of users aged 18 and older in the Polish border region were using at least one social media platform, compared to the total population aged 18 and older in the region at that time. More broadly, 78.0% of the total number of internet users in the Polish border region (regardless of age) were using at least one social media platform in January 2024. At that time, 50.4% of social media users in the Polish border region were women, and 49.6% were men.

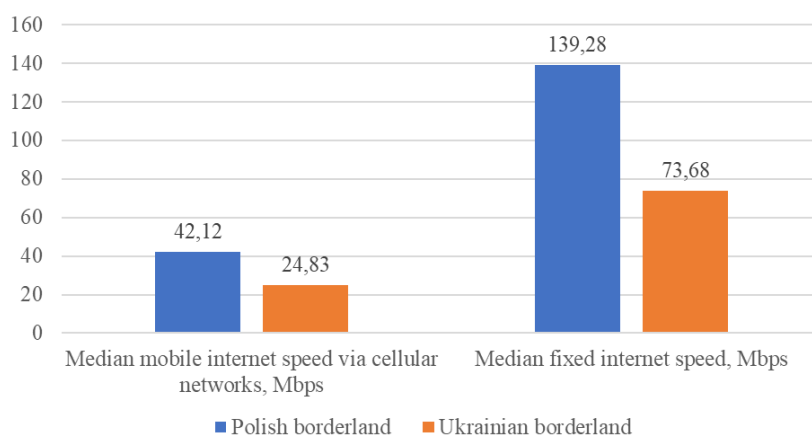


Fig. 8. Comparison of the median speed of mobile and fixed Internet in the regions of the Polish and Ukrainian borderland at the beginning of 2024, Mbps

Source: compiled by the author based on (Global Digital Reports Poland, 2024; Global Digital Reports Ukraine, 2024).

The Kepios analysis shows that the number of social media users in the Ukrainian border region decreased by 9.0% between the beginning of 2023 and the beginning of 2024. The number of social media users in the Ukrainian border region at the beginning of 2024 was 64.9% of the total population of the Ukrainian border region.

Meanwhile, data published in the advertising planning tools of leading social media platforms indicate that at the beginning of 2024, 69.3% of users aged 18 and older in the Ukrainian border region were using at least one social media platform, compared to the total population aged 18 and older in the region at that time. More broadly, 82.0% of the total number of internet users in the Ukrainian border region (regardless of age) were using at least one social media platform in January 2024. At that time, 52.9% of social media users in the Ukrainian border region were women, and 47.1% were men.

Data published in Meta tools indicate that the potential reach of Facebook ads in the Polish border region decreased by 4.2% between January 2023 and January 2024. The potential reach of Facebook ads in the Ukrainian border region increased by 7.8% between January 2023 and January 2024.

Thus, the digital transformation of the Polish-Ukrainian border region is a key factor in accelerating the socio-economic development of both countries, particularly in the context of enhancing economic, social, and security ties. Investments in digital technologies at the border will help modernize infrastructure, ensure more efficient and secure cross-border processes, and contribute to innovation and Ukraine's European integration.

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TRANSFORMATIONS
OF THE POLISH-UKRAINIAN BORDERLAND

THE CONCEPT AND DIMENSIONS OF REGIONAL AND CROSS-BORDER GREEN TRANSFORMATION

The concept of green transformation – legal and financial foundations

The concept of inclusive development, considering economic, social, and environmental aspects (eco-development, sustainable development) has been known since the 1970s and 1980s (*A Report for the Club of Rome: The Limits to Growth from 1972; Brundtland Report from 1987, etc.*). It is a response to environmental pollution, climate change, and resource consumption associated with the traditional pattern of industrialization and urbanization (*Bqk, Cheba, 2022; Xu, Li, Yang, 2024*). Green transformation refers to the process of transforming economies, communities, and systems to be more ecologically sustainable, reduce greenhouse gas emissions, support renewable energy sources, and promote responsible resource management. In the evolution of this approach to the development of national and regional economies, attention was drawn to the impact of factors such as technological progress, energy consumption, resource consumption, environmental quality, economic development, government policy, consumption model, and others (*Xu, Li, Yang, 2024*).

Green transformation also has solid foundations in international, EU, and national strategies. It represents a fundamental shift towards sustainable development, thus fulfilling commitments, including the *Paris Agreement (2015)*, the *UN Agenda for Sustainable Development 2030*, and the *Sustainable Development Goals (2015)* or the *European Green Deal (2019)*. In fact, it constitutes a strategy for economic growth and social development that is efficient, harmonious, and sustainable (*Xu, Li, Yang, 2024*). The 2030 Agenda outlines a common plan for sustainable development that integrates and balances three dimensions: economic, social, and environmental (*Transforming..., 2015, p. 3*). The European Green Deal aims to transform the European Union into a welfare society and a competitive and resource-efficient economy that will achieve climate neutrality by 2050 (*EC, 2019, p. 2*). The implementation of the EGD requires an environmental reorientation in such leading areas as:

- climate ambitions and energy security, including the energy union, the Energy System Integration Strategy,
- industrial strategy for a circular economy (CE) within the New Industrial Strategy and the New EU Action Plan for a Circular Economy for a cleaner and more competitive Europe,
- energy- and resource-efficient construction, including the “renovation wave” and the “new European Bauhaus”,
- sustainable and smart mobility – Sustainable and Smart Mobility Strategy,
- safe and sustainable food systems within the Farm to Fork Strategy and the Common Fisheries Policy and the EU Action Plan: Protection and Restoration of Marine Ecosystems for Sustainable and Resilient Fisheries,
- protection and restoration of natural capital/ecosystems and biodiversity, including the EU Biodiversity Strategy for 2030, the New Forest Strategy 2030, and the upcoming Blue Deal,
- elimination of air, water, and soil pollution for a non-toxic environment.

However, the implementation of the EGD faced unfavorable conditions of the COVID-19 pandemic and Russia’s aggression against Ukraine, which caused the migration and energy crisis and brought security to the forefront. As a long-term process, it will encounter a dynamic political and economic situation caused by elections, changes in public opinion, or external shocks.

The expected long-term effects create uncertainty and current costs of changes, especially in mining regions and emission-intensive industrial locations. Decarbonization of harmful production activities may lead to job losses and employee relocations. The spatial technological differentiation is also significant, which may deepen the differences between cores and peripheries (*Barbieri, 2023*). The green transition thus poses a challenge to ensure effective legal and economic instruments “in a fair way, leaving no one behind.” New strategies (above), as well as legislation and appropriate financing mechanisms, are to ensure that all European Union policies contribute to achieving the goal of climate neutrality, taking into account social justice.

The green transition has strong legal foundations in the legislative solutions of environmental policy (directives, EU regulations), which address various issues, including water and air pollution, chemical waste disposal, waste management, protection of species and natural resources. Alongside legal regulations, operational principles have evolved in this policy, such as sustainable resource management, preventive actions, “polluter pays,” and integration, which express the necessity of considering environmental protection requirements when establishing and implementing EU policies and actions (*Article 11 TFEU, 2016*). The EGD additionally introduced the “green promise: no harm” (*Sikora, 2021*). Meanwhile, climate law provided a legal basis for the net-zero emissions target, to be achieved by balancing

emissions and greenhouse gas (GHG) absorption no later than 2050, with a perspective of striving for negative emissions. At the same time, it established a binding target for 2030, which aims to reduce net GHG emissions across the Union by at least 55% compared to 1990 levels. (*Regulation 2021/1119*).

The intermediate goal is supported by the “Fit for 55” legislative package, which was strengthened after Russia’s invasion of Ukraine by the REPower EU plan and adopted in 2023. It introduces a number of reforms aimed at ensuring greenhouse gas emission reductions: in sectors covered by the EU Emissions Trading System (EU ETS) (by 62% compared to 2005), which will be expanded to buildings, road transport, and additional sectors (mainly small industry) (as ETS 2), a new Effort Sharing Regulation target (1,513 MtCO₂e) for non-EU ETS sectors, as well as in the gas sector, and tightening CO₂ emission standards in cars and aviation. Climate and energy ambitions also include increasing the share of energy from renewable sources to at least 42.5% (with an aspiration of 45%) and improving energy efficiency, which will contribute to reducing primary and final energy consumption. Furthermore, the energy system integration strategy assumes coordinated planning and operation of the system as a whole, taking into account various energy carriers, as well as infrastructure and other energy consumption sectors (industry, construction, transport) (*EC, 2020*). At the same time, the EU net absorption target has been raised to at least 310 million tons MtCO₂e and national targets in the Land Use, Land Use Change and Forestry (LULUCF) sector. The transformation towards zero emissions includes all sectors of the economy and policy areas, including energy, agricultural, cohesion, trade, and foreign policy. By 2030, climate and energy goals are focused on both reformed climate policy tools, the Innovation Fund, and the Modernization Fund, as well as the multiannual financial framework (MFF) and funding sources of the European Investment Bank Group.

The European Green Deal Investment Plan has planned additional investments of at least 1 trillion Euro (about 1.5% of GDP from 2018) from the EU budget, which will be supported by national and private funds (*EC, 2020, p.2*). In the MFF for 2021–2027 and the Recovery and Resilience Plan, a public overall target of at least 30% for climate-relevant expenditure was established and contained the following key elements: a “climate adjustment mechanism,” development of an effective climate tracking methodology to track the level of expenditure, and the application of the ‘do no harm’ principle. The EU’s green budget is established around four areas: climate mitigation and adaptation, biodiversity, and clean air. Increased spending on climate goals is incurred by almost all EU funds (including cohesion policy, agricultural policy, fisheries) and programs managed by the European Commission (e.g., Horizon Europe, LIFE, Pre-Accession Assistance Instrument), while the largest contribution will come from the Recovery and Resilience Facility (*Szafran, 2023*).

The socially just dimension of the transformation is taken into account by existing support instruments (e.g., European Social Fund+), as well as newly created ones – the Climate Social Fund and the just transition mechanism, which includes a new Just Transition Fund supporting regions and sectors dependent on fossil fuels and high-emission processes. They are intended to support investments and solutions for people and areas that will be most affected by greenhouse gas emissions pricing policies, e.g., investments in public transport, the issue of energy poverty, and measures supporting reskilling. The scale of the green transformation requires ensuring long-term support.

Alongside the EGD, the “Digital Agenda” was announced, hence the dual transformation – ecological and digital – will impact all sectors of the economy, communities, and areas in all territorial configurations.

“Green energy” in regions and municipalities

Mitigation of climate change by preventing or reducing greenhouse gas emissions and increasing their absorption (IPCC, Glossary) has been the main focus of interest and agreements made at the international and national level. Nevertheless, it is the regions, municipalities, and cross-border areas that will implement them on their own ground and introduce their own green transformation strategies. Some cities and regions have also committed to climate neutrality by participating in the EU Mission: Climate-Neutral and Smart Cities by 2030 (Kraków as a leader and Łódź, Rzeszów, Warsaw, and Wrocław). Others aim to reduce CO₂ emissions by at least 40% by 2030 compared to 1990 (or the most recent available data) under the Covenant of Mayors (CoM) (Fig. 1).

In the Lublin and Lviv regions, emissions from industrial combustion (including chemical, manufacturing, machinery, and metal industries) dominate, with the share in Lublin decreasing from 60% to 43%, while in Lviv it increased from 35% to 44% of total GHG emissions. In Podkarpackie, most emissions came from the energy sector, including electricity and heat generation and supply for buildings, as well as from transport. Emissions from transport are rising in both Polish regions, while on the Ukrainian side they increased until 2010 and in 2021, and have now stabilized. In the Volyn region, GHG emissions from agriculture (from crop production, waste burning, manure, and enteric fermentation of animals) have a larger share. Due to the agricultural nature of this area, they occur in all studied regions. It is also worth noting that until 2020, emissions from waste combustion and disposal and wastewater management were decreasing, but since then they have slightly increased. Cities play a key role in the transition to a low-emission society, as they account for 80% of energy consumption in Europe and the majority of greenhouse gas emissions (Fig. 2).

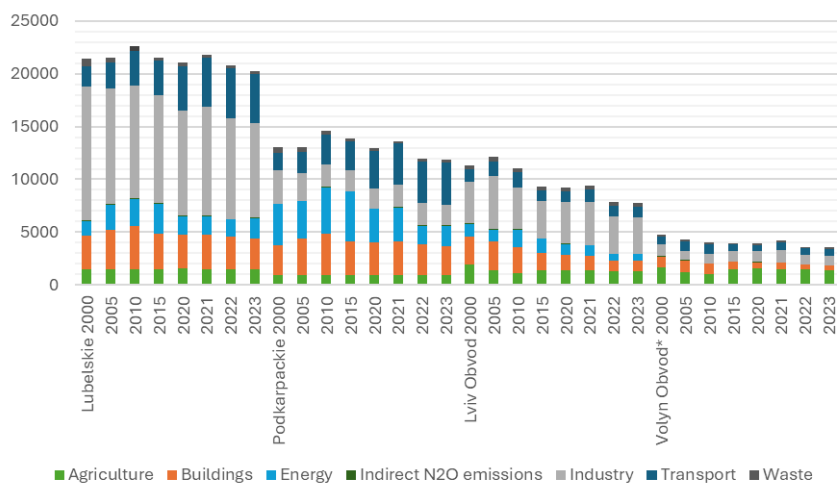


Fig. 1. Total GHG emissions by NUTS 2 and by sector in 2000–2023 (in ktonCO₂eq using Global Warming Potential Values from IPCC AR5, they include fossil CO₂ only, CH₄, N₂O and F-gases) Explanations: Volyn Obvod* – No data from energy sector (power generation).

Source: Own elaboration based on data EDGAR_2024_GHG_NUTS2. GHG Emissions at sub-national level. European Commission, Joint Research Centre (JRC) [Dataset] doi:10.2905/D67EEDA8-C03E-4421-95D0-0ADC460B9658

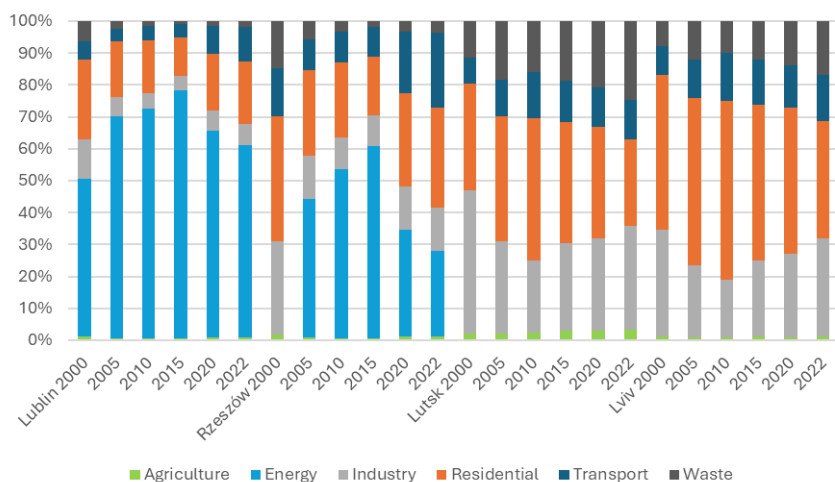


Fig. 2. Structure of urban GHG emissions by sector in Lublin, Rzeszów, Lviv, and Lutsk in 2000–2022 (in %, using Global Warming Potential Values from IPCC AR5)

Explanations: Rzeszów in 2000, Lutsk and Lviv – No data from energy sector.

Source: Own elaboration based on Urban Centre Database, European Union 2024, European Commission, Joint Research Centre (JRC), EDGAR, Community GHG database, comprising IEA-EDGAR CO₂, EDGAR CH₄, EDGAR N₂O and EDGAR F-gases version EDGAR_2024_GHG.

The main sources of GHG emissions in cities include coal-fired power plants producing energy for industry and housing, as well as individual heating systems using solid fuels in homes, and transport. In Ukrainian cities, significant participation also have emissions from waste.

In the decarbonization of the national and regional economy, which leads to the reduction of GHG emissions, an increase in energy from renewable sources is necessary.

In response to the EU's increased ambitions for the share of renewable energy in gross final energy consumption, Poland has declared the achievement of a 32.6% share of renewable energy by 2030. This means a target of 56.1% renewable energy in electricity, 35.4% in heating and cooling, and 17.7% in transport (Ministry of Environment and Climate, 2024, p. 19).

Considering that from 2004 to 2023, the share of energy from renewable sources in the national economy increased from 6.88% to 16.5%, including in electricity from 2% to 25.8%, in heating and cooling from 10% to 20.2%, and in transport from 1.58% to nearly 6% (*EUROSTAT, accessed 15.12.2024*), it is necessary to involve various entities from the public and private sectors in increasing its capacity and developing infrastructure. An alternative to the centralized energy supply model is the distributed energy model, also called "citizen energy" (*Dyka, Klassenberg, Szymalski, 2019*). Distributed generation involves "the production of electricity in distribution networks or on the customer side" and is often based on renewable sources such as solar, wind, water, biomass, or geothermal energy (*Rabe, 2023, p. 22*).

Distributed energy resources (DER) allow for a reduction in dependence on fossil fuels and negative environmental impact. Producing energy directly at the site of consumption also allows for a reduction in losses associated with its distribution and additional reduction of GHG emissions. Thanks to local energy sources, it can develop in every region and municipality. Energy producers can be residents, entrepreneurs, organizations, as well as local institutions such as healthcare, education, or social assistance facilities. This contributes to greater ecological awareness and participation in environmental protection. The green transformation towards renewable energy sources offers new opportunities for less developed regions, rural areas, and off-grid locations that can benefit from their natural resources and geographical position. A recent study on the untapped potential of these areas and the impact of its utilization on job creation and economic growth showed that the gradual phasing out of fossil fuels for energy production and the implementation of wind and solar energy will lead to higher added value (up to 1570 EUR more per capita) and greater employment (up to 4.9% more) in underdeveloped rural regions (*Többen et al. 2023*). The condition for unlocking their potential in renewable energy is knowledge sharing, technical support, and investments in renewable energy production, distribution infrastructure, digitalization potential, and connectivity.

Additionally, the impact on their landscapes, biodiversity, and rural communities must be considered.

Since the full-scale invasion of Russia into Ukraine in February 2022, nearly two-thirds of energy production capacity in Ukraine has been occupied, damaged, or destroyed. DER, such as solar panels, wind turbines, batteries, and small modular gas turbines enable local energy production, which helps meet energy shortages and reduces vulnerability to targeted attacks. According to the IEA, a diverse mix of DER represents a cost-effective and resilient path to rebuilding Ukraine's energy system (IEA, 2024).

Given the increasing GHG emissions from transport, actions to develop public transport and eco-friendly means of transport, such as buses and electric and hydrogen vehicles, bicycles, or scooters, are essential as an alternative to individual motorization. Within the competencies of spatial planning, development programs, and investments to ensure access to roads and transport, local and regional entities are responsible for developing sustainable transport systems, such as public, cycling, and pedestrian transport. These actions include the development of road infrastructure and tram networks, the replacement of urban transport fleets with low- and zero-emission vehicles, and the creation of charging infrastructure for electric and hydrogen vehicles. At the same time, it is necessary to ensure safe and convenient cycling paths and bike parking. Additionally, incentives for electric vehicles are being introduced (e.g., tax breaks, subsidies for the purchase of electric vehicles), and charging stations are being built, and promoting car-sharing and ridesharing, that is, initiatives for shared use of cars can reduce the number of cars on the roads, and thus lower emissions. In the implementation of the concept of compact city, "15-minute city", spatial planning and development play a key role, which favors pedestrians and, by locating services and workplaces nearby, can contribute to reducing the need to use cars. Equally important is education and informing about the advantages of public transport. In the process of decarbonizing transport, other non-fossil fuels produced using energy from renewable sources, such as green methanol and green ammonia (mainly in maritime and inland transport, heavy land transport), as well as synthetic gas or other synthetic fuels, can also play a certain role. Furthermore, the EU directive REDIII indicates that the total share of advanced biofuels and biogas, as well as renewable fuels of non-biological origin in the energy supplied to the transport sector should reach at least 1% by 2025 and 5.5% by 2030 (*Renewable Energy Directive 2023/2413*).

To ensure appropriate air quality standards, Polish municipal and regional authorities are required to monitor pollution concentrations and develop a range of planning documents (e.g., Environmental Protection Program, Noise Protection Program, Guidelines for the heat, electricity, and gas fuel supply plan). For urban areas and metropolitan areas where permissible and target concentration levels of

at least one substance (PM 10, PM 2.5, SO₂, benzo- α -pyrene) have been exceeded, the Regional Board develops an Air Protection Program and a short-term action plan. Meanwhile, the municipalities should then prepare a Low Emission Reduction Program. In order to increase the share of energy from renewable sources and reduce energy consumption with the participation of EU funds, municipalities are preparing Low-Emission Economy Plans. Additionally, they adopt non-mandatory electromobility strategies, cycling policies, traffic standards, or prepare grant programs for residents that support them in replacing inefficient heating sources, thermomodernization of buildings, as well as protective measures to prevent energy poverty.

Regional and local adaptation to climate change

In the face of increasing threats associated with global warming (including heat-waves, droughts, hurricanes, floods, and diseases), alongside mitigation actions, adaptation to changing conditions and related challenges is necessary. Individual regions, cities, and rural areas differ in environmental pollution and exposure to climate change. As indicated by the database of urban centers in the Copernicus program (Fig. 3), the compared area is exposed to recurring severe winds, extreme temperatures, and droughts.

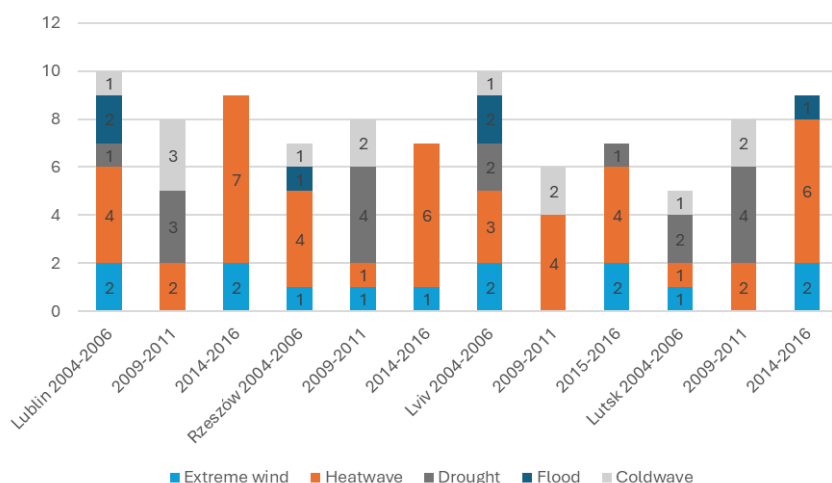


Fig. 3. Climate risks in Lublin, Lutsk, Lviv, and Rzeszów in the compared periods from 2004 to 2021

Source: Own elaboration based on (Copernicus.eu, <https://human-settlement.emergency.copernicus.eu/ucdb2024visual.php#> (Dostęp, 17.12.2024)).

Additionally, floods have been recorded everywhere during this period. Heat-waves are occurring more frequently, accompanied by increasingly prolonged droughts. The latter cause the greatest losses in agricultural crops and also result in urban heat islands (UHI) and heat stress, which are dangerous for human life and ecosystems. Between 2010 and 2019, intense droughts affecting a large part of Poland occurred on average every 2.5 years, which is twice as often as in previous decades. During the analyzed period, droughts were also the most common cause (over 30%) of losses in agriculture in the Lublin and Podkarpackie Voivodeships, where they were reported 340 and 207 times, respectively (*Atlas skutków...*, 2022). Other causes of agricultural losses included spring frosts, heavy rainfall, hurricanes, and hail. In turn, densely built-up and sealed urban areas experience losses in infrastructure, water management, and buildings at least once a year due to heavy rains and flooding, as well as hurricanes, with floods causing the greatest losses.

Adaptation includes anticipating climate changes and taking appropriate actions to prevent or reduce their negative impacts on society, the economy, and the environment, as well as leveraging the positives of these changes (EEA, 2023). Territorial differences provide justification for regional and local management of environmental transitions, so that spatially diverse transformation trajectories reflect local needs and potentials (Truffer, Coenen, 2012). Among the range of adaptive actions, traditional architectural and engineering solutions stand out, such as the construction of flood embankments, modernization of transport, energy, or water and sewage infrastructure (gray adaptation), as well as the use of new ICT technologies, e.g., in risk mapping and early warning systems (IPCC, 2022). Recently, more attention in the literature has been given to ecosystem-based adaptation (EBA) utilizing ecosystem services and nature-based solutions (NBS), including blue-green infrastructure (BGI). Different types of ecosystems (forests and parks, street trees, lakes, and rivers) perform many functions and provide people with a range of ecosystem services that have been classified as provisioning, regulating, cultural, and supporting (Kronenberg, 2012; *Ecosystem services...*, 2023). According to the definition of NBS, nature-inspired and nature-supported solutions address various climate threats, are economically viable, and simultaneously provide a range of environmental, social, and economic benefits (EEA, 2021, p. 17). NBS clean the air from emissions and provide a cooling effect in the UHI problem (Bowler et al., 2010; Marando et al., 2022), retain rainwater and protect against floods, purify water, serve health and biodiversity protection (Burchard-Dziubińska, 2016; Warchalska-Troll, Pistelok, 2023). Due to the cross-cutting nature of climate threats to quality of life and economic sectors, various solutions are practically combined according to local conditions and constraints. Based on the European Green Deal of 2019, a new EU Strategy for Adaptation to Climate Change was adopted in 2021, which advocates for systemic adaptation within development policy at all levels and sectors, based on

improved planning, integration into macroeconomic and budgetary policy, nature-based solutions, and local actions (*European Commission, 2021, p. 9*).

National and local documents contain assumptions and proposed actions regarding both adaptation to climate change and mitigation of these changes, e.g., the Strategic Adaptation Plan for sectors and areas vulnerable to climate change by 2020 with a perspective to 2030 adopted in 2013, the State Environmental Policy 2030 from 2019, and the National Urban Policy from 2015 and 2022 with a perspective to 2030. International experiences show that more and more cities and agglomerations are preparing adaptation plans and/or mitigation plans, or incorporating these issues into sustainable development strategies, spatial planning, or sectoral planning in the areas of economy, transport, or energy (*Aylett, 2014, p. 16*). In 2017–2019, Warsaw and 44 largest cities in Poland prepared climate change adaptation plans for the first time with the participation of EU funds. Meanwhile, changes in the Environmental Protection Law from December 2024 impose an obligation to develop adaptation plans in cities with more than 20,000 inhabitants by 2028. Adaptation plans combine planning and organizational actions (including spatial planning, crisis management, green space protection), and investments (e.g., in infrastructure).

Challenges in implementing green transformation in cross-border regions

Pollution causing climate change and its negative effects are intersectoral, difficult to control, freely cross borders, and deepen developmental inequalities. Cooperation among cross-border regions enables the engagement of communities and a greater number of diverse actors in reducing greenhouse gas emissions, water pollution, and protecting ecosystems, as well as better adapting to the negative effects of climate change. However, it faces a number of obstacles in jointly implementing green transformation. The most significant of these include differing political priorities, legal-administrative systems, levels of economic and technological development, as well as language barriers, access to information, and current, reliable data. In the case of regions in Ukraine, which is in a state of war, communication problems additionally arise from restrictions on freely crossing the border and lack of telecommunication connectivity.

As experiences from the implementation of the Paris Agreement have shown, there is a long way from declaration to realization; for example, during this time the governing political option may change. Countries are reluctant to transfer decision-making autonomy to international institutions or other states that would oversee the implementation and compliance with environmental protection regulations. This results in international agreements often being voluntary, and their enforcement depends on the goodwill of the individual parties. Given that individual states have

different economic and social priorities and interested actors in their implementation, a challenge is also the lack of coherence and consistency in the application of international environmental agreements. The differences in legal systems between countries hinder the creation of uniform regulations and their effective enforcement. Agreements and the scope of cooperation must be adapted to various legal and political structures, which often leads to compromises that weaken their effectiveness. As mentioned, the *acquis communautaire* in environmental and climate policy has evolved, encompassing various regulations, principles, detailed emission standards, and ecological standards that are generally stricter than those in non-EU countries. This creates difficulties in agreeing on common standards. Adapting to these norms will be more costly and time-consuming, which may discourage engagement in joint projects. Differences may also concern intellectual property law and technology transfer principles, which can affect the sharing of knowledge and technologies necessary for the implementation of environmental projects. Additionally, there are different administrative procedures, such as ensuring public participation (e.g., in adaptation plans), project approval, monitoring indicators, and reporting. Following the European Council's decision in December 2023 to begin accession negotiations with Ukraine and the approval of the negotiation framework in June 2024, it formally began the process of aligning its legislation. Meanwhile, on September 1, 2017, the association agreement came into force, outlining the framework for modernizing the Ukrainian economy and mutual trade relations. As part of the Eastern Partnership policy after 2020, Ukraine was included in its objectives, including: resilience to climate change and environmental issues, a resilient and sustainable economy, responsible institutions and the rule of law, and a fair and inclusive society. The financial outcome of this cooperation was access to investment funds under the European Neighbourhood Instrument. As the accession process progresses, it will also gain access to broader funding from the Instrument for Pre-accession Assistance.

To support Ukraine in dealing with the social, economic, and environmental consequences of the war, its reconstruction and modernization, as well as cohesion and integration processes with the EU, the implementation of legal *acquis* and reforms, the Instrument for Ukraine was established (*Regulation 2024/792*). Among the specific objectives of its assistance are: ensuring energy security, transitioning to a sustainable and climate-neutral economy, developing and strengthening environmental protection and a fair green transformation across all sectors of the economy, as well as supporting cross-border cooperation with member states bordering Ukraine in areas such as environmental protection. At least 20% of the total investment amount should be allocated to climate change mitigation and adaptation actions. This instrument should be as consistent as possible with EU climate and environmental standards. It cannot therefore support actions or measures that are inconsistent with

Ukraine's national energy and climate plan, just as Poland programs funds from EU resources taking into account the provisions of its energy and climate plan.

As a member state, Poland has access to budgetary funds and programs as well as the Recovery and Resilience Facility. The latter provides grants and loans for investments and reforms included in the National Recovery Plan, allocating at least 37% of the allocation for climate actions in the years 2020–2026. The new objectives of cohesion policy and its funds reflect the priorities of the EGD, in particular CP2 – a more environmentally friendly, low-emission, and resilient Europe, funded by the European Regional Development Fund (ERDF) and the Cohesion Fund. The ERDF co-finances, among other things, productive investments, infrastructure, and innovations in environmental protection, transport, energy, and the transition to a low-emission economy across all sectors of the economy, as well as territorial cooperation. The Cohesion Fund has focused from the beginning on projects in the field of the environment and transport, in particular trans-European transport networks (TEN-T), and now also on improving energy efficiency, RES and sustainable mobility. In addition, the European Social Fund Plus (ESF+) supports investments in education and training in the development of skills and qualifications in a low-emission economy or adaptation to climate change. The European Regional Development Fund (ERDF) budget for the 2021–2027 cohesion policy period has allocated around 92.6 billion euros for investments in the climate area, including at least 30% of the total allocation of the ERDF and 37% of the allocation of the Cohesion Fund.

Furthermore, the cohesion policy has been supported by the Just Transition Fund, which focuses on a specific objective, namely mitigating the consequences of transformation towards achieving climate and energy goals by 2030 and climate neutrality by 2050. The Lublin Voivodeship is not its beneficiary. The green transformation of rural areas is supported by structural funds (e.g. development of RES), as well as funds of the common agricultural policy, within direct payments (e.g. agri-environmental schemes and animal welfare) and rural development (agri-environment-climate payments, adaptation to climate change). In turn, the Horizon Europe Programme supports the clean transformation in the field of research and development of green technologies and their implementation in enterprises that will contribute to sustainable development and environmental protection. The functioning until 1992 LIFE programme supports the implementation of Community law and environmental protection policy as well as the promotion of new solutions in the field of the environment and climate. In the years 2021–2027, in these two areas, four sub-programmes are implemented, including “Mitigating climate change and adapting to it” and “Transition to Clean Energy”. The main goals of the Connecting Europe Facility (CEF) are the construction, modernization and integration of trans-European transport, energy and digital networks, as well as facilitating cross-border cooperation in the field of renewable energy.

In the years 2021–2027, cross-border cooperation between Poland and Ukraine is continued within the Interreg NEXT Poland – Ukraine Programme. Among the goals of this programme is cooperation in environmental protection, climate change adaptation, access to water and nature protection. Previous experiences in cooperation within the Bug Euroregion, Partnership and Neighbourhood Instrument and cross-border cooperation have shown the role of local government engagement and local communities. Research has shown that local authorities are more willing to take initiative and act faster because they better know grassroots trends, can react in an innovative way and faster than national government levels. Examples of such international initiatives and networks of cities and municipalities are the United Cities and Local Governments (UCLG) climate conferences, Metropolis, ICLEI – Local Governments for Sustainability (ICLEI), C40 Climate Leadership Group, World Mayors Council on Climate Change (WMCCC) and its EU equivalent, along with their regional and national organizations (*van Staden, Musco, 2010*). Currently, 86 Polish and 347 Ukrainian local units are signatories to the Mayors’ Agreement (Covenant of Mayors – CoM). Based on the Sustainable Energy and Climate Action Plans (SECAP), they strive to reduce CO₂ emissions by at least 40% by 2030 compared to 1990 (or the last available data). The largest cities also participate in other European initiatives, such as the Mission to 100 Climate-Neutral and Intelligent Cities by 2030.

To overcome potential difficulties in cooperation, it is crucial to build dialogue and trust, as well as introducing common training programs and development strategies that will take into account local conditions and residents’ needs.

Summary

The Green Transformation is a complex and long-term process aimed at transforming economies, communities, and systems to be more ecological and resilient, taking into account differences in development and social justice. It includes reducing emissions and developing renewable energy, protecting and responsible management of resources, as well as building resilience to climate- risk and other threats.

Implementing the European Green Deal is supported by EU strategies, legislation, and budgetary and extrabudgetary financing mechanisms, which aim to ensure “green mainstreaming” in all EU policies. In the context of the regional and transboundary dimension of the “green transition”, the possibility of involving local and regional communities in mitigating climate change has been considered, which focuses on reducing GHG emissions through increased energy efficiency and the development of renewable energy sources. In this regard, distributed energy solutions, the development of balanced transport systems, and promoting public transport, as well as reducing other emissions, such as from buildings, are particularly promising. On the other

hand, climate change adaptation within the framework of adaptation plans combines organizational, investment, and information-educational activities in the field of infrastructure, new technologies, and NBS, appropriate to local conditions and taking into account various threats and needs. For the success of the green transformation process, multi-faceted cooperation is crucial. It enables the exchange of knowledge, technologies, resources, and coping with formal limitations. The integration process with the EU supports the adaptation of law and investments in green transformation, as well as transboundary cooperation with neighboring countries.

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CLIMATE CHANGE AND THE COMPETITIVENESS OF BORDER REGIONS¹

Introduction

The aim of this study is to attempt to operationalise the impact of climate change on the competitiveness of regions using a proprietary method based on the Regional Climate Change Competitiveness Index (RCCCI). Climate change is one of the most important processes occurring in the modern world. They are not only of interest to the natural sciences, but also to the social sciences, including the economic sciences, as one of the most significant causes of climate change has been the hitherto pursued, resource-intensive, linear model of socio-economic development, the most important measure of which has been: GDP, GDP per capita and GDP dynamics. On the other hand, climate change, and especially its increasingly perceptible effects, is becoming an impetus to search for and define a new paradigm of socio-economic development, namely sustainable development. However, it does not mean development that is rapid in time and spatially even, but development that is sustainable (stable) and self-sustaining. It is (*Kistowski, 2003, Kistowski, Kałamucka, 2021*):

¹ The article draws on the results of research carried out under a NCN grant „Modelling of climate change impacts on regional competitiveness” 2019/35/B/HS5/01548.

- a type of socio-economic development realised by humans in the technosphere, which is part of the natural environment,
- an intergenerational concept, a process integrating human activities in the ecological, social and economic spheres, which also has spatial consequences,
- an egalitarian concept, assuming the maximisation of individual satisfaction of the needs of all inhabitants of the Earth.

It has also been operationalised on a global scale through the formulation of 17 goals contained in the UN General Assembly resolution entitled Transforming our world: the 2030 Agenda for Sustainable Development (2030 Agenda). These goals are as follows:

1. eradicate poverty in all its forms worldwide,
2. eliminate hunger, achieve food security and improved nutrition and promote sustainable agriculture,
3. ensure a healthy life for all at all ages and promote well-being,
4. ensure quality education for all and promote lifelong learning,
5. achieve gender equality and empower women and girls,
6. ensure access to water and sanitation for all through sustainable management of water resources,
7. ensure access to affordable sources of stable, sustainable and modern energy for all,
8. promote stable, sustainable and inclusive economic growth, full and productive employment and decent work for all people,
9. build stable infrastructure, promote sustainable industrialisation and foster innovation,
10. reduce inequalities within and between countries,
11. make cities and human settlements safe, stable, sustainable and inclusive,
12. ensure patterns of sustainable consumption and production,
13. take urgent action to address climate change and its impacts,
14. protect and sustainably use the oceans, seas and marine resources,
15. protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss,
16. promote peaceful and inclusive societies, ensure access to justice for all, and build effective and accountable, inclusive institutions at all levels,
17. strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

Objectives: 1, 3, 4, 5, 10, 16 fall under the social pillar, goals: 2, 8, 9, 11, 17 – economic, and the remaining objectives: 6, 7, 12, 13, 14, 15 – environmental. All of them undoubtedly have a global dimension, but also transnational (e.g. within the EU), national, regional and local dimensions. From the point of view of the objective un-

der consideration, Objective 13 is particularly relevant. Under it, it is necessary to strengthen adaptive capacity and resilience to climate risks and natural disasters in all countries of the world, facilitated by the development of national policies, strategies and plans, increasing education and human and institutional capacity, and raising awareness of climate change mitigation (including through educational activities), adaptation and the impacts of climate change, and early warning systems for risks.

The evolution of the concept of regional competitiveness

One of the categories that is being re-evaluated in relation to climate change is that of competitiveness considered both nationally and regionally. The concept of competitiveness has evolved from a single to a multifactorial one, considering initially only effects (outcomes) as manifestations of competitiveness, over time broadened to include the inputs required to achieve the effects.

The competitiveness of regions is undoubtedly a complex and multidimensional issue. It is the resultant of a number of interrelated factors acting in different directions and with different intensity. The catalogue of factors driving its growth is very broad and undergoing dynamic change. The diversity, specificity and developmental disproportions of regions make it impossible to present a single, universal set of factors determining the growth of competitiveness in regional terms. Numerous studies are therefore undertaken to diagnose the factors that significantly support development and territorial competitiveness. A high level of regional competitiveness is related to the possession of an advantage of favourable conditions and features that other regions possess to a lesser extent, while the so-called competitive distance is a resultant of unfavourable conditions or lack of advantages and resources important for development (*Kasztelan, 2010*). Of key importance for regional competitiveness are: economic and social capital, innovation, technical infrastructure and environmental conditions (*Wlazlak, 2010*).

According to Porter (2001), the advantage of regions may result from the human factor related to knowledge and education, the capital factor and favourable location, the aggregate consumption and production demand of a given region, the business environment, i.e. industries supporting and facilitating the activities of economic agents, and the structure of economic agents of a given region. A diversified structure of the economy, an appropriately developed economic base, i.e. technical, economic and social infrastructure, the intellectual and investment climate, the business environment and a good state of the natural environment are also indicated as basic factors of regional competitiveness (*Winiarski, 2004*).

Identifying the object scope of regional competitiveness to date, the following areas can be distinguished (*Karman et al., 2022*):

- economic – covering the attributes and characteristics of the economy that allow for more efficient use of factors of production and the adaptability of entities to changing economic conditions in domestic and foreign markets, which translates into higher levels of income and employment,
- social capital – related to human capital, understood quantitatively (demographics) and qualitatively (education, professional experience, health), which constitutes the supply side of the labour market; and social capital, which enables the achievement of synergetic effects thanks to openness to cooperation of particular individuals and social groups (binding capital) and openness to contacts with the environment (bridging capital),
- innovation and technology – meaning the ability to innovate and orientation towards technology and information, which, thanks to the dynamic combination of science, knowledge and technology, creates a sustainable competitive advantage and, through access to the latest technology, increases the region's capacity to adapt to changes in its environment,
- environmental, in which competitiveness is combined with gaining advantage on the basis of available natural resources and their skilful use in the processes of socio-economic development, which means referring to the concept of sustainable development.

In the face of ongoing climate change, the competitiveness of regions is also manifested in their ability to achieve and maintain a competitive advantage under the constraints of climate change effects. This approach is clearly an extension of the concept of regional competitiveness, taking into account the region's impact on climate change and the region's adaptive and proactive actions (*Karman et al., 2021*). Proactivity is defined as voluntarily initiated behaviour aimed at bringing about transformation through appropriate foresight, supported by forward-looking actions (*Parker et al., 2006*). Gaining a competitive advantage through climate proactivity makes it possible to mitigate the effects of progressive climate change caused by negative anthropogenic activities. There is a noticeable growing role for an environmental focus in many areas of life, including business. In the light of progressive climate change, factors such as renewable natural resources, efficiency in the use of non-renewable energy sources, nature conservation and maintaining the stability of ecological processes and ecosystems will be important for the long-term competitiveness of regions (*Kociszewska-Panaszek, 2004*). Climate change poses a major challenge to the competitiveness of industry, or jobs in particularly energy-intensive industries.

The uncertainty resulting from climate change is causing regional competitiveness to be increasingly linked to the concept of resilience. It can be identified in various ways (*Fröhlich, Hassink 2018*). A region is resilient when, after a shock, it returns to its previous equilibrium or does not allow itself to be pushed into an alternative

equilibrium. By treating the region as a system, external factors (generally weakening resilience) and internal factors (generally strengthening resilience) are analysed.

Regional resilience can be a manifestation of path-dependent development, which is a consequence of cumulative decisions made over a long period of time. In the broadest terms, regional resilience can be defined as the ability of a regional economy to survive or recover from market, competitive and environmental shocks, through adaptive changes in economic structures and social and institutional arrangements, in order to maintain or restore its previous development path or to move to a new, sustainable path, characterised by a fuller and more productive use of physical, human and environmental resources (*Martin, Sunley 2015*).

Regional (but also local, national, transnational or global) resilience is thus a kind of resultant or balance of, on the one hand, vulnerability (sensitivity) to threats (shocks) and, on the other hand, adaptive capacity (*Zaucha et al. 2014*). When analysing it, it is important to determine the scale, nature and duration of the shock and then to analyse the regional economic structure, resources, capacities and competences affecting regional resilience. The reason for the variation in resilience between regions may be due to the fact that entities that are more or less resilient to shocks play an important role in the structure of the regional economy (*Gong et al. 2020*).

Analysis of climatic competitiveness

With reference to the above considerations, the author's method of evaluating the climatic competitiveness of regions, as well as determining its levels and ranking for all EU regions at the NUTS-2 level, is presented. The difficulties associated with conceptually defining the concept of climatic competitiveness should be highlighted, as well as those associated with capturing this phenomenon using one or more indicators.

Traditional analysis of regional competitiveness used published reports (e.g. Regional Competitiveness Index, RCI) and methods of multi-criteria comparative analysis. A synthetic construction of competitiveness indicators was used, on the basis of which its level was determined for selected regions. In turn, the analysis of the determinants of competitiveness was of cognitive and practical importance – it guided improvement and formed the basis for planning and implementation work. The proposed methods for assessing the level of regional competitiveness consisted of selecting a certain set of measurement indicators, depicting selected aspects of competitiveness. However, previous analyses of this phenomenon have not taken into account the challenges generated by changes in the climate for regional competitiveness.

The methodological proposal presented here is based on the approach adopted by the European Commission in its methodology for estimating the RCI. As such,

the proposed index of climate competitiveness focuses on the determinants of the level of productivity of the regional economy, which is the source of local prosperity. In the authors' view, the approach adopted will provide a synthetic picture of the climate competitiveness of EU regions, taking into account a broad and balanced range of factors shaping the long-term and short-term potential of regional economies under climate change.

The primary research tool used in the study is the Regional Climate Change Competitiveness Index (RCCCI), which provides an estimate of regional competitiveness under climate change conditions. Based on an analysis of the literature, 28 areas were proposed as the main pillars of the proposed method. Structurally, the developed construct is 'derived' from the RCI (regional competitiveness index), but differs as a result of:

1. the addition of thematic areas directly related to climate change (e.g. attitudes towards climate change),
2. the deletion of thematic areas with no connection to climate change (e.g. financial market sophistication, which is included in the RCI),
3. transfers between areas (e.g. higher education was merged with education).

From a structural point of view, the areas (pillars) defined within the RCCCI were the input or output components of competitiveness. They were thus the driving forces (input) or outputs of a competitive economy (output).

The input components (input) refer to four aspects, viz:

- human (education, human development, health, climate change awareness, attitudes towards climate change, strength of NGOs),
- institutional (institutions, macroeconomic stability, infrastructure, institutions dedicated to climate change),
- technological (concentration of economic units, technological readiness),
- environmental (air and water quality).

The output components, on the other hand, relate to aspects:

- sectoral (agriculture, tourism, energy, transport, industry and construction),
- object-oriented (water pollution, air pollution, biodiversity, efficiency in achieving objectives, labour market efficiency, emission intensity, resource efficiency, innovation, perceived quality of life, market size).

The two components (air quality and water quality) are two-sided: on the one hand, their primary state (e.g. air quality) determines a region's competitiveness; on the other hand, emissions and pollutants generated by the regional economy affect the 'output' state of these components.

The selected areas were characterised by quantitative indicators. The primary source of data was the Eurostat database, but for some variables other data sources were also used, including the ESPON database. The initial selection of indicators took into account the results of the literature review and expert surveys.

In the case of the Polish-Ukrainian borderland – due to the lack of available data for the Ukrainian Oblasts of Volyn and Lviv, the presentation of results was limited to only two Polish Voivodeships, i.e. Lubelskie and Podkarpackie. In the future, it is undoubtedly possible to use the RCCCI for the entire borderland.

On the basis of the obtained data, six RCCCI sub-indices were constructed, viz:

- basic, comprising the following pillars: institutions (variables: corruption, quality of governance, quality of law), macroeconomic stability (inflation rate, public debt as a proportion of GDP, regional gross domestic product per capita, natural resource rents as a % of GDP), infrastructure (road density, rail density, population connected to sewage treatment plants, water consumption per capita, amount of municipal waste), education (mean value of learning outcomes in reading PISA, mean value of learning outcomes in mathematics PISA, average PISA learning outcomes in science, population by tertiary educational attainment, number of universities in 200 EU, public expenditure on education), institutions related to climate change (national climate policy, expenditures on fixed measures to protect the air and climate, regions claiming to have a climate policy), concentration of economic actors (share of SMEs in the region, number of companies in the mining sector),
- nature, comprising pillars such as water quality, air quality, biodiversity (farmland bird index, forest areas, grasslands, resource productivity), effectiveness of achieving climate targets (greenhouse gas emissions gap, RES gap, energy efficiency gap, advancement of ‘phasing out’ of the carbon economy),
- innovation, made up of the pillars: technology readiness (households’ access to the internet, individual online shopping, businesses with online shopping, employment in knowledge sectors, innovation (workers in science and technology, eco-innovation, product and process innovation, market applications, innovative SMEs, R&D inputs),
- efficiency, comprising the following pillars: labour market efficiency (employment rate, unemployed 18–24 year olds, average working hours, share of ‘green’ jobs in total jobs, employment in climate-sensitive sectors), market size (disposable income per capita, market for green products), economic emissions intensity (demand-driven emissions intensity, production-driven emissions intensity, consumption-driven emissions intensity, annual emissions), resource efficiency (material circularity index, resource productivity, domestic material consumption),
- sectoral, comprising the following pillars: agriculture (agricultural area, water use in crop production, agricultural productivity index, change in number of days with precipitation), tourism (number of beds, tourists using accommodation, emissions from hotels and restaurants), energy (energy balance, RES energy production capacity, energy productivity, energy interruption time

index, individual solar energy production capacity, energy produced by industrial generators), transport (transport emissions, high-speed rail transport, newly registered electric cars, number of public transport passengers), industry (emissions from electricity and heat, emissions from industrial processes, volume of production of environmental goods), construction (emissions from construction, energy consumption in construction),

- social, consisting of the pillars human development (happiness index HPI, human development index HDI), environmental awareness, environmental attitudes, perceived quality of life, health (number of hospital beds, life expectancy, premature mortality due to air pollution), strength of NGOs (employment in the third sector, participation in voluntary activities).

Given the high diversity of EU regions, both in terms of climate policy and initiatives implemented in this area, it was necessary to differentiate regions according to their level of climate protection performance. The strength of the factors that influence climate competitiveness varies between regions, as actions by regional governments to slow climate change, change the economic conditions of sectors and businesses. As a result, the level of climate competitiveness and potential varied between the regions studied.

To assess the level of this variation, the Climate Change Performance Index (CCPI) was adopted, taking into account regions that together account for more than 90% of global greenhouse gas emissions. The value of this index is estimated on performance in terms of: GHG emissions, renewable energy, energy consumption, climate policy.

The logic used to select these four components of the index takes into account the effectiveness and impact of climate policies on energy consumption, renewable energy, GHG emissions reduction. The performance in the indicated components of the Climate Change Performance Index allows a country to be assigned to an appropriate level of development (Table 1).

Table 1. Classification of areas CCPI

Area Level of development	GHG emissions per capita	Share of renewable energy	Energy consumption	Climate policy
Very high	<2,5	>35%	<60	>4,5
High	2,5–5,5	20%–35%	60–90	3,5–4,5
Medium	5,5–8,0	10%–20%	90–120	2,5–3,5
Low	8,0–11,0	5%–10%	120–160	1,5–2,5
Very low	>11,0	<5%	>160	<1,5

Source: Karman et al. (2022).

The aggregated values for the CCPI areas – then averaged – determine the score achieved by the country. Based on the CCPI, for the purpose of the climate competitiveness evaluation method, regions are classified according to national affiliation into five levels of development: from very low to very high (depending on the CCPI

level). ‘Transition’ to a higher level is achieved through improved energy efficiency, expansion of RES or more effective climate policies.

Within the proposed RCCCI method, the different levels of development were assigned weights. It was assumed that the importance of the basic sub-index is necessary for the functioning of the regional economy. The quality of governance, human resources, infrastructure determine regional development, with their importance being highest in the least developed regions, implying higher weights for these regions. The efficiency sub-index indicates regions with a more structured labour market and higher resource efficiency. The innovation sub-index describes the innovativeness of the regional economy and its network readiness. Regions with higher values in both these sub-indexes can be expected to have higher competitiveness. In contrast, the natural environment does not determine the economic competitiveness of economic units, so the weights assigned to this sub-index are equal regardless of the level of development of the region. It should be noted that regional development is highly dependent on carbon-intensive sectors, e.g. energy, industry, or on climate-sensitive sectors, e.g. tourism or agriculture, so the sectoral dimension, which includes the performance of climate-sensitive sectors, is more relevant in regions less engaged in the decarbonisation process. As climate protection performance determines both health and quality of life, regions with lower CCPI values are perceived as less attractive for investment and tourism, which translates into lower competitiveness.

Table 2. Weights assigned to the RCCCI sub-indexes

CCPI level Sub-index	Very high	High	Medium	Low	Very low
Primary	0,16	0,16	0,17	0,19	0,19
Natural	0,16	0,16	0,16	0,16	0,16
Efficiency	0,21	0,19	0,19	0,16	0,15
Innovation	0,19	0,19	0,15	0,15	0,15
Sectoral	0,15	0,15	0,17	0,18	0,19
Social	0,13	0,15	0,17	0,17	0,17
Total	Σ1	Σ1	Σ1	Σ1	Σ1

Source: as in Table 1.

The weights indicated in Table 2 are the result of the work of a group of international experts from scientific bodies and non-profit institutions working on climate change². As already mentioned, the level of variation in climate competitiveness

² The reader will find the full report on the experts’ determination of the model weights at <https://www.pine.org.pl/wp-content/uploads/2021/07/Raport-Delphi.pdf>.

between regions is linked to the level of the CCPI for the region. Higher CCPI values are held by regions that:

1. take action to achieve the emission reduction targets set by 2030,
2. develop RES-based energy,
3. improve energy efficiency,
4. have policies to promote renewable energy sources, improve energy efficiency, reduce emissions in emitting sectors and implement them.

Thus, higher climate competitiveness will be characterised by regions relying on low-carbon sectors, developing renewable energy, reducing energy consumption in the economy through innovation, emphasising efficiency gains and regional investment. Each of the RCCCI sub-indices is weighted differently to reflect their different impact on the final RCCCI index value, taking into account the level of initiatives implemented to address climate change.

It should be noted that the source of climate competitiveness is primarily innovation and efficiency. The importance of these sub-indices increases as the value of the CCPI index increases. At the same time, despite the inclusion of weights in the model, the final value of the index depends primarily on the performance of its component sub-indices. Indeed, the value of the RCCCI index is the sum of the weighted values of the sub-indices. The results of the RCCCI index for the regions with the highest and lowest index values are summarised in Table 3.

Table 3. Regions with the highest and lowest index values RCCCI

NUTS2	Region	Index value	NUTS2	Region	Index value
SE11	Stockholm	0,588	EL64	Sterea Ellada	-0,542
FI1B	Helsinki-Uusimaa	0,566	RO41	Sud-Vest Oltenia	-0,588
NL41	Noord-Brabant	0,514	RO31	Sud – Muntenia	-0,611
SE22	Sydsverige	0,474	RO21	Nord-Est	-0,640
SE23	Västverige	0,431	RO22	Sud-Est	-0,656
DE21	Oberbayern	0,407	BG33	Severoiztochen	-0,665
DK01	Hovedstaden	0,405	BG34	Yugoiztochen	-0,682
NL31	Utrecht	0,395	BG32	Severen tsentralen	-0,693
NL22	Gelderland	0,392	PL62	Warminsko-Mazurskie	-0,741
DE14	Tübingen	0,390	BG31	Severozapaden	-0,792

Source: as in Table 1.

The highest levels of climate competitiveness are found in the regions of Sweden, Germany, the Netherlands and Finland. These countries play a key role in climate change mitigation and adaptation. At the national level, they have ambitious climate policy targets, while at the regional level they are pursuing the goal of zero emissions. These regions have achieved high values for institutional quality (Finland, Germany), green job creation (Germany, the Netherlands), eco-innovation (Finland), technology readiness (Sweden). Further room for improvement concerns: public transport

system (Sweden), decarbonisation of transport (Germany), energy efficiency of buildings (Sweden, Germany), faster phase-out of coal (Germany), reduction of emissions from heating (Netherlands), changes in the agricultural sector (Finland).

Romania and Bulgaria have the lowest level of climate competitiveness. The main challenges for Romania are an unambitious climate policy, emission reductions in the transport sector and a slow introduction of RES. For Bulgaria, these are the lack of a progressive climate policy, dependence on liquid fuels, and lack of government support for RES projects. The ranking of countries' climate competitiveness shows the key positions of the North Sea and partly Baltic Sea catchment countries: Denmark, the Netherlands, Sweden, Norway Germany and Finland. They strive for climate resilience by increasing the share of renewable energy in the energy mix (e.g. in Germany, the target is 65% by 2030), significantly reducing emissions (e.g. Denmark by 70% by 2030 compared to 1990) and introducing extensive economic and legal instruments (e.g. German climate policy based on principles such as polluter pays, precautionary, cooperation).

The post-communist countries of central and south-eastern Europe ranked lowest: Poland, Hungary, Romania, Bulgaria, with different reasons for this. The low ranking of Poland and Hungary is due to their opposition to climate action at the European and national level, as confirmed by the Climate Action Network (CAN) Europe report (2018). In contrast, Bulgaria and Romania show infrastructural and technological backwardness and a 'weak' institutional environment (*Melenciuc, 2018*).

Table 4 shows the results of the ranking for Polish regions, which shows that of the 281 ranked EU regions, the Warsaw Capital Region ranks highest, but only 221. It is the best developed region in socio-economic terms in the country. Regions bordering Ukraine are ranked respectively: 245th place (Podkarpackie) and 260th (Lubelskie). Lubelskie Voivodeship is still ahead of the other six regions.

Table 4. Ranking of Polish regions according to the RCCCI index

Ranking position	Regional code	Region	RCCCI
221	PL91	Warszawski stołeczny	-0,282
225	PL51	Dolnośląskie	-0,294
234	PL21	Małopolskie	-0,348
241	PL41	Wielkopolskie	-0,410
242	PL63	Pomorskie	-0,415
245	PL82	Podkarpackie	-0,419
246	PL71	Łódzkie	-0,427
250	PL22	Śląskie	-0,437
253	PL42	Zachodniopomorskie	-0,452
255	PL61	Kujawsko-Pomorskie	-0,468
260	PL81	Lubelskie	-0,486
261	PL43	Lubuskie	-0,487
263	PL52	Opolskie	-0,498

Ranking position	Regional code	Region	RCCCI
266	PL92	Mazowiecki regionalny	-0,518
268	PL72	Świętokrzyskie	-0,524
269	PL84	Podlaskie	-0,528
280	PL62	Warmińsko-Mazurskie	-0,741

Source: as in Table 1.

Conclusion

The briefly described method and research procedure, as well as the obtained results, allow us to state that the presented study is primarily methodological in nature. It is a proposal to fill the research gap related to the consideration of climate change in the analysis of regional competitiveness. On the other hand, it has a cognitive character, which makes it possible to conclude that it can be the basis for undertaking activities of an applied character within the framework of regional and national climate policies and the European Green Deal. It also seems useful to use for a more detailed analysis of climate competitiveness of Ukrainian regions, especially those bordering Poland.

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HUMAN CAPITAL DEVELOPMENT: CONTEMPORARY TRANSFORMATIVE TRENDS

Introduction

This section explores selected conceptual and theoretical aspects of human capital: its definition and measurement, as well as its significance for economic growth and regional development, providing a contextual framework for the discussions in this and the following section. The analysis considers the perspective of less-developed regions, including peripheral areas. Subsequently, contemporary transformative trends affecting human capital are presented, drawing from the concept of megatrends, which are frequently employed in qualitative analyses of modern economic transformations and in future studies (*cf. Malik, Janowska, 2018; Naughtin et al., 2024*). Particular attention is given to four megatrends: the aging of the labor force and depopulation, the widespread adoption of education (especially higher education), technological progress (including digitalization and AI), and the energy transition. Special emphasis is placed on the mechanisms through which these megatrends influence the transformation of human capital and the labor market in Poland and Ukraine, with a focus on the cross-border regions between Poland and Ukraine. This section is based on a review of economic literature, particularly in the fields of labor economics and regional economics.

The Concept and Measurement of Human Capital in the Literature

The concept of human capital gained prominence in economic theory during the 1960s, primarily due to the works of *Becker (1962)*, *Mincer (1958)*, and *Schultz (1961)*. According to Becker, human capital encompasses individuals' knowledge, ideas, skills, and health. It constitutes a valuable asset that individuals invest in and enhance through education and training, thereby increasing its potential productivity

and economic value. Becker emphasized that this capital is embodied in individuals and influences their future income. Mincer defined human capital as the sum of knowledge acquired in educational institutions during formal education and experience gained in the workplace. He also demonstrated that individual wage level is a function of education and professional experience. Schultz viewed human capital as comprising qualitative components such as skills, knowledge, and similar attributes that affect individuals' ability to perform productive work. These authors highlighted the necessity of investing in human capital.

Human capital is an unobservable and multidimensional variable. Its measurement can be approached through three methods: education-based, cost-based, and income-based. The education-based method employs indicators such as enrollment rates, schooling participation, and the educational structure of the workforce. Despite limitations – such as disregarding the quality of education or individual differences in ability – these measures are widely used in empirical research due to the availability of statistical data. The cost-based method sums up the costs of investments in human capital and the costs of lost opportunities. However, due to difficulties in classifying these costs, this method is rarely used. The income-based method uses Mincer's wage equation to estimate the value of human capital based on income, but its application is constrained by the lack of suitable wage distribution data. In empirical analyses, human capital is most often proxied using a set of indicators related to education (e.g., years of schooling, the percentage of individuals with higher education, exam results), as well as public investments in education, research and development expenditures, the number of employees in research and development, and life expectancy (Roszkowska, 2013). These indicators are often aggregated into composite measures. Furthermore, contemporary analyses increasingly utilize results from international tests of knowledge and skills.

In macroeconomics, a milestone in human capital research was the inclusion of this type of capital in endogenous growth models by Lucas (1988) and Romer (1990). Lucas rejected the assumption of constant returns to scale in production functions, which leads to external effects resulting from human capital accumulation. According to Romer's model, technological change incentivizes continued accumulation of human capital, thereby enhancing productivity growth. Technological progress is modeled as an increasing function of the level of human capital and the utilisation of this capital in the research and development sphere. Both models suggest that externalities of human capital accumulation can permanently raise the long-term economic growth rate, though this requires a shift from current consumption toward investment in human capital (cf. Barro, 2001; Cichy and Malaga, 2005; Roszkowska, 2013).

Studies on the role of human capital in economic growth at the national level have inspired economists specializing in regional development. A key premise of

this research is the significant and persistent regional disparities within national economies. Against this backdrop, increasing investments in human capital in lagging regions is often recommended, while deficiencies in human capital and its outflow to other regions are recognized as critical barriers to the development of less-developed and peripheral regions (*cf. Faggian et al., 2019*). On the other hand, in leading regions, human capital resources constitute a significant element of their competitive advantage, alongside higher potential in educational institutions (*cf. Herbst, 2012*). However, reducing regional disparities in human capital resources is not an easy task. Investments in educational institutions do not necessarily lead to narrowing developmental gaps, as regional economies are far more interconnected than national economies, and barriers to the flow of human capital between regions with different levels of development are significantly lower. Human capital migration typically occurs from lagging, less urbanized regions with lower levels of socio-economic development to more developed regions, particularly large urban agglomerations (*Faggian et al., 2017*).

Megatrends, Regional Economies, and Human Capital

The first megatrend negatively affecting human capital resources is the shrinking and aging of the labor force. Depopulation in Central and Eastern European countries has become one of the most pressing socio-economic issues and a key focus of policy agendas. Its primary causes are low fertility rates and a negative migration balance. In Poland, the population has been systematically decreasing since 2012, with the labor force shrinking since 2015. Labor shortages are felt across many industries, which, combined with rapid economic growth, have contributed to a sharp decline in unemployment and exacerbated labor market shortages (*Maleszyk, 2020*). In Ukraine, the population has been declining since 1994. In both Poland and Ukraine, the COVID-19 pandemic and its effects led to increased mortality rates and decreased birth rates. In Ukraine, depopulation has been further accelerated by war-related mortality and international migration; according to World Bank estimates, the country's population decreased by 15% between 2021 and 2023.

Population dynamics, including depopulation, exhibit significant spatial variability. Due to migration, faster pace of depopulation are observed and projected in less-developed regions, particularly rural areas and small to medium-sized towns located outside the areas of influence of major urban centers (*cf. Śleszyński, 2019*). In Poland, this trend is documented by demographic projections from the Central Statistical Office (GUS) for voivodeships: between 2023 and 2060, Poland's population is projected to decrease by 17.8%, but in the Podkarpackie and Lubelskie Voivodeships, the expected decline will be significantly higher, at 21.1% and 26.4%,

respectively. In some medium-sized cities (e.g., Przemyśl or Chełm) and border local administration units (e.g., Hrubieszów), population reductions of 40% or more are anticipated.

Depopulation in Poland and Ukraine poses serious and long-term economic consequences. Demographic trends are expected to exacerbate labor shortages, and the lack of qualified workers may become a major barrier to business development. The reduced availability of human capital resources will also decrease the investment attractiveness of these countries, particularly in the regions most affected by shrinking workforce pool. This is especially concerning, as a skilled and competitively priced labor force has been a competitive advantage for Poland within the EU, contributing to the development of high-productivity, knowledge-based industries and services with strong international linkages.

The decreasing human capital resources resulting from demographic trends can be mitigated through improvements in the quality of human capital. Education and training are investments by individuals and firms that involve upfront costs in exchange for anticipated future returns. Governments provide public education to address market failures, such as incomplete capital markets, the significant time lag between educational decisions, their costs, and the realization of benefits, the contractual trap between employers and employees, and the positive externalities of investment in education (*cf. Boeri, van Ours, 2014*). Public spending on education, measured as a percentage of GDP, has shown an increasing trend in recent decades, with the most significant changes observed in higher education institutions. In developed countries, higher education gained popularity in the second half of the 20th century. For instance, in the United States, one in seven individuals aged 18–24 attended college in 1950, compared to one in two by 1990 (*cf. Snyder, 1993*). In Poland, the dynamic expansion of higher education occurred during the 1990s, largely driven by the proliferation of private HEI. Despite concerns about the massification of education and the overeducation of labor force, the labor market outcomes for higher education graduates in developed countries, measured by wage premiums and unemployment risk, remain better than those of individuals with lower investments in human capital (*Machin and McNally, 2007; Boeri, van Ours, 2014*). Similar findings are observed in studies conducted in Poland (*Wincenciak, 2017; Chłoń-Domińczak, 2019*).

Universities play a particularly significant role in human capital accumulation in cities and regions. Their influence on regional development operates through multiple channels. First, universities enhance human capital accumulation, improving the quality of the labor force by realising their educational mission. Second, universities contribute to innovation development through scientific research, knowledge transfer, and technological advancement. Both education and research activities are especially important in the context of the growing knowledge-based economy. Third,

universities fulfill various social functions: they collaborate with social stakeholders, participate in cultural development, promote civic attitudes, contribute to the development of social capital, and cooperate with local governments (*for more, see Olechnicka and Wojnar, 2008*).

It is also essential to consider the accumulation of human capital at earlier stages of education, where young people primarily develop basic skills. International comparisons are facilitated by the PISA survey, in which Poland has participated since 2000. Poland continues to rank among the top OECD countries in terms of educational quality, particularly in mathematics and science, while inequalities between schools and socio-economic disparities are less pronounced than in many other OECD countries. In contrast, Ukraine's results, both during the war-affected year of 2022 and in 2018, were significantly below the OECD average (*OECD, 2019; Kaźmierczak and Bułkowski, 2024*).

Although the impact of education on individual career outcomes is undeniable, the quality of educational institutions and the education wage premium vary significantly across regions. In Poland, educational disparities can be attributed to three factors (*cf. Herbst, 2012*). The first is the historically shaped division between the more developed western part of the country and the less developed eastern part. Educational attainment statistics are higher in western Poland than in the east. However, over the past two decades, there has been substantial investment in education in eastern Poland, with the Lubelskie and Podkarpackie Voivodeships recording some of the highest increases in the proportion of the population with higher education. School exam results also reveal a strong determination among residents of eastern Poland to pursue education. Furthermore, *Herbst (2012)* demonstrated that public investments in education do not adequately explain the territorial distribution of exam results in Poland; instead, cultural and historical factors, such as lower social capital in western and northern Poland (the so-called "Recovered Territories"), play a more significant role. This lower social capital is linked to the nearly complete population replacement in these areas after their incorporation into Poland in 1945 and the legacy of state-owned agricultural enterprises.

The second factor explaining educational outcomes is the traditional rural-urban divide, which is gradually being overshadowed by the trend toward the metropolisation of socio-economic life. Currently, human capital development is concentrated in largest cities and their functional areas, while significantly poorer results are recorded in rural areas far from large urban centers – referred to as internal peripheries – as well as in small and medium-sized towns. The highest educational potential is found in agglomerations, which attract and educate large numbers of students and benefit from an influx of skilled workers from more remote parts of the region and other areas of the country (*cf. Olechnicka and Wojnar, 2008; Herbst, 2012; Stanny, 2013*).

The highlighted trends in education, including the development of higher education, play a significant role in shaping the transformation of Polish-Ukrainian border regions. Several reflections can be drawn from the above considerations. First, regional capital cities such as Lublin and Rzeszów in Poland and Lviv and Lutsk in Ukraine play a crucial role in human capital accumulation. Due to its size and supra-regional functions, Lviv, in particular, holds a strategic position among these cities. Second, the development of human capital in these cities is supported by their well-established academic functions. Third, migration can significantly affect both the quantity and quality of human capital. Border regions in Poland, due to their lower levels of development and population outflows to other regions, are more vulnerable to the human capital deterioration. Ukrainian regions, on the other hand, are in a somewhat different situation: while they face the effects of war, these impacts are less severe than in central or eastern Ukraine. Before the war, the economic development level (measured by GDP per capita or productivity) of the Lviv Oblast was the highest in western Ukraine (*Chugaievskia and Tokarski, 2018; Dykas et al., 2020*), while the inflow of population from other regions following the war outbreak could enhance the potential of both the Lviv and Volyn Oblasts. Fourth, the disparity in the quality of educational institutions between Poland and Ukraine, alongside geographic and cultural proximity, is a significant factor driving educational migration from Ukraine to Poland. Finally, assuming a scenario of war cessation, Ukraine's reconstruction, and its economic and political integration with the European Union, the border location could provide economic development opportunities for both Ukrainian and Polish regions. Reconstruction process will be influenced by human capital and, in the long term, should also positively impact the human capital developments in border regions.

Another challenge related to the development of human capital is technological progress. From a macroeconomic perspective, the impact of technological advancement on employment depends on the interplay between the effects of capitalization and creative destruction. The capitalization effect arises from the introduction of innovations that increase labor productivity, boost production, and enhance company profits, leading to increased labor demand and reduced unemployment. Product innovations, which create new jobs, professions, and even entire industries, have a particularly strong pro-employment effect. Conversely, the creative destruction effect, resulting from a decline in the marginal revenue of maintaining jobs associated with outdated technologies, contributes to job elimination and increased unemployment. This effect is more pronounced in the context of process innovations. Empirical evidence from highly developed countries disregards the notion that technological progress or technological change negatively impacts the total demand for labor. Employment levels in OECD countries have demonstrated a strong upward trend, while the development and dissemination of new technologies have caused

shifts in labor market demand, particularly in occupational and skill compositions (*cf. Acemoglu and Restrepo, 2018, 2019; Kwiatkowski and Arendt, 2023*).

For a long time, the evolution of employment's skill composition driven by technological progress was explained by the theory of Skill-Biased Technical Change (SBTC). A formal exposition of this concept can be found in Acemoglu (2002). This theory assumes that technological progress favors more educated individuals (those with higher education), who are better equipped to utilize new technologies than low-skilled workers. Technological advancement increases the attractiveness of highly educated workers to employers, leading to higher demand for their labor while reducing demand for low-skilled workers (Kwiatkowski and Arendt, 2023). From this perspective, the expansion of higher education would increase labor market resilience to structural changes. However, empirical evidence has not confirmed the effects predicted by this theory. Furthermore, trends in the employment composition and skill demand in advanced economies contradicted SBTC's predictions. Increasingly, research findings point to a growing polarization of the labor market in terms of labor demand and wage structures. This polarization "favors" not only highly skilled workers but also those with low skill levels, while the group most adversely affected comprises workers with medium-level skills and wages (*Gajdos and Arendt, 2018*).

The Skill-Biased Technical Change (SBTC) concept was eventually replaced by the Routinisation-Biased Technical Change (RBTC) model, primarily based on findings from Autor, Levy, and Murnane (2003). This approach analyzes the labor structure not through the lens of occupations but through tasks performed. Tasks are classified into five categories: non-routine analytical, non-routine interpersonal, routine cognitive, routine manual, and non-routine manual. Technological progress oriented towards routinization replaces routine tasks (both manual and cognitive) while complementing non-routine analytical and interpersonal tasks, leading to corresponding changes in labor demand composition. The impact of technology on non-routine manual tasks, however, remains ambiguous. Empirical analyses for highly developed countries indicate that changes in labor demand align with the RBTC hypothesis (*cf. Kwiatkowski and Arendt, 2023, with cited literature; Acemoglu et al., 2023*).

The above findings pertain to technological progress, but similar question concerns the impact of digital transition, including the recent rise of artificial intelligence (AI), on employment and required skills. In their pioneering study, Frey and Osborne (2017) examined the risk of computerization for 702 occupations, estimating that 47% of jobs in the United States have a very high probability of being replaced by computer technologies within the next two decades. While the negative impact of technological change on employment in manufacturing is not surprising, their findings predicted the most significant reallocation processes in the services sector, with the largest labor shedding anticipated in areas such as retail, administration,

and transportation. By contrast, low computerization risk applies to education, healthcare, social work, legal services, arts and media, STEM (science, technology, engineering, and mathematics), management, and business and financial services. While these findings are consistent with the RBTC concept, the estimated scale of displacement effects has been highly controversial. Subsequent studies criticized Frey and Osborne's methodology for focusing solely on displacement effects – labor-saving impacts of process innovations – while neglecting job creation effects stemming from product innovations. Various authors (e.g., *Autor & Handel, 2013; Arntz et al., 2016*) have demonstrated that automation does not eliminate entire occupations but rather transforms the tasks performed within them. Thus, instead of analyzing prospects for entire professions (averages), the focus should be on task changes at the level of individual jobs. Later OECD estimates (*Nedelkoska & Quintini, 2018*), based on improved methodologies, suggest that the percentage of jobs at high risk of automation (minimum 70%) is approximately 14% for OECD countries. Significant task changes due to automation are estimated for 32% of occupations. However, the expected scale of these processes in Central European countries may be slightly higher.

Until recently, the situation in Poland differed somewhat from the trends observed in highly developed countries. *Hardy et al. (2018)* demonstrated that, similar to advanced economies, the importance of jobs involving non-routine cognitive tasks (both analytical and interpersonal) increased up to 2015, while the significance of manual tasks declined. However, unlike in these countries, the importance of routine cognitive tasks, typical of simple office and service jobs, also increased. This phenomenon was considered temporary and attributed mainly to foreign investment inflows and low labor costs. More recent studies based on job advertisements (*Arendt et al., 2023*) suggest signs of growing polarization in the Polish labor market in recent years.

One potential response to these challenges is to enhance technological competencies. Polish workers outperform the average in analytical and critical thinking skills but lag in digital skills (*Burski et al., 2013*). Additionally, business surveys indicate that growing difficulties in finding adequately skilled workers are driving increased automation and robotics in the industrial sector, though no substitution effect has been observed (*PIE, 2024*).

In the light of these findings, it is reasonable to expect that AI outcomes on labor market will follow mechanisms described in the Routinisation-Biased Technical Change (RBTC) framework. AI is likely to create a range of new tasks favoring workers with skills such as problem-solving, adaptability, and creativity. On the other hand, AI technologies will replace employees performing routine and repetitive tasks, both manual and cognitive. This particularly affects medium-wage and medium-education jobs in the service sector. Changes in the demand for jobs and skills in the labor market will intensify pressure on education and training systems.

Nevertheless, the question of whether future developments, including AI diffusion, will generate effects similar to those indicated by existing theories and models remains open. Many experts view AI as a groundbreaking innovation accompanied by mechanisms similar to those seen historically, albeit at a faster pace. For instance, Christopher Pissarides (2023), a Nobel laureate in economics for his research on the labor market, sees the development of AI as an opportunity to increase productivity. Conversely, other authors like Brynjolfsson and McAfee (2014) and Frey and Osborne (2017) emphasize the qualitative change in contemporary technological progress: the advancement of big data algorithms, artificial intelligence, and the growing sensory sensitivity and dexterity of robots could, in their view, intensify structural labor market disruption compared to historical trends. They suggest that the current processes deviate from historical patterns, with a significantly greater scale of job destruction and potentially negative impacts of technological progress on aggregate labor demand. They also note that the pace of human replacement by computer technologies will be influenced positively by an adequate supply of STEM-skilled workers and negatively by the availability of cheap labor. At this stage, however, these opinions remain in the minority and are voiced primarily by technology researchers rather than labor market economists.

Despite differing views on the impact of technological change on aggregate employment, there is broad consensus that digitization, robotics, and AI development are driving significant structural changes in the labor market. Based on historical experience, it can be assumed that new technologies will be adopted faster in major urban centers and wealthier regions offering agglomeration economies, characterized by significant human capital and innovation potential. These regions are also expected to experience the strongest job creation effects in areas complementary to new technologies. On the other side, technological changes may undermine the development prospects of less urbanized and peripheral regions, such as the Polish-Ukrainian borderlands. This suggests that economic strategies focusing on identifying and supporting regional smart specializations (Research and Innovation Strategies for Smart Specialization – RIS3) should prioritize economic activities based on non-routine tasks that are difficult to replace with new technologies. Given the low innovation potential of such regions, these activities should not rely on advanced digital technologies. The identification of these specializations should be accompanied by changes in public education and training systems, aimed at building human capital aligned with the chosen specializations.

Another megatrend influencing human capital in developed countries is the energy transition, driven by the commitments of the Paris Agreement. The energy transition is particularly relevant to the Polish-Ukrainian border regions, which include the Lviv-Volyn coal basin. A key driver of this transition is the European Union's climate policy. In 2019, EU member states adopted the European Green

Deal, committing to achieve climate neutrality (net zero greenhouse gas emissions) by 2050 (European Commission, 2019), a goal intrinsically tied to the energy transition process.

In the context of global climate change, the energy transition can be understood as the shift from fossil fuel-based energy systems to zero-emission systems, primarily those relying on renewable energy sources. In a broader sense, the energy transition encompasses both quantitative and qualitative changes in energy supply (in terms of sources and volume) and energy demand (*cf. Drobnia et al., 2022*). This process involves reducing greenhouse gas emissions, developing renewable energy sources (RES), improving energy efficiency, and phasing out fossil fuels (*cf. Kabeyi & Olanrewaju, 2022*). Climate mitigation and adaptation are now central to development research (*Nordhaus, 2021*), reinforced by the 2030 Agenda for Sustainable Development, which established Goal 7: ensuring universal access to affordable, reliable, sustainable, and modern energy.

The significance of the energy transition is further underscored by the strategic importance of energy and energy markets to economic functioning. Economic growth remains traditionally correlated with increasing electricity consumption, even though this correlation has weakened in Poland in recent years (*cf. Forum Energii, 2024*). Energy prices and supply stability are critical factors in a country's investment attractiveness and entrepreneurial development (*UNCTAD, 2023; World Bank Group, 2020*). Research confirms that energy prices influence business location decisions, particularly in energy-intensive industries (*Kahn & Mansur, 2010; Godlewska-Majkowska & Komor, 2021*). Energy prices and supply stability also affect firm survival, especially in the manufacturing sector (*Mulhall & Bryson, 2013*).

Recent analyses suggest emerging relationships between energy markets and the investment attractiveness of countries and regions. To meet sustainability goals and align with ESG principles, large corporations, especially multinational ones, are increasingly seeking locations offering renewable energy (*Patchell & Hayter, 2021; UNCTAD, 2023*). Ensuring affordable and clean energy is therefore a critical challenge for the long-term development of Poland's economy which has greatly benefited from foreign direct investment inflows, while heavily relies on fossil fuels which accounted for over 70% of energy consumption in 2024. For Ukraine, ensuring stable energy supplies and rebuilding energy infrastructure is vital for the nation's economy as it combats Russian aggression. One potential solution to Ukraine's current challenges lies in decentralized renewable energy systems, which, over the long term, could enhance the competitiveness of the its industrial sector.

The energy transition is driving changes in labor demand, creating green jobs. A common feature of these jobs is their connection to environmental protection and combating climate change through energy and resource conservation, promotion of renewable energy sources, and other forms of environmental actions. Green jobs

emerge across various sectors and industries, spanning the entire value chain, from research to production, distribution, and services, in both advanced technology sectors and traditional industries (*cf. ILO, 2018*). An empirical analysis of the U.S. labor market by *Curtis et al. (2024)* revealed that transitions from carbon-intensive to green jobs increased tenfold between 2005 and 2021, though they still account for less than 1% of total labor market flows. The authors confirmed significant regional variation in the levels and persistence of employment in emission sectors. They also found that older workers and those without higher education are less likely to transition to green jobs and are more often diverted to other carbon-intensive jobs, other occupations, or unemployment. This underscores the need for adjustments in education and training systems.

In the context of Poland, findings by *Sokołowski et al. (2022)* provide an interesting perspective. They analyzed past and projected labor market transitions of coal mining regions, driven by the phasing out of coal since 1990. The authors argue that, since the 2010s, employment alternatives to mining have increased, and areas where coal mining once dominated are now better prepared for a future without coal than they were in the 1990s. They highlight that achieving the goals of Poland's Energy Policy will require reducing employment in mining by 14,000 workers by 2030. However, other labor market trends, including growing labor shortages in Poland, will likely facilitate worker relocation. Further, the transition of post-mining regions is a long-term process generating high social costs. This is evident in examples from Polish regions such as Wałbrzych, parts of Silesia, and Lesser Poland. Different social groups are exposed to these costs to varying degrees. While mining sector employees, who are relatively well-organized and protected, bear a significant portion of the burden, cooperative sectors linked to mining also face challenges, though their links to mining industry are less visible in official statistical data.

In this context, the energy transition brings profound economic and social consequences, disproportionately affecting regions and industries. Regions with economies reliant on mining, extraction, and high greenhouse gas emissions, including border areas, will bear the greatest economic and social costs. Structural changes in labor markets induced by the energy transition should be preceded by adjustments in education and training systems to support the necessary transformation of human capital. Addressing these challenges require leveraging financial resources from various EU policy measures that support the transition toward low- and zero-emission economies (*cf. Szafran, 2023*), while mitigating, avoiding, and reducing social costs to achieve the goal of a just transition. In the context of the European Green Deal, a just transition entails ensuring equal access to environmental resources (e.g., clean air, water, and green spaces), labor markets, social and technical infrastructure, and reducing developmental disparities to provide a high quality of life and long-term growth opportunities. A just transition, therefore, cannot be reduced to energy transition or the restructuring of the

mining and conventional energy sectors alone. A crucial component of a just transition is supporting the diversification and modernization of local economies and mitigating the negative employment impacts of climate transition through retraining and active labor force integration (*cf. Drobniak et al., 2022*). Efforts toward a just transition are implemented through a place-based approach, which is supported in the literature (*e.g., Nowakowska et al., 2021; Drobniak et al., 2022; Weck et al., 2022*). This approach emphasizes the need to mobilize local resources and actors and tailor interventions to the spatial (territorial) contexts. Such tailored interventions are critical for ensuring that the transition benefits the communities most affected and supports long-term regional development.

Conclusions

This section presents transformative trends in human capital developments applying the framework of megatrends. Specifically, it discusses how human capital is affected by the aging of the workforce and depopulation, the expansion of higher education and learning, the technological progress, and the energy transition. Further, it offers a particular focus on the context of the Polish-Ukrainian borderland, showing why these regions are particularly vulnerable to the described megatrends. Demographic trends and technological advancements are accompanied by mechanisms that exacerbate regional inequalities, potentially diminishing the development prospects of these areas. While the energy transition poses certain risks, it also offers some opportunities. These challenges might significantly alter the long-term development trajectories of the Polish-Ukrainian borderland. Addressing these challenges requires human capital development, in which higher education institutions should play a central role.

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HUMAN CAPITAL AND LABOR MARKET IN BORDER REGIONS

Introduction

The aim of this section is to assess the human capital potential of the analyzed Polish-Ukrainian borderland. An empirical analysis of selected indicators representing the quantity and quality of human capital resources serves two primary purposes: first, to assess the development gap between the analyzed regions, and second, to evaluate the position of the border regions relative to other regions of Poland and Ukraine.

The analyzed data were sourced from Local Data Bank (Statistics Poland) and the State Statistics Service of Ukraine. The scope of the analysis is significantly constrained by the availability of regional-level data for Ukraine. Consequently, human capital and labor market conditions were approximated using the following indicators:

1. The number of students in higher education institutions relative to the population aged 18–24,
2. The number of academic staff per 10,000 residents,
3. Unemployment rate,
4. Employment rate,
5. Immigration rate,
6. Emigration rate,
7. Mortality rate.

The data required to compute these indicators, made available through the online databases of the State Statistics Service of Ukraine, mostly pertain to the years 2019–2021 (labor market indicators and population data), occasionally covering earlier years (mortality rate) or more recent ones (higher education data). Migration data were provided only for 2021. This limitation prevents the construction of a longer time series that could be used to assess developmental trends. Given that the regions experienced impacts of the pandemic in 2020–2021 and Russia's aggres-

sion against Ukraine since 2022, where possible, the indicators were calculated as three-year or five-year averages (2019–2021 or 2019–2023, respectively).

The spatial scope of the analysis also warrants additional commentary. For Poland, all 16 voivodeships were included. However, due to the Russian occupation, the State Statistics Service of Ukraine does not collect data from Crimea and Sevastopol, and data for Luhansk and Donetsk Oblasts are incomplete.

Empirical analysis

To begin with, the human capital of the border regions was approximated using data related to higher education. Figure 1 presents the following indicators: the number of academic staff employed in higher education institutions (including research, teaching, and research-teaching staff, averaged for the period 2019–2023) per 10,000 residents (as of 2021), and the number of students (averaged for the period 2019–2023) relative to the population aged 18–24 (as of 2021).

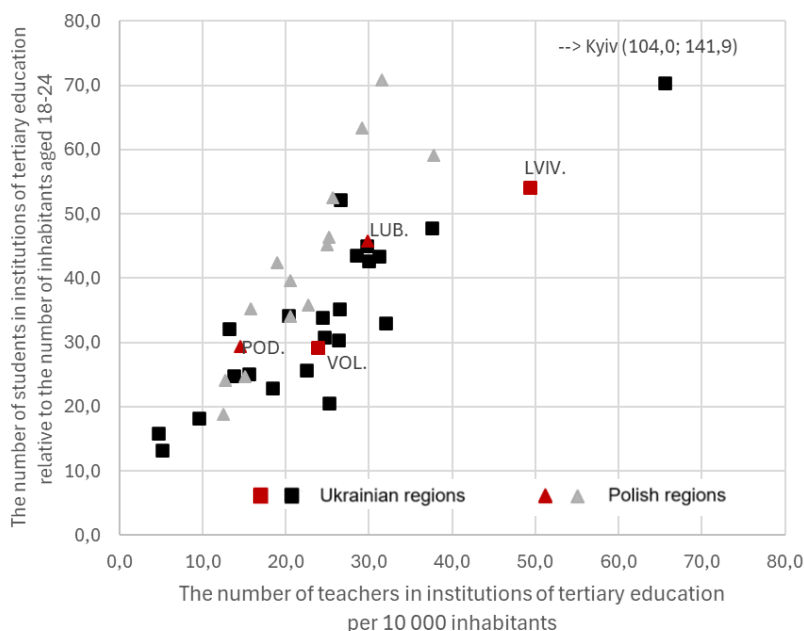


Fig. 1. Students and teachers in Higher Education Institutions

Source: own calculations based on data from Local Data Bank, Statistics Poland, <https://bdl.stat.gov.pl/bdl/start> [accessed 05.12.2024] and State Statistics Service of Ukraine, <https://stat.gov.ua/en/> [accessed 05.12.2024].

First, attention should be drawn to the performance of the border regions, marked in red on the graph. The Lviv Oblast demonstrates the highest academic potential, driven by the strong academic functions of the city of Lviv. The Lubelskie Voivodeship, with Lublin as its academic center, exhibits relatively high academic potential given the size of the city, positively influencing the level and accumulation of human capital. In contrast, the Podkarpackie Voivodeship and Volyn Oblast, particularly their capitals Rzeszów and Lutsk, display significantly less developed academic functions.

When comparing the academic potential of Lviv and Volyn Oblasts with other Ukrainian territories, it is evident that Lviv stands out as one of Ukraine's strongest academic hubs with national significance. The stronger academic centers are only Kyiv and Kharkiv, the latter located in the eastern part of Ukraine. Meanwhile, Volyn Oblast rank slightly lower than most other oblasts in Ukraine. The Polish border regions lack academic centers of national significance; however, the Lubelskie Voivodeship boasts relatively high academic potential compared to other Polish voivodeships, clearly surpassing the Podkarpackie Voivodeship. Data in the graph also suggest a much higher concentration of academic potential and human capital in Ukrainian oblasts with major cities, resulting in stronger regional disparities in Ukraine.

In this context, two additional comments are worth noting. First, the distance between regions, as measured by the analyzed indicators, is not large. This suggests that cooperation between academic centers could yield mutual benefits and offer an opportunity to enhance academic potential and improve the quality of human capital in border regions. However, straightforward comparisons of these indicators require caution given the systemic weaknesses of education system in Ukraine (OECD, 2017). Second, during the analyzed period, significant fluctuations in the number of students in Ukraine were observed. After peaking at 1.43 million in 2019, the student population declined to 1.05 million over the next two years (marked by the COVID-19 pandemic) before rebounding to 1.15 million in 2023 amid the war. Over the entire period, the number of academic staff systematically decreased.

The accumulation of human capital can improve labor market performance, yet the extent to which this capital is utilized depends on the economic situation. Regional labor markets in Poland and Ukraine can be approximated using data on employment rates and unemployment rates (measured according to International Labor Organization standards), presented in Figure 2.

Regarding the employment rate, the situation in the Lubelskie, Podkarpackie Voivodeships, and Lviv Oblast before the war was relatively similar. However, in terms of unemployment, the Lviv Oblast faced slightly worse conditions than the Polish border regions. The worst situation occurred in the Volyn Oblast, which experienced high, double-digit unemployment rates and a notably lower employment rate before the war. Unfavorable labor market indicators suggest a challenging economic performance and limited opportunities for leveraging human capital within enterprises.

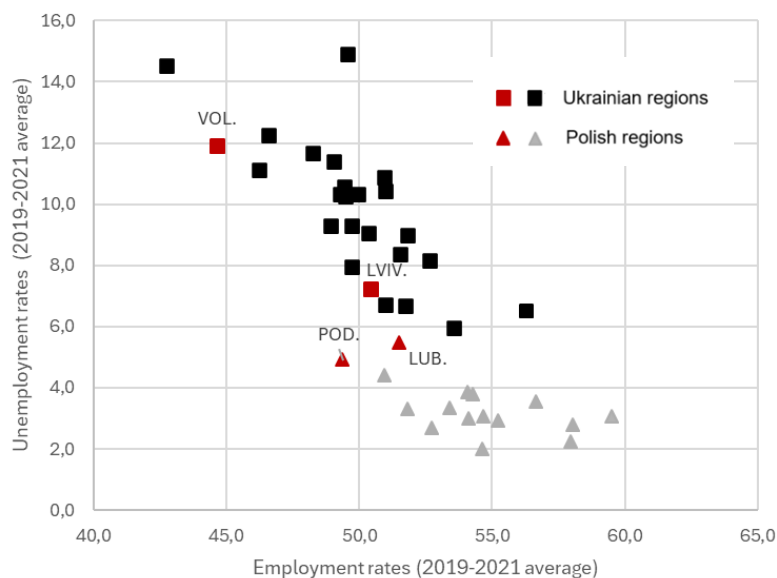


Fig. 2. Employment and unemployment rates

Source: as in graph Fig. 1.

Comparing regions across the two countries reveals interesting findings. Before the war, labor market conditions in Poland and Ukraine were markedly different. Polish regions exhibited very low unemployment levels and, generally, higher – though varied – employment rates compared to Ukraine. These indicators signal high labor demand and labor shortages, especially in Poland's most developed regions. Ukraine's labor market performance was considerably worse and highly variable in terms of regional unemployment and employment rates. Within Ukraine, the labor market in Lviv Oblast was relatively favorable, while conditions in Volyn Oblast ranked among the worst in the country. Meanwhile, the labor markets of Poland's border regions ranked among the weakest in the country, though their unemployment rates were still substantially lower compared to Ukraine.

Human capital resources within a region can change significantly in the result of migration. Figure 3 presents two indicators to assess this issue: the immigration rate, calculated as the number of incoming migrants (domestic and international) per 10,000 inhabitants, and the emigration rate, measuring the outflow of population from the region per 10,000 inhabitants. These indicators offer some insight into the migratory attractiveness of the border regions.

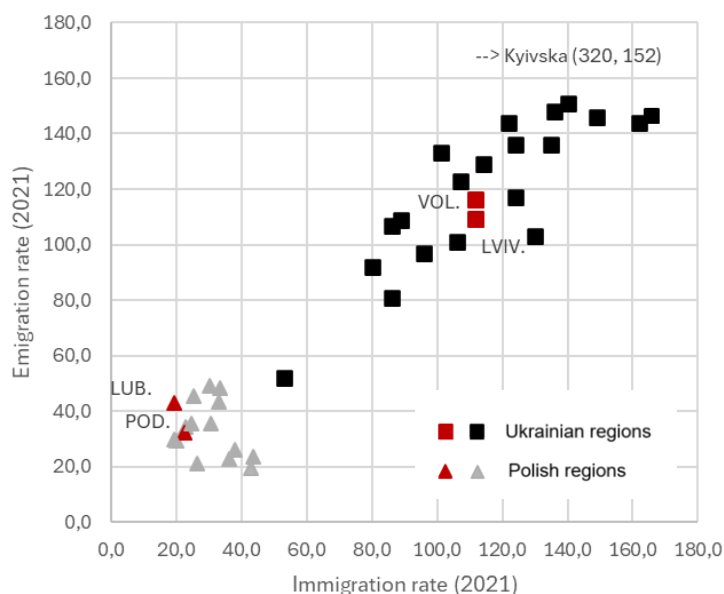


Fig. 3. Immigration and emigration rates

Source: as in Fig. 1.

The data reveal stark differences between Poland and Ukraine, which may stem from higher individual mobility in Ukraine. It is notable that official migration statistics in Poland are dominated by internal migration, while in Ukraine, international migration-often of a shuttle or circular nature-prevails. Within Ukraine's internal migration patterns, the Kyiv Oblast (excluding Kyiv city) stands out as the main destination for incoming residents. Nevertheless, the observed differences might also result from cross-country differences in measurement methods. In Poland, many migrations are not accompanied by a change of registered address which is the basis for migration statistics compiled by Statistics Poland. In Ukraine, such problems with unregistered mobility might be less prominent. Consequently, direct comparisons between the Polish and Ukrainian border regions raise significant methodological concerns, necessitating caution in interpreting the results and drawing broader conclusions.

Despite the outlined limitations, it is possible to compare the border regions based on the relationship between immigration and emigration rates. The Polish border regions exhibit low settlement attractiveness, with emigration rates significantly exceeding immigration rates, particularly in the Lubelskie Voivodeship, where this disparity ranks among the most unfavorable in the entire country. In contrast, the situation in the Ukrainian border regions appears comparatively better, with migration inflows and outflows relatively balanced and average mobility levels compared to other regions.

Surprisingly, the inflow to the Lviv Oblast, characterized by more favorable labor market performance and higher academic potential, does not appear to be greater than in the Volyn Oblast. However, these findings should be interpreted cautiously, as the data are limited to 2021—a year marked by the ongoing pandemic—and migration measurements in both countries may not fully capture the scale of the phenomenon.

The last measure of human capital, which approximates the population's health status, is the mortality rate, defined as the number of deaths per 1,000 inhabitants. Figure 4 differs from the earlier ones, as it presents the same indicator for two distinct years: 2019, a year without major crises, and 2021, when elevated mortality was driven by the COVID-19 pandemic and its consequences.

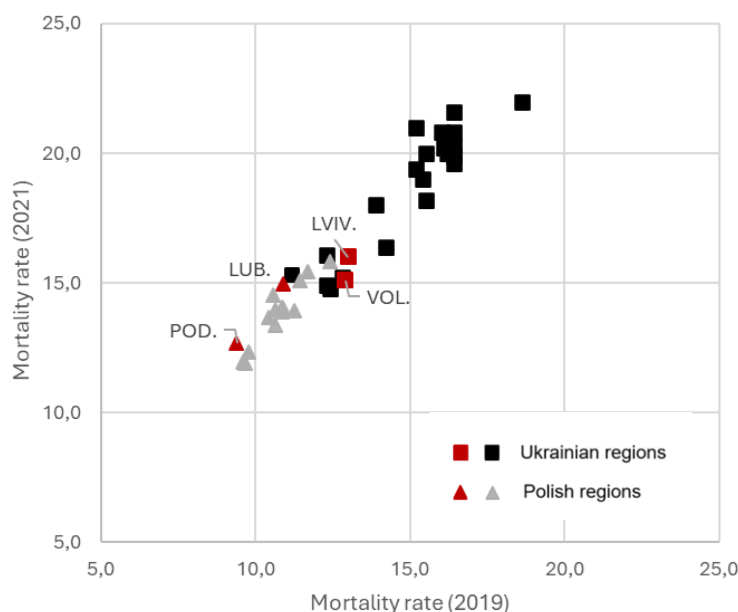


Fig. 4. Mortality rates in 2019 and 2021

Source: as in Fig. 1.

According to the data for 2019, Polish border regions exhibited lower mortality rates compared to the Lviv and Volyn Oblasts. The border regions also displayed relatively favorable conditions compared to other regions within each country, with distinctly lower mortality rates in Poland than in Ukraine. During the pandemic period, both countries experienced increased mortality, which resulted in narrowing the gap between the Polish and Ukrainian border regions. Nonetheless, the markedly lower mortality rate in Poland reflects better health conditions and medical care, which consequently translates into a higher quality of human capital.

Conclusions

The empirical analysis shed some light on human capital resources in the Polish-Ukrainian border regions by comparing various indicators both within these regions and against other regions in Poland and Ukraine. In terms of academic potential, the Lviv Oblast stands out, with its capital serving as one of Ukraine's most prominent academic centers. Among the Polish border regions, the Lubelskie Voivodeship demonstrates significant academic potential, albeit without nationally significant academic institutions. Higher education is more prevalent in the Lviv and Lubelskie regions compared to the Volyn and Podkarpackie regions. Labor market conditions reveal significant national disparities – Polish regions are characterized by low unemployment rates and strong labor demand, whereas Ukraine's labor market conditions are notably less favorable, particularly in the Volyn Oblast. Migration patterns further underscore differences between the two countries. Internal migration dominates in Poland, while international migration, often circular, prevails in Ukraine. In 2021, the settlement attractiveness of the Ukrainian border regions was average compared to other Ukrainian regions, while the Polish border regions experienced negative migration balances and low population inflows relative to other Polish regions. The analysis of mortality rates highlights better health outcomes among Polish residents, translating into higher human capital quality. However, the pandemic significantly affected the indicators in both countries, reducing the differences between regions.

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DIGITAL TRANSFORMATION – DIRECTIONS AND CONSTRAINTS

Introduction

Digital development constitutes one of the key pillars of the modern economy, shaping competitiveness and innovation at the global, regional, and local levels. It also contributes to the implementation of sustainable development policies based on the integration of social, economic, and environmental goals. In this context, digitalization serves as a tool that supports modernization processes and creates new development opportunities, enabling the reduction of spatial inequalities.

Digitalization plays a special role in the context of border regions, which, due to their specific geographic location, can experience numerous structural and functional constraints. Physical and geographical borders present significant barriers to the free flow of capital, consequently restricting opportunities for cross-border cooperation. These challenges contribute to deepening territorial inequalities and suppressing the economic potential of such areas. However, border regions also possess the potential to act as bridges between areas located on either side of the border. With appropriate support, this geographical positioning can be transformed into an asset, fostering the development of innovative solutions and intensifying economic and social cooperation.

This chapter provides a detailed analysis of the directions and constraints associated with the process of digital transformation. It focuses mainly on institutional conditions, which form the foundation for setting the frameworks and priorities of digital development. The chapter also reveals the key directions of research on digital transformation, as defined by leading international organizations and institutions dealing with digital development issues. Finally, the chapter outlines key constraints associated with the process of progressive digital transformation.

The concept and development of digitalization

Digitalization is one of the groundbreaking global socio-economic phenomena. It encompasses processes that utilize information and communication technologies (ICT) to enhance efficiency, strengthen competitiveness, and improve quality of life. Initially, the term digitization referred to the process of converting information from analogue to digital form (*Benedetti et al., 2023*). Over time, the concept has been broadened and redefined to represent the transformation of social and business practices through digital technologies (*Principato et al., 2023*).

In contemporary terms, digitalization is understood as the application of digital tools to increase productivity, which includes the introduction of innovative products, optimization of processes, and effective resource management (*Nasiri et al., 2022*). According to the European Commission (2020), digitalization involves the integration of digital technologies into all aspects of daily life and economic activity. This includes the development of technologies, digital skills, infrastructure expansion, and the creation of digital applications. Such a comprehensive model aims to improve citizens' quality of life while enhancing economic efficiency across Europe.

Digitalization is closely linked to the concepts of the information economy, digital economy, knowledge-based economy, and artificial intelligence (*Dubey et al., 2024*). Through these interconnections, digitalization plays a key role in socio-economic transformation processes, shaping the functioning of both enterprises and public institutions. However, the dynamic development of digital technologies also poses regulatory challenges, including data protection, cybersecurity, and the promotion of ethical and responsible technology use.

A central element of digitalization is the integration of advanced technologies such as the Internet of Things (IoT), which enables the creation of intelligent device networks, cloud computing, which facilitates remote data storage and analysis, artificial intelligence (AI), used to automate processes and analyze large datasets and blockchain, which ensures transaction security and transparency (*Bejjani et al., 2023*). Equally important are digital skills, which include both basic and advanced competencies essential for effective functioning in an increasingly digitalized world. These skills range from everyday use of technology to advanced capabilities such as programming and IT infrastructure management (*Zhao et al., 2023*). Digitalization requires not only technological progress but also investments in capacity and knowledge development to fully leverage the potential of emerging solutions. Moreover, data analysis plays a strategic role, enabling the effective use of insights from large datasets.

Technological infrastructure serves as the backbone of the modern digital economy. This includes broadband connectivity, which provides high-speed internet access, data centers that support the storage and processing of vast amounts of information and 5G networks, which enable ultra-fast communication and other

advanced technologies (*Niedzielski & Markiewicz, 2023*). Another significant aspect of digitalization is business transformation. Enterprises are adapting to the digital reality by developing innovative business models and utilizing technologies to create new revenue streams. Process automation enhances operational efficiency, while digital tools enable personalization and the establishment of long-term relationships with customers (*Krivý, 2023*). Digitalization also involves data management, which has become one of the most valuable resources in the contemporary economy. Big Data technologies allow for advanced data analysis, driving innovation and product development. Concurrently, the importance of cybersecurity is increasing to protect systems from threats, while data privacy remains critical in the context of legal regulations and building user trust.

Digitalization effectively eliminates geographical and physical barriers, opening access to a wide range of resources and services (*Wang & Shao, 2024*). Digital solutions make labour markets more accessible, providing new employment opportunities regardless of location. Additionally, digital technologies influence lifestyles by introducing innovations that support more sustainable and eco-friendly approaches to daily activities. Mobile applications and online platforms enable informed decisions regarding consumption, transportation, and energy management (*Chatterjee et al., 2023*).

Digitalization is also a key component in achieving sustainable development goals and driving green transformation. It significantly enhances the resilience of regions, particularly in the face of economic crises, natural disasters, and other emergency situations. Digital transformation can stimulate innovation, support entrepreneurship, and foster the creation of new business models that contribute to the accelerated recovery and growth of regions (*Shaukat et al., 2020*).

Nevertheless, progress in digitalization is not without risks. While it influences socio-economic development, competitiveness, and institutional efficiency, it can also exacerbate inequalities and poverty. Regions with limited access to digital technologies may become increasingly marginalized, contributing to greater social disparities. Digitalization can also result in new forms of social exclusion, particularly for individuals lacking access to modern tools or digital competencies. Addressing these challenges requires coordinated efforts to ensure inclusive digital development that balances technological advancement with equitable access and opportunities for all.

Directions of Digital Transformation

Digital transformation is a complex and multifaceted process, the dynamics and directions of which are closely dependent on the pace of technological progress, public policies, and the degree of societal adaptation to modern solutions. This process is shaped by a wide range of factors, including legal regulations, the level

of access to digital infrastructure, and the readiness of organizations to implement innovative technologies (Bruno *et al.*, 2023).

Among the contemporary trends dominating digital transformation, several key areas can be identified. One of these is the growing role of artificial intelligence (AI) and automation, which are significantly reshaping production and service processes. Another major direction is the development of cloud technologies, which provide organizations with flexible resource management and efficient data processing and storage. Equally important is the digitalization of business processes, which enables operational optimization within companies and the transformation of business models (Hao *et al.*, 2024). Digital transformation also has a profound impact on the functioning of societies, leading to fundamental changes in work practices, communication methods, and everyday life. The increasing integration of technology into both private and professional spheres, along with the necessity of acquiring new digital skills, introduces new challenges while simultaneously creating opportunities for development. Moreover, the growing focus on data security and privacy protection has become a critical element of digital transformation on a global scale (Murthy *et al.*, 2021).

The directions of digital transformation in Europe are significantly shaped by the European Union's regulatory frameworks, which play a pivotal role in creating a cohesive, inclusive, and sustainable digital space in the region. The European Union undertakes multifaceted legislative actions aimed not only at harmonizing the development of digital technologies but also at establishing the foundations for their safe and ethical use. These regulations provide legal frameworks for key areas of transformation, such as personal data protection, the development of the Digital Single Market, the promotion of digital skills, artificial intelligence, and cybersecurity. EU policy particularly emphasizes ensuring equal access to modern digital tools, eliminating technological barriers, and fostering innovation among member states (Table 1).

Table 1. Key EU Regulations on Digitalization

Regulation	Regulation description
Horizontal regulations	
eEurope-An information society for all (1999/687)	10 Priorities: Introducing European youth to the digital era, Providing more affordable Internet access, accelerating e-commerce, ensuring high-speed Internet access for researchers and students, implementing smart cards, facilitating venture capital for technologically advanced SMEs, promoting e-participation for people with disabilities, developing online healthcare services, advancing intelligent transportation systems, establishing e-government services.
An Action Plan eEurope 2002 – An Information Society for All (2000/330)	3 main objectives: more affordable, faster, and safer Internet; investing in people and digital skills; and promoting the use of the Internet, particularly in commerce, healthcare, and transportation systems.

Regulation	Regulation description
An Action Plan eEurope 2005 – An Information Society for All (2002/263)	Promoting secure services, applications, and content based on widely accessible broadband infrastructure.
The i2010 Strategy – A European Information Society for Growth and Employment (2005/229)	Promoting a single digital market, supporting innovation and investment in ICT, and enhancing social inclusion.
A Digital Agenda for Europe (2010/245)	Developing broadband Internet infrastructure, digitalizing public services, and promoting digital skills.
A Digital Single Market Strategy for Europe (2015/100)	Eliminating regulatory barriers, establishing a unified legal framework for the digital market, and thereby transforming the national markets of EU member states into a single common digital market.
Shaping Europe's Digital Future (2020/67)	3 main pillars: Technology that works for people, a fair and competitive digital economy, and an open, democratic, and sustainable society.
2030 Digital Compass: the European way for the Digital Decade (2021/118)	4 main directions: a digitally skilled society and highly qualified digital professionals, secure, efficient, and sustainable digital infrastructure, digital transformation of businesses, and the digitalization of public services.
The „Digital Europe” Programme (2021/694)	5 objectives: high-performance computing, artificial intelligence, cybersecurity and trust, advanced digital skills, and the optimal use of digital capacities and interoperability.
The „Path to the Digital Decade” Policy Programme until 2030 (2022/2481)	Digital sovereignty, development of digital skills, strengthening the collective resilience of EU countries, bridging the digital divide, economic transformation, regulatory environment, sustainability and innovation, security, and privacy.
Thematic Regulations	
1. Cybersecurity	
Cybersecurity Strategy of the European Union: An Open, Safe and Secure Cyberspace (2013/01)	Enhancing the cyber resilience of IT systems, reducing cybercrime, protecting critical infrastructure, promoting international policy and cooperation, and advancing research in the field of cyberspace.
Network and Information Security Directive (2016/1148)	Enhancing the security of networks and IT systems, protecting essential services, and strengthening cooperation and information exchange among member states.
Cybersecurity Act (2019/881)	Unified cybersecurity framework, increased cooperation and coordination at the European level.
The EU's Cybersecurity Strategy for the Digital Decade (2020/18)	Strengthening Europe's role as a leader in developing international standards and legal regulations in the field of cybersecurity.
Regulation Establishing the European Cybersecurity Industrial, Technology and Research Competence Centre and the Network of National Coordination Centres (2021/887)	The European Cybersecurity Industrial, Technology and Research Competence Centre, along with a network of national coordination centers, was established to enhance the security of networks and IT systems, including those in sectors such as transportation, healthcare, energy, digital infrastructure, water, financial markets, and banking.
Network and Information Security Directive 2 (2022/2555)	Expanded the scope of cybersecurity regulations to include additional sectors and entities.
The Cyber Solidarity Act (2023/0109)	Enhancing the detection of network threats or security incidents, strengthening cooperation, and improving the collective resilience of the European Union against cyber threats. A European Cybersecurity Shield was established.

Regulation	Regulation description
Regulation on Cybersecurity for EU Institutions (2023/2841)	Establishing unified cybersecurity standards for EU institutions, bodies, and agencies. Creating the Interinstitutional Cybersecurity Board.
2. Protection of Personal Data and Privacy	
Data Protection Regulation (RODO/GDPR) (2016/679)	Greater control and security of personal data. It established the European Data Protection Board.
E-Privacy Regulation (2017/03)	Expands the definition of data derived from electronic communications, increases transparency regarding cookies, and extends protection to metadata such as location or website visit information.
Directive on Open Data and the Reuse of Public Sector Information (2019/1024)	Focuses on protected data, where respecting the rights of others is required. Introduces a mechanism for a data altruism approach, enabling easier and safer sharing of data for the common good (particularly in the area of scientific research). Regulates matters related to the reuse of certain categories of protected data, data-sharing services, and the activities of data intermediaries.
An European Strategy for Data (2020/66)	Creating a single data market while respecting ethical principles.
Data Governance Act, DGA (2022/868)	Providing greater access to data and facilitating data exchange between sectors and countries.
Data Act (2023/2854)	Ensuring fair access to and use of data among various market participants in the digital economy.
3. Artificial Intelligence	
Artificial Intelligence for Europe” (2018/237)	The first comprehensive EU strategy on AI focuses on increasing investments in research and development, promoting international cooperation, developing appropriate AI-related skills and competencies, and establishing suitable ethical and regulatory frameworks.
Coordinated Plan on Artificial Intelligence (2018/795)	Harmonizing the approach to investments, research, and AI policy at the European level.
Building Trust in Human-Centric Artificial Intelligence (2019/168)	Defines principles and requirements for the development and implementation of AI in an ethical and trustworthy manner, respecting fundamental rights and values. The guidelines are non-binding and encompass seven principles: human oversight and control, technical robustness and safety, privacy and data governance, transparency, diversity, non-discrimination and fairness, social and environmental well-being, and accountability.
White Paper on Artificial Intelligence- A European approach to excellence and trust) (2020/65)	Ethical issues, necessary legal regulations for the European ecosystem of excellence, and digital infrastructure.
Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence -Artificial Intelligence Act) (2021/206)	The first comprehensive set of legal regulations on artificial intelligence in the world, representing a pioneering step towards regulating AI technology in a way that balances innovation with the protection of citizens' rights and safety.
Regulation on Establishing Harmonized Rules on Artificial Intelligence (2024/1689)	Establishes harmonized rules for the marketing, deployment, and use of AI systems within the Union, as well as prohibitions on certain AI practices.
4. Digital Single Market	
Digital Single Market Strategy for Europe (2015/192)	3 pillars: better access for consumers and businesses to goods and services online across Europe, creating the right conditions for the development of digital networks and services, and maximizing economic growth generated by the European digital economy.

Regulation	Regulation description
Communication: Digitizing European Industry – Fully Exploiting the Potential of the Digital Single Market (2016/180)	Actions supporting the digitalization of industry, enabling the full utilization of the potential of the Digital Single Market.
Communication: Connectivity for a Competitive Digital Single Market – Towards a European Gigabit Society (2016/587)	The vision of a European „Gigabit Society” based on universal access to high-speed Internet.
Communication: 5G for Europe – An Action Plan (2016/588)	Ensuring universal availability of 5G networks by 2025.
Communication: A Connected Digital Single Market for All (2017/228)	Improving access to digital goods and services, creating appropriate conditions and equal opportunities for the development of digital networks and innovative services, and maximizing the economic growth potential associated with the digital economy.
Digital Markets Act (2020/1828)	Ensuring fair competition.
Digital Services Act (2022/2065)	Ensuring the security and accountability of online platforms for user-generated content.
5. Digital Skills	
The New European Skills Agenda (2016/381)	Strengthening human capital, increasing employment opportunities, and enhancing the competitiveness of the EU economy.
Strengthening European Identity through Education and Culture (2017/673)	The Vision of a European Education Area.
Digital Education Action Plan (2018/022)	3 priorities: better use of digital technology in teaching and learning, developing digital competencies and skills relevant in the era of digital transformation, and improving education through enhanced data analysis and programming.
The European Skills Agenda for Sustainable Competitiveness, Social Fairness, and Resilience (2020/274)	Promotes sustainable competitiveness, social fairness, and resilience to changing economic and technological conditions, thereby supporting economic growth, social inclusion, and the personal development of EU citizens.
Digital Education Action Plan 2021–2027: A New Approach to Learning and Training in the Digital Era (2020/624)	2 strategic priorities: supporting the development of a highly effective digital education ecosystem and enhancing digital competencies and skills relevant in the era of digital transformation. It established a European Digital Education Hub to assist Member States in the field of digital education.
Horizon Europe Programme (2021/764)	The largest research and innovation funding program in the European Union, aimed at supporting the development of science, technology, and their applications to address global challenges.
Regulation Establishing the Erasmus+ Programme (2021/817)	Support educational, professional, and personal development in the areas of education and training, youth, and sports, both in Europe and beyond.

Source: Based on EU regulations.

Poland's digital policy draws significantly from the experiences and regulatory frameworks of the European Union, which serve as the foundation for national digitalization initiatives. This process is based on harmonizing Polish strategies and legal regulations with EU guidelines, enabling the creation of a cohesive and sustain-

able digital environment that supports both the development of technologies and their effective implementation across various economic sectors and social domains. Poland's digital policy is shaped by a range of legal acts that establish principles for data protection, cybersecurity, e-government, and the development of innovative digital services (Table 2).

Table 2. Key Regulations on Digitalization in Poland

Regulation	Regulation description
Goals and Directions for the Development of the Information Society in Poland (2000)	The first comprehensive plan for building the information society in Poland.
ePoland: Action Plan for the Development of the Information Society in Poland for 2001–2006	Main objectives: development of telecommunications infrastructure, universal, more affordable, faster, and safer Internet, investing in people, encouraging better use of Internet opportunities, ICT development in rural areas, and the advancement of digital radio and television.
The Act of February 17, 2005, on the Informatization of Entities Performing Public Tasks (Journal of Laws 2005, No. 64, item 565)	Required public administration entities and other entities performing public tasks to implement and use information and communication technologies to enhance the efficiency and transparency of their operations.
ePoland-2006: Action Plan for the Development of the Information Society in Poland	Included an outline of the most significant issues, the directions of undertaken actions, and a catalog of key objectives. It also emphasized the necessity of creating local and regional strategies for the development of the information society.
The State Informatization Plan for 2006 (Journal of Laws 2006, No. 147, item 1064)	Creating the conditions for building a cohesive national and European system of online services based on the cooperation of ICT systems, aimed at meeting the needs of citizens and businesses.
The State Informatization Plan for 2007–2010 (Journal of Laws 2007, No. 61, item 415)	Defined the priorities and objectives of state informatization, a list of sectoral and cross-sectoral IT projects, an action program for the development of the information society, and public tasks to be implemented electronically (priority services for citizens and businesses).
The Strategy for the Development of the Information Society in Poland until 2013	Set strategic directions and defined objectives aimed at achieving the development of the information society in Poland.
Public Data Opening Program (Resolution No. 107/2016 of the Council of Ministers)	Increasing citizen participation in co-decision-making on public matters and improving the quality and availability of public data.
The National Cybersecurity Policy Framework of the Republic of Poland for 2017–2022 (Resolution No. 52/2017)	Regulated the principles of ensuring cybersecurity in Poland. It defined the goals, priorities, and actions related to the protection of networks and information systems in the country, as well as cooperation between various government institutions, the private sector, and international organizations in the field of cybersecurity.
The Act of July 5, 2018, on the National Cybersecurity System (Journal of Laws 2018, item 1560)	Introduced to align Polish law with the requirements of the EU Network and Information Security (NIS) Directive.
The Personal Data Protection Act (Journal of Laws 2018, item 1000)	Regulates the principles of personal data processing and the rights of individuals whose data is being processed.

Regulation	Regulation description
Assumptions for the AI Strategy in Poland: Action Plan of the Ministry of Digital Affairs 2018	The foundation for creating a strategic action plan aimed at the development and utilization of AI technologies, focusing on four key areas: data-driven economy, funding and development, education, and law and ethics.
The Act of 4 April 2019 on the Digital Accessibility of Websites and Mobile Applications of Public Sector Entities, (Journal of Laws 2019, item 848)	Defines the requirements for the content, review, and digital accessibility of websites and mobile applications of public sector entities.
The Cybersecurity Strategy for 2019–2024 (Resolution No. 125/2019)	Enhancing resilience to cyber threats and the level of information protection in the public, military, and private sectors, as well as promoting knowledge and best practices.
Memorandum for the Development of Artificial Intelligence in Poland 2019	Emphasizes the need to develop the artificial intelligence ecosystem and to create a Roadmap for the Development of Artificial Intelligence in Poland.
Artificial Intelligence Development Policy in Poland for 2019–2027: Trustworthy AI, Autonomy, and Competitiveness +PL	Defines the directions and objectives for the development of trustworthy artificial intelligence.
„Policy for the Development of Artificial Intelligence in Poland since 2020” (Resolution No. 196 of the Council of Ministers)	Outlines actions that Poland should implement and goals it should achieve in the short term (by 2023), medium term (by 2027), and long term (after 2027) to foster the development of society, the economy, and science in the field of artificial intelligence.
National Action Plan for the „Path to the Digital Decade” Policy Programme until 2030 (Resolution Np.125 of the Council of Ministers 2024)	Includes policies, interventions, and actions that the Polish government administration commits to undertaking in order to accelerate the digital transformation.

Source: Based on Polish regulations.

The regional framework of digital policy in Poland is based on national and EU guidelines, yet voivodeships also develop their own digital development strategies tailored to specific local needs and challenges. Regional digital policies consider the diversity of economic, social, demographic, and infrastructural conditions, enabling a more precise response to the unique challenges faced by individual regions. Strategic documents on digital development vary in scope, level of detail, and degree of formalization.

Voivodeships in Poland adopt diverse approaches to digitalization within regional development policies. One approach involves the creation of dedicated digitalization strategies, which allow for a detailed diagnosis of local needs and more precise monitoring of progress toward achieving established goals. This method facilitates the alignment of actions with regional specificities, taking into account local conditions. Another solution is the integration of digitalization issues into broader regional development strategies, such as Regional Innovation Strategies (RIS) or smart specialization strategies. This approach fosters the coordination of activities and the optimization of resource utilization, both financial and organizational. Digi-

talization is sometimes incorporated into general development strategies (Table 3). In this case, digital initiatives become part of broader regional modernization plans, enabling the integration of digitalization goals with other development priorities. However, this approach may limit the ability to closely monitor outcomes and to adjust activities to specific local needs.

Table 3. Classification of Polish Voivodeships by the Integration of Digitalization in Development Strategies

Group	Voivodeships
Voivodeships with Dedicated Digitalization Strategies	Mazowieckie, Śląskie
Voivodeships with Digitalization Incorporated into Innovation and Development Strategies	Małopolskie, Wielkopolskie, Lubelskie, Opolskie, Świętokrzyskie, Podkarpackie, Zachodniopomorskie, Łódzkie, Lubuskie
Voivodeships with Digitalization Incorporated into Smart Specialization Strategies	Kujawsko-pomorskie, Podlaskie
Voivodeships with Digitalization Incorporated into General Regional Development Strategies	Dolnośląskie, Warmińsko-mazurskie, Pomorskie

Source: Based on available regional strategies.

The diversity of applied solutions indicates the absence of a unified model for digitalization policy at the regional level. On one hand, this allows strategies to be tailored to local conditions; on the other, it may pose a challenge to the coherence and effectiveness of actions on a national scale.

Research Directions of Digital Transformation

The research directions on digitalization encompass a multidimensional analysis of the impact of digital transformation on various aspects of socio-economic life, taking into account the evolving needs of society, the economy, and public administration (Table 4). These studies focus both on assessing the level of technological advancement and identifying challenges related to the adoption of digital technologies. The primary objective of digitalization research is to develop effective models for implementing digital technologies.

The diversity of research topics reflects the complexity and multidimensional nature of digital transformation processes, which encompass not only technological aspects but also economic, social, cultural, and institutional dimensions. The dynamic development of new technologies will undoubtedly lead to a further intensification of research on this issue. As a result, there will be growing interest in both the theoretical and practical dimensions of digital transformation, simultaneously expanding the scope of analyses and scientific discussions at both global and regional levels.

Table 4. Areas of Digital Transformation and Monitoring Institutions

Area	Topic	Institutions
Connectivity and Digital Infrastructure	Development of Broadband Internet and 5G Networks. Accessibility of Information and Communication Technologies (ICT).	European Union (EU) – DESI, EIS, RIS. International Telecommunication Union (ITU) – ICT Development Index (IDI). IMD World Competitiveness Center – Digital Competitiveness Ranking. Digital Planet (Tufts University) – Digital Intelligence Index (DII).
Human Capital and Digital Skills	Assessment of Basic and Advanced Digital Skills. Education in Digital Technologies. Preparing Societies for Digital Transformation.	EU – DESI, RIS. Portulans Institute & University of Oxford – Networked Readiness Index (NRI). IMD World Competitiveness Center – Digital Competitiveness Ranking (pillars: knowledge and technology).
Digital Public Services and E-Government	Development and Availability of E-Government Services. Digital Health (e-health) and Other Online Public Services. Transparency and Accessibility of Digital Administration.	EU – DESI, E-Government Benchmark. UN – E-Government Development Index (EGDI) and E-Participation Index (EPI).
Digital Innovation and Competitiveness	The Level of Firms' Innovativeness and Their Ability to Implement Digital Technologies. The Linkages Between Digitalization and Innovation.	EU – European Innovation Scoreboard (EIS). EBRD – Knowledge Economy Index (KEI). Digital Planet – Ease of Doing Digital Business (EDDB).
Digital Economy and Enterprises	The Use of Big Data, Cloud Computing, AI, and Automation in Business. Developing Business Models Based on the Digital Economy.	EU – DESI. IMD World Competitiveness Center – Digital Competitiveness Ranking. Digital Planet – Emerging Geography of AI.
Future Readiness and Sustainable Development	Adaptation to the Challenges of Digital Transformation. Sustainable Development of Digital Technologies.	Portulans Institute – Networked Readiness Index (NRI). Digital Planet – Progress to Digital Parity Scorecard.
E-Participation and Civic Engagement	The Use of Digital Tools in Decision-Making Processes. Facilitating Interaction Between Government and Citizens.	UN – E-Participation Index (EPI).
Global Digital Competitiveness	Positioning of Countries in the Global Digital Competitiveness Ranking. Assessment of Digital Infrastructure Advancement and Innovation.	IMD World Competitiveness Center – Digital Competitiveness Ranking. Digital Planet – Digital Intelligence Index (DII).

Source: Based on the literature.

Constraints

Progressing digitalization plays a pivotal role in shaping contemporary regional development. At the same time, it generates numerous institutional, social, economic, and cultural challenges, where a proactive approach becomes essential to ensure

flexible adaptation to ongoing changes. Digitalization also fosters sustainable development by enabling more efficient resource management, reducing environmental impacts, and enhancing socio-economic integration across different societal groups. It allows regions to develop new economic sectors, such as green technologies or the knowledge-based economy, addressing current challenges related to environmental protection and climate change mitigation. Furthermore, digitalization plays a significant role in aiming developmental opportunities, particularly in peripheral regions or those facing socio-economic difficulties, by increasing access to digital services, online education, and remote work (*Nasiri et al., 2022*).

However, the development of digitalization in regions is not free from challenges. Many regions face constraints stemming from various social, technological, institutional, and economic factors. On the social view, a lack of adequate digital competencies among residents is a major issue. Insufficient digital education and the exclusion of certain societal groups further deepen existing inequalities (*Peng et al., 2023*).

From a technological perspective, the lack of access to modern digital infrastructure, such as high-speed internet and 5G networks, represents a significant barrier, particularly for less developed regions. Inequalities in access to technology can exacerbate digital exclusion, making it difficult for peripheral regions to achieve equal development opportunities compared to more privileged areas (*9th Cohesion Report, 2024*).

The pace and efficiency of digitalization processes are also influenced by institutional factors, such as the absence of coherent digitalization strategies at the regional level and insufficient collaboration between various levels of administration. Weak coordination of activities and inadequate engagement of public institutions in promoting digital innovation may limit the adoption of modern solutions in both public administration and the private sector (*Kańduła 2023*).

Economic constraints further hinder the progress of digitalization, including insufficient financial resources for investments in digital infrastructure and technological innovations. Many regions, especially those with lower levels of economic development, are unable to independently finance large-scale digital transformation projects, increasing their reliance on external support, such as EU funds or national development programs.

Overcoming barriers to digitalization requires coordinated efforts from various stakeholders and the implementation of a long-term strategy tailored to the specific needs and capabilities of a given region.

Conclusion

The analysis conducted in this chapter allows for the formulation of conclusions regarding both the potential and limitations associated with the process of digital transformation. Digitalization, as a tool supporting modernization processes, plays a crucial role in achieving sustainable development policies by offering new opportunities to reduce spatial inequalities and enhance competitiveness. It is particularly significant in border regions, which despite specific structural and functional limitations, can leverage digitalization to transform their geographic location into a key economic and social asset.

The considerations presented indicate that the foundation of effective digital transformation lies in institutional conditions, which establish the framework for action and define development priorities. In this context, the role of international organizations and research institutions is also essential, as their efforts focus on developing tools, indicators, and methodologies for monitoring digitalization progress. At the same time, identified barriers, such as infrastructure deficits, digital exclusion, or the lack of coordination at the cross-border level, represent significant challenges that require coordinated efforts at both local and international levels. Undoubtedly, digital transformation is a multifaceted process that demands an interdisciplinary approach and cooperation among multiple stakeholders. Only through such collaborative efforts can the full potential of digitalization be harnessed to build competitive, innovative, and sustainable regions capable of effectively addressing contemporary development challenges.

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DEVELOPMENT OF THE INTELLECTUAL PROPERTY SYSTEM, SCIENTIFIC AND INNOVATIVE ACTIVITIES IN THE REGIONS OF THE UKRAINIAN BORDERLAND

Digitalization processes are taking place across all spheres of our lives. Digital technologies are actively used in manufacturing, healthcare, commerce, education, science, and even in the creation of inventions and creativity. This indicates that the intellectual property (IP) system, like many other fields, is also influenced by digital transformation. “Digitalization” is the foundation of business development, as the most successful companies in recent years are those that directly apply information technologies in their core activities. Digitalization in modern conditions is a structural factor of socio-economic development, influencing competitiveness and efficiency across all sectors of the economy” (*Commercialization of innovations, 2022, p. 84*).

Digital technologies open up numerous opportunities for the development of IP. Much of this is connected to the emergence and development of the internet. Now it is not difficult to find the information we need. There are many websites with films, books, and works of writers and musicians, making IP objects more open and accessible. Access to such data may be paid, promoting the commercialization of creative activity, which in turn stimulates the development of creativity.

These facts show that thanks to the internet, the number of IP objects is increasing, new mechanisms for their distribution and use are emerging, as well as new ways of marketing and promoting them. The development of e-commerce, one of the components of which is online sales, also affects the IP system. Selling goods via the internet has several advantages, such as reducing costs, eliminating intermediaries between the seller and the buyer, and expanding the target audience. This

undoubtedly attracts manufacturers, which leads to the production of more goods, and consequently, the appearance of new brands that are IP objects.

The core of digital transformation is the growing volume of data. The relationship between data and IP objects can be viewed from different angles. First, data can become the basis for the development of inventions, the creation of copyright objects, or serve as an idea. For example, a scientific article is an IP object, and different data can be used in its writing. The more data there is, the more opportunities arise for the creation of various works where this data can be applied, thereby expanding the IP market. Looking at another side of the data-IP relationship, it should be noted that the characteristics of IP objects are also data that are subject to certain rules regarding protection, distribution, and access.

Inventions, industrial designs, works of art, science, cinema, and the works of photographers and writers – all these are results of creative and inventive activity and are considered IP objects. The definition of an IP object is not fixed in the Civil Code of Ukraine. The legislator only provides a list of IP objects in Article 420 of the Civil Code of Ukraine (*The Civil Code of Ukraine, 2003*). Therefore, IP policy cannot be carried out without encouraging and stimulating innovation and creativity. In the innovation field, a true breakthrough has been made with the creation of artificial intelligence (AI). The development of AI influences the IP system, changing many of its components.

Currently, a significant number of IP objects can be created using AI or work with AI. An example is the “smart” glove “Bright Sign,” the technology of which was developed by Saudi inventor Hadil Ayoub. This development uses machine learning, where the glove remembers a person’s gestures, forming a sign language library based on them. When using the glove, the gestures are converted into speech (*Jewell, 2019*). Other examples include AI-based developments by Baidu: a body temperature measurement system; the software solution “Virtual Doctor Consultant,” which helps doctors diagnose diseases; and the unmanned transport system. While humans are the creators of these objects, they used AI as a tool in the process of creation (*Lian, 2020*). However, there are cases where inventions have been created by AI without human participation. Examples include a plastic food storage container and a traffic signal lamp created by the “creative machine” “DABUS.” In 2019, participants in the “Artificial Inventor” project submitted several patent applications, with the AI program “DABUS” listed as the inventor (*Abbott, 2019*).

AI is also used to solve various administrative issues in the field of intellectual property (IP). The World Intellectual Property Organization (WIPO) implements AI-based technologies in managing the IP system. These include WIPO Translate, which is used for translating patent documents, an image search system designed for brands, patent and trademark classification systems (*WIPO, 2024*). The use of these technologies significantly simplifies and makes IP management more efficient.

The impact of AI on the IP system was discussed above. There is also a reverse connection between them. IP objects can serve as the basis for training an AI program. In such cases, various works of art, music, literature, research results, images, and other IP objects are incorporated into the process of AI training. These data are necessary to teach and train the program.

The use of AI also reveals some shortcomings in the classical IP system. Questions arise regarding inventions created by AI. According to the European Patent Convention and patenting policies in many countries, the inventor can only be a human, and only they can have rights to IP objects (*Abbott, 2019*). As mentioned earlier, there are inventions created without human involvement, yet patent applications listing AI as the inventor are rejected. This can lead to problems, for example, when someone tries to conceal the fact that the technology was created by a machine and claims the results as their own. Therefore, this issue should be addressed, and new mechanisms for protecting such objects might need to be considered.

Thus, digital transformation has become one of the driving forces behind the development and expansion of the IP market, making many processes more convenient and efficient. However, due to the transformation of the economy, several questions and issues have arisen that are difficult to resolve within the classical IP system.

Let's return to the impact of the Internet, which, unfortunately, undermines the protection of IP rights. There are pirated copies of many intellectual works, such as software, and often different data is «leaked.» For example, a book may be sold over the Internet, someone buys it, and then posts it online for free access. Undoubtedly, this negatively affects sales. Controlling illegal content is quite challenging, which raises the issue of property rights protection. There are also situations where people actively use the results of intellectual work they easily find on the internet but do so without the author's permission or attribution. Another issue is the illegal collection, use, and storage of data that has economic value for the entity. In the era of digital transformation, the amount of data is increasing, making it more difficult to manage their protection.

In this context, there is a need to improve mechanisms for protecting intellectual property objects on the Internet, combat piracy, illegal use and distribution of copyright objects, and safeguard databases from hacking. This can be achieved through the improvement of IP legislation.

The ongoing Russian-Ukrainian war significantly limits opportunities for safe entrepreneurship, affects international cooperation, and reduces opportunities for scientific research and innovation. However, on the other hand, industries that become strategically important during this period, such as developments in security and defense, increasingly require protection. The IP field faces the challenges and obstacles of wartime, despite undergoing numerous legislative changes. Issues related to the protection of trademarks, patents, and copyrights remain relevant today (*Borysenko, 2023; On the Protection of Intellectual Property Interests, 2022*).

On October 28, 2022, the Cabinet of Ministers of Ukraine adopted Resolution No. 943-p «On Some Issues of the National Intellectual Property Authority». As a result, the State Enterprise «Ukrainian Intellectual Property Institute» (UKRPATENT) ceased performing the functions of the National IP Authority, and the State Organization «Ukrainian National Office of Intellectual Property and Innovations» (UKRNOPI) took over its responsibilities (*Order of the Cabinet of Ministers*, 2022). The reform of the state IP system began back in 2016, and the full-scale invasion accelerated these changes. Many modifications are related to harmonizing Ukrainian and European legislation, as Ukraine officially obtained the status of a European Union candidate on June 23, 2022. The Ukrainian IP office operates on the «single window» principle, similar to European institutions. Additionally, the concept of the National IP and Innovation Hub was presented, which will unite many functions, such as ensuring the filing of IP registration applications, conducting expertise, registering the transfer of rights, holding startup competitions, organizing support programs for entrepreneurs and innovators, and creating associations of authors, creators, inventors, business professionals, lawyers, and investors.

In the spring of 2023, the Ukrainian National Office of Intellectual Property and Innovations (UKRNOPI) opened information about IP applications submitted for registration but without a defined submission date in search systems. This facilitates the work of specialists, rights holders, and interested parties, as they can quickly check for identity and similarity and, for example, track applications that may infringe on previously submitted or registered objects.

Changes have also been introduced for applicants and their representatives. Firstly, according to the Cabinet of Ministers of Ukraine Resolution No. 859 dated August 15, 2023 (*Resolution of the Cabinet of Ministers*, 2023), new types of fees have been introduced, old terms have been clarified according to new regulations, and some benefits have been increased. For example, previously, applicants could pay 80% of the fee for submitting a trademark application electronically, but now the fee is reduced to 75%. For non-profit organizations, fees for IP actions (except for codes 13300, 13400, 13500, and 13700) have been reduced from 20% to 12% if the entity is the applicant or patent holder, and from 40% to 30% if the entity is the applicant or rights holder for a utility model.

On January 1, 2023, a new law, Law No. 2811-IX «On Copyright and Related Rights» (*On copyright and related rights*, 2022), came into effect. During its preparation, European legal norms were taken into account to fulfill the obligations of the Association Agreement, introduce new modern provisions that were previously absent, clarify existing terminology, and remove outdated provisions. For example, new objects have been added to the list of copyrighted works, such as font designs, artistic forging, circus performances, stage designs, and musical-light shows. It should be noted that while these works were not explicitly mentioned in the previ-

ous version of the law, they were still protected under copyright law because the list is not exhaustive, unlike objects not protected by copyright, which are finite. Non-protectable objects now include official documents (e.g., decrees, laws, regulations, government standards, decisions, etc.), facts, and photographs that lack originality (not photographic works).

A new provision has been introduced detailing the concept of «sui generis» – a special right for non-original objects created using computer programs without human involvement, i.e., works created by artificial intelligence (AI). The law offers a broad list of potential right holders, including AI developers, their heirs, legitimate users, and those who have been granted rights under a license for the computer program that can generate such objects. Moral rights to «sui generis» works do not arise, but economic rights, as with any copyright work, are defined in Article 12 of the Law of Ukraine «On Copyright and Related Rights». Unlike the general rule, where economic copyright lasts for the author's life and 70 years after their death, the special right lasts 25 years after the generation of the object, and «sui generis» rights for databases last only 15 years. It is important to note that works created by individuals using computer technologies do not fall into this category. For example, if an artist creates a digital illustration on a computer or tablet, using apps or programs but drawing it themselves, they will retain full copyright over the result of their creative activity.

A balance must be maintained between protecting data and ensuring the free exchange of information, which is an integral part of scientific, creative, commercial, and other activities, as well as technical and innovative development.

However, the changes to the legislative framework are not enough. There is a problem that many people simply do not know what they can and cannot do with IP objects. Therefore, when copying information, using pirated software, or utilizing data protected by copyright or patents, they are often unaware that they are engaging in illegal actions. In this regard, it is crucial to raise awareness about these issues, showing the benefits of using licensed versions to avoid the temptation to bypass the law.

The IP market is indeed undergoing changes in the context of the digital transformation of the economy: the number of IP objects is increasing, their accessibility is rising, more opportunities for the commercialization of creative activities are emerging, and innovation and technology implementation in the IP system are being stimulated. However, the challenges posed by digitalization highlight some issues and shortcomings within the classical IP system. This indicates the need for changes in IP management policies and mechanisms, as the classical system is becoming outdated in certain areas. Only with constant improvement will the IP system be able to keep pace with technology and the demands of the modern world, providing answers to all questions regarding the protection and management of intellectual property.

An important indicator of the effectiveness of the implementation of a country's scientific-technological (intellectual) potential is the registration of intellectual property (IP). According to the State System of Intellectual Property Legal Protection of Ukraine, the situation in the field of IP reflects the overall macroeconomic trends. Thus, compared to the indicators of 2022, the number of applications for industrial property objects (IPO) increased by 47.6% in 2023. This indicator in 2023 exceeds the previous one (22,195 applications) by more than 10.5 thousand applications, but is still lower than the pre-war level of 2021 (41,003) (*Scientific and Scientific-Technical Activity*, 2023). Inventions, as the most significant industrial property object, show a 5.5% increase. The dynamics of applications for other industrial property objects are higher: utility models – 47.4%; industrial designs – 34.8%; trademarks – more than 55.4%. Statistical data on the filing of applications for inventions and utility models show that the inventive activity of national applicants increased by 42.5% in 2023 compared to the previous year. The total number of registrations of inventions and utility models in the name of national applicants amounts to 3,104, which is 16.6% more than in 2022. Comparing the indicators of 2022 and 2023, the number of utility model registrations increased by 31.7%. Intellectual property is an integral part of innovation recovery, as ensuring the implementation of new technologies and, consequently, the establishment of manufacturing in Ukraine requires proper protection of intellectual assets.

Therefore, the post-war revival of the country depends significantly on the development of the innovation sector. One of the main factors in the development of the country's innovation sector is expenditure on research and development (R&D). Data analysis indicates that Ukraine, like Ireland, Turkey, and Russia, has a low level of spending on R&D, which may indicate a lag in the development of science and technology. For example, Ukraine's R&D spending decreased from 0.43% in 2020 to 0.29% in 2022. Overall, the data points to the diversity of strategies and levels of commitment of countries in the development of the scientific-technical sector, which affects their competitiveness and innovation potential (*Scientific and Scientific-Technical Activity*, 2023).

Based on available statistical data for 2000–2020, further detailed analysis of the dynamics of scientific and innovation activities in Ukraine and the regions of the Ukrainian borderlands will be conducted. In the first stage, we will examine the change in the number of organizations performing scientific and scientific-technical work in the regions of the Ukrainian borderlands between 2000 and 2020 (Fig. 1).

The graph above demonstrates the dynamics of the change in the number of organizations engaged in scientific and scientific-technical activities in three western Oblasts of Ukraine: Volyn, Zakarpattia, and Lviv, over the period from 2000 to 2020. Analyzing these data allows for the identification of general trends and characteristics of scientific potential development in the regions of the Ukrainian borderlands.

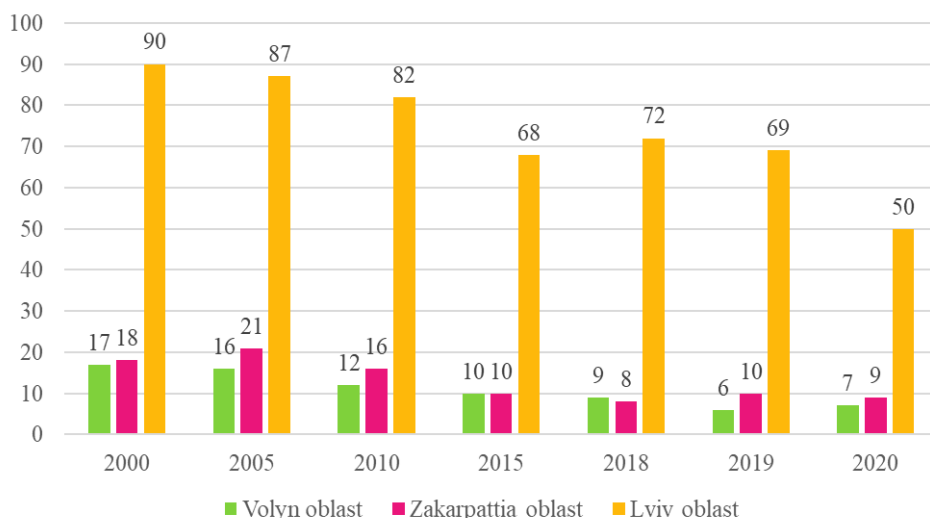


Fig. 1. Changes in the number of organizations performing scientific and technical work in the regions of the Ukrainian border in 2000–2020, units

Source: compiled by the author based on data from (State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024; State Statistics Service of Ukraine, 2024).

From the graph, it is evident that the total number of organizations conducting scientific research in all three regions exhibits a fluctuating pattern, with a tendency towards a decline at the end of the analyzed period. Volyn Oblast shows the most significant decrease in the number of scientific organizations compared to the other regions. After a slight increase in the early 2000s, the number of such organizations began to steadily decrease. The dynamics of the number of scientific organizations in Zakarpattia Oblast is more stable compared to Volyn. However, after a peak in 2005, a gradual decline is observed. Lviv Oblast traditionally demonstrates the largest number of scientific organizations among the regions considered. Despite some fluctuations, the general trend also points to a decrease in the number of such organizations.

Therefore, based on the presented data, it can be stated that, despite some regional differences, the overall trend indicates a reduction in the number of organizations engaged in scientific activities in all three regions. The decrease in the number of scientific organizations is related to the overall economic situation in the country, insufficient funding for science, and the outflow of qualified personnel abroad. Regional characteristics of science development are determined by various factors, such as historical conditions, the level of industrialization, the presence of scientific centers, and others.

Further, the dynamics of the change in the number of specialists engaged in scientific and scientific-technical work in the regions of the Ukrainian borderlands from 2000 to 2020 will be examined (Fig. 2).

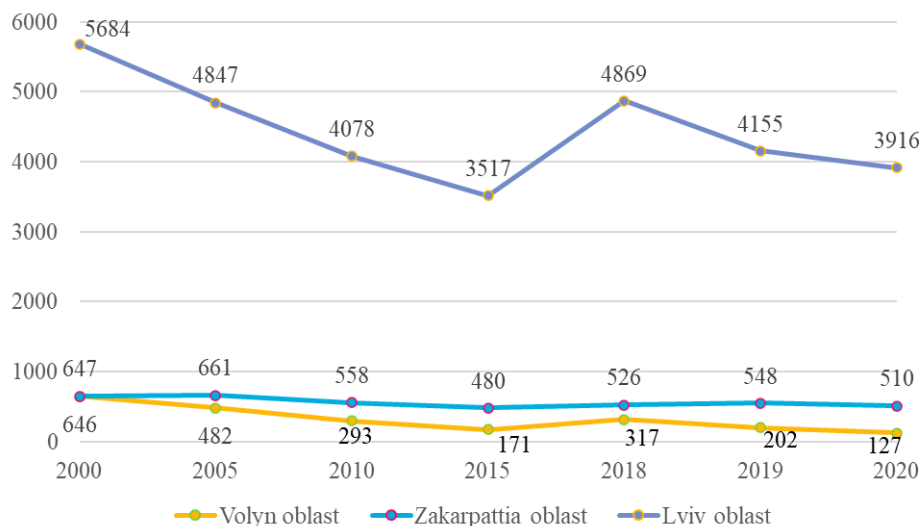


Fig. 2. Changes in the number of specialists performing scientific and technical work in the regions of the Ukrainian border in 2000–2020, units

Source: built by the author on the basis of data (State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024; State Statistics Service of Ukraine, 2024).

The analysis of the data presented in this figure allows for the identification of general trends and characteristics of the development of scientific potential in the regions of the Ukrainian borderlands from the perspective of human resources. The graph shows that the total number of scientific workers in all three regions exhibits a fluctuating pattern with a tendency to decrease towards the end of the analyzed period.

Lviv Oblast has the highest number of scientific workers throughout the entire study period. However, the number of specialists in Lviv also shows an overall trend of decline, particularly noticeable after 2010. In Volyn Oblast, the number of scientific workers is the lowest among the regions considered. There is a steady decrease in the number of specialists throughout the entire study period. Zakarpattia Oblast shows a more stable dynamic in the number of scientific workers compared to the other regions. However, after the peak in 2005, a gradual decline is observed.

Based on the presented data, it can be concluded that, despite some regional differences, the general trend indicates a decrease in the number of scientific workers in all three regions. The reduction in the number of scientific workers in the Ukrainian borderland regions is a concerning signal, indicating the need for measures to

support the scientific potential of the regions. To address this issue, a set of measures needs to be developed aimed at enhancing the prestige of scientific activities, increasing funding for science, creating favorable conditions for scientists to work, and attracting young specialists to scientific work.

It is also important to analyze the change in the sum of internal current expenditures on scientific and scientific-technical works performed by scientific organizations in the Ukrainian borderland regions from 2000 to 2020 (Fig. 3).

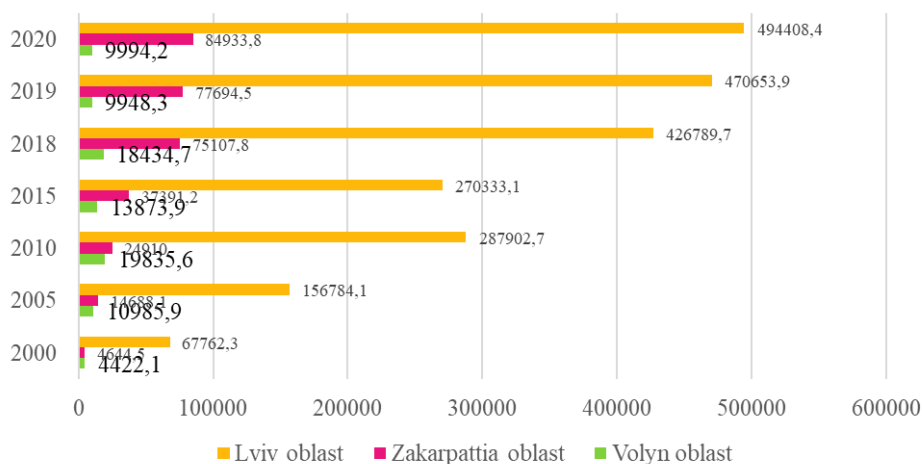


Fig. 3. Changes in the amount of internal current expenditures on scientific and technical work performed by scientific organizations in the regions of the Ukrainian border in 2000–2020, thousand UAH

Source: built by the author on the basis of data (State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024; State Statistics Service of Ukraine, 2024).

The figure shows that the total sum of internal current expenditures on scientific research in all three regions demonstrates an increasing trend throughout most of the analyzed period. However, the growth rates and levels of funding differ significantly between the regions.

In Lviv Oblast, the largest amount of funding for scientific research has been observed throughout the entire study period. The expenditure dynamics show a steady upward trend, indicating active development of the scientific sphere in the region. In Zakarpattia Oblast, the volume of internal current expenditures on scientific research also demonstrates growth, but the growth rate is slower compared to Lviv Oblast. In Volyn Oblast, the amount of funding for scientific research is the lowest among the regions analyzed. The expenditure dynamics are more uneven, with noticeable fluctuations over the period under study.

Thus, despite some differences between the regions, the overall trend indicates an increase in internal current expenditures on scientific research in all three regions. This suggests a rising prioritization of scientific activities in the regions and an increase in investments in science. The levels of funding for scientific research and the rates of their growth differ significantly between the regions. Lviv Oblast is a leader in funding, reflecting a more developed scientific infrastructure and favorable conditions for conducting scientific research. The dynamics of research funding are closely tied to the overall economic situation in the regions and the country as a whole. Periods of economic growth are typically accompanied by an increase in science investments, whereas economic crises result in funding reductions.

The increase in internal current expenditures on scientific research in the Ukrainian borderland regions is a positive trend, reflecting growing interest in science and innovation. However, to further develop the scientific potential of these regions, measures need to be taken to optimize the use of funds, stimulate scientific activities, and attract additional investments.

At the next stage, the dynamics of the number of applications submitted for the issuance of protective documents to the State Department of Intellectual Property of Ukraine in the Ukrainian borderland regions from 2000 to 2020 were studied (Fig. 4).

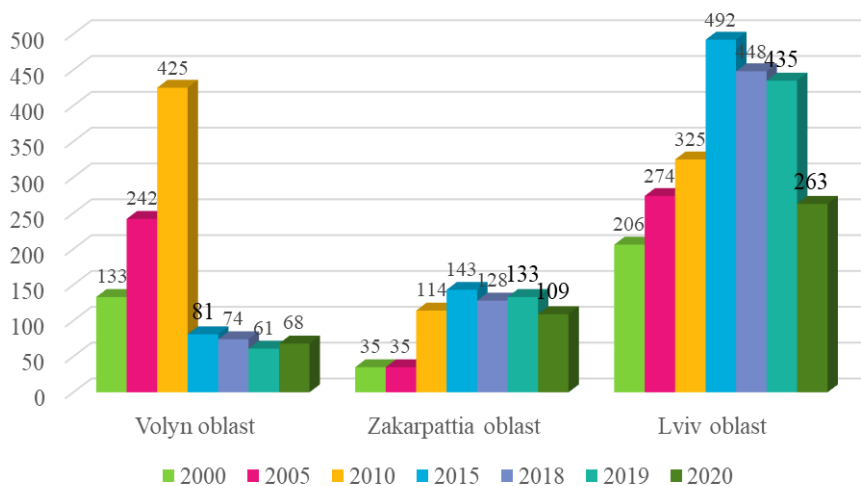


Fig. 4. Changes in the number of applications for titles of protection filed with the State Department of Intellectual Property of Ukraine in the regions of the Ukrainian border in 2000–2020, units

Source: compiled by the author on the basis of data (State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024; State Statistics Service of Ukraine, 2024).

The graph shows that the total number of applications for the issuance of protective documents in all three regions demonstrates an increasing trend over most of the analyzed period. Lviv Oblast consistently had the highest number of applications for protective documents throughout the study period. The dynamics of application submissions until 2020 have a steady growth pattern, indicating a high level of innovative activity in the region and effective intellectual property protection efforts.

In Zakarpattia Oblast, the number of applications for the issuance of protective documents also predominantly shows growth, although the growth rate is slower compared to Lviv Oblast. The number of applications in Volyn Oblast is the smallest among the analyzed regions. The dynamics of application submissions are more uneven, with noticeable fluctuations throughout the study period, trending towards a decrease. Based on the presented data, some differences between the regions can be observed. However, the overall trend indicates a predominant increase in the number of applications for protective documents in all three regions. This reflects a rise in innovative activity in the regions and a growing understanding of the importance of intellectual property protection. The rates of application submissions and their growth vary significantly between the regions.

The predominant growth in the number of applications for protective documents in the Ukrainian borderland regions is a positive trend, indicating an increase in innovative activity and a growing awareness of the importance of intellectual property protection. However, for further development of the innovation sector, measures must be taken to improve the intellectual property protection system, stimulate innovation activities, and attract investments.

Next, the dynamics of the number of industrial enterprises that implemented innovations in the Ukrainian borderland regions from 2000 to 2020 were studied (Fig. 5).

The graph shows that the total number of industrial enterprises implementing innovations in all three regions demonstrates a fluctuating trend with a tendency to decrease at the end of the analyzed period.

Lviv Oblast has the largest number of industrial enterprises implementing innovations throughout the entire study period. However, after a peak in 2010, there is a steady decline in the number of such enterprises. The number of industrial enterprises implementing innovations in Zakarpattia Oblast is the smallest among the studied regions. The dynamics of this indicator show a more pronounced downward trend. The dynamics of the number of innovative active enterprises in Volyn Oblast also shows a general downward trend, although some fluctuations are observed.

Thus, the overall trend indicates a decrease in the number of industrial enterprises implementing innovations in all three regions. This reflects a general decline in innovative activity in the industrial sector of the regions. Regional features of innovation development are influenced by various factors, such as the structure of industry, the presence of research institutes, the level of state support for innovation activities, etc.

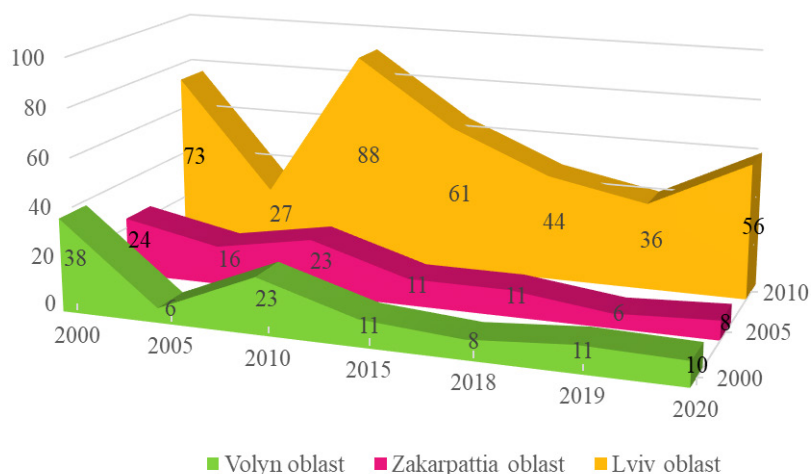


Fig. 5. Changes in the number of industrial enterprises that implemented innovations in the regions of the Ukrainian border in 2000–2020, units

Source: compiled by the author on the basis of data (State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024; State Statistics Service of Ukraine, 2024).

The decrease in the number of industrial enterprises implementing innovations in the Ukrainian borderland regions is a worrying signal that indicates the need for measures to stimulate innovation activities. To address this issue, a set of measures should be developed aimed at increasing the innovative activity of enterprises, creating a favorable innovation climate, and attracting investments in innovative projects.

The conducted analysis of the dynamics of key indicators of scientific and innovation activities in Ukraine and the studied regions allows us to formulate a series of generalized conclusions.

The overall trend is characterized by contradictory processes. On the one hand, there is a decrease in the number of organizations engaged in scientific activities and the number of scientific workers. This indicates certain difficulties in the functioning of the scientific sector, related, in particular, to insufficient funding, the outflow of qualified personnel, and other factors. On the other hand, there is an increase in internal expenditures on scientific research and development, which may indicate improved efficiency in the use of funds or an increase in the cost of scientific research. Additionally, there is a positive trend in the number of patent applications, indicating a rise in innovation activity in the country. However, the instability in the implementation of innovations in production suggests certain gaps between science and industry. Regional characteristics show significant differentiation. Lviv Oblast demonstrates the

highest indicators of scientific and innovation activity, indicating a more developed scientific infrastructure and favorable conditions for innovation development. Volyn and Zakarpattia Oblasts have lower indicators, which may be related to lower levels of funding for science, fewer concentrations of scientific institutions and enterprises.

The main reasons for the identified trends are the following factors:

1. Insufficient funding of science due to the lack of funds for research is a deterrent to the development of the scientific sphere.

2. The outflow of qualified personnel due to the departure of young scientists abroad leads to the loss of the country's scientific potential.

3. Low innovation activity of enterprises, as many Ukrainian companies do not invest in innovation, which hinders economic development.

4. Insufficient coordination of scientific and innovation activities due to the lack of a clear state policy in the field of science and innovation, as well as the dispersion of responsibilities between different authorities, complicate the efficient use of resources.

To overcome the identified problems and stimulate further development of scientific and innovative activities, it is proposed to:

- increase funding for science, in particular, it is necessary to significantly increase public spending on research and development;
- creation of favorable conditions for the work of scientists, as a competitive system of remuneration for scientists should be created, and they should be provided with housing and social guarantees;
- support for innovative activities of enterprises, as it is necessary to develop a set of measures aimed at stimulating innovative activities of enterprises, such as tax benefits, grants, access to financing;
- creation of an effective system of science and innovation management, first of all, it is necessary to create a single state body responsible for coordination of science and innovation policy.

Thus, the study allows us to conclude that it is necessary to take a set of measures aimed at intensifying scientific and innovation activities in Ukraine and the regions of the Ukrainian border in particular.

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DIRECTIONS FOR THE INTELLECTUAL TRANSFORMATION OF THE ECONOMY IN THE POLISH-UKRAINIAN BORDER REGIONS

Intellectual transformation is understood as a process of profound changes occurring in society and individuals driven by the development of technology, science, and new approaches to thinking. This is not merely a shift in information but rather a rethinking of how we perceive the world, learn, work, and interact with one another.

Ensuring the intellectual transformation of the economy in the current era of globalization and digitalization is crucial. Intellectual transformation accelerates the economic development of countries, regions, and individual business entities. As the world is changing faster than ever, those who can adapt to these changes are more likely to succeed.

Intellectual transformation also opens new opportunities to address global challenges such as climate change and inequality. New technologies enable the automation of routine tasks and improve efficiency across most economic sectors. Intellectual transformation can create a more convenient and comfortable environment for living in line with the principles of sustainable development.

Thus, intellectual transformation is a complex and multifaceted process with both positive and negative consequences. It is important to understand these changes to adapt effectively and leverage new opportunities at the national and regional levels, including the regions of the Polish-Ukrainian border.

The aim of this study is to identify the main issues, key aspects and benefits, and to substantiate the directions for the intellectual transformation of the economy in the Polish-Ukrainian border regions, particularly in education and science.

Various issues directly or indirectly related to the process of intellectual transformation have been researched by many scholars in recent years. The foundational theoretical framework for understanding and studying the features of intellectual transformation is presented in the work of *Duderstadt (1995)*. Further, *Xuhua et al.*

(2023) explored the strategic and substantial innovative transformation of fundamental research outcomes in the context of intellectual property protection.

On the other hand, *Khanin et al. (2021)* developed conceptual foundations for activating intellectual-innovative determinants to intensify the development of regional economic systems. Additionally, *Khanin, Tulchynska et al. (2021)* systematized the functional features of intellectual-innovative determinants for intensifying regional economic development. From a regional perspective, *Marcin (2013)* presented the concept of intellectual capital. *Toma & Laurens (2024)* studied the interplay between regional development and intellectual capital, revealing the dilemma between innovation and tradition. Some researchers, such as *Švarc et al. (2021)*, analyzed the role of national intellectual capital in the digital transformation of EU countries. Kazakh scholar *Seitkazieva et al. (2018)* considered intellectual potential as a key factor in regional competitiveness. *Kozak (2011)* outlined the conceptual foundations for intellectual capital development, using the Silesian region of Poland as an example. Meanwhile, *Melnikas (2012)* focused on studying the new challenges of the intellectual economy and the creation of a knowledge society under global transformations. *Vo & Tran (2024)* examined the independent and combined effects of digital transformation and intellectual capital on firm performance in Vietnam.

In another study, *Doroshenko (2024)* analyzed the impact of intellectual transformation on innovation in Chinese enterprises. Other Chinese researchers, such as *Lv et al. (2024)*, investigated the prospects of leveraging the innovative advantages of intellectual transformation in market competition and its impact on the quality of green innovations in Chinese companies (*Han & Mao, 2023*). They concluded that intellectual transformation plays a crucial role in enhancing the innovative capabilities of regions. Additionally, *Yubing et al. (2021)* studied how companies undergoing digital transformation can utilize their relational capital and environmental management initiatives to improve financial performance, benefiting the entire supply chain. Although researchers have examined various aspects of intellectual transformation, there is a lack of systematic studies on this issue concerning the Polish-Ukrainian border regions. Therefore, there is a need to develop directions for the intellectual transformation of the economy in these regions.

The process of intellectual transformation, despite its clear advantages, faces numerous challenges in the Polish-Ukrainian border regions. These challenges are specific to each region but also share many similarities between the two countries:

- insufficient funding: investments in scientific research, the development of innovative infrastructure, and education are often inadequate, hindering the advancement of new technologies and their implementation in the economies of the Polish-Ukrainian border regions;
- shortage of qualified personnel: the labor market in the Polish-Ukrainian border regions is experiencing a sharp demand for specialists in IT, science

and engineering. The lack of such professionals slows down the development of innovative projects and solutions;

- bureaucratic barriers: complicated procedures for registering IT businesses, obtaining permits, and accessing financing impede the growth of innovative enterprises, particularly joint Polish-Ukrainian ventures;
- weak integration between academia and business: the lack of effective interaction between researchers and entrepreneurs complicates the commercialization of scientific developments tailored to real business needs;
- digital inequality: uneven access to the internet and modern technologies creates obstacles for innovation, especially in rural areas of the Polish-Ukrainian border regions.

A number of problematic issues for Polish border regions can be separately identified. For Polish border regions, innovation tends to concentrate in large cities such as Warsaw, Krakow, and Wrocław, leading to a developmental imbalance between central, eastern, and western regions. Additionally, some traditional industries, such as coal mining and metallurgy, resist innovation to preserve local jobs. Labor migration of scientists is another critical issue, as young and skilled professionals often leave the country seeking better opportunities, resulting in a shortage of research personnel in Poland.

On the other hand, a number of key issues regarding the intellectual transformation of Ukraine's border regions have been identified. The primary issue at present is the prolonged full-scale war in Ukraine, which creates additional economic and social problems not only for regions located in the combat zones but also for all other regions, as resources that could have been directed toward further innovation development in peacetime are being diverted. Additionally, war-related economic risks lead to a deterioration of the investment climate, hindering long-term business planning. Corruption in Ukraine remains a serious problem that impedes the development of business and innovation. Furthermore, the underdevelopment of infrastructure, particularly in the transportation and energy sectors, complicates business operations and the attraction of investments in Ukraine.

Based on the identified challenges, several key aspects of intellectual transformation require urgent attention to inform targeted measures:

1. Accelerated development of artificial intelligence (AI): AI is increasingly permeating various aspects of life, from medicine to finance. Algorithms capable of analyzing vast amounts of data and making decisions previously limited to humans are transforming industries.

2. Digital transformation: The shift to digital technologies is reshaping education, business, and everyday life. Online platforms, mobile applications, and cloud services have become indispensable.

3. Transformation of the education system: Traditional teaching methods are giving way to more interactive and personalized approaches. Online courses, virtual reality, and AI open new opportunities for lifelong learning.

4. Changes in work types and conditions: The COVID-19 pandemic and the war in Ukraine have accelerated the development of remote and alternative work formats. Automation and robotics are eliminating some professions while creating new ones. Highly skilled specialists adept at working with advanced technologies and adapting to change will be in the highest demand.

5. Transformation of social interactions: The internet and social networks are fundamentally altering how people communicate and build relationships, both personally and professionally. These changes have both positive and negative effects on society.

Intellectual transformation is a key factor for the successful development of the economies in the Polish-Ukrainian border regions for several reasons, as systematized in Table 1.

The intellectual transformation of the Polish-Ukrainian border regions is a strategic task that requires joint efforts from the governments, businesses, scientific communities, and civil society of both countries. The main ways to address the issues of intellectual transformation in the Polish-Ukrainian border regions can be identified (see Fig. 1).

Solving these problems is a complex task that requires joint efforts by governments, businesses, academic institutions, and civil society in both countries.

The focus now shifts to justifying the main directions of intellectual transformation for the Polish-Ukrainian border regions. Intellectual transformation in these regions should become a priority to ensure their sustainable development and enhance competitiveness.

Table 1. Systematization of the Benefits of Intellectual Transformation of the Economy in the Polish-Ukrainian Border Regions

Advantages	Main Areas of Advantage	Description
Enhancement of Economic Competitiveness of Border Regions	Innovation	Thanks to intellectual transformation, regions gain the ability to implement new technologies, develop innovative products and services, allowing them to remain competitive in the global market
	Efficiency	New technologies and management approaches help optimize production processes, reduce costs, and increase the efficiency of enterprise operations.
Creation of New Jobs in All Regions	High-Tech Industries	Intellectual transformation stimulates the growth of high-tech industries, creating demand for skilled professionals and new job opportunities
	Entrepreneurship	Promoting an innovation-friendly environment supports the growth of small and medium-sized businesses, which also contributes to job creation
Increase in Trade Turnover and Export Beyond Regional Borders	High-Quality Products	Innovative products produced in the regions have higher added value and enjoy greater demand in global markets.
	New Markets	Intellectual transformation opens new opportunities for exporting products and services.

Advantages	Main Areas of Advantage	Description
Increase in Investments in Border Regions	Attractiveness for Investors	Regions actively developing intellectually become more appealing to investors who see potential for growth and innovation
	Development of Innovative Infrastructure	Investments are directed towards the development of research centers, technology parks, and other innovative infrastructure facilities
Improvement of Living Standards for the Population of Border Regions	Social Services	Intellectual transformation enables the introduction of new technologies in healthcare, education, and other social sectors, improving the quality of life for the population.
	Environmental Sustainability	New technologies contribute to the development of more environmentally friendly production processes and reduce negative environmental impacts.
Cooperation Between Border Regions	Exchange of Experience	Intellectual transformation promotes the exchange of experience and best practices between regions, accelerating the development of each region.
	Joint Projects	Joint projects within the framework of intellectual transformation help solve common problems and achieve synergistic effects.

Source: Developed by the author.

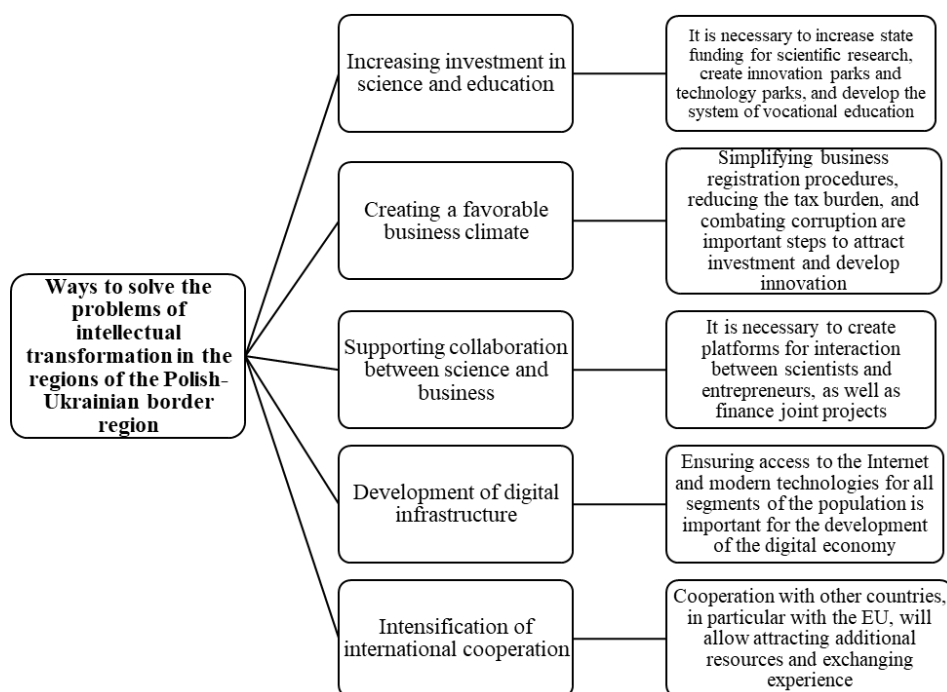


Fig. 1. Ways to Address the Issues of Intellectual Transformation in the Polish-Ukrainian Border Regions

Source: Developed by the author.

Table 2 summarizes the key directions of intellectual transformation and corresponding priority tasks for each of the Polish-Ukrainian border regions.

Additionally, several shared directions for intellectual transformation in these regions can be highlighted:

- development of Innovation Infrastructure — creation of technology parks, business incubators, and accelerators to support startups and small businesses;
- improvement of Education – investment in education, particularly in vocational and higher education, with an emphasis on STEM disciplines;
- development of the Digital Economy – implementation of digital technologies in all sectors of the economy and society, as well as the expansion of internet access;
- support for small and medium-sized businesses – simplification of business registration procedures, provision of financial support, and consulting for entrepreneurs;
- interregional cooperation – creation of joint projects and programs, exchange of experiences, and best practices.

Table 2. Main Directions of Intellectual Transformation for Polish-Ukrainian Border Regions

Regions	Directions of Transformation	Priority Tasks
Polish border regions		
Lubelskie Voivodeship	Development of Agrotechnologies	Given the developed agricultural sector, the priority is to implement modern agrotechnologies, such as precision farming, automated irrigation systems, and the use of drones for field monitoring
	Logistics and Transport	Expansion of infrastructure for logistics centers and development of multimodal transport systems that integrate road, rail, and water transport
	Tourism	Creation of new tourist routes and development of tourism infrastructure, particularly related to cultural heritage and natural resources of the region
Podkarpackie Voivodeship	Energy	Development of renewable energy sources, including wind and solar energy, and construction of energy-efficient buildings
	Forestry	Optimization of forest resource usage and development of the wood processing industry, with an emphasis on high-quality product manufacturing
	Tourism	Expansion of tourist routes focused on the natural beauty of the Carpathians and development of winter resorts
Ukrainian border regions		
Volyn Oblast	Agribusiness	Modernization of agriculture, implementation of new technologies for crop cultivation and product processing
	Tourism	Development of ecotourism, cultural tourism, and religious tourism. Creation of tourist routes linked to historical landmarks and natural landscapes of the region
	Woodworking Industry	Modernization of the woodworking industry and development of furniture production and other wooden products
Lviv Oblast	IT Industry	Creation of favorable conditions for the development of IT companies, including the establishment of technology parks and incubators

Regions	Directions of Transformation	Priority Tasks
Zakarpattia Oblast	Tourism	Development of cultural tourism associated with the historical landmarks of Lviv and other cities in the region, as well as medical tourism
	Light Industry	Modernization of the light industry and development of textile and clothing production
	Energy	Development of hydropower and geothermal energy

Source: Developed by the author.

The implementation of these directions will enable the Polish-Ukrainian border regions to become more competitive, create new jobs, and improve the quality of life for the population. It is important to note that successful intellectual transformation requires a comprehensive approach and close cooperation between government bodies, businesses, academic institutions, and civil society organizations.

Special attention should be focused on substantiating the directions of intellectual transformation in the fields of education and science in the Polish-Ukrainian border regions. Intellectual transformation in education and science is a key factor in the development of these regions. It involves the introduction of innovative approaches to learning, research, and collaboration between educational and scientific institutions.

The intensity of intellectual transformation processes depends on the development of the education sector, especially its long-term funding. In this context, capital investments play a significant role. These include funds allocated for acquiring new equipment, repairing or modernizing existing infrastructure, and new construction projects. Since such capital investments are directed towards developing the intellectual potential of the population, their effectiveness should be assessed based on the investment amount per capita in the respective region. To ensure comparability of these indicators, it is advisable to convert them into a common unit of measurement, considering the purchasing power parity (PPP) of national currencies (hryvnia and zloty) to the US dollar as the international currency.

Figure 2 presents a comparison of capital investment in education per capita in the Polish-Ukrainian border regions from 2010 to 2021, adjusted for PPP in US dollars.

It can be observed that in all Ukrainian border regions the volume of capital investment per capita was unstable throughout the analyzed period. It decreased in 2015, increased in 2020, and then declined again in 2021. Overall, there is a diverse dynamic of capital investments in education per capita in the Polish-Ukrainian border regions from 2010 to 2021. There is no clear upward or downward trend across all regions.

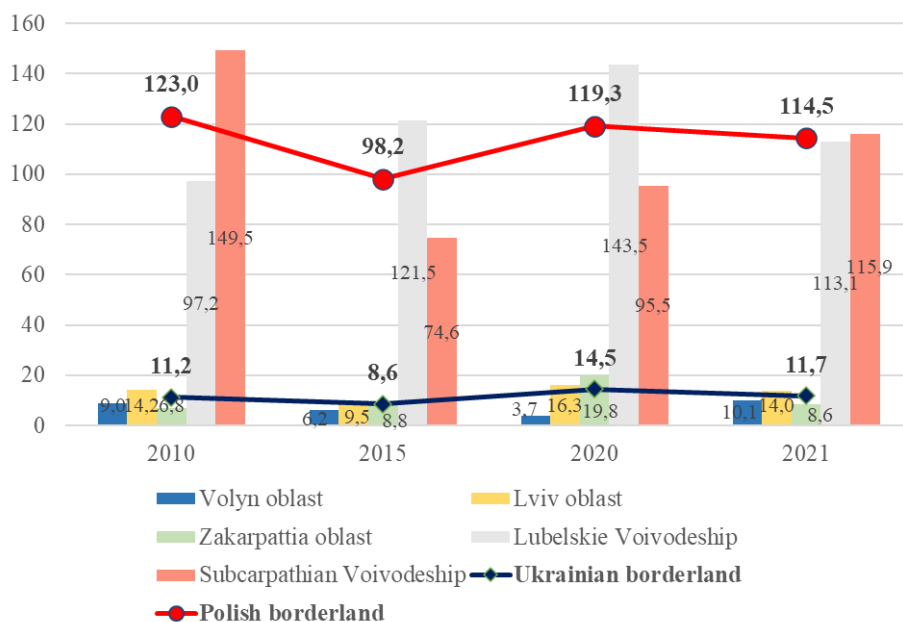


Fig. 2. Comparison of the amount of capital investments in education per capita in the regions of the Polish-Ukrainian border region for 2010–2021, by purchasing power parity of US dollars

Source: built based on data (Statistics Poland, 2024; State Statistics Service of Ukraine, 2024; State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024).

Among Ukrainian regions, Volyn Oblast shows significant fluctuations in investment. After a decline in 2015, there was a sharp increase in 2021. In Lviv Oblast, investment levels also fluctuate, but overall, they remain relatively stable. Zakarpattia Oblast experienced the largest increase in investment in 2020, followed by a slight decline. The Ukrainian border regions as a whole demonstrate generally positive dynamics, albeit with noticeable fluctuations in certain years.

When analyzing the Polish regions, Lubelskie Voivodeship shows a steady increase in investments throughout the study period. In Podkarpackie Voivodeship, after significant growth in 2010, there was a decline in investments in 2015, followed by gradual recovery. Overall, the Polish border regions demonstrate higher levels of investment compared to the Ukrainian border regions, as well as more stable dynamics.

However, when comparing the values of this indicator between Ukrainian and Polish regions, it is evident that Polish regions have a significant advantage in terms of capital investments per capita. Specifically, in 2010, Polish border regions spent on average 11 times more capital investments on education development than their Ukrainian counterparts.

Although this disparity decreased to 9.8 times by 2021, it remains highly significant. Based on this, it can be concluded that Ukrainian regions have significantly

fewer opportunities to activate intellectual transformation processes compared to Polish regions due to inadequate funding of the education system.

Therefore, the data analysis indicates that the level and dynamics of investments in education differ significantly both within Ukrainian regions and within Polish regions. This highlights the influence of various regional factors, such as economic conditions, government policies, international cooperation, and others. For instance, significant instability in investment levels is observed in Ukrainian regions, potentially linked to the overall economic situation in the country, political changes, and insufficient stable funding for education. On the other hand, Polish regions show much higher levels of investment in education compared to Ukrainian regions, attributable to greater opportunities for accessing European funds, a more stable economic environment, and more developed infrastructure.

Despite the significant differences between regions, there is a general trend of increasing capital investment in education, especially in Polish regions. This reflects growing awareness of the importance of investing in human capital for economic and societal development.

Higher education forms the foundation for adequate staffing of intellectual transformation, making it appropriate to compare the number of students in higher education institutions per 10,000 population in the Polish-Ukrainian border regions from 2010 to 2021 (Fig. 3).

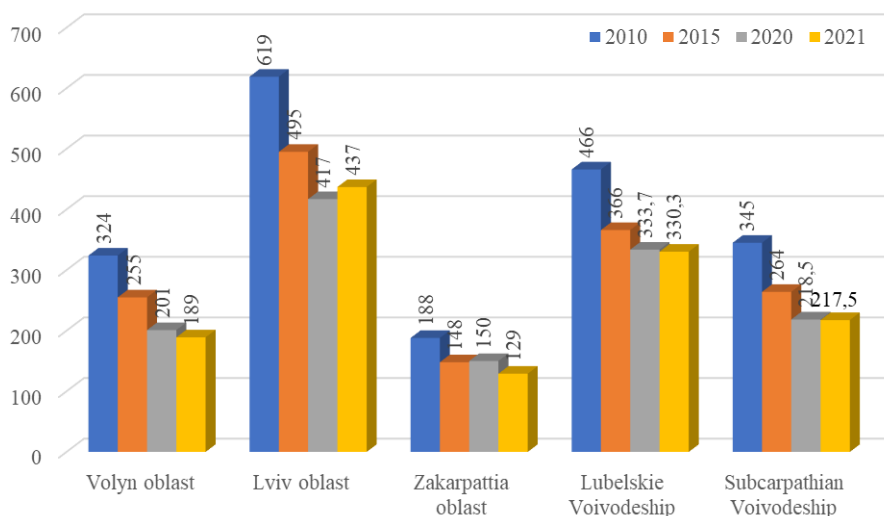


Fig. 3. Comparison of the number of students in higher education institutions per 10 thousand population in the regions of the Polish-Ukrainian border region for 2010–2021, people

Source: built based on data (Statistics Poland, 2024; State Statistics Service of Ukraine, 2024; State Statistics Office in Volyn Oblast, 2024; State Statistics Office in Lviv Oblast, 2024; State Statistics Office in Zakarpattia Oblast, 2024).

There is a general trend toward a decrease in the number of higher education students per 10,000 population across all Polish-Ukrainian border regions during the period from 2010 to 2021. This indicates certain changes in the higher education sphere in these regions, which may be associated with demographic shifts, economic factors, changes in education policy, and more.

Specifically, in Volyn Oblast, the most significant decline is observed, from 324 students per 10,000 population in 2010 to 189 in 2021. This may point to issues within the region's higher education system or youth migration to other regions for education. Lviv Oblast also shows a decline in student numbers, though it is less pronounced than in Volyn. Lviv, being one of Ukraine's traditional educational hubs, may be experiencing this decrease due to competition from other regions and a reduction in the overall number of applicants. Zakarpattia Oblast exhibits a slower but consistent decline in student numbers, linked to the region's socio-economic characteristics and migration processes.

Among the Polish regions, Lubelskie Voivodeship also demonstrates a decline in student numbers, though the rate of decrease is somewhat lower than in the Ukrainian regions. Podkarpackie Voivodeship similarly shows negative dynamics in student numbers.

The primary reasons for the decline in student numbers in all Polish-Ukrainian border regions include demographic changes, as a consistent decline in birth rates leads, after a certain time lag, to a decrease in the number of young people entering higher education. Economic crises, the COVID-19 pandemic, unemployment, and low living standards often force young people to abandon education or choose more practical specialties. Educational reforms, changes in admission requirements, and reductions in funding also negatively affect student numbers. Furthermore, youth emigration abroad for education or work in more developed countries contributes to this decline. Competition in the educational services market from more developed regions in both countries also plays a role.

The results highlight the need for a more detailed analysis of the reasons behind the decline in student numbers in the Polish-Ukrainian border regions. This will enable the development of effective measures to improve the situation in the higher education sector and ensure its further development.

To promote intellectual transformation in education and science, several common directions of activity can be identified for all regions of the Polish-Ukrainian border area:

- internationalization of education through the establishment of joint educational programs, student and faculty exchanges, and the implementation of English-language programs;
- digital transformation of education by integrating digital technologies into the educational process, creating online platforms, and fostering the development of e-learning;

- support for scientific research through funding research projects, establishing science parks and incubators, and attracting private investment in science;
- university-business collaboration by creating joint laboratories, developing collaborative projects, and organizing internships for students in enterprises.

At the same time, specific individual directions of intellectual transformation in education and science can be highlighted for each region of the Polish-Ukrainian border area.

For Polish border regions, particularly the Lubelskie Voivodeship, it is essential to advance education and science in the field of agrotechnologies. This includes creating joint educational programs with universities in Ukrainian border regions in agronomy and veterinary science, as well as fostering collaborative scientific research in precision agriculture and biotechnologies. Additionally, it is advisable to enhance research in logistics by developing educational programs in logistics management and supply chain management, alongside advancing scientific studies in transport systems.

For the Podkarpackie Voivodeship, it is important to promote educational and scientific projects in the tourism sector by establishing educational programs in tourism and hotel management and stimulating research in ecotourism and cultural heritage. Focus should also be placed on forestry, with the development of educational programs in forestry management and wood processing, and the intensification of scientific research in sustainable forest use, particularly considering the specifics of mountain areas.

On the other hand, priority directions for intellectual transformation in education and science can also be identified for Ukrainian border regions.

For Volyn Oblast, it is essential to develop educational and scientific projects aimed at advancing the agro-industrial complex. This involves improving educational programs in agronomy, animal science, and food technologies, as well as encouraging scientific research in organic farming and agricultural product processing. Furthermore, it is important to expand educational programs in tourism, hotel management, and local history, alongside fostering scientific studies in cultural and ecological tourism.

For Lviv Oblast, considering its existing achievements, the focus should be on developing educational and scientific projects in the IT sector. This includes refining educational programs in informatics, software engineering, and cybersecurity, as well as promoting research in artificial intelligence and machine learning. Another significant area of research for this region is culture and the arts, which entails enhancing educational programs in art history, music, and theater, along with supporting scientific research in cultural history and art studies.

Given the available natural and resource potential, it is advisable for Zakarpattia Oblast to develop educational and scientific projects in the field of ecology and

natural resources. This can be achieved by improving educational programs in ecology and environmental management, as well as promoting scientific research in environmental protection and biodiversity conservation. Tourism also represents a priority area for educational and scientific activity. This includes refining programs in tourism, hotel management, and mountain tourism, along with advancing scientific studies in mountain tourism and resort management.

The following key measures can be identified to implement the outlined directions for intellectual transformation in education and science for the regions of the Polish-Ukrainian border area:

- development of joint educational programs through the creation of unified curricula, faculty exchanges, and the organization of joint scientific conferences;
- enhancement of student and faculty mobility by implementing permanent exchange programs and scholarship initiatives for students and educators from the Polish-Ukrainian border regions;
- establishment of joint knowledge exchange centers with a focus on fostering modern research and innovation, integrating the efforts of scientists and entrepreneurs from both countries;
- support for youth-driven (particularly student) startups by creating joint Polish-Ukrainian incubators and accelerators aimed at helping young entrepreneurs develop innovative products and services;
- engagement of the private sector in scientific and technical activities by setting up non-governmental funds to finance research projects.

The implementation of these measures will enable the Polish-Ukrainian border regions to become hubs of innovation and development, improve the quality of education, and prepare skilled professionals for the modern labor market.

An important accelerator of the intellectual transformation of the economy of the Polish-Ukrainian border regions can be attributed to the stimulation of the development of innovative activity. After all, the intellectual transformation of the economy of the Polish-Ukrainian border regions opens up wide opportunities for the development of various areas of innovative activity.

It is possible to detail the promising areas of innovative activity for the border regions of each country. In particular, for the Polish border regions it is advisable to develop innovations in the field of agrotechnology through the introduction of precision farming, the use of drones for field monitoring, the development of biotechnology in agriculture. In the field of energy, it is advisable to accelerate the development of renewable energy sources (solar, wind, biomass), the creation of energy-efficient buildings and infrastructure. For the development of logistics, it is important to optimize logistics processes using digital technologies, the development of multimodal transport systems. In medicine and pharmaceuticals, it is advisable to

stimulate the development of new medicines, medical devices, and the development of telemedicine. The promising development of IT technologies involves the creation of software, the development of mobile applications, the development of artificial intelligence and blockchain. In the field of tourism, one should focus on the creation of interactive tourist routes, the development of ecotourism and agrotourism.

On the other hand, for the Ukrainian border regions, the priorities of innovative activities include the development and implementation of innovations in the agro-industrial complex aimed at processing agricultural products with high added value, the development of organic farming, and the creation of agro-clusters. The introduction of innovations in the energy sector is also of great importance, achieved through stimulating the development of renewable energy sources and improving the energy efficiency of industrial enterprises. The IT sector should focus on software development, the creation of IT startups, and the expansion of IT outsourcing services. In the field of tourism, attention should be directed towards the development of cultural, ecological, and medical tourism, as well as the creation of tourist routes. Innovations in the light industry sector are related to the modernization of textile production, footwear manufacturing, and garment production. The woodworking industry requires product and technological innovations, particularly in the production of furniture, wooden structures, and paper products.

It is also possible to identify common directions for activating innovative activities for the regions of the Polish-Ukrainian border, which primarily involve strengthening cross-border cooperation through the creation of joint research centers, technology parks, and incubators. It is equally important to develop innovation infrastructure by constructing research laboratories, technology parks, and incubators in each region. Supporting small and medium-sized businesses should also be a priority through financial aid, consulting, and creating a favorable business climate.

Attention should be focused on the development of human capital, which includes expanding and modernizing training programs for employees and attracting foreign consultants and specialists. Digital transformation should play a critical role, with the introduction of digital technologies into all sectors of the economy and society in the regions of the Polish-Ukrainian border.

To create a favorable environment for the development of innovative activities in the Polish-Ukrainian border area, additional state support from the governments of both countries is essential. This involves establishing a supportive legislative framework, financing innovative projects, and investing in the development of innovation infrastructure. It is crucial to promote various forms of cooperation between universities, businesses, and the state by creating joint interstate research centers and initiating joint innovative projects. This includes strengthening international cooperation among all regions of the Polish-Ukrainian borderland through attracting foreign investments and participating in international scientific projects. Finally,

developing an innovation culture is essential, which requires creating an environment conducive to the emergence and growth of new ideas.

The implementation of these measures will enable the regions of the Polish-Ukrainian border to become more competitive in the global market, create new jobs, and improve the standard of living in each region.

At the same time, to realize these measures, it is necessary to overcome the main challenges associated with insufficient funding for innovative projects, a shortage of qualified personnel, bureaucratic barriers, and weak integration between research centers and businesses. To address these challenges, the authorities in the regions of the Polish-Ukrainian border need to increase state funding for science and innovation, develop the education and training system, simplify business registration and permit procedures, and create effective mechanisms for interaction between science and business.

Thus, intellectual transformation is strategically important for the regions of the Polish-Ukrainian border, as it strengthens the regional economy and enhances competitiveness, creates new jobs, improves the population's well-being, increases exports, attracts investments, improves the quality of life, preserves the environment, and establishes strong partnerships between regions. Intellectual transformation is not just a contemporary trend but a necessity for the successful development of the economies of the Polish-Ukrainian border regions.

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ASSESSMENT OF THE LEVEL OF DIGITALIZATION OF THE REGIONAL BUSINESS ENVIRONMENT

The modern specifics of the functioning of economic systems are determined by their constant complexity under the influence of the intensive development of digital and information technologies. At the same time, the level of implementation of all components of digitalization influences the competitiveness not only of individual enterprises but also of entire regions. This competitiveness is of particular importance for regions that, within the framework of cross-border cooperation, interact in the field of attracting investments for the implementation of community and territorial development projects.

In this aspect, the relevance of assessing the level of digitalization of the business environment of regions becomes especially important, due to the rapid transformation of economic processes under the influence of digital technologies. It is well known that the modern economy operates within the paradigm of digital development, which implies a multifunctional synergistic interaction of technologies, management decisions, and the institutional environment. Therefore, the level of digitalization becomes a key indicator of the competitiveness of regional business, reflecting its innovative potential and adaptability to global challenges.

The digitalisation of the business environment is a multifactorial process that includes the introduction of the latest information technologies and automation of business processes, innovative approaches to management, and digital transformation of customer relations. That is why assessing the level of digitalisation allows for a comprehensive diagnosis of the regional economy in terms of institutional and technological development.

In general, the assessment of the digitalisation of the business environment is based on the use of indicators that characterise the level of use of modern technologies in key areas of economic activity. In particular, it may include the following elements:

- the level of implementation of automated business management systems;
- use of analytical platforms for processing big data;

- level of e-commerce development;
- the level of integration of artificial intelligence tools to optimise business processes.

The assessment of such parameters allows us to form an appropriate basis for analysing the innovation activity of enterprises, monitoring technological development and identifying 'digital divides' between regions.

In practical terms, the level of digitalization directly affects the competitiveness of regional businesses. Enterprises that actively invest in digital technologies and integrate them into their business processes gain significant competitive advantages, such as reduced operational costs, expanded sales markets, increased productivity, and more.

Thus, a comprehensive assessment of the level of digitalization is a necessary prerequisite for the development of effective regional development strategies focused on digital transformation. At the same time, it can provide targeted identification of priority areas for investment and the integration of regions into the global digital space.

However, it is important to note that the methodology for assessing the level of digitalization of the business environment currently faces challenges in practical application. Specifically, some of the main obstacles in this regard include the following:

- the lack of standardized approaches to measuring the level of digital development;
- unequal access to digital technologies across different regions;
- the limited availability of objective data regarding the level of innovation and investment activity of small and medium-sized enterprises.

Accordingly, to address these issues, it is necessary to develop unified indicators of the level of digital development of the business environment that would enable the integration of data from various sources, including both government statistics and private sector data that can be used to monitor the business environment.

In general, it should be noted that assessing the level of digitalisation of the region's business environment is a critical tool for ensuring strategic management of regional development in the context of cross-border cooperation. This is due to the possibility of identifying key growth points and generally increasing the competitiveness of the local business environment in the long term. At the same time, only a systematic approach to analysing digitalisation indicators can ensure that analysts achieve significant results in shaping a sustainable and innovative regional economy.

Currently, several key approaches to assessing the level of digitalization of regions can be identified, which serve as important tools for determining the extent of digital technology implementation and their impact on the socio-economic development of territories:

1. Digital Economy and Society Index (DESI) – this index was developed by the European Commission and is designed to monitor the overall digital efficiency of Europe and track the progress of EU countries in digital competitiveness. Although the DESI index primarily evaluates countries along

four main dimensions: human capital, connectivity, integration of digital technologies, and digital public services, it is also applicable for assessing the level of digitalization of individual regions in practice (*The Digital Economy and Society Index*, 2024).

2. Networked Readiness Index (NRI) – developed within the framework of the World Economic Forum and currently supported by the Portulans Institute, this index measures the readiness of countries and regions to use information and communication technologies (ICT) for social and economic development. It evaluates infrastructure, access to digital technologies, the level of their use by businesses and populations, and regulatory support for digitalization (*Networked Readiness Index*, 2024).
3. Global Innovation Index (GII) – developed by the World Intellectual Property Organization (WIPO), the GII assesses the innovative development of countries, including the level of digital technology usage. It takes into account factors such as access to technology, infrastructure, human capital, and the impact of innovations on the economy. It is similar to the DESI index (*Global Innovation Index*, 2024). This indicator is also used to assess the level of digitalization of individual regions.
4. ICT Development Index (IDI) – created by the International Telecommunication Union (ITU), this index evaluates the level of development of information and communication technologies in different countries. It is based on parameters such as access to information networks (internet coverage, mobile communication, etc.), use of technologies (e-commerce, e-services), and digital skills [9]. In practice, this indicator can be used to assess the level of digital development of regions, although it is not frequently applied for these purposes.
5. E-Government Development Index (EGDI) – developed by the United Nations, the EGDI assesses the level of e-government development in countries and regions. It is based on three components: online services, telecommunication infrastructure, and human capital (*E-Government Development Index*, 2024). This index can also be used to assess the digitalization of regions, although there are issues with the reliability of normalizing the components of this indicator when processing regional statistics.

Each of these methods has its own specific features and approaches to evaluation, which allows analysts to get a comprehensive picture of the level of digitalisation of regions and, based on the information obtained, to identify areas for their further development. It should be noted that there are also a number of author's approaches to the calculation of relevant indices proposed by individual scientists and including various indicators that characterise the overall state of development of information and communication technologies in the regions. In this aspect, we can note the

methods developed by A. Gevorgyan (2021), O. Popelo and A. Samoilovich (2022), G. Shu and R. Anderl (2020). However, these approaches are not widespread and are not used in practice either at the national or regional level.

It should be noted that all of these approaches to assessing the level of digitalisation of regions are based on the calculation of integral indices. This is because this approach provides a comprehensive and systematic assessment of digitalisation as a phenomenon characterised by multidimensionality and complexity. Since it covers various aspects of economic, social, technological and governance development, its assessment requires taking into account numerous interrelated factors. It is integral indices that allow combining these heterogeneous indicators into a single numerical expression that simplifies the interpretation of results and provides a possibility of comparison between the objects of analysis.

The functional advantage of this approach lies in its ability to synthesize complex data into a convenient format, which facilitates the use of the obtained results for strategic decision-making in the development of individual regions and territories. Composite indices allow for the assessment of the overall level of digitalization and the identification of priorities for further development. They also effectively provide a comparative analysis between different regions, which stimulates the development of regional competitiveness.

In addition, composite indices offer relatively higher objectivity in analysis, as the use of weighting coefficients allows analysts to account for the relative importance of individual indicators within the overall digitalization system. This is particularly important for multifactorial phenomena, where different aspects have unequal impacts on the final result. For example, in some regions, the availability of internet access may play a decisive role, while in others, human capital or the quality of e-services may be more important. Accordingly, composite indices allow for the adaptation of digitalization assessments to the specific context of a particular environment. Moreover, the composite approach significantly simplifies communication of results with investors or public administration, who can easily use generalized indicators to form forecasts or regional development strategies.

Therefore, basing methodologies on the calculation of composite indices is an objective and justified solution, as it combines accuracy and analytical flexibility, contributing to the effective analysis of regional digitalization and supporting strategic management of their development.

When discussing methods for assessing regional digitalization in Ukraine and Poland, both countries apply their own approaches based on methodologies specifically developed by government bodies. In Ukraine, such an assessment is carried out based on the Digital Transformation Index of Ukraine's Regions. This methodology was developed by the Ministry of Digital Transformation of Ukraine to monitor the level of digitalization across regions, evaluate the effectiveness of government

programs in the field of digitalization, identify digital gaps, and stimulate regional competition (*Digital Transformation Index of Ukrainian Regions, 2024*). Currently, strategies for digital transformation are being developed based on this index and its components, focusing on ensuring the adaptation of Ukraine's regions to the digital economy. The index itself serves as a functional tool for objective analysis and decision-making in the field of digitalization.

In Poland, the equivalent methodology is the Information Society Development Index, which was developed by the Central Statistical Office of Poland and is used to assess the level of development of the information society across various voivodeships. It takes into account indicators such as access to the internet, the use of information and communication technologies in households and businesses, and the level of electronic services provided by government authorities (*Information society indicators, 2022*). When comparing the specifics of calculating the Digital Transformation Index of Ukraine's Regions and the Information Society Development Index of Poland, it is important to note that they share several common features, as both methodologies are aimed at evaluating the level of digitalization and the impact of information and communication technologies on the socio-economic development of regions. At the same time, they differ in their approaches to defining the structure of the index, selecting indicators, and the emphasis placed on measurement aspects.

In particular, when discussing the common features, both methodologies use a systemic approach to digitalization analysis, which involves calculating an integral indicator based on several thematic blocks and sub-indices. In the Ukrainian methodology, areas such as institutional capacity, internet penetration, digital education, and electronic services are taken into account. The Polish index, on the other hand, also includes indicators related to internet access, the level of information and communication technology (ICT) usage in households and businesses, as well as the development of digital services.

Both methodologies are also aimed at identifying regional disparities in the level of digitalization, which allows for the determination of regions with high and low development levels, identification of «digital gaps,» and contributes to the development of targeted measures to overcome these gaps. Additionally, both methodologies consider factors that impact social and economic development, such as the effectiveness of forming digital skills among the population.

As for the differences, one of the key distinctions lies in the emphasis in the structure of the index. The Digital Transformation Index of Ukraine's Regions focuses on assessing the implementation of digital tools in the public sector and the development of digital culture. It places a clear emphasis on e-government, digital services, and sectoral digital transformation. This aligns with Ukraine's overall strategy for modernizing the public administration system.

In contrast, the Information Society Development Index of Poland is concentrated on measuring the level of access to technologies and their usage both by households and businesses. Special attention is paid to aspects such as the level of broadband internet penetration, the proportion of the population using the internet for communication and accessing services, and the implementation of ICT in small and medium-sized enterprises. A distinctive feature of the Polish methodology is its strong focus on indicators of consumer activity and the accessibility of technologies.

Another important distinction lies in the methodological basis of the calculation. Specifically, the Ukrainian methodology is partly based on the approaches of the European Commission (DESI index) but is adapted to the national context and focused on supporting a large-scale digital reform program. The Polish index, developed by the Central Statistical Office of Poland, is based on harmonized European statistical standards, which defines the information base for its calculation.

In general, it can be noted that a characteristic feature of both methodologies is the assessment of the level of digitalization at the regional level and the identification of key disparities in the digital development of regions. However, functionally, they are adapted to the specific needs of each country. Both methodologies emphasize the importance of composite indices as a universal tool for evaluating complex multifactorial processes and highlight the role of digitalization as a driving force for regional development. Now, let's try to compare the level of digital development in the border regions of Poland and Ukraine using similar digital development indicators. Given the different methodologies for forming these indicators, we will use the ranking of each region according to the respective indicator within its country (Fig. 1).

As we can see, within each country, there is a difference in the level of digital development of the analyzed regions. Specifically, their average ranking positions are as follows: Lubelskie Voivodeship – 11, Podkarpackie Voivodeship – 6.8, Volyn Oblast – 5.4, Lviv Oblast – 3.2. Taking into account the different numbers of regions included in the ranking for each country, we can make a comparison that shows that the aforementioned voivodeships in Poland are at an average level of digital transformation. Meanwhile, Volyn and Lviv Oblasts are among the leaders in Ukraine for this indicator. Additionally, the best overall indicator across all analyzed regions was the penetration of basic e-services into the administrative management system.

At the same time, if we look at the individual indicators used in the regional digitalization assessment systems in both the Polish and Ukrainian methodologies, we can conclude that the primary focus of these methodologies is on evaluating the level of development and access to digital infrastructure, as well as the implementation of digital services in the public administration system. Specifically, let's examine the key indices of both methodologies (Tabl. 1).

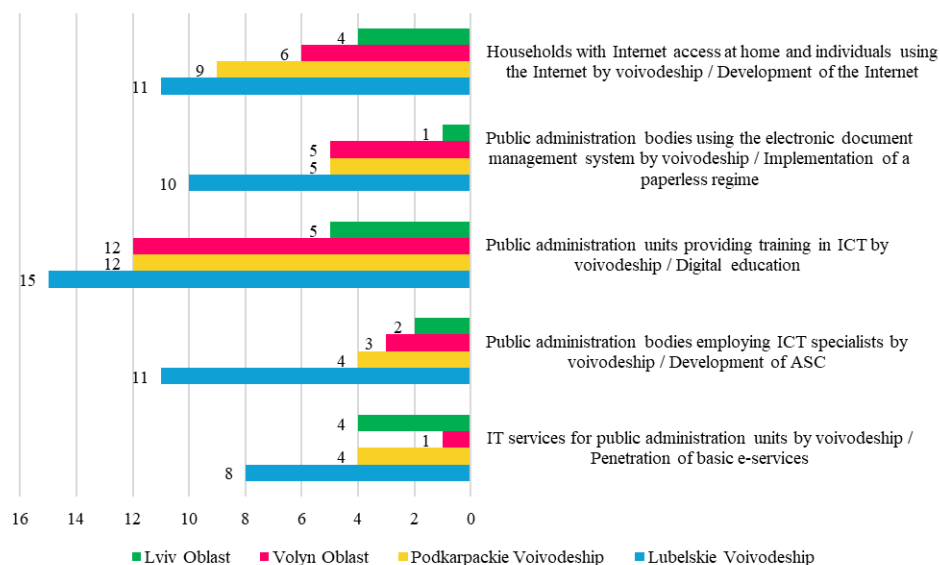


Fig. 1. Rating assessment of the state of digital development of the border regions of Ukraine and Poland by selected digitalisation criteria

Source: compiled by the author based on (Digital Transformation Index of Ukrainian Regions, 2024; Information society in Poland, 2023).

Note: Lubelskie and Podkarpackie Voivodeships were ranked on a scale of 16 regions, Volyn and Lviv Oblasts – on a scale of 25 regions

Based on the analysis of the indicators included in the assessment methodology, it can be stated that the Polish approach to assessing the level of regional digitalization is currently more advanced, as it includes three indicators that characterize the level of digitalization in the business environment. At the same time, the Ukrainian Digital Transformation Index includes only one indicator that reflects the level of digital transformation in specific sectors of the economy. However, business digitalization is critically important for ensuring the effective functioning of the regional economy since only a digital economy creates the conditions for the development of digital services. This is because foundational digital solutions were initially implemented in networked business processes and only later expanded to the e-governance system, which is conditionally derived from business solutions. Ultimately, the innovations implemented in the business digitalization system are primarily oriented toward the business environment and only later find application in non-commercial digital systems.

Table 1. Components of methods for assessing the level of digitalisation of regions in Poland and Ukraine

Poland	Ukraine
Access to Digital Infrastructure: <ul style="list-style-type: none"> – percentage of households with access to the internet; – broadband penetration levels; – number of mobile internet users; – development of optical networks. 	Institutional Capacity <ul style="list-style-type: none"> – availability of a regional digital transformation roadmap; – presence of a Chief Digital Officer (CDO) in the structure of regional administrations; – existence of a regional digital transformation strategy; – implementation of digitalization measures.
Use of Information and Communication Technologies <ul style="list-style-type: none"> – frequency of internet usage among the population; – share of the population using the internet to access services; – level of ICT usage in business. 	Development of the Internet <ul style="list-style-type: none"> – share of settlements with access to broadband internet; – Internet penetration in urban and rural areas; – development of optical networks in the region; – Internet connection quality (speed and stability).
Development of Electronic Services <ul style="list-style-type: none"> – share of public services available in electronic format; – number of users of electronic government services; – availability of platforms for electronic interaction between government and citizens. 	Development of Administrative Service Centers <ul style="list-style-type: none"> – number of digitalised ASCs per 100 thousand people; – availability of integrated electronic services in the ASC; – availability of online appointments at the ASC; – average processing time of requests through the ASC.
Level of digital skills <ul style="list-style-type: none"> – share of the population with basic digital skills; – share of ICT professionals among the employed population; – number of programmes aimed at improving digital literacy. 	Digital education <ul style="list-style-type: none"> – share of the population that has taken digital literacy courses; – number of digital curricula in schools and higher education institutions; – availability of free online courses for residents of the region; – availability of digital resources for educators.
Integration of ICT into business <ul style="list-style-type: none"> – share of enterprises using cloud services; – share of enterprises using big data; – use of ICTs to automate business processes. 	Paperless mode <ul style="list-style-type: none"> – share of electronic documents in the total document flow of government authorities; – integration with the Unified State Electronic Document Management System; – use of e-signatures for internal processes; – share of electronic requests from citizens processed by the authorities.
Development of innovation activities <ul style="list-style-type: none"> – number of innovative projects in the ICT sector; – the amount of funding for digital-related innovations – number of digitalisation start-ups. 	Business card of the region <ul style="list-style-type: none"> – availability of an official website of the region; – quality of design and usability of the website; – availability of the English version of the website – average website traffic.
Socio-economic impact <ul style="list-style-type: none"> – the impact of digitalisation on labour productivity; – changes in the structure of employment due to digitalisation; 	Penetration of basic e-services <ul style="list-style-type: none"> – share of citizens using electronic services through Diia; – availability of basic e-services in the areas of housing and communal services, healthcare, and education; – the level of use of e-services by local authorities;

Poland	Ukraine
– the impact of digital technologies on improving the welfare of the population.	– average number of transactions via electronic platforms.
	Sectoral digital transformation <ul style="list-style-type: none"> – implementation of digital solutions in the agricultural sector; – use of IT in industry; – integration of digital platforms in logistics and transport; – - number of regional projects aimed at digital transformation of the economy.

Source: Systematized by the author based on sources (Digital Transformation Index of Ukrainian Regions, 2024; Information society in Poland, 2023; Information society indicators, 2022).

This specificity necessitates the development of separate approaches to assessing the level of digitalization in the business environment of a region. Currently, digitalization serves as a key factor of competitiveness, determining the ability of regional economies to adapt to changes in the business environment and attract new investments. The absence of a unified methodology for systematically assessing the level of business digitalization complicates the identification of the strengths and weaknesses of the regional economy, which, in turn, hinders the development of effective regional development strategies by authorities.

The practical purpose of such a methodology should be to assess the state of the business environment in terms of the accessibility and use of digital technologies, as well as to identify problems in the implementation of innovations. The importance of this approach is due to the need to analyze the impact of digitalization on the economic productivity of the region. Furthermore, the existence of such a methodology would contribute to an objective comparison of regions in terms of economic development within the context of digital transformations, which is necessary to stimulate competition between regions and encourage businesses to adopt advanced technologies more broadly.

Currently, there are two sufficiently effective methodologies for assessing the level of business digitalization – the Digital Maturity Model (DMM) and the Acatech Industrie 4.0 Maturity Index (Acatech). The first was developed by researchers at the Massachusetts Institute of Technology and assesses the level of digital maturity of enterprises. It covers five key aspects: leadership, digital strategy, technology implementation, business process integration, and customer orientation. The model defines several maturity levels – from the initial stage, where digital technologies are barely used, to the innovative stage, where enterprises create new business models based on digital solutions (*Gill & VanBoskirk, 2016*). Practically, DMM helps businesses assess their current state of digitalization and prioritize further development.

Acatech is a model developed by the German Academy of Science and Engineering, specializing in evaluating the digital maturity of manufacturing enterprises within the framework of Industry 4.0. This model defines six levels of digitalization,

ranging from computerization to autonomy. It emphasizes aspects such as process transparency and data-driven forecasting. The index provides specific recommendations for integrating the Internet of Things (IoT) and automating analytics, enabling enterprises to gradually transition to a high level of digital maturity (*Schuh et al., 2020*). However, while both models are recognized by experts as effective and reliable, they are focused on assessing the level of digitalization of individual enterprises or business processes. At the same time, the issue of effectively and reliably assessing the level of digitalization of the entire business environment within a region remains unresolved.

It should be noted that business digitalization is a highly multidimensional process that includes the automation of production and management processes, the implementation of e-commerce, the integration of information and communication technologies into business models, and more. Therefore, a proper methodology for assessing business digitalization would allow for systematization of data on these aspects and serve as the foundation for forming an analytical basis for decision-making on regional development.

At the same time, it is essential to account for the local specifics of business, related to the structure of the regional economy, the scale of enterprises, and the overall level of infrastructure development, which is especially important for border regions.

The proposed methodology for assessing business digitalisation is of strategic importance for attracting investment, as potential investors currently require data on the level of development of digital infrastructure and business readiness to innovate. The availability of such data in a standardised form can greatly facilitate the assessment of the region's investment potential, which will also facilitate the development of targeted support programmes for small and medium-sized businesses that have fewer resources to implement digital technologies but play a key role in shaping the regional economic environment.

To develop a methodology for assessing the digitalization of the business environment in a region, it is necessary to define the main criteria, the evaluation of which will reflect the depth of digitalization of business processes. These criteria should provide a comprehensive understanding of the level of implementation of digital technologies in the region's business processes, and their components should be suitable for both qualitative and quantitative assessment. Based on the business components of well-known methods for evaluating the level of digitalization (DESI, NRI, GII, etc.), the following directions are proposed for grouping these criteria:

1. Infrastructure Availability:

- access to broadband internet for enterprises;
- mobile internet coverage (including 4G and 5G);
- degree of development of fiber-optic networks for business.

2. Level of Digital Technology Usage in Business:
 - share of enterprises using automated management systems;
 - use of cloud services for data storage and processing.
3. Digital Literacy of Employees:
 - level of digital skills among enterprise employees;
 - number of businesses conducting training or workshops on digital technologies for their staff.
4. Business Innovation Activity:
 - share of enterprises implementing digital innovations;
 - number of regional startups related to digital technologies.

Taken together, these criteria form the basis for the formation of a methodology that allows for an objective assessment of the level of digitalisation of the region's business environment and identification of problematic aspects in this area. In practical terms, we believe that such a methodology should be based on the definition of an integral digitalisation index, due to the functional complexity of the assessment process itself, since digitalisation covers quite different components of business functioning, from infrastructure provision to economic impact on regional economic systems. At the same time, a separate analysis of each such aspect does not provide a holistic picture, while the integral index allows combining these heterogeneous indicators into a single numerical expression. On the other hand, this approach simplifies the comparison of the level of digital development of different regions, which should be used to assess the effectiveness of digitalisation policy.

Thus, the integral digitalization index is a weighted aggregate indicator that reflects the overall level of digital technology development in the business environment of a region. From a mathematical perspective, it should be formed based on several groups of indicators, each with its own weight, which accounts for its significance in the overall assessment. Therefore, the integral digitalization index of the business environment in a region will be calculated as the weighted average of individual sub-indices:

$$I_c = \frac{\sum_{k=1}^4 \omega_k I_k}{\sum_{k=1}^4 \omega_k}$$

where: I_k – the value of the sub-index for the k-th criterion;
 ω_k – the weight coefficient for each digitalization criterion.

Sub-indices and indicators for each criterion will be calculated according to the general scheme, taking into account the number of indicators in the respective sub-index.

1. Infrastructure availability (I_1):

$$I_1 = \frac{P_{1.1} + P_{1.2} + P_{1.3}}{3}$$

where $P_{1.1}$ – share of enterprises with access to broadband Internet;

$P_{1.2}$ – 4G/5G mobile internet coverage;

$P_{1.3}$ – development of fibre-optic networks.

2. Level of digital technology use (I_2):

$$I_2 = \frac{P_{2.1} + P_{2.2}}{2}$$

where $P_{2.1}$ – share of enterprises with automated management systems;

$P_{2.2}$ – share of enterprises that use cloud services.

3. Digital literacy (I_3):

$$I_3 = \frac{P_{3.1} + P_{3.2}}{2}$$

where $P_{3.1}$ – level of digital skills of employees (average of estimates);

$P_{3.2}$ – share of enterprises that provide training in digital technologies.

4. Innovation activity (I_4):

$$I_4 = \frac{P_{4.1} + P_{4.2}}{2}$$

where $P_{4.1}$ – share of enterprises implementing digital innovations;

$P_{4.2}$ – number of start-ups per 1000 enterprises related to digital technologies.

To ensure the reliability of the calculations, each of the four indicators should be normalised using a standard formula:

$$P_{k,j} = \frac{P_{k,j} - P_{k,j}^{min}}{P_{k,j}^{max} - P_{k,j}^{min}}$$

where $P_{k,j}$ – actual value of the indicator;

$P_{k,j}^{min}$ and $P_{k,j}^{max}$ – respectively, the minimum and maximum values of the indicator among all analysed regions.

In addition, it should be noted that the integral index will reflect the level of digitalisation of the region, but there is a need to properly interpret the data obtained

to assign the level of digital development to a particular category. Therefore, we will apply the standard five-sector approach to the distribution of efficiency (Tabl. 2).

Table 2. Recommended scale for assessing the level of digitalisation of a region

Value Range	Digitalization Level	Description
0.00–0.20	Very Low	Digital processes are almost not integrated, infrastructure is absent or outdated
0.21–0.40	Low	Basic digital technologies are implemented, but their use is limited.
0.41–0.60	Medium	Basic level of digitalization, core technologies are implemented, and digital skills are being developed.
0.61–0.80	High	Well-developed digital infrastructure, high level of technology integration.
0.81–1.00	Very High	Digitalization meets leading standards, full integration of innovations and technologies.

Based on this methodology, we will try to assess the level of digitalisation of the border regions of Ukraine and Poland. To do this, we will determine the indicators of individual indicators necessary for calculating the digitalisation sub-indices (Tabl. 3).

Table 3. Indicators of digitalisation of the border regions of Ukraine and Poland

Indicators	Volyn Oblast	Lviv Oblast	Lubelskie Voivodeship	Podkarpackie Voivodeship
Share of enterprises with access to broadband internet, %	87,0	91,4	98,7	98,1
Mobile internet coverage (4G and 5G), %	74,5	82,4	87,5	84,1
Development of fiber-optic networks	64,7	69,5	62,4	66,7
Share of enterprises with automated management systems, %	29,7	35,4	38,7	35,2
Share of enterprises using cloud services, %	10,2	12,4	26,1	27,4
Level of digital skills among employees, %	62,4	84,0	64,3	59,4
Share of enterprises conducting training on digital technologies, %	8,7	10,7	15,6	18,9
Share of enterprises implementing digital innovations, %	16,2	18,4	21,3	24,6
Number of startups related to digital technologies (per 1,000 enterprises)	12,0	27,0	18,0	15,0

Source: compiled by the author based on [1; 2; 3; 4; 10; 14; 16].

Note: Indicators of digital skills of staff may be relatively subjective due to the difference in the methodology of their calculation in Poland and Ukraine.

To normalise the data, let's determine the minimum and maximum values of the indicators (Tabl. 4).

Table 4. Minimum and maximum values of digitalisation indicators

Indicators	p_{min}	p_{max}
Share of enterprises with access to broadband internet, %	87,0	98,7
Mobile internet coverage (4G and 5G), %	74,5	87,5
Development of fiber-optic networks	62,4	69,5
Share of enterprises with automated management systems, %	29,7	38,7
Share of enterprises using cloud services, %	10,2	27,4
Level of digital skills among employees, %	59,4	84,0
Share of enterprises conducting training on digital technologies, %	8,7	18,9
Share of enterprises implementing digital innovations, %	16,2	24,6
Number of startups related to digital technologies (per 1,000 enterprises)	12,0	27,0

Based on the minimum and maximum values of the indicators, we will normalise the digitalisation indicators (Tabl. 5).

Table 5. Normalised values of digitalisation indicators of the border regions of Ukraine and Poland

Indicators	Volyn Oblast	Lviv Oblast	Lubelskie Voivodeship	Podkarpackie Voivodeship
Share of enterprises with access to broadband internet, %	0,000	0,377	1,000	0,956
Mobile internet coverage (4G and 5G), %	0,000	0,609	1,000	0,731
Development of fiber-optic networks	0,324	1,000	0,000	0,618
Share of enterprises with automated management systems, %	0,000	0,633	1,000	0,578
Share of enterprises using cloud services, %	0,000	0,125	0,933	1,000
Level of digital skills among employees, %	0,120	1,000	0,196	0,000
Share of enterprises conducting training on digital technologies, %	0,000	0,195	0,678	1,000
Share of enterprises implementing digital innovations, %	0,000	0,267	0,622	1,000
Number of startups related to digital technologies (per 1,000 enterprises)	0,000	1,000	0,400	0,200

Based on the determined normalised values of the indicators, we will calculate the sub-indices and the final integrated index of the level of digitalisation of the regions (Tabl. 6).

The results of the calculations of the integrated digitalisation index show that Podkarpackie and Lubelskie Voivodeships have the highest level of digitalisation – 0.664 and 0.645 respectively.

Table 6. Sub-indices and integral index of digitalisation of the border regions of Ukraine and Poland

Region	I_1	I_2	I_3	I_4	I_c
Volyn Oblast	0,108	0,000	0,060	0,000	0,042
Lviv Oblast	0,662	0,379	0,598	0,634	0,568
Lubelskie Voivodeship	0,667	0,967	0,437	0,511	0,645
Podkarpackie Voivodeship	0,768	0,789	0,500	0,600	0,664

This allows us to classify them as regions with a high level of digitalisation, thanks to their well-developed infrastructure, integration of technologies and digital innovations. Lviv Oblast, on the other hand, is in the medium digitalisation sector with a score of 0.568. This is due to the insufficient integration of technology into the business processes of local enterprises compared to Polish regions.

It is worth noting that Volyn Oblast has a very low level of digitalisation – 0.042, which is due to the minimum values for most digitalisation indicators. In particular, in this aspect, it is worth noting the low level of implementation of modern digital services in business, the low level of automation of business processes, and generally weak innovation initiatives in the local business environment. As a result, we conclude that it is in the Volyn Oblast that digital infrastructure needs to be developed at an accelerated pace and business innovations need to be introduced to improve results.

It should be noted that this methodology for assessing the level of digitalisation of the region's business environment is quite universal and can be expanded by introducing additional sub-indices and indicators into the calculation. In particular, in the future, four more characteristic groups may be included:

1. The level of development of the digital economy:
 - the share of e-commerce in the region's total sales;
 - the number of businesses using online platforms for sales and customer interaction;
 - the impact of digital technologies on labour productivity in the business environment.
2. Integration of electronic services:
 - the level of use of electronic services by businesses, including tax reporting, registration and licensing services;
 - availability of digital platforms for business interaction with local authorities.
3. Economic effect of digitalisation:
 - the level of cost reduction through the automation of business processes;
 - growth of enterprise revenues due to the introduction of digital technologies;
 - the impact of digitalisation on job creation.
4. Regulatory environment:

- the level of support for business from the state and local authorities in the implementation of digital technologies;
- availability of regional digitalisation incentive programmes;
- simplification of regulatory procedures through digital tools.

It is worth noting that in practical terms, the application of this methodology is limited only by the availability of the necessary data to analyse the level of digitalisation of the business environment by individual indicators, as well as the inconsistency of certain methodological approaches to calculating basic statistical indicators in Ukraine and Poland. On the other hand, the simplicity of the methodology allows it to be applied without a special mathematical and econometric analysis apparatus, which makes it accessible to a wide range of users.

At the same time, it should be noted that in the course of calculations, a drawback was identified regarding the use of the standard normalisation formula in cases with minimal values, so in the future this methodology can be improved by using alternative approaches (logarithmic normalisation or normalisation with a shift). In general, the proposed methodology for assessing the level of digitalisation of the region's business environment is universal and flexible, which allows it to be adapted to different conditions and assessment goals.

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FORMATION OF A POLICY OF ECONOMIC STIMULATION OF THE 'GREEN' TRANSFORMATION OF THE POLISH-UKRAINIAN BORDERLAND

An important catalyst for the sustainable development of the regions of the Ukrainian-Polish borderland is the «green» economy, as its concept, in the economic aspect, mainly involves the «greening» of the already established economic system and anticipates the emergence of fundamentally new «eco-oriented» (waste-free) industries, which, in turn, leads to positive socio-economic consequences, such as the active development and implementation of innovations in the business practices of manufacturing enterprises and public life, as well as the creation of new (additional) jobs, which, in this way, influences the reduction of unemployment and the improvement of the quality of life of the local population in general.

Thus, the issue of accelerating the «green» transformation of the Polish-Ukrainian borderland becomes particularly relevant, specifically the search for ways to economically stimulate the comprehensive process of transitioning to ecological principles and activities in sectors such as energy, agriculture, mining and processing industries, construction, transport, etc. In this regard, let us examine in more detail the significance of «green transformation» for sustainable development.

At the end of the 20th century, the issue of «green» transformation of the economy became one of the priorities and most discussed topics at the global level among scientists, business entities, and legislative and executive authorities. The process of «green transformation» is characterized by a dynamic nature, and the reasons for its implementation are primarily such factors as: rapid changes in the boundaries of natural resource extraction and exploitation in a particular region, the gradual increase in the degree of their pollution and limited access to their use, as well as the constant growth of the scale of damage caused to the environment in general (*Li et al., 2022*).

It should be noted that the scientific literature rarely contains a clear definition of the term «green transformation»; its essence is mainly revealed in the goals and

measures to be implemented in the process of achieving global environmental objectives on the path to sustainable development. Moreover, the content of this term may differ depending on the specifics of the field in which the transition to «green» growth principles takes place, and therefore may focus to varying degrees on important social, ecological, and economic issues. V.Yu. Khudoley, O.O. Karpenko, and other scholars, summarizing the definition of the term «green» transformation, consider it as *«the process of transitioning from traditional, insufficiently sustainable economic and production models to environmentally sustainable and sustainable production, consumption, and lifestyle»* (Khudoley et al., 2023).

To better understand the essence and significance of «green» transformation for sustainable development, it is advisable to examine its main goals and measures that are to be implemented to achieve the results of balanced socio-ecological-economic development (Fig. 1).

Thus, «green» transformation is an important and necessary stage in the sustainable development of the Polish-Ukrainian border regions, which, by the way, have great potential for this. At the same time, cross-border cooperation, which has been ongoing between them for a long time, provides significant advantages for ensuring this process.

In this regard, the issue of shaping the economic stimulation policy for accelerating the «green» transformation of the Ukrainian-Polish borderland becomes of great importance, which, in turn, involves a set of measures for the development and implementation of joint financial and investment programs and strategies aimed at the introduction of energy-efficient and simultaneously «ecological» technologies, primarily focused on the development of «ecologically» sustainable sectors of the economy, as well as increasing the social responsibility of society, business entities, and the state.

It should be noted that the «prospects of green transformations» and their direction largely depend on the economic policy of the state, which has a direct and indirect relationship to the creation of a whole complex of corresponding prerequisites and can influence the activation of transformation factors in various ways (Kotsko, 2021).

To ensure an objective assessment of the main challenges and opportunities of the «green» transformation of the Polish-Ukrainian border regions, it is advisable, in our opinion, to consider the degree of influence of various factors affecting their economic development, as each of these regions operates in a different economic environment, which, in turn, requires an individual approach.

For example, the border regions of Poland are characterized by a more stable economic situation, and thus, high adaptability to possible changes due to developed infrastructure and stable access to financial and technological resources. At the same time, in Ukraine, due to the war, even in regions far from the front line (Volyn, Lviv, Zakarpattia Oblasts), risks are increasing, and new challenges arise in the path of economic development. Therefore, it should be taken into account that there are significant differences in the conditions of economic development between

the regions of Poland that share a border with the regions of Ukraine, which affect the perception and implementation of «green» initiatives.

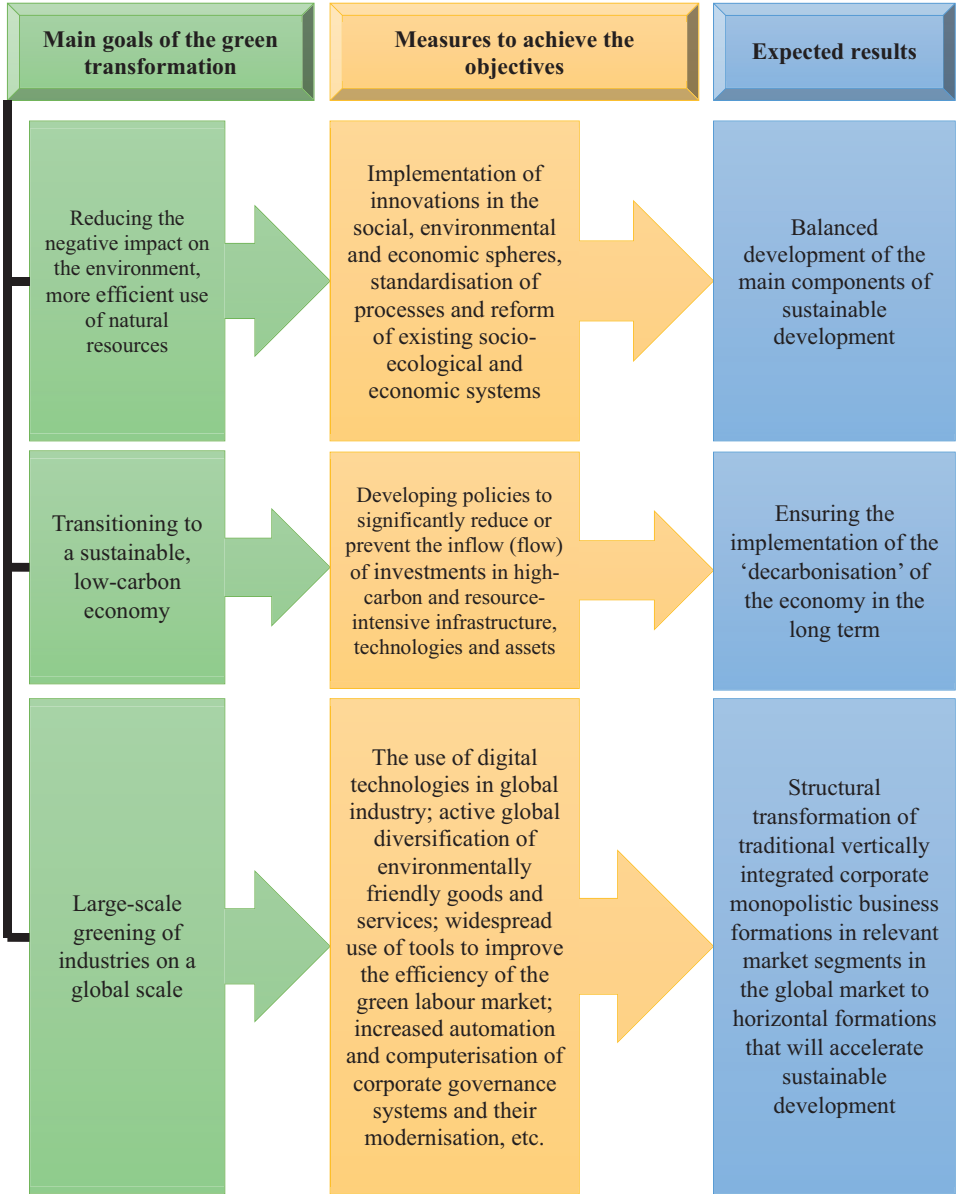


Fig. 1. The main goals and importance of the “green” transformation for sustainable development

Source: built by the author on the basis of sources (Khudoley et al., 2023; Ekins & Zenghelis, 2021; Chala, 2022).

In the scientific work «Rethinking regional economic resilience: Preconditions and processes shaping transformative resilience» (Trippel, M., Fastenrath, S., & Isaksen, A.), the scholars propose a new perspective on the transformational resilience of regions, defining it as the ability to use a crisis to create new, more resilient and environmentally-oriented models of economic development. In the context of the study, «transformational resilience» is understood as the ability of regions to adapt to any spontaneous challenges in their development path, not only ensuring the recovery of the economy to pre-crisis levels but also the ability to use these obstacles as a driving force for significant structural changes, including the modernization of elements of the economic system, particularly in terms of accelerating the transition to «green» practices and, as a result, gradually abandoning environmentally harmful forms of economic activity (Trippel et al., 2021).

Therefore, it can be said that the war in Ukraine today necessitates a reassessment of the economic structure and opens new opportunities for balanced socio-ecological-economic development. In this context, cross-border cooperation between the Polish and Ukrainian border regions can provide certain advantages for both countries. First and foremost, for the regions of Ukraine, this will enable the strengthening of resource mobilization necessary for the «green» transition during infrastructure recovery and the resolution of pressing socio-ecological-economic problems through the implementation of joint programs funded by the European Union. For the border regions of Poland, new opportunities will arise for the effective integration of «green» innovations into the local economic system and a harmonious transition to more ecological production.

The above highlights the need for close cross-border cooperation and clear coordination of actions between Polish and Ukrainian regions on the path of «green» transformation of their economies. Furthermore, these regions have quite similar and favorable natural-climatic conditions, as well as a similar resource potential for economic development, which, from this perspective, gives them certain advantages.

For example, the Lubelskie Voivodeship is a developed agricultural region of Poland, creating conditions for the development of the food industry. The mining industry also plays an important role in the economy of this region. Moreover, this region is rich in building materials such as limestone, marl, chalk, clay, construction and glass sand, which has led to the development of the building materials industry. Additionally, the forest and woodworking industries are well-developed, oriented towards the processing of its own forest resources (*Uprawnienia Lyubliński koho Voyevodstva*, 2021).

To the east of the aforementioned region is the Volyn Oblast, whose industrial base is also comprised of the forestry and agribusiness complexes. In this region, significant reserves of mineral raw materials are concentrated, such as construction sand, clay, chalk, marl, lime, peat, sapropel, basalt, and others. However, the industrial potential of Volyn, in our opinion, is not fully utilized and is insufficiently

rationalized, as the region does not have a sufficiently developed deep processing of the natural resources available within its territory (*Shubaly & Kosinskyi, 2019*).

To the south and southeast, the Lubelskie Voivodeship borders the Podkarpackie Voivodeship and the Lviv Oblast of Ukraine, where the most significant sectors of industrial production are food, fuel, machinery manufacturing, metalworking, and electric power (*L'viv's'ka Oblasna Viys'kova Administratsiya, 2019*).

The Podkarpackie Voivodeship is not traditionally an industrial region but potentially (if positive trends are maintained) has prospects of becoming one of Poland's new innovation-industrial centers (*Samovryaduvannya Pidkarpat-S'koho Voyevodstva, 2020*). However, due to the natural resources in the region, as well as those in the adjacent Lviv and Zakarpattia Oblasts of Ukraine, there is potential for the development of the tourism sector, which also stimulates the growth of small businesses in the service industry.

Considering the above, it becomes evident that the natural-resource potential of the Polish-Ukrainian border regions forms unique prospects for achieving global sustainable development goals, which, in turn, create the foundation for the «green» transformation in a cross-border context (Table 1).

One of the important stimulating factors that, in our opinion, requires strengthening cooperation between the Polish-Ukrainian border regions in the direction of «green transformation» is the European Green Deal (agreement) adopted in 2019. The European Green Deal serves as one of the most important climate strategies of the European Union, aiming for a significant reduction in greenhouse gases, particularly carbon dioxide, in the relatively near future, based on specific measures and rules.

Table 1. Main areas of green transformation of the Polish-Ukrainian borderland in line with the global sustainable development goals

Sustainable Development Goal (Direction)	Required Actions	Factors That Provide Advantages	Expected Results
<i>Climate Change Mitigation</i> (Goal 13)	Development of renewable energy, conservation of natural ecosystems, rational use of natural resources	Presence of significant biomass and other natural resources that can serve as alternative energy sources or eco-friendly building materials	Reduction of greenhouse gas emissions, improved air quality, and increased energy independence of cross-border regions
<i>Ensuring Access to Clean Energy</i> (Goal 7)	Alternative investments in renewable energy and ecological infrastructure		Reduction of fossil fuel dependence; establishment of stable alternative energy infrastructure at the local level
<i>Sustainable Cities and Communities</i> (Goal 11)	Projects aimed at developing ecological transportation, energy-efficient housing and public buildings, etc.		Reduction of the negative impact of urbanization on the environment; creation of more comfortable living conditions

Sustainable Development Goal (Direction)	Required Actions	Factors That Provide Advantages	Expected Results
<i>Protecting and Restoring Terrestrial Ecosystems</i> (Goal 15)	Joint programs for sustainable forestry, protection of natural areas, development of eco-tourism and recreation	Sufficient biodiversity in the Polish-Ukrainian border regions	Preservation of the surrounding natural environment
<i>Strengthening the Global Partnership for Sustainable Development</i> (Goal 17)	Strengthening cooperation in science, education, and innovative technologies; attracting international investments	Common political-strategic interests; strong cultural ties; shared ethnodemographic roots	Strengthening interstate relations that promote the integration of socio-ecological-economic processes

Source: compiled by the author on the basis of (Upravlinnya Lyublyns'koho Voyevodstva, 2021; L'vivs'ka Oblasna Viys'kova Administratsiya, 2019; Samovryaduvannya Pidkarpat-S'koho Voyevodstva, 2020; Petras & Balyuk, 2024; United Nations, 2024).

As a result, it demands radical and fundamental «ecologically» oriented solutions in various sectors of the economy, primarily in energy (development of renewable energy and the abandonment of fossil fuel-based energy production), land use, forestry, and water management (*European Union, 2024*).

However, the implementation of the European Green Deal in Poland faces certain challenges that may significantly impact the country's energy security and slow down the transition to a low-carbon economy. For example, these include the Russian-Ukrainian war and the rise in prices of previously imported energy resources. Moreover, «Poland still lacks sufficient renewable energy sources, and therefore, compared to other European Union countries, it will need to make considerable efforts to achieve climate neutrality and energy independence» (*Kierasiński, 2023*).

This situation «threatens the achievement of Poland's goals under the European Green Deal,» and experts also expect a «renaissance of nuclear energy production,» as evidenced by pro-ecological efforts in this regard (*Krawczyńska et al., 2024*).

At the same time, the war in Ukraine and the negative effects of the COVID-19 pandemic highlight Poland's need to accelerate its transition to low-carbon energy. In this case, the effective implementation of the European Green Deal is only possible through close interregional cooperation and the adoption (adaptation) of positive experiences from countries that have faced similar challenges.

To correct the unfavorable situation in Poland, significant financial and investment flows must be directed towards the modernization of the country's energy infrastructure through the integration of regional and international efforts, which are vital for improving its energy independence.

As for Ukraine, the European Green Deal remains one of the main benchmarks in the process of Eurointegration of its regions, as evidenced by the adoption of stra-

tegic documents and laws aimed at achieving climate neutrality by 2050 (*Ministerstvo zakhystu dovkillya ta pryrodnykh resursiv Ukrainy*, 2024). Despite a number of obstacles, Ukraine is actively adapting its legislation to European Union standards, including the implementation of a national emissions trading system for greenhouse gases and strengthening the monitoring of their emissions. These measures create new opportunities for international cooperation and investment attraction, while also contributing to the country’s economic modernization and emphasizing its desire to take a rightful place among European countries in the field of sustainable development.

As we can see, for both countries, the European Green Deal promotes the active implementation of sustainable practices in their economic systems aimed at reducing dependence on fossil fuels and increasing energy efficiency. However, in this context, the Polish-Ukrainian border regions face challenges such as the need for significant investments, insufficient infrastructure for implementing innovative technologies, and the need to adapt local economies to new environmental standards.

As a result of the research conducted, an overview was made of the main national and regional documents aimed at ensuring the «green transformation» of the Polish-Ukrainian border regions. It was determined that at the national and regional levels, for the border regions of Poland, the «green transformation» process is mainly carried out in accordance with the: Energy Efficiency Law, National Energy and Climate Plan for 2021–2030 (NECP PL), Energy Policy of Poland until 2040 (EPP 2040), «Stop Smog» program, «Clean Air» program, Lubelskie Voivodeship Development Strategy until 2030, and the Development Strategy of the Podkarpackie Voivodeship 2030 (Table 2).

Table 2. National and regional documents aimed at ensuring the “green transformation” of Poland’s border regions

Document Title	What It Illustrates	Main Goals in the Context of „Green” Transformation	Features of the Document in the Context of „Ecological” Transition
<i>Energy Efficiency Law</i>	Legal basis for improving energy efficiency, rational energy consumption, and reducing CO ₂ emissions	Improving energy efficiency in the national economy	Aligns with the provisions of Directive 2012/27/EU (Energy Efficiency Directive)
<i>National Energy and Climate Plan for 2021–2030</i>	Strategy for achieving the energy and climate goals set by the European Union	Accelerating the development of renewable energy sources, reducing greenhouse gas emissions	Aligns with and complements the Strategy for Responsible Development and its related sectoral strategies
<i>Poland’s Energy Policy until 2040 (EPP 2040)</i>	Conceptual basis for the „green” development of the fuel and energy sector, representing a plan with set transformation frameworks	Ensuring energy security and optimizing energy resource use while enhancing economic competitiveness	Actively supports the implementation of the Paris Agreement, ensuring a fair and responsible transition to „ecologically” clean energy

Document Title	What It Illustrates	Main Goals in the Context of „Green” Transformation	Features of the Document in the Context of „Ecological” Transition
<i>„Stop Smog” Program</i>	Program for improving energy efficiency and reducing emissions in the residential sector	Replacing inefficient heating sources with new „ecologically” clean ones; thermomodernization and connecting residential buildings to heating networks powered by alternative renewable energy sources (RES)	The program provides financial support to low-income homeowners and municipalities
<i>„Clean Air” Program</i>	Initiative to improve air quality through thermal modernization of old housing and replacing inefficient heating systems with new, ecologically clean ones	Improving air quality, significantly reducing greenhouse gas emissions, and increasing energy efficiency in single-family homes	State funding is provided for efficient coal and gas boilers, as well as pumps that meet EU standards for ecological design
<i>Lubelskie Voivodeship Development Strategy until 2030</i>	Regional development plan highlighting key areas in sustainable development and energy efficiency	Strengthening ecological initiatives in various areas of the region, especially in the development and active use of RES	Involves local communities in the „green transformation” process of the region
<i>Podkarpackie Voivodeship Development Strategy 2030</i>	Regional development plan outlining strategic goals reflecting global sustainable development trends	Increasing energy efficiency, increasing investments in renewable energy development and environmental protection projects	Envisions integrating renewable energy sources with the development of the region's infrastructure

Source: compiled by the author based on (Uprawnienia Lyubliński koho Voyevodstva, 2021; Samovryaduvannya Pidkarpat-S'koho Voyevodstva, 2020; Bayda, 2023).

National and regional documents aimed at the «green transformation» of the Polish border regions collectively form a comprehensive legal, financial, and strategic framework for implementing a range of eco-economic initiatives. They establish national frameworks for the implementation of sustainable development policies, promote the integration of European Union environmental standards, and serve a stimulating function in attracting investments in the development of renewable energy in the regions, as well as in the modernization of the existing socio-economic system, primarily in the economic sectors and public utilities.

In particular, the Energy Efficiency Law provides the legal foundation for reducing emissions and rational energy consumption, while the National Energy and Climate Plan for 2021–2030 outlines priority areas for the development of renewable energy sources. Poland's Energy Policy until 2040 aims to combine energy security with economic competitiveness and actively implement the provisions of the Paris Agreement. Programs such as «Stop Smog» and «Clean Air» contribute to improving

energy efficiency in the residential sector of the Polish border regions by replacing outdated heating systems with modern eco-friendly technologies, as well as through the thermomodernization of old buildings, etc.

Regional strategies for the Lubelskie and Podkarpackie Voivodeships are more focused on the specific economic needs and natural-resource potential of these regions. They adapt national goals and objectives to the socio-economic conditions and needs of local communities, thereby emphasizing the importance of local initiatives in promoting sustainable development, for example, through the development of regional renewable energy clusters or the implementation of support programs for small and medium-sized enterprises in the energy efficiency sector.

The features of national and regional documents aimed at ensuring the «green» transformation of Ukraine's border regions are presented in Table 3.

The «green» transformation of Ukrainian border regions largely depends on national strategies and programs that create the foundation for ecological development by providing legal and resource support. In particular, the National Energy and Climate Plan for the period until 2030 defines the priorities of energy independence, reducing greenhouse gas emissions, and increasing the share of renewable energy sources, based on medium- and long-term forecasts. The SUN4Ukraine program ensures the integration of Ukrainian cities into the international initiative to achieve climate neutrality, which will facilitate the implementation of smart technologies. The «Green Transformation of Ukrainian Universities» project is aimed at «greening» the education sector in certain regions, and as a result of its implementation, the creation of «green standards» and a «green campus» model is expected.

The development strategies of Volyn, Lviv, and Zakarpattia Oblasts also take into account the specifics of the natural resource potential, which influences the economic development characteristics of each of these regions. They are generally oriented towards implementing waste management systems, preserving natural resources, developing energy-efficient technologies, and increasing the ecological awareness of the local population.

The national and regional documents considered, which are aimed at the «ecological transition» of the economies of Ukrainian border regions, are mostly strategic plans for achieving sustainable development, as well as «ecological» modernization of economic sectors in accordance with European environmental policy standards.

Table 3. National and regional documents aimed at ensuring the “green transformation” of Ukraine’s border regions

Document Title	Main Purpose	Main Goals in the Context of the „Green” Transformation	Features of the Document in the Context of Ecological Transition
<i>National Energy and Climate Plan of Ukraine for the Period up to 2030</i>	Strategic document aimed at aligning energy and climate policy to ensure sustainable development and the recovery of the country’s economy	Reduction of greenhouse gas emissions; increasing energy independence; increasing the share of renewable energy sources in the total energy consumption structure; achieving climate neutrality in the energy sector	The plan is based on medium- and long-term energy system development scenarios and greenhouse gas emission forecasts
<i>Sustainable Network of Climate-Neutral Cities of Ukraine (SUN4Ukraine)</i>	Program aimed at supporting Ukrainian cities in achieving climate neutrality	Ensuring the transition of Ukrainian cities to net-zero emissions and the implementation of smart technologies	Launched under the Horizon Europe Program, it involves pairing Ukrainian cities with participants of the EU Mission „100 Climate-Neutral and Smart Cities”
<i>Green Transformation of Ukrainian Universities</i>	Project supporting the academic community in Ukraine	Development and implementation of „green standards” in education and academic activities of universities; creation of the „green campus” model	Includes a course on „Green Technologies for the Development of Ukrainian Society” and the introduction of a micro-certification system for students in the field of „green transformation”
<i>Volyn Oblast Development Strategy for the Period up to 2027</i>	Regional development plan for Volyn, outlining strategic goals for waste management in an ecological context	Formation of a modern innovative waste management system; implementation of innovative waste recycling and disposal capacities	Includes the development and implementation of the Regional Waste Management Plan by 2030
<i>Lviv Oblast Development Strategy for the Period 2021–2027</i>	General regional development plan outlining strategic goals for the development of a clean environment	Preservation of water and air resources, biodiversity, and the formation of ecological awareness among the population	Includes a set of measures to support energy-efficient technologies in industry and the communal sector
<i>Zakarpattia Oblast Development Strategy for the Period 2021–2027</i>	Long-term regional development plan	Ensuring sustainable development of the region amid systemic reforms	Envisions socio-economic development with consideration of ecological aspects

Source: compiled by the author based on (Lvivs’ka Oblasna Viys’kova Administratsiya, 2019; Ministerstvo ekonomiky Ukrainy, 2024; European Union, 2024; Ofis Horyzont Yevropa v Ukraini, 2024; Natsional’ne ahenstvo..., 2024; Volyns’ka oblasna derzhavna administratsiya, 2020; Zakarpat-s’ka oblasna viys’kova administratsiya, 2024).

Thus, it can be said that national-level documents set general boundaries and directions for the «green transformation» of border regions of Poland and Ukraine, while regional documents focus more on local characteristics and take into account the specifics of these territories. At the same time, the main differences between national and regional documents aimed at the «green transformation» of border

regions of Poland and Ukraine lie in the scope, priorities, and levels of detail in the implementation of set goals (tasks). In order to ensure an effective «green transformation» in the context of cross-border cooperation between Polish and Ukrainian border regions, it is necessary to strengthen the cooperation policy between them at all levels.

At the national level, it is important to continue implementing large-scale programs to reduce the carbon footprint and actively develop renewable energy. Meanwhile, at the regional level, close cooperation between the administrations of Polish regions and Ukrainian oblasts should be intensified within the framework of joint projects aimed at «greening» industrial sectors, environmental protection, developing green infrastructure, and implementing innovative ecological solutions in the social and economic spheres. In the process of forming the economic stimulation policy to accelerate the «green» transformation of the Polish-Ukrainian border regions, it is important to select the main areas for their joint cross-border cooperation.

Considering global challenges, natural-climatic conditions, natural-resource potential, strategies and plans for ensuring «green transformation,» and other socio-ecological aspects, we believe that the priority economic sectors for the «green» transformation of the Polish-Ukrainian border regions are the agro-industrial, fuel and energy, and forestry sectors. To accelerate the «green» transformation in the agro-industrial complexes of the border regions of Poland and Ukraine, we can propose certain measures aimed at organic production, deep processing of agricultural products, innovative development, waste-free production, and ensuring food security (Table 4).

Table 4. Directions and measures to enhance the green transformation of the agricultural sector in the regions of the Polish-Ukrainian borderland

Incentive Vector	Measures for the Development of the Agro-Industrial Sector in the Border Regions
<i>Organic Production and Processing</i>	Production of organic seed and planting material, development of organic crop and livestock farming
	Creation of high-quality, environmentally safe, and competitive organic agricultural products and their processed products
	Active use of bio-packaging, bio-fertilizers, veterinary drugs based on natural ingredients, etc.
<i>Deep Processing</i>	Development of a system of powerful processing complexes, including close cross-border cooperation
	Development of strategically important industries (e.g., those fulfilling orders for special state bodies, ministries, etc.)
<i>Innovative Development</i>	Large-scale digitization of the agro-industrial sector
	Implementation of ecological technologies (e.g., for producing eco-friendly fertilizers, reducing water usage, ensuring high-speed sowing and harvesting of crops)
	Use of artificial intelligence and modern robotic platforms for performing various agricultural tasks

Incentive Vector	Measures for the Development of the Agro-Industrial Sector in the Border Regions
<i>Waste-Free Production</i>	Creation of tech-solutions based on agro-industrial complexes in the regions
	Agricultural cooperation between the Polish-Ukrainian border regions and various sectors of their agro-industrial complexes, involving the use of one agricultural enterprise's waste by others
<i>Food Security</i>	Active implementation of biological pest control methods in agricultural production
	Breeding and growing varieties of cereals, vegetables, and fruit crops that are resistant to various natural-climatic conditions (e.g., drought, flooding, high soil acidity)

Source: compiled by the author.

In the process of “green” transformation of the regions of the Polish-Ukrainian borderland, joint projects for the construction of eco-houses made of grain straw, which is one of the innovative technologies in the construction industry, can play an important role. Straw-bale houses are based on the use of straw as the main building material, which is usually obtained during the harvesting of grain crops.

Having determined the possible production volumes of strawbale blocks in the Polish-Ukrainian border regions, as well as the construction of medium-sized straw-bale houses, it is possible to assume that the use of straw as a natural eco-material will become a sustainable development priority for these areas and creates a significant potential for the construction of eco-housing (Fig. 2).

Given the available reserves of traditional natural resources (coal, oil, natural gas), as well as the need to reduce greenhouse gas emissions, the Polish-Ukrainian border regions should focus their joint efforts on developing the renewable energy sector.

Since agriculture and forestry constitute a significant part of the resource base for the industry in the Lubelskie Voivodeship, Volyn and Lviv Oblasts, this creates the foundation for cross-border projects aimed at the development of renewable energy sources. These could be based on the deep processing of biomass from natural resources and waste from forestry and agriculture, offering a relatively «cheap» alternative to the use of traditional fuels.

Rapeseed is an excellent raw material for producing eco-friendly fuel. Given the volumes of rapeseed and canola production in the Polish-Ukrainian border regions, the potential for biodiesel production based on these crops was considered. This analysis aims to assess the feasibility of developing joint projects for the establishment of biodiesel plants in these regions (see Fig. 3).

In the Volyn and Zakarpattia Oblasts, as well as the Lubelskie Voivodeship, forestry plays a significant role in the economy, which has led to the development of forest complexes in these areas. In this regard, it is proposed to create joint development programs for these regions aimed at sustainable forest management, «ecologically clean» and advanced wood processing, among other initiatives.

It should be noted that the Podkarpackie Voivodeship, as well as Lviv and Zakarpattia Oblasts, due to their natural resources and attractiveness for tourism, can

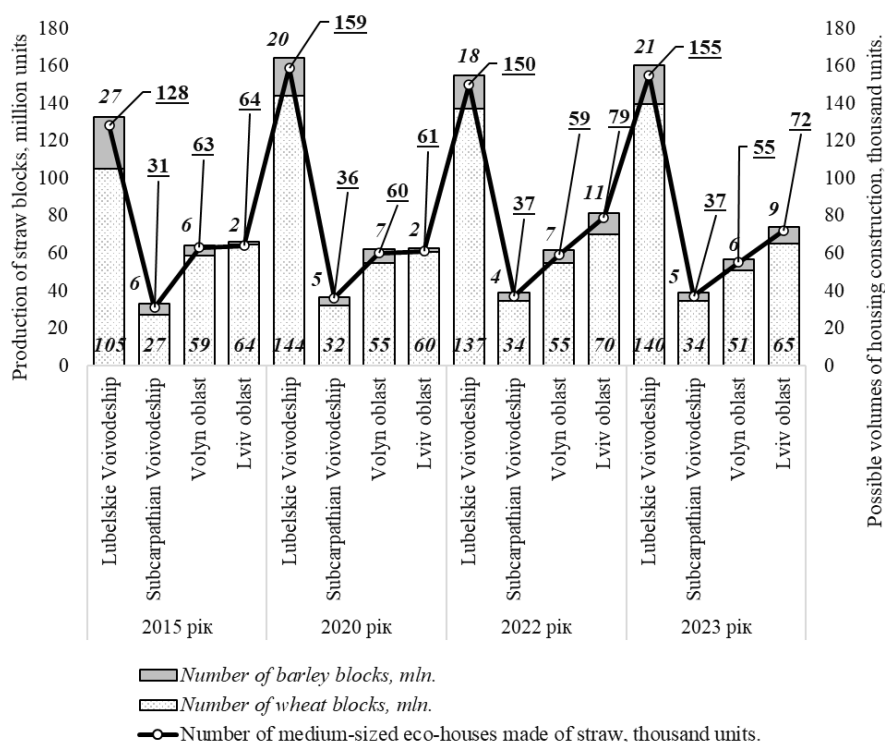


Fig. 2. Potential for the production of eco-materials and eco-houses from grain straw in the regions of the Polish-Ukrainian borderland

Source: based on (Statistics Poland, 2024; Holovne upravlinnya statystyky u Volyns'kiy oblasti, 2024; Holovne upravlinnya statystyky u Lvivs'kiy oblasti, 2024)

develop joint strategies and tools based on the forest complex to attract investments in ecotourism, which will contribute to the development of small businesses and socio-economic stability in these regions.

Based on the above, we can conclude that the most priority directions for stimulating the «green transformation» of the Polish-Ukrainian border regions at the moment will be the development and implementation of joint economic development programs (projects), including:

- transition to organic agricultural production and processing of agricultural products (*most relevant for cooperation between the Lubelskie Voivodeship, Volyn, and Lviv Oblasts*);
- development of renewable energy sources (*relevant for all Polish-Ukrainian border regions*);
- ecological construction (*most suitable for the Lubelskie Voivodeship, Volyn, and Lviv Oblasts*);

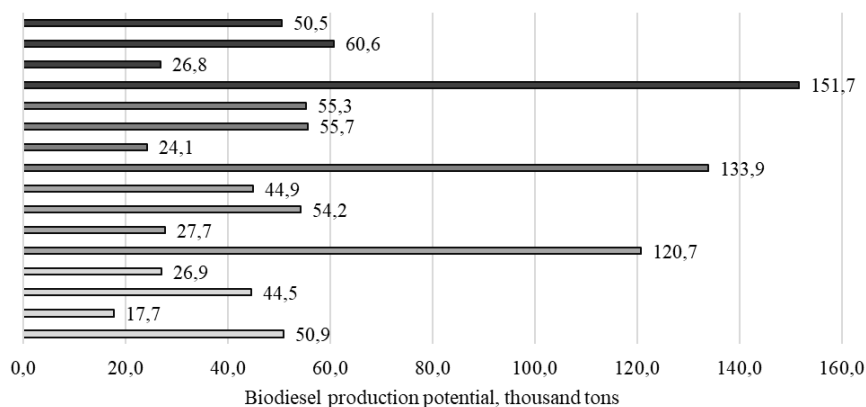


Fig. 3. Potential for biodiesel production from rapeseed and colza in the regions of the Polish-Ukrainian border

Source: based on (Statistics Poland, 2024; Holovne upravlinnya statystyky u Volyns'kiy oblasti, 2024; Holovne upravlinnya statystyky u Lvivs'kiy oblasti, 2024).

- deep processing of local natural resources and ecological modernization of industrial enterprises (*relevant for all Polish-Ukrainian border regions*);
- waste management and ensuring waste-free production (*primarily relevant for the Lubelskie and Podkarpackie Voivodeships and Lviv Oblast*);
- development of ecotourism and «green» tourist infrastructure (*a promising direction for joint projects between Zakarpattia Oblast and the Podkarpackie Voivodeship*).

We believe that the above proposals will help in selecting the correct and effective tools in the process of shaping the policy for joint economic stimulation to accelerate the «green transformation» of the Ukrainian-Polish border region. It should be noted that national and regional strategies, targeted programs, and plans in both Poland and Ukraine support this process. However, for successful implementation, it is also necessary to ensure significant financial investments in large volumes.

It is important to emphasize that, at present, there is no unified strategy or program that covers all aspects of investment in the «green» development of the Polish-Ukrainian border economy. Existing programs are functioning in parallel and could be integrated into a single strategic framework. Thus, in the process of forming the policy for economic stimulation to accelerate the «green transformation» of the Polish-Ukrainian border regions, there is a pressing need to create a unified investment support system for the «green» development of these regions. This system should consider the possibility of comprehensive use of financial-economic, strategic, innovation-technological, and socio-ecological tools within a single effective mechanism.

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“GREEN” TRANSFORMATION OF COAL MICROREGIONS OF THE UKRAINIAN-POLISH BORDERLAND: PROBLEMS AND DIRECTIONS OF PROCESS INTENSIFICATION

Despite the growing geopolitical tensions in the world, the energy transition is one of the key challenges for the EU countries, which have set themselves the ambitious task of a sustainable transition to climate neutrality across Europe by 2050 (*Green Deal. Boosting...*, 20224). To achieve this goal, the EU is actively implementing innovations in the governance system:

- 1) strategic and other conceptual documents with a planning horizon of 2030 and 2050 are being developed (EU Biodiversity Strategy 2030, EU Forest Strategy, New EU Adaptation Strategy (for climate change), etc.);
- 2) the process of updating European legislation and regulations (European Climate Law, a package of laws under the common title “Fit for 55 package”) was launched;
- 3) institutional environment is developing (EU system for emissions trading in energy, aviation, ships, and land transport, Carbon Border Adjustment Mechanism, Climate Social Fund);

- 4) the system of financial support for the implementation of the European Green Deal measures is being expanded (Just Transition Fund, improvement of the Eastern Partnership mechanism).

Despite the challenges of war, the state of Ukraine (under the EU-Ukraine Association Agreement, and then as a candidate country for EU membership) is developing in line with the European Green Deal. On July 31, 2021, Ukraine's Nationally Determined Contribution was updated in the Register of Nationally Determined Contributions under the Paris Agreement (*Nationally Determined Contributions Registry*, 2024) and a goal was set to reduce greenhouse gas emissions by 65% by 2030 (the previous goal – 40%) compared to 1990. This goal is being achieved in the context of intensifying cooperation between Ukraine and the EU through the implementation of numerous programs and projects at all levels of the public administration system, attracting financial resources from EU funds, developing the institutional environment, and bringing the national legal framework in line with European legislation.

The energy transition of coal regions is one of the important areas of the European Green Deal. Scientists emphasize that coal regions are the “starting points” for the regional energy transition in Europe in the institutional context and link this to the development of the EU on the basis of the European Coal and Steel Community (Loewen, 2022).

A set of actions on the green transition resulted in the largest reduction in the share of fossil fuels in electricity production in United Europe: in January-June 2023, it was down to 33% compared to the same period of the previous year. Despite the war in Ukraine and the resulting energy crisis, which (as expected) could have led to a “coal comeback,” the largest decline was in coal power, when the share of the resource in EU electricity generation reached a historic low of less than 10% (Za-*lezhnist' YES*, 2023; *A sign of the times'...*, 2023).

Clearly identifying the connection between coal regions and old industrial areas, scholars emphasize their dependence on technological progress and an inherent problem of “deep specialization in long-established technologies and industries with little scope for further economic exploitation of knowledge”. This “blocking” leads not only to economic, functional, political, and hierarchical isolation of the region but also to the consolidation of the worldview of economic actors, depriving them of creativity and imagination necessary for the development of new ideas and going “beyond” the usual (Coenen *et al.*, 2018). Its consequences are evident in the lower level of socio-economic development of coal regions and communities compared to the average in the countries of which these regions are territorial units (Dias *et al.*, 2018). They are manifested in the following characteristics common to European coal regions:

- an industrial monostructure characterized by high capital intensity, barriers to entry to and exit from local markets, large size of coal companies, and oligopolistic market structure;

- significant influence of national and supranational institutions on the development of the leading sectors of the economy (primarily in energy, innovation, and industry);
- the presence of a clearly defined circle of stakeholders who are focused on preserving the position of the coal industry (*Hassink, 2010*).

According to a study by the EU’s Joint Research Centre, regions and communities in Central and Eastern Europe will experience the most direct negative impacts of coal phase-out (*Dias et al., 2018*). Although the Centre’s study does not cover the territory of Ukraine, unfavorable expectations are also inherent in coal microregions in our country, which face the same threats as coal regions in the EU.

The Lvivsko-Volynskyi coal basin located in the Ukrainian-Polish border area is a key center of coal production in western Ukraine. Two coal microregions have developed on this basis: Chervonohradskyi in Lviv Oblast with the center in Chervonohrad and Volynskyi in Volyn Oblast with the center in Novovolynsk (Fig. 1, Tabl. 1).

For decades, they have been and still are key industrial centers within the respective oblasts and the state fuel and energy complex, with specific employment and socio-economic development features inherent in them. However, just like the coal regions in the EU, they face the problem of specialization in outdated technologies and industries with low innovation capacity.

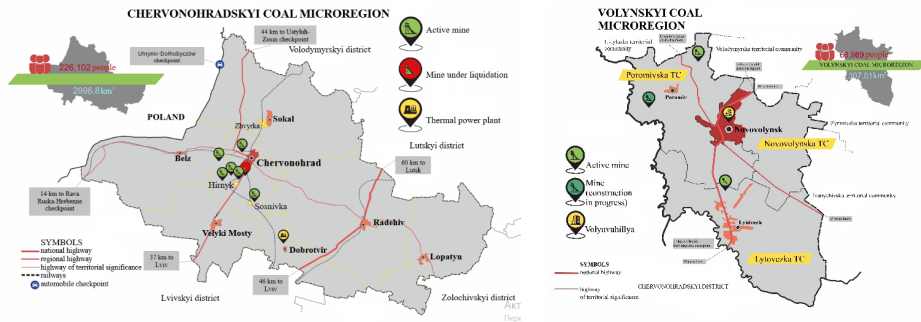


Fig. 1. Maps of coal microregions of the Ukrainian-Polish border with the location of coal mining and power generation enterprises

Source: (Plan for the fair transformation..., 2024; Plan for the fair..., 2024).

Table 1. Characteristic features of Chervonohradskyi and Volynskyi coal microregions

Indicator	Chervonohradskyi coal microregion	Volynskyi coal microregion
Area, km ²	2 996.80	307.81
Population, persons	226,102	66,969
Location of territorial communities	Chervonohradska, Belzka, Velykomostivska, Dobrotvirska, Lopatynska, Radehivska, Sokalska	Novovolynska, Lytovetska, Poromivska
Number of settlements	205	32
Socio-economic centers of the microregion	Chervonohrad, Sokal, Radehiv	Novovolynsk

The economic specialization of the microregions of the Ukrainian-Polish border was formed at the beginning of the last century during the first exploration of coal deposits in Lvivsko-Volynskyi basin. From the mid-twentieth century to the present day, their development has been directly connected to the mining industry.

The decline of the coal mining industry in Ukraine dates back to the 1990s and as of 2024 saw the closure of six out of 12 mines in Chervonohradskyi microregion (50%) and eight out of ten operating mines in Volynskyi coal microregion (80%). The economic situation of operating coal enterprises is difficult.

First of all, there is a rapid decline in coal production (Fig. 2).

While excluding the loss of mines in the territories occupied in 2014, the decline in the actual volume of coal mined in Ukraine in 2021 compared to the 2010 base year was 26.2%, the decline rate at the mines on the Ukrainian-Polish border was twice as high – 59.9%: in 2021, the mines of Chervonohradskyi coal microregion produced 39.0% of the actual volume of 2010, and Volynskyi coal microregion – only 6.4%.

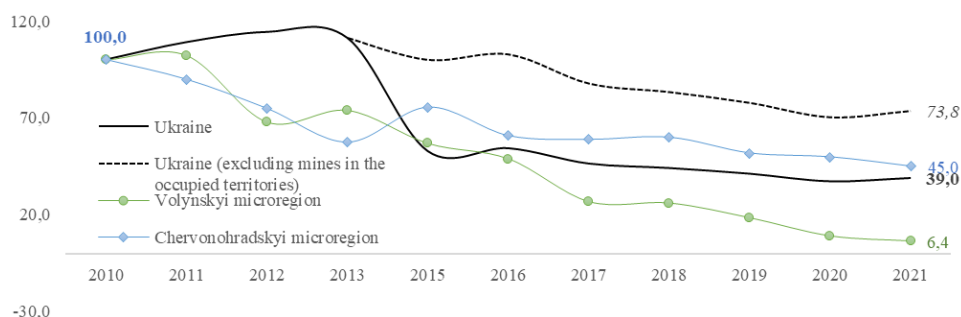


Fig. 2. Comparison of the dynamics of coal production by Ukrainian mines and coal microregions of the Ukrainian-Polish border, 2010–2021, %*

* relative to the 2010 base year; Ukraine (excluding mines in the occupied territories) – for 2015–2021, 2015 was chosen as the base year

Source: based on data (Energy Map, 2024).

Second, the problem is the long-lasting unprofitability of state-owned coal mining enterprises, which have operated for thirty years of Ukraine's independence using inefficient, outdated, and non-transparent management mechanisms. A clear indication of this is the constant excess of the unit cost of finished coal products over the selling price at coal mining enterprises (Fig. 3). Over the period 2010–2020, the cost of production at state enterprise Lvivvuhillya was on average 1.6 times higher than its selling price, while at Volynvuhillya it was 4.3 times higher (with the difference having increased significantly in the last two years). Nadiya mine (100% owned by the state of Ukraine) was the only profitable coal mining enterprise within the coal

microregions of the Ukrainian-Polish border. Still, even here the ratio of cost to selling price has been fluctuating around 1.0 since 2016.

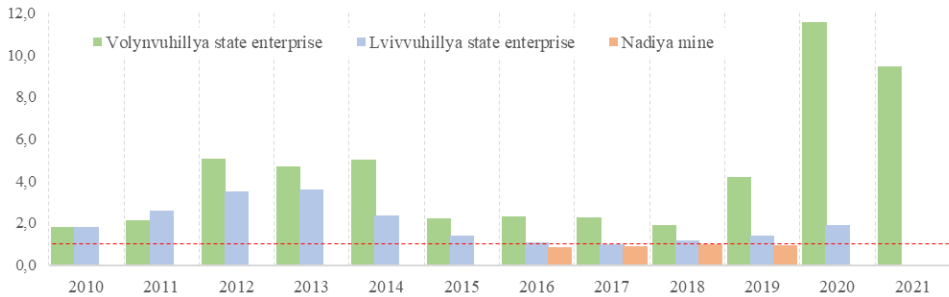


Fig. 3. Dynamics of the ratio of the unit cost of finished coal products to their selling price at coal enterprises of the Ukrainian-Polish border, times, 2010–2021

Source: based on data (Energy Map, 2024).

The increase in the cost of finished coal products is caused by a number of problems that result from (as mentioned above) inefficient management of state-owned enterprises in this area: the use of outdated equipment, lack of focus on the introduction of innovative mechanisms of coal mining and labor safety, low labor productivity of miners (50% of coal miners employed in state-owned mines in Ukraine produce only 10% of coal (*Orel, 2021*), state restrictions on the cost of electricity, complexity of relations between market entities, etc. Amid the war and the missile threat to the infrastructure of the Ukrainian energy sector, the danger of coal mining enterprises losing their markets is becoming more urgent since coal produced in Lvivsko-Volynskyi coal basin is an energy source. In particular, we are talking about the TPP in Dobrotvir, which before the war was one of the main places of sale of coal for microregions of western Ukraine, and as of 2024 is almost completely destroyed.

Third, the declining role of coal enterprises as key employers in local labor markets also indicates the decline of the industry (Fig. 4). A steady decline in the number of employees is recorded at all mines and other separate divisions of coal companies. Moreover, while the decline in the number of employees in Chervonohradskyi microregion is slower than the average Ukrainian rate, the loss of jobs in Volynskyi microregion is much more intense: as of 2020, 40.6% of full-time employees remained at the industry's enterprises.

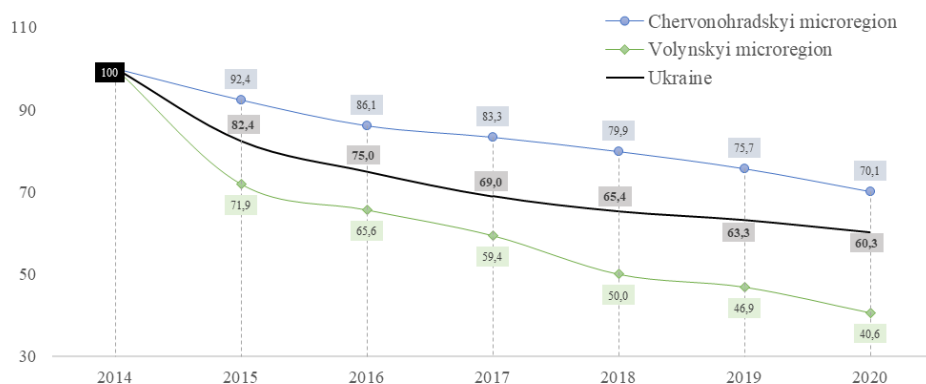


Fig. 4. Comparison of the dynamics of the average number of full-time employees at enterprises in the mining industry of Ukraine and coal microregions of the Ukrainian-Polish border, 2014–2020, %*

* against the 2014 base year

Source: based on the data (Energy Map, 2024).

In general, the situation in coal mining in Ukraine is in line with the trends in the development of the coal sector in other countries (Germany, Czech Republic, Romania, Poland) and is characterized by a change in approaches to energy production towards the environmentalization of these processes.

Despite the long-term disappointing trends in the coal market, the economy of the communities of Chervonohradskyi and Volynskyi coal microregions is largely formed around the coal enterprises on their territory. According to DIW Econ GmbH (*The regional economic...*, 2024), the functioning of the coal mining sector in the microregions of the Ukrainian-Polish border, along with direct effects (generated by the economic activities of coal companies), also has indirect effects (the impact of coal companies on the development of related sectors) and induced effects (those resulting from the spending of income of employees of coal enterprises and companies in related sectors).

Coal enterprises generate UAH 2.1 billion of value added in Lviv Oblast (0.8% of the total value added in the region) and UAH 182 million in Volyn Oblast (0.2% of the total regional value added) (Fig. 5, a). It is worth mentioning that the direct economic effect plays a dominant role in the overall economic effect in both regions, which indicates a weak influence of the sector's enterprises on the development of regional economic sectors. According to experts (*The regional economic...*, 2024), every UAH 1 of value added received by coal enterprises amounts to UAH 1.6 of value added in Lviv Oblast and UAH 1.4 in Volyn Oblast, while in Dnipropetrovsk Oblast (where coal mines are privately owned) it is almost twice as much – UAH 2.3.

The coal mining sector has an impact on the creation of 11,000 jobs in Chervonohradskyi microregion and 1,500 in Volynskyi (Fig. 5, b). Analyzing the role of the industry in the development of regional labor markets, we can see the predominance of direct effects and the limited indirect and induced effects: only about 3,000 jobs in Chervonohradskyi and more than 200 in Volynskyi microregions are the result of indirect impulses from the industry’s enterprises. Therefore, we can state that a steady and intensive reduction in employment at coal enterprises is indeed accompanied by the risk of job losses not only at coal enterprises but also in other related areas, but this impact is limited.

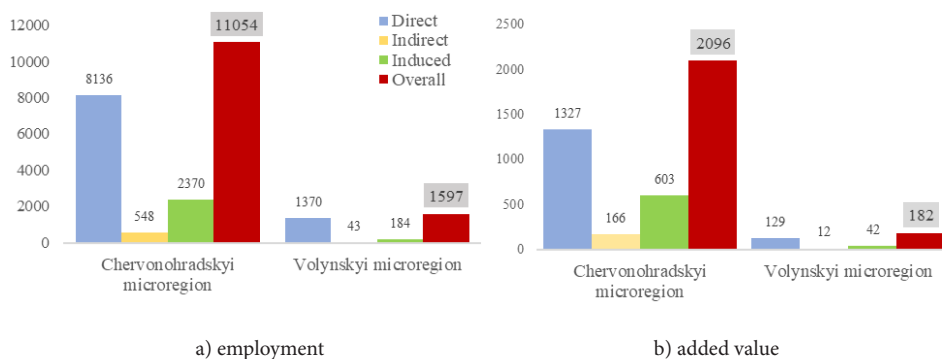


Fig. 5. Labor market effects of the coal mining sector in the coal microregions of the Ukrainian-Polish border, persons

Source: (The regional economic..., 2024).

Although the limited impact of coal state-owned enterprises on the development of related economic sectors in the Ukrainian-Polish borderland is a negative aspect (a deterrent to economic development), it may be seen as a certain “airbag” in the context of the need for economic transformation and closure of coal mines due to the economy’s lower dependence on the coal industry.

Nevertheless, when comparing the economic development of Chervonohradskyi and Volynskyi microregions and the role of coal mining in this process, certain differences should be noted.

The economy of Chervonohradskyi microregion largely depends on the development of the mining industry and the results of the functioning of budget-forming enterprises in this industry on their territory. Out of the seven territorial communities formed here, the level of dependence in two (Belzka, where the Stepova mine is located, and Dobrotvirsk, where the Dobrotvirsk TPP is the budget-forming enterprise) is critically high and is accompanied by significant risks to their financial capacity (Fig. 6). Chervonohradsk, which is the center of coal mining in the mi-

croregion (five of the six operating mines and offices of coal companies are located here), and Sokalska have a lower level of dependence as they are more economically developed communities with centers in cities that were developing as a city of oblast significance (Chervonohrad) and a district center (Sokal) before the 2014–2020 reform. However, as in the Velykomostivska community, local labor markets here are focused on coal mining. The communities formed on the basis of the settlements of the former Radehivskyi district – Radehivska municipal and Lopatynska settlement territorial communities – have an agricultural economy. But it is also home to a large share of workers employed in the mines or the enterprises that service them.

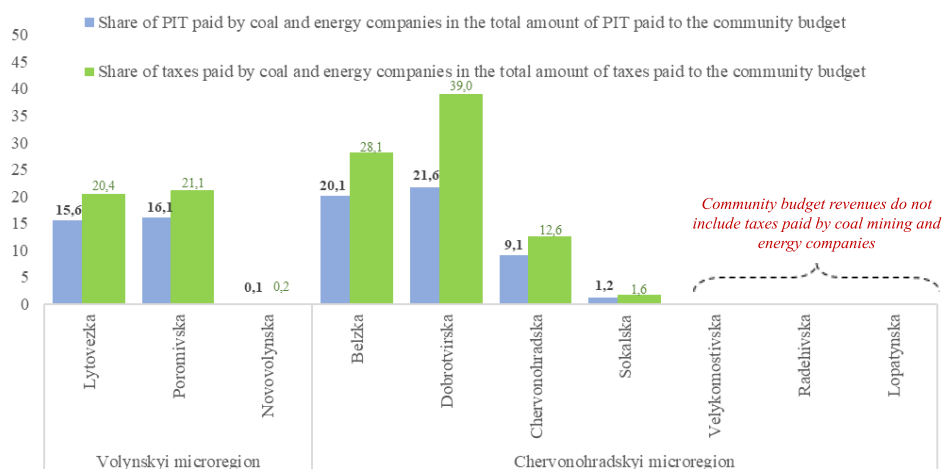


Fig. 6. The share of taxes paid by coal and energy enterprises in the total tax revenues of community budgets of coal microregions in the Ukrainian-Polish border, %, 2023

Source: based on data from the structural units of the State Tax Service in Lvivska and Volynska oblasts.

Unlike the coal microregion in Lviv Oblast, Volynskyi microregion is much smaller in terms of territory. More than 80% of the mine fields and a key section of the Novovolynskyi geological and industrial area are concentrated in three communities of the microregion. Meanwhile, the microregion is characterized by a high imbalance in economic development. The city of Novovolynsk, one of the largest cities in Volyn Oblast, is its socio-economic center. In recent years, the city has been outperforming all administrative units in the region in terms of economic growth dynamics (Fig. 7), including Lutsk. In contrast to other large cities, the number of enterprises and employees has increased only here. The situation deteriorated only in terms of the dynamics of the volume of products sold, as in all other administrative-territorial formations, although the rate of decline in the city was lower than in the region.

Since the closure of mines in Volyn Oblast was much faster than in other regions of Ukraine (less than 20% of the operating mines remained in 2024), the level of dependence of the microregion’s economy on coal mining is currently low. First of all, in contrast to Chervonohradskyi coal microregion, Volynskyi microregion is characterized by much lower employment in the mining industry. While 15% of employees in Chervonohradskyi coal microregion are engaged in coal mining, this figure does not exceed 5% in Volynskyi microregion.

Despite being the center of coal mining, Novovolynska community, which collectively covers 92% of the microregion’s economic entities and, in fact, “forms” the demand in the local labor market (90% of vacancies are concentrated in Novovolynsk) [14], depends on this sector for only 0.1–0.2% with regard to the amount of taxes paid to the budget by the coal mining enterprise. Moreover, there is a steady trend of a rapid decrease in the amount of taxes paid by economic entities in the coal mining industry (only 1/3 of the amount of 2021 in 2023).

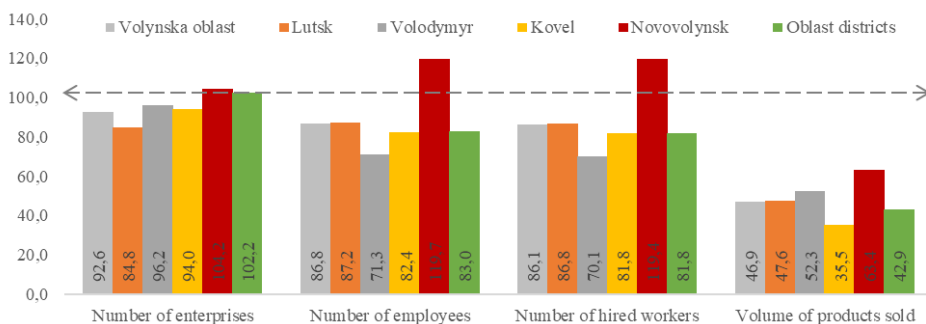


Fig. 7. Economic growth rate of cities and districts of Volyn Oblast by selected indicators, %, 2020/2015

Source: based on data (Main Department of Statistics in Volyn Region, 2024).

The deterioration of the situation in the mining industry in Novovolynsk is systemic and has been going on since Ukraine’s independence. Since 1991, seven mining enterprises that were part of Volynvuhillya have been liquidated.

In 2001, with the adoption of the Law of Ukraine “On the Special Regime of Investment Activity in the Priority Development Territory in Volyn Oblast” (No. 2354-III of April 5, 2001; expired in 2022), the city of Novovolynsk and the village of Blahodatne (Zhovtneve) were classified as priority development territories in Volyn Oblast, where a special investment regime was introduced to create new jobs. The policy resulted in the attraction of new businesses to the community (in particular, BRV-Ukrayina and Kronospan UA companies). This approach has become an important condition for creating jobs after the closure of mines; labour migration to

EU countries (including coal mines in Poland and the Czech Republic) was another opportunity for former miners and their families to find employment.

At the present stage, Novovolynsk is the center of production, entrepreneurial activity, and development of the tertiary sector in the microregion. The lion's share of the labor market demand in the microregion is generated by employers from Novovolynsk. Due to the advantage of its location near the EU border and the government's favorable policy towards the city over the years, a powerful galaxy of industrial enterprises has been concentrated here, which has significantly reduced dependence on coal mining enterprises. On the other hand, having had the status of a city of regional significance prior to the 2020 administrative and territorial reform, which provided a certain "prioritization" in social and economic development, the city is an important social center in the region (i.e., there is a significant number of public sector jobs available).

The other two communities, Lytovezka and Poromivska rural communities, which are developing in the wake of Novovolynsk, have an agro-industrial specialization and are much "weaker" in terms of economic development, and therefore depend on budget-forming enterprises on their territory:

- Lytovezka community – Novovolynska mine № 9 of Volynvuhillya, which paid about 1/3 of taxes to the local budget (in 2023 – 15.6%) and provided more than 370 jobs;
- Poromivska community – Buzhanska mine located in the village of Bortniv and Buddyrektsiya state enterprise. Together, they provide 16.1% of tax revenues to the community budget. In addition, Poromivska community is the only one in Ukraine where a coal mining enterprise is being built – Novovolynska mine № 10.

The location of operating mines in communities is one of the key conditions for the economic development of each of them. Mines are the main place of employment in these communities. The possibility of their closure is a challenge for each of the communities, which carries the risk of the loss of financial solvency.

Under current conditions, Chervonohradskyi and Volynskyi coal microregions are identified in strategic documents at the national level as areas requiring special attention and implementation of effective tools to support development in the context of just transformation (Energy Security Strategy approved by the Resolution of the Cabinet of Ministers of Ukraine №907-r as of 4 August 2021 (*Energy Security Strategy, 2021*); 2050 Energy Strategy of Ukraine approved by the Resolution of the Cabinet of Ministers of Ukraine №373-r as of 21 April 2023 (*Energy Strategy of Ukraine until 2050, 2023*); 2030 Concept of the State Target Program for the Just Transformation of Ukrainian Coal Regions approved by the Resolution of the Cabinet of Ministers of Ukraine №1024 as of 22 September 2021 (*Concept of the State Target Program..., 2021*), etc.). They also receive particular attention at the regional level:

- Chervonohradskyi coal microregion: according to the Scheme of Planning the Territory of Lviv Oblast developed by the Ukrainian State Research Institute of Urban Planning and Development “Dnipromisto” in 2008 (the estimated validity of the document is till 2031) (*Planning scheme of the territory of Lviv region, 2008*), the Chervonohrad-Dobrotvir zone is outlined as one of the three centers that have prerequisites for the formation of industrial hubs; within the framework of the updated 2021–2027 Lviv Oblast Development Strategy (*Development Strategy of the Lviv region..., 2024*), the depletion of coal deposits is identified as a weakness of the region in the context of SWOT analysis, while the economic and geographical location on the border is among the strengths. The objectives in the region’s goal tree include optimizing its fuel and energy balance, increasing the use of distributed generation, and developing renewable energy;
- Volynskyi coal microregion: The Scheme for Planning the Territory of Volyn Oblast (*Planning scheme of the territory of Volyn region, 2024*) developed by the State Enterprise Ukrainian State Research Institute for Urban Design “DIPROMISTO” named after Yuriy Bilokon for the estimated period of validity until 2031 suggests stimulating the development of three key industrial hubs in Volyn Oblast – in Lutsk, Novovolynsk, and Kovel. The industrial hub in Novovolynsk is defined as a diversified industrial region that includes two industrial centers: Novovolynsk, which specializes in fuel and energy minerals, machine building, and chemical and food industries, and Volodymyr, which specializes in food industry and machine building. According to the Scheme, the priority development zone covers the territory of the entire Volynskyi coal microregion. Moreover, most of the microregion’s territory is characterized as a territory of predominantly urban development (urbanization zone), where it is recommended to intensify the existing scientific and production capacity and develop agriculture of predominantly suburban type and areas of short-term recreation. The city of Novovolynsk is defined as the territory of priority development of high-tech industries and certain metropolitan activities (finance, science, exhibition activities, etc.), and the area around the city (rural settlements of Novovolynska, Lytovezka, and Poromivska communities) is defined as the territory of priority development of mining and high-tech industries; the northwestern territories of Poromivska and southwestern territories of Lytovezka communities are classified as the territories of priority development of the ecological network of the oblast.

At the present stage, plans for the just transformation of Chervonohradskyi and Volynskyi coal microregions are being developed with the participation of all stakeholders (regional and local authorities, coal mining and energy companies, miners, businesses, active citizens, certain segments of the population (including youth), etc.). The sources of funding for the projects and activities in the action plans

will include the state budget, local budgets, international technical assistance funds, and other sources not prohibited by law. The government is currently discussing the establishment of the Just Transformation Fund for Coal Regions as an effective and transparent mechanism for financing transformation projects in coal regions. Meanwhile, there is currently no legislative and regulatory framework for the creation of a financial resource fund that would accumulate funds to finance projects within the framework of the just transformation of coal regions.

Upon Ukraine's accession to the European Union, coal microregions will have access to the European Just Transition Fund, which aims to mitigate the transition to a carbon-neutral economy by financing measures to diversify and modernize the local economy and reduce the negative impact on employment by supporting retraining. The Just Transition Fund finances projects in regions that are heavily dependent on fossil fuels and carbon-intensive sectors of the economy, including microregions of the Ukrainian-Polish border.

The main directions of maintaining and stimulating the level of economic development of microregions in the Ukrainian-Polish border in the context of the closure of coal enterprises include:

1) *preservation and development of the demographic capacity of the territories, which has a significant impact on the socio-economic trends of microregions through the development of the local labor market, intensification of interaction with young people, reform of the specialized education system in microregions, re-profiling and support of miners in their employment, involvement of IDPs (including families with children), and their integration into the socio-economic life of communities.*

The employment structure in the coal microregions of the Ukrainian-Polish borderland is characterized by a high share of employees in the mining and processing industries, as well as in the public sector. The share of people employed in the service sector is significantly lower, indicating that this sector is underdeveloped in the microregion. Moreover, the labor markets in both microregions are characterized by a "staff shortage" and a large number of vacancies for blue-collar professionals, including jobs at coal mining and energy generating enterprises. The labor markets of Belzka, Dobrotvirska, Lopatynska, Poromivska, and Lytovezka territorial communities are formed essentially around one large employer and the public sector.

The process of transforming the economy of microregions will lead to a situation where in the coming years the demand for labor performing simple, repetitive work will significantly decrease, and professions requiring higher, more specialized skills and characterized by a high degree of creativity will become more in demand. New skills will be required for specialists in Industry 4.0, ICT, medicine, new energy, circular economy, etc. These industries will replace the traditional specialization of the microregion. Therefore, resources should be directed, on the one hand, to the introduction of these specialties and the creation of a material and technical base

of vocational education institutions, which will increase the level of automation, digitalization, and innovation of production processes, and, on the other hand, to support employees in adapting to new labor market requirements.

2) *development of a competitive economic environment in microregions*. The directions of economic development of Chervonohradskyi microregion include:

- preserving the status of Chervonohrad and Sokal as industrial centers of Lviv Oblast and their further development based on economically sound, energy efficient, and environmentally friendly mechanisms in the process of the country’s “green” transition and reform of the coal industry;
- strengthening economic activity and redirecting the activities of economic entities involved in coal mining, which will help maintain the financial stability of territorial communities. This includes the development of logistics capacities given the region’s border location and the burden on Lviv as a logistics center; creation of an energy hub based in Dobrotvir with a focus on decentralized renewable energy sources, which will help attract energy-intensive enterprises to the region; development of light and processing industries, including furniture production and metalworking, which are already actively represented in the region; development of recreational and tourist potential, especially with a focus on the opportunities of the Bug River, the closed mines, as well as the cultural heritage of the region;

in Volynskyi coal microregion:

- reducing imbalances in the economic development of Volynskyi coal microregion by attracting investments and diversifying economic activities of Lytovezka and Poromivska communities, which largely depend on the mining industry and the performance of coal enterprises. In particular, the development of the agricultural sector, the expansion of the industrial hub in Novovolynsk, and support for microenterprises;
- supporting the entrepreneurial activity of the microregion’s residents and expanding the range of their economic activities as most individual entrepreneurs operate in trade (providing 79% of taxes paid by entrepreneurs to local budgets), processing industry (12%), and transport (7%);
- solving the problem of the long-term construction of Novovolynska mine No. 10 of Volynvuhillya, which at the beginning of its construction had great prospects for development, and at the present stage is characterized by outdated equipment and the need for its modernization;
- promoting the development of renewable energy, which is at an early stage in Volyn Oblast, by utilizing the experience of neighboring communities in growing energy crops;
- developing a network of industrial parks, promoting them as priority development territories with favorable economic and geographical location in the Ukrainian-Polish border.

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SPATIAL PLANNING OF LOGISTICS INFRASTRUCTURE IN VOLYN REGION

Volyn Oblast is located in the north-western Ukraine, occupying a part of the Polissya lowland and Volyn upland. The geographical position of the region is determined by its borders with neighboring countries: in the west – with the Lubelskie Voivodeship of the Republic of Poland, in the north – with the Brest region of the Republic of Belarus. Within Ukraine, the region borders Rivne Oblast in the east and Lviv Oblast in the south.

As a result of the administrative-territorial reform, Volyn was reorganized, as a result of which its administrative division was reduced to four districts: Lutsk, Volodymyr, Kamin-Kashyrsk and Kovel. Before the reform, the number of administrative districts in the region was 16. The total length of the state border that runs through the Volyn Oblast is 395 kilometers. There are 9 international checkpoints on this border: Ustyluh, Yahodyn, Izov, Domanove, Dolsk, Pishcha, Pulemets, Ry-machi and Zabolottya.

Let's look at the example of modernizing logistics infrastructure in the EU border regions on the example of Volyn Oblast. Given the political situation and the strategic European vector of Ukraine's development, it is clear that the cross-border development potential of Volyn Oblast is revealed in cooperation with the European side.

Transport infrastructure is one of the most important factors that form the basis for the development of Volyn Oblast. Volyn Oblast is located at a short distance from the capitals and most major cities of Central and Western Europe, on intensively growing world economic ties in the West-East and North-South directions, which are realized through a relatively developed network of transport highways, in particular, Kyiv-Kovel-Warsaw-Berlin, Kyiv-Kovel-Brest, Kovel-Lutsk-Lviv, etc. The international transport corridor (ITC) "Baltic Sea – Black Sea" (road and rail

transport) passes through the territory of Volyn. The interstate transport corridor Uzhhorod –Lviv –Kovel –Domanovo, with a length of 510 km along the main route and 185 km along the branches, also passes through the territory of the region (*Development Strategy of Volyn Oblast, 2020*), (Fig. 1).

The favorable economic, geographical location and transit potential of Volyn Oblast are preconditions for the creation of logistics hubs in this region, which should become a strategic goal and pole of growth for the territory.

The construction of logistics hubs in Volyn Oblast, as a border region with the EU, has several important advantages and strategic goals (Fig. 1):

1. Strengthening transit potential, as Volyn Oblast is located on important transport corridors between Ukraine and the European Union. Logistics hubs will provide an efficient transshipment point for goods crossing the border, which will increase speed and reduce transportation costs.

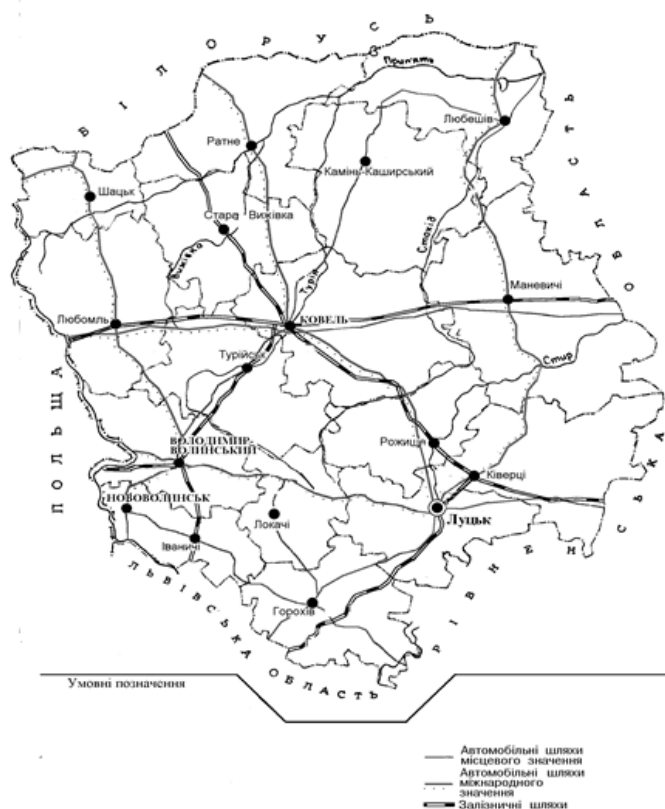


Fig. 1. Map of Volyn Oblast with marking of roads

Source: based on (*Development Strategy of Volyn Oblast, 2020*).

2. Growth of exports and imports, as the hub infrastructure will facilitate the export of Ukrainian products to the EU and the import of European goods to Ukraine. This is important for supporting the national economy and integration with European markets.

3. Optimization of cross-border trade, as logistics centers will be able to simplify customs clearance procedures, warehousing, sorting and distribution of goods, which will reduce the time spent at the border.

4. Integration into international transport corridors, as the Volyn Oblast has access to the European transport network, in particular TEN-T (Trans-European Transport Network). Logistics hubs will allow for more active integration into these corridors, increasing transportation volumes.

5. Job creation and economic development, as the construction and operation of logistics centers will create new jobs for residents of the region, promote the development of small and medium-sized businesses, and increase tax revenues to local budgets.

6. Development of the region's infrastructure, as hubs will stimulate the development of the region's transport, road and warehouse infrastructure, which will increase its attractiveness for investors and enterprises.

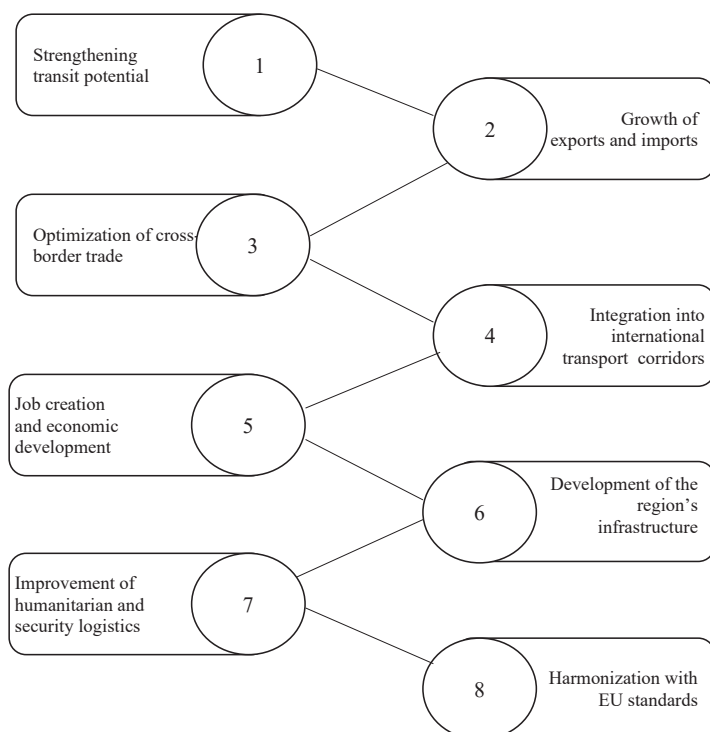


Fig. 2. Advantages of creating logistics hubs in Volyn Oblast bordering the EU

Source: developed by the authors.

7. Improvement of humanitarian and security logistics, because in light of military risks and humanitarian challenges, logistics centers can serve as important hubs for delivering humanitarian aid and ensuring regional stability.

8. Harmonization with EU standards, as logistics centers will help implement European standards in transport and warehouse logistics, contributing to Ukraine's European integration.

Thus, the construction of logistics hubs in Volyn Oblast is an important part of the development of the region as a strategic bridge between Ukraine and the EU. Let us dwell on the justification of locations for the creation of logistics infrastructure in the Volyn Oblast (Table 1).

Table 1. Characteristics of locations for creating logistics infrastructure in Volyn Oblast

Location	Characteristic	A decisive advantage
Yahodyn	Border crossing, the main hub for trade between Ukraine and Poland	Proximity to the EU (provides quick access to European markets)
Kovel	A large railway junction, optimal for multi-modal and transport and logistics centers	Integration into transport corridors (TEN-T)
Lutsk	Administrative and industrial center of the region, suitable for class "A" warehouses, e-commerce hubs	The possibility of attracting investments for the development of the region's infrastructure and economy
Ustyluh	Border zone for additional logistics points, in particular for agricultural products	Proximity to the EU (provides quick access to European markets)
Ratne and Luboml	Favorable location for customs and logistics operations near the border	Proximity to the EU (provides quick access to European markets)

Source: developed by the authors.

Let us focus on the analysis of positive practices in creating logistics hubs in EU countries and their importance in the development of countries and regions.

Europe has a number of leading logistics hubs, which are key transport and warehousing nodes integrated into global supply chains.

Table 2 provides examples of the best logistics hubs in Europe and their advantages.

Outlining the best practices of European logistics hubs provides insight into the following conclusions:

1. Multimodality (combination of sea, railway, road and air transport) is a key success factor. Multimodality in the context of creating logistics hubs in border regions means organizing a system where several modes of transport (for example, road, rail, sea or air) are integrated to ensure the most efficient movement of goods.

The main idea of multimodality is to optimize the transportation process by using the advantages of each mode of transport, reducing time and cost, and reducing environmental impact. For example, in border regions, multimodal hubs can use road transport to deliver goods to a rail terminal, and then rail for long journeys to a seaport. This significantly reduces costs and increases the speed of delivery.

2. Digitalization and automation allow to increase the efficiency of hubs, in particular, through: using supply chain management systems to monitor and coordinate transportation; automating processes to minimize delays; applying e-commerce.

3. Location at the intersection of international transport corridors increases logistical significance. This requires ensuring the same multimodality, infrastructure integration, in particular through the unification of transport hubs, such as railway stations, ports, road junctions, and the creation of terminals that provide fast transshipment logistics between different modes of transport in the most appropriate places on international transit corridors.

4. Environmental friendliness is one of the basic principles of creating logistics hubs in Europe. This involves the use of environmentally friendly modes of transport (e.g. rail) at certain stages and the optimization of routes to reduce CO₂ emissions.

Table 2. The best logistics hubs in Europe and their advantages

Name	Hub type	Advantages
Port of Rotterdam (Netherlands)	Seaport, multimodal logistics center	The largest port in Europe and one of the busiest in the world Direct access to the North Sea Integration with the inland waterway, railway and motorway network High level of automation and digitalization (Port of Rotterdam Authority) A wide range of warehousing and logistics services
Port of Hamburg (Germany)	Seaport with a multimodal approach	Main transshipment point for Northern and Eastern Europe Connection to the railway network of Germany and Central Europe Developed container terminal infrastructure Resilience to climate challenges through digital solutions
Frankfurt Airport (Germany)	Aviation logistics hub	One of the largest cargo airports in Europe Processing of perishable goods, medical products, e-commerce cargo Modern warehouses with temperature control Direct access to railway and motorways
Liege Airport (Belgium)	Air cargo hub	Specializes in fast processing of e-commerce products Direct access to rail and road transport Low level of cargo delays due to lack of significant passenger traffic
Port of Antwerp (Belgium)	Seaport	The second largest port in Europe after Rotterdam Wide network of warehouses and processing plants Integration with inland waterways Large volume of petroleum products and chemicals processing
Salzburg (Austria)	Multimodal transport hub	Integration of rail and road transport Location at the crossroads of transport corridors between Western and Eastern Europe Focus on cargo from/to the Balkans, Italy and Germany
Madrid-Coslada Logistics Park (Spain)	Ground logistics park	Warehouse complexes for e-commerce, FMCG and pharmaceuticals Integration with the Spanish high-speed rail network Convenient location near the capital and Madrid-Barajas International Airport
Budapest Transport Center (Hungary)	Transport hub for Eastern Europe	Location at the intersection of TEN-T transport corridors Main distribution center for goods from Central Asia and China Connection to the Danube River

Source: developed by the authors based on materials from (Rodrigue, 2024; Notteboom & Winkelmanns, 2012; European Commission, 2024).

These hubs are an example for the Volyn Oblast in planning its own logistics infrastructure and ensuring economic development of the border region.

However, the above logistics hubs of European countries mainly contain seaports. Since the Volyn Oblast does not have access to the sea, let us focus on the peculiarities of creating dry ports in different countries of the world.

Dry ports or inland logistics hubs play a key role in multimodal logistics. They provide a link between seaports, rail and road transport.

Let us dwell on the study of successful cases of dry logistics hubs in the world. The need for their creation is based on the impossibility of expanding port territories, at the same time, dry ports contain their own functional load. Let us dwell on the features and advantages of dry ports/hubs. Let us consider the following of them: Zaragoza Plaza (Spain), Duisburg Intermodal Terminal (Germany), Dry Port of Zaragoza – Puerto Seco de Madrid (Spain), ICD Tughlakabad (India), Bettembourg-Dudelange Terminal (Luxembourg), Khorgos Gateway (Kazakhstan), Terminal Busto Arsizio-Gallarate (Italy) (Tabl. 3).

As the analysis shows, the peculiarities of dry ports, like other logistics hubs, are multimodality, i.e. a combination of rail, road, and water transportation. They perform the functions of providing logistics for both external and internal markets, transit trade, and reducing congestion in seaports by transshipment of goods in internal hubs.

The advantages of dry logistics hubs are: the possibility of creating them not only near seaports; the ability to quickly change delivery routes, ensuring logistics flexibility; economic efficiency due to reduced transportation time; stimulation of economic development of regions where dry ports are located.

These examples can be used to model dry ports in the Volyn Oblast, taking into account its transit potential and proximity to the EU border.

Let us dwell on the justification of the types of logistics hubs that are appropriate for the Volyn Oblast (Tabl. 4).

Firstly, the creation of border logistics hubs is relevant for Volyn. These should be centers for processing, transshipment and customs clearance of goods crossing the border. This is facilitated by the economic and geographical location of the Volyn Oblast. Therefore, the territories near the “Yahodyn” and “Ustyluh” checkpoints are appropriate locations.

Secondly, it is advisable to create large, modern warehouse complexes of class A and A+ in Volyn (*Classes of warehouses*, 2021) for storing goods intended for export to the EU or imported from the EU and awaiting further shipment. Such hubs should be created in the area of the regional center – the city of Lutsk, the geographical center of Volyn – the city of Kovel, in the area of highways M07 (Kyiv-Kovel-Yahodyn) and M19 (Dubno-Lutsk-Kovel).

It is also advisable in Volyn Oblast, in our opinion, to create transport and logistics centers (TLC), i.e. complexes for sorting, distribution and coordination of cargo

with the involvement of road and rail transport. In addition to these functions, these centers can provide acceptance of cargo for storage and provision of other services. The location for the creation of transport and logistics centers in Volyn Oblast, in our opinion, should be the city of Kovel, as a large railway junction and locations with direct access to highways and railways.

Table 3. Features and advantages of dry port practices in countries around the world

Name	Hub type	Features	Advantages
Zaragoza Plaza (Spain)	The largest logistics park in Southern Europe, located in Zaragoza	Connected to the rail network, providing direct connections to the ports of Barcelona and Valencia. Specializes in container handling and warehousing. Integration with cargo sorting centers for e-commerce	Large volume of goods transported to Europe due to its location between Spain and France
Duisburg Inter-modal Terminal (Germany)	The largest inland port in the world, located in the city of Duisburg on the Rhine	Integrated into China's „One Belt, One Road” initiative. High level of container transportation involving rail, water and road transport. Used for transportation between Europe, China and Central Asia	Location at the intersection of rail and water transport corridors
Dry Port of Zaragoza – Puerto Seco de Madrid (Spain)	Domestic hub serving cargo from the ports of Barcelona and Valencia	Highly efficient container handling system. Integration with the high-speed rail network. Using digital technologies to track cargo	Unloads seaports, reducing congestion and improving logistics.
ICD Tughlakabad (India)	India's largest dry port, located in Delhi.	Handling large volumes of containers arriving at Mumbai seaports. Integration with the Indian railway network. Warehouses for agricultural, industrial and consumer products.	Provides logistical support to the Indian domestic market and international trade.
Bettembourg-Dudelange Terminal (Luxembourg)	Domestic hub for multimodal transport between Luxembourg, France and Germany	Connections with key seaports in Europe. Using innovative container systems. Large volume of cargo transportation between EU countries.	Supporting intra-European trade and reducing the burden on seaports.
Khorgos Gateway (Kazakhstan)	The largest dry port in Central Asia, located on the border with China.	Integration into the New Silk Road. A transshipment point between Chinese railways and the Kazakhstan railway network. Warehouses for goods from China exported to Europe	Connection between Asia and Europe, stimulation of transit trade.
Terminal Busto Arsizio-Gallarate (Italy)	Dry port in northern Italy, near Milan	Integrated with the rail network for transporting containers to the seaports of Genoa and Venice. Center for processing goods for European markets	Reduces congestion at seaports and speeds up the delivery of goods.

Source: developed by the authors based on materials (Rodrigue, 2024; Notteboom & Winkelmans, 2012; European Commission, 2024).

Since the Volyn Oblast is an agrarian territory, it is advisable to create specialized agro-logistics hubs. These should be centers for storage, processing and export of agricultural products.

Table 4. Justification of the feasibility of creating logistics hubs in the Volyn Oblast (by type)

Hub type	Description	Expediency	Location
Border logistics hubs	Centers for processing, transshipment, and customs clearance of goods crossing the border.	Due to the geographical location of Volyn, such hubs optimize export-import operations, reduce delays at the border, and promote integration into European logistics chains.	Checkpoints “Yapodyn” and “Ustyluh”
Warehouse complexes of classes A and A+	Large modern warehouse complexes with temperature control and automated systems	Necessary for the storage of products, especially agricultural, food and pharmaceutical products, exported to the EU or imported	Near Lutsk (economic center of the region), Kovel (geographic center of the region), in the area of highways M07 (Kyiv–Kovel–Yahodyn) and M19 (Dubno–Lutsk–Kovel)
Transport and Logistics Centers (TLC)	Complexes for sorting, distributing and coordinating cargo involving road and rail transport	Volyn is a key transit region for transportation between Ukraine and the EU. TLCs will ensure effective management of goods flows	Kovel (large railway junction) and locations with direct access to highways and railways
Agricultural and logistics hubs	Centers for storage, processing and export of agricultural products	Volyn has a strong agricultural sector, and such hubs will provide quick access to EU markets	Lutsk district and the area near the “Yahodyn” checkpoint
E-commerce hubs	Centers for storage, packaging and express delivery of goods	The growing popularity of online shopping in both Ukraine and the EU requires infrastructure to process orders	Lutsk (administrative and commercial center of the region), regional transportation centers, other locations that provide convenience for the population
Multimodal and logistics hubs	Integrated hubs that combine road, rail and air transportation	Hubs increase the efficiency of transportation between different modes of transport.	Kovel (railway junction), Izov station and areas with access to the M07 and M19 motorways

Source: developed by the authors.

The location of such centers is Lutsk district and the district near the “Yahodyn” checkpoint. It should be noted that today in Volyn Oblast, a segment of services for receiving grain, oilseed and other agricultural crops has been formed to some extent, consisting of 7 points and belonging to the Limited Liability Company “Volyn-Zerno-Product”. All elevator complexes meet modern standards and market requirements and provide the full range of services for working with grain and oilseed crops, ensuring the fulfillment of customer needs. The total capacity of simultaneous storage is 380,000 tons (*Volyn-Zerno-Product*, 2024). At the same time, there is a need to form additional agro-logistics hubs, which will also create a competitive field, provide quick access to EU markets, and promote economic development.

The development of e-commerce, the growing popularity of online shopping both in Ukraine and in the EU, necessitates the modernization of the infrastructure for processing orders, in particular, the creation of e-commerce hubs. These are certain centers for storage, packaging and fast delivery of goods. The locations for such hubs should be the places closest to the population: cities, centers of territorial communities of the region. To a certain extent, this function is performed by the extensive network of Nova Poshta and post offices. At the same time, the expansion of e-commerce necessitates the creation of additional locations.

The creation of multimodal logistics hubs, as integrated centers that combine road, rail, and air transportation, is also relevant for Volyn Oblast. Such hubs will be certain poles of growth for Volyn Oblast, because by ensuring the efficiency of transportation between different modes of transport, they will stimulate demand for this type of service. The locations can be the city of Kovel, as the main railway hub of the region, and locations located near international highways. A separate issue requires substantiation of the feasibility of creating aviation hubs in Volyn Oblast.

One of such multimodal centers for Volyn Oblast, in our opinion, should be a logistics hub near the Izov railway station. The potential for the development of this multimodal hub is the combination of rail and road transportation, rail transshipment of goods (between wide and narrow gauge), class "A" warehouse complexes for agricultural, industrial and e-commerce products, the organization of a transport and logistics center for sorting and distributing goods between road and rail routes. The arguments in favor of its creation are as follows:

1. Location near the EU border. Izov station is located at the border crossing between Ukraine and Poland, which provides a direct connection to the EU rail networks. The crossing serves freight flows heading to Poland, Germany and other European countries. The proximity to the Yagodyn-Dorohusk road crossing point contributes to the integration of rail and road transportation.

2. Integration with the railway network. Izov station is a hub, providing cargo transshipment between wide (1520 mm) and European narrow (1435 mm) gauges. This allows for convenient transportation of goods between Ukraine and the EU without delays in changing wheelsets.

3. Motorways as part of international corridors. Volyn Oblast has a profitable network of motorways, in particular: M07 (Kyiv – Kovel – Yahodyn), which is part of the international transport corridor TEN-T; M19 (Dubno–Lutsk–Kovel), which provides connections with other regions of Ukraine. Motorways complement the railway infrastructure, allowing for flexible cargo transportation.

4. Logistic function of the Izov station: the possibility of creating a dry port for container transshipment and customs clearance; optimization of the export of agricultural products, metals, and machine-building equipment; a convenient point for the transit of imported goods (machinery, equipment, consumer goods). The logistical

advantages are: location in the Ukraine–Poland–Germany transit flow zone; support for international TEN-T corridors connecting Eastern and Western European countries; reduction of costs and time, as there is an opportunity to integrate cargo flows of various types without long delays at the border.

5. Impact on regional development: attracting investments in transport and warehouse infrastructure; creating new jobs for local residents; logistical integration: Volyn Oblast will become an important link between Eastern Europe and the EU; increasing Ukraine's export potential through optimization of commodity flows.

Given these arguments, the Logistics Hub in the area of Izov station will become a key element of the transport and logistics infrastructure of Volyn Oblast, ensuring the effective integration of Ukraine into European logistics networks and stimulating the economic development of the region. The main challenge for this is the need for electrification section Kovel-Izov – State Border on both sides (Ukraine and Poland). This would create great transit opportunities for Volyn Oblast and Ukraine and develop economic potential.

Let us focus on the aspects of digitalization, which covers all areas of modern life, promoting automation, integration and effective process management, which ensures resource savings, increased productivity and transparency. In industry, this is implemented through the implementation of Industry 4.0, in the service sector – through e-commerce and CRM systems, and in management – through cloud platforms and artificial intelligence. In particular, digitalization is critically important for logistics, as it allows you to optimize supply chains, automate warehouses, implement IoT-based transport solutions, forecast demand through Big Data and ensure transparency of international trade through blockchain.

That is, digital technologies create an ecosystem that unites all sectors, including logistics, into a single digital space for the effective development of both the global and national and regional economies. The relevance of the use of digital technologies in logistics hubs is explained by their impact on the efficiency, accuracy and competitiveness of modern logistics processes.

Logistics hubs are critical points in global and local supply chains, and digitalization opens up opportunities to optimize their operations, in particular (Fig. 3):

1. Optimization of resources and processes. Digital technologies allow automating key operations in logistics hubs: optimization of warehouse loading through WMSA systems; automated planning of transportation routes through TMS; effective management of vehicle queues through YMS.

2. Cut costs: the use of Big Data analytics helps to reduce fuel, personnel and maintenance costs; robotics and process automation reduce dependence on the human factor, minimizing errors.

3. Speed and flexibility: IoT technologies allow real-time monitoring of cargo location and condition of goods (temperature, humidity, etc.); cloud platforms ensure rapid data exchange between all participants in the supply chain.

4. Increased accuracy and transparency: Blockchain technology ensures transparency of all transactions and helps to avoid fraud; AI algorithms increase the accuracy of demand forecasting and inventory management.

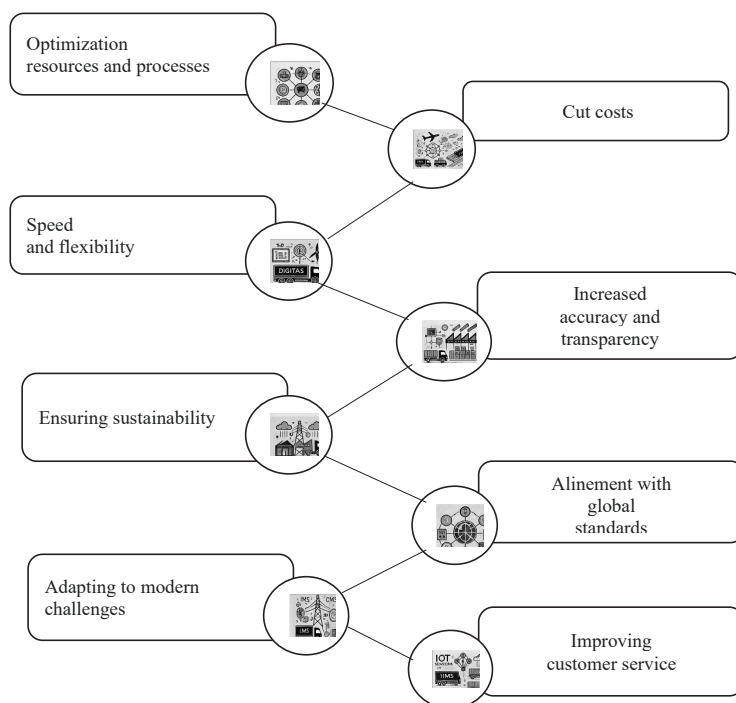


Fig. 3. The importance of digitalization of logistics hubs

Source: developed by the authors.

5. Ensuring sustainability: using technology to optimize routes and reduce fuel consumption contributes to environmental safety; innovative solutions, in particular autonomous vehicles and drones, reduce CO₂ emissions.

6. Alinement with global standards: digital solutions integrated with European and global platforms facilitate international trade, especially for hubs operating at the intersection of global routes; integration with customs platforms contributes to faster inspections and document processing.

7. Adapting to modern challenges. Pandemics, supply chain disruptions, military conflicts, and other crises are required logistics hubs to adapt quickly. Digital technologies allow them to respond quickly to changes in demand or routes.

8. Improving customer service. Digital platforms allow customers to track the status of their orders in real time. CRM systems are integrated with logistics platforms to manage customer requests. For example, Amazon uses robotic warehouses and

AI to optimize deliveries, DHL has implemented analytical platforms to manage demand and transport, and Maersk uses blockchain to track containers.

For Volyn Oblast, as a region with strong transit potential and proximity to European markets, the introduction of digital technologies in logistics hubs will allow:

- integrate into international transport corridors;
- reduce logistics costs;
- improve the export potential of agricultural and industrial products;
- ensure the stability of supply chains in conditions of instability.

Thus, the digitalization of logistics hubs is an important condition for increasing the efficiency of the region's operations in the modern global economy.

Among the most common systems used in logistics hubs around the world, ensuring effective management of transport, warehouse operations and general logistics processes, the following stand out:

1. Transportation Management Systems (TMS). These systems automate the processes of planning, executing and optimizing the physical movement of goods. They help in selecting optimal routes, managing transportation and tracking cargo in real time. An example is the Qguar TMS system, which is used to manage transportation processes and integrates with other logistics solutions.

2. Warehouse Management Systems (WMS). These systems provide control over warehouse operations, including receiving, storing, and shipping goods. They increase inventory accuracy and optimize the use of warehouse space. Qguar WMS is an example of such a system that offers a comprehensive logistics solution for warehouse facilities.

3. Yard Management Systems (YMS). These systems coordinate the movement of vehicles within a logistics hub, ensuring efficient loading and unloading, as well as optimizing the use of docks and parking spaces. Qguar YMS is an example of such a system, which allows you to manage traffic flow and visitor movement.

4. Supply Chain Management (SCM) Systems. These systems integrate and coordinate all aspects of the supply chain, from suppliers to end customers, ensuring transparency and efficiency of processes.

For Volyn Oblast, considering its geographical location and the potential for the development of logistics infrastructure, it is advisable to implement modern information systems that meet international standards. In particular, the use of TMS and WMS systems can significantly increase the efficiency of transport and warehouse operations management. Integration of these systems with existing business processes will help optimize logistics flows and improve customer service. It is also worth considering the experience of other regions of Ukraine, where the implementation of such systems has already shown positive results. For example, in Lviv Oblast there is a PERETYN logistics center located at the intersection of the Kyiv-Warsaw transport routes, which offers modern warehouse and multi-temperature premises

for storing goods. In general, the implementation of modern information systems in the logistics hubs of the Volyn Oblast will contribute to the integration of the region into the European and global transport and logistics network, increasing competitiveness and attractiveness for investors.

Information and communication technologies (ICT) and software products used in logistics hubs around the world are aimed at automating, integrating and optimizing all logistics processes. They allow for the coordination of complex operations between supply chain participants, ensuring speed and accuracy.

In logistics hubs of Volyn Oblast, it is advisable to use the following software products:

1. IoT (Internet of Things). Used to monitor cargo, transport, warehouse temperature and other parameters in real time. For example: SenseAware – cargo status monitoring system; Smart Port Logistics for port operations management.

2. Cloud technologies are served for data storage and ensure availability of information at any time and from any place: SAP Logistics Business Network – a platform for data exchange between supply chain participants; Oracle Transportation Management Cloud – a solution for planning and monitoring logistics operations.

3. AI (Artificial Intelligence) and machine learning. Used for demand forecasting, route optimization, and planning automation: Blue Yonder – AI platform for warehouse and transportation management; CognitOps – a solution for optimizing warehouse processes.

4. Warehouse automation systems (WMS): Manhattan WMS is one of the most popular systems for managing warehouse processes; Infor WMS is an integrated solution for automating warehouse operations.

5. Big Data and analytics: Tableau is a platform for visualization and analysis of logistics data; Microsoft Power BI is an analytical tool for tracking performance.

6. Robotics and drones. Use of autonomous vehicles and robots in warehouses. For example: Amazon's Kiva robots for order processing; drones for delivery of goods (e.g. Zipline).

7. Blockchain. Provides transparency and security of information in the supply chain. For example, TradeLens is a blockchain platform for freight management (developed by IBM and Maersk).

The following software products are suitable for use in logistics hubs in Volyn Oblast:

1. Transport Management Systems (TMS). It is advisable to implement solutions that can integrate with European standards, for example: SAP Transportation Management; Cargowise.

2. Warehouse automation (WMS). Qguar WMS is a system adapted to Ukrainian conditions.

3. IoT sensors. For monitoring temperature conditions in warehouses, especially for agricultural products in Volyn Oblast.

4. Analytical platforms. Tableau or Power BI for analyzing the efficiency of logistics operations and forecasting demand.

5. Mobile applications for logistics. For example, for managing carriers and drivers: KeepTruckin – a mobile application for monitoring transport.

6. Cloud platforms: AWS IoT Core for integrating data from IoT devices.

Considering the geographical location of Volyn Oblast, it is advisable to implement solutions that support international integration, adapt to EU customs and transport standards, and contribute to the automation and increase the productivity of regional logistics facilities.

Therefore, the modernization of the logistics infrastructure of Volyn Oblast is an important strategic step to ensure the economic growth of the region, increase its competitiveness and integration into international supply chains. The region has an advantageous geographical location at the intersection of transport routes of Ukraine and Europe, which creates significant potential for the development of logistics hubs. Investments in the digitalization and automation of logistics processes will allow: to reduce the costs of transportation and storage of goods; to accelerate the processes of customs clearance and integration with European transport corridors; to improve the efficiency of resource management and warehouse capacities; to ensure flexibility and adaptability to modern challenges, such as changes in demand, crisis situations or new environmental standards.

So, the modernization of the logistics infrastructure of Volyn Oblast will contribute to the economic development of the region, attract foreign investment, improve business conditions, and strengthen Ukraine's position in the global logistics system.

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HOMeward BOUND – THE CHANGING APPROACH TO BUSINESS LOCATION DECISIONS OF SMALL- BUSINESS OWNERS IN WARSAW THROUGH THEIR RESIDENTIAL PREFERENCES¹

The business location evolution has in recent years been undermined by the growing significance of home-based work and remote work, bringing the residential dimension of entrepreneurial location to the fore. This paper aims to review the factors influencing these preferences of business owners, weighed against the less reliability of business address as the real place of conducting business. The analysis focuses on Warsaw, Poland, a post-socialist city that has experienced a remarkable transformation in entrepreneurial patterns over the last two decades. Census data reveals a near doubling of the self-employed population between 2002 and 2021, with most businesses being small-scale enterprises. The research highlights the increasing prevalence of home-based and remote work, with nearly 30% of surveyed Warsaw entrepreneurs engaging in remote work, in consonance with broader national trends. It also explores the influence of the housing market, characterised by overcrowding and rapidly rising property prices, on entrepreneurs' decisions to prioritise residential over business locations. Finally, the study investigates the growing role of virtual offices in addressing these challenges, particularly among young and small-scale entrepreneurs.

Introduction

Following the turbulent time of Poland's pro-democratic systemic change in 1989, the country found itself in the grip of the foul interplay between rampant inflation and severe unemployment rates (*OECD, 2001*). Some nationwide woes notwith-

¹ This article is part of the NCN project "The post-socialist city in the era of metropolization: transformations of the social space of 21st century Warsaw."

standing, Warsaw was flourishing with 2.3% joblessness in June 1997, fast-paced development of the tertiary sector and highly positive economic outlooks (Wilk, 1998). Into the 21st century and Poland's accession to the EU in 2004, Warsaw has since continued its path of precipitous growth (European Commission, 2018). Warsaw, a post-socialist city, is home to a population close to two million people within its administrative borders (GUS, 2023) and the populace of its metropolitan area exceeding (Eurostat, 2023). Located in the heart of a country with a consistent over 30-year history of positive GDP growth (World Bank, 2023), barring the pandemic year of 2020, with highly optimistic economic growth projections (IMF, 2025), Warsaw is widely regarded as the mainstay of entrepreneurial activity in Poland (GUS, 2023). It also serves as an important business nexus EU-wide, deemed the eight best city for start-up activity across the bloc, outstripping Amsterdam, Milan and Stockholm, to name but a few (RAISE, 2024).

In the last twenty years, Warsaw saw a considerable change in terms of entrepreneurship patterns, first and foremost a steep increase in the number of business owners. Census data from 2002 shows there were less than 90,000 self-employed people during that period, whereas in 2021 this value surpasses 170,000, with 78% of them not employing anyone. This marks a 93.4% increase in the number of businesses, while the population of Warsaw grew by 10.1% over the course of the intercensus period. The vast majority of these enterprises, constituting 97.1%, are small businesses with a maximum of nine employees.

The changes have also been dramatic across various sectors of economic activity. A remarkable 39.3% of the city working population are employed as specialists, which marks a surge from 26.5%, according to the 2021 and 2002 census data, respectively. This category is followed by 18.9% of Warsaw's professionally active people working as technicians (a hike from 18.2% in 2002) and 12.9% earning a living in the line of personal services and sales (a rise from 9.2% in 2002). The opposite trend was observed in terms of workers, craftsmen, operators and assemblers, whose share in the total of workers in Warsaw, slumped from 13.3% in 2002 to a mere 6.2% in 2021. What should be underlined at this point is that most entities (19.3%) were engaged in professional, scientific and technical activities (GUS, 2024), combined with Warsaw playing host to the emergence of technological start-ups (Smętkowski et al., 2019).

Though registration of a business does not require a specific business address anymore for a mobile type of business (*Biznes.gov.pl, n.d.*)², running a company of one's own traditionally necessitates the designation of a specific address for official correspondence and administrative purposes. In Poland, while some entrepreneurs register their businesses at their place of residence, the regulations permit alternative arrangements, such as the use of virtual offices or rented properties, in the latter

² Providing authorities with a mailing address remains mandatory.

case provided the landlord's consent is granted (*Biznes.gov.pl, n.d.*). Although there is no data on how many entrepreneurs assign their home address as their business address, this tendency is believed to be particularly pervasive among small-business owners. This does not only allow them to ease the cost of renting a separate office or room, but it also accrues to their business activity through a host of tax benefits, notably including tax deductions (*Business Insider, 2021*).

Virtual office

The image of a company is strongly related to the business address; therefore some small-business owners turn to the so-called virtual offices to have the seat of the company in a more prestigious, central location. Though a virtual office is usually defined as “a virtual office gives businesses a physical address and office-related services without the overhead of a long lease and administrative staff,” (*Investopedia, 2022*), the scope of services is sometimes confined solely to the address of the company and a mailing service. There is a growing pool of Warsaw-based companies offering a virtual address for companies, which can be seen in Table 1.

Some of the operators have more than one location, a majority of which are located in the Śródmieście district of Warsaw but some of them are also in other districts, including some virtual offices in Żoliborz, Wola, Ochota and Mokotów. Surprisingly though, one of the virtual office operators renders its far from the city centre but close to Warsaw Chopin Airport. In the case of the non-Śródmieście-based virtual offices, it seems that the location in the capital city of Warsaw is prominent enough (*InterviewMe, 2024*).

Table 1. Virtual offices in Warsaw

Name	Address	Numer of entities registered
Ale-biuro.pl	Mickiewicza 37 lok. 58	181
Ale-biuro.pl	Lindleya 16	180
Ale-biuro.pl	Jerozolimskie 89 lok. 43	99
Ale-biuro.pl	Nowogrodzka 64 lok. 43	60
Beyond Office	Żelazna 51/53	17
Biuro 29	Hoża 86 lok. 410	268
BiznesCentrum	Jana Pawła II 43A/37B	5
BiznesCentrum	Smulikowskiego 4A lok. 21	14
Cube Centre	Piękna 24/26A	53
E-biuro Warszawa	Stefana Batorego 18 lok. 108	344
Hub Kolektyw	Świeradowska 47	378
Hub Kolektyw	Puławska 77	120
Mlokal	Nowogrodzka 31	153
Nowy Świat 33	Nowy Świat 33 lok. 13	269
Regus	Marszałkowska 126/134	10

Name	Address	Numer of entities registered
Regus	Wspólna 70	6
Regus	Złota 59	40
Regus	Emilii Plater 53	18
Regus	Prusa 2	6
Regus	Waryńskiego 3	3
Regus	Solec 18/20	8
Regus	Jerozolimskie 9	0
Simply Office	Jana Pawła II 27	245
SkyOffice	Żurawia 6/12 lok. 745	34
Start Office	Chmielna 2 lok. 31	381
Sterling Group	Marszałkowska 115	40
Tower Office	Plac Bankowy 2	144
Wirtualne Biuro 360	Długa 29	302
Wirtualne biuro Warszawa – Adres i firma	Nowy Świat 54/56	31
Workin	Senatorska 2	15

Source: Own elaboration based on CEIDG business register and websites of virtual office operators.

With the price of the most basic service starting at less than PLN 30 a month, the virtual offices are usually targeted at freelancers, copywriters, and head-hunters. In more general terms, these are small start-ups, people working remotely, as well as people who live abroad but for legal purposes require a Polish business address (*InterviewMe, 2024*). As the rationale behind opting for a virtual address is that small-business owners might not want their home address to be featured in the public domain. The option of virtual addresses might be particularly appealing to younger entrepreneurs, who do not have their own apartment and would require an official permit from their landlord to register business in a rented flat (*InterviewMe, 2024*).

Given there is no limit to how many entities might be registered at one address, some virtual office operators boast upwards of 300 clients. This, however, entails an increased number of audits for companies registered at the address of a virtual office, as tax authorities place limited trust in such entities (Rzeczpospolita, 2018). For some of the newly registered companies, there have been instances of Polish tax offices refusing to register them as a VAT payer due to their business location at a virtual office's address (*Gazeta Prawna, 2013 and Rzeczpospolita, 2018*). Those shortcomings notwithstanding, it is estimated that at least forty thousand entities are using virtual offices (*DesktoMy, 2021*), however, those figures might necessitate further corroboration.

This trend is further supported by the existence of coworking spaces, which also offer short-term solutions to small business-owners. In Warsaw, coworking spaces have seen substantial growth, with 136 such spaces operating in 2021, accounting for over 3% of the city's office real estate market (*Smętkowski and Wojnar, 2023*). Concentrated primarily in the central Śródmieście district, coworking spaces provide flexible work environments tailored to the needs of freelancers, start-ups, and entrepreneurs. These spaces often serve as an alternative to both home-based work

and virtual offices, offering physical infrastructure without the long-term financial commitment associated with traditional office rentals.

Other factors

The seemingly less fathomable separation of home and work has long been a central theme in discussions about domestic spaces, rooted in dualistic thinking that distinguishes private from professional life. However, as Mason et al. (2008) argue, home has historically been a site of both unwaged and waged labour, a dynamic that persisted despite the industrial shift to factory-based production. Recent advancements in information and communication technology have further revived home-based working, attracting substantial attention in academic and policy discussions (Mason et al., 2008). In Warsaw, a survey of 64 entrepreneurs revealed that 29.7% of respondents regularly engage in work from home, a figure consistent with findings from Pracuj.pl, where 28% of Poles reported working remotely or in a hybrid arrangement (Pracuj.pl, n.d.). This blurring of the boundaries between professional and private life aligns with broader trends in Poland, where workers are among the most industrious in Europe, averaging 39.3 hours per week in their main jobs, surpassed only by Greece and Romania (Eurostat, 2024). Moreover, 45% of Poles take on additional work, dedicating up to nine hours weekly to tasks often unrelated to their primary roles (Gi Group, 2024). These long working hours and the pressure to balance multiple commitments underscore the appeal of minimising commute times, especially for entrepreneurs (Table 2). Research has shown that business owners typically prefer much shorter commutes than the general working population, with time constraints and the flexibility of business location choices driving this preference (Reuschke, 2020).

Challenges in the housing market further shape entrepreneurs' decisions to work close to or within their residences. Poland is mired by significant housing constraints, including the second-largest average household size in the EU and the third-lowest number of rooms per person.

Table 2. Responses to the question of remote work mode among Warsaw-based entrepreneurs

If you work, to what extent do you work remotely?		
Answer	Number of respondents (total = 64)	Percentage of answers
Exclusively.	10	15.6%
Most days of the week.	6	9.4%
Some days of the week.	3	4.7%
Occasionally.	11	17.2%
I do not work remotely.	34	53.1%

Source: Own elaboration based on a survey conducted in Warsaw by IPC Research Institute within the NCN project "The post-socialist city in the era of metropolisation: transformations of the social space of 21st century Warsaw."

Additionally, 33.9% of Poles live in overcrowded homes, more than double the EU average of 16.8%, creating substantial pressure on housing availability (Eurostat, 2023). These challenges are compounded by the rising demand from real estate investors, who account for 45% of residential property purchases (Metrohouse, 2024). Median housing prices in Warsaw have increased by 40% since the pandemic, which caused a seismic shift in working models and urban living in cities and beyond. Even prior to the pandemic, housing costs had been rising steadily, with the median price per square metre increasing by over 5% annually since 2016, as shown in Figure 1.

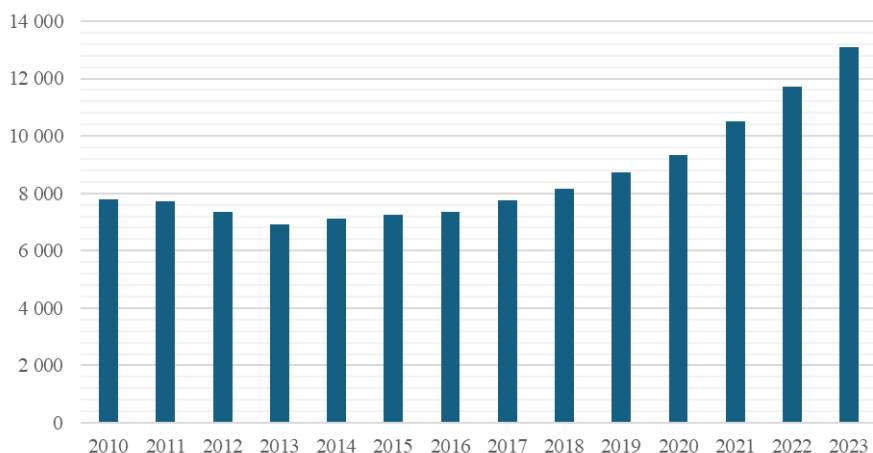


Fig. 1. Median price per square metre of a flat sold in market transactions.

Source: Bank Danych Lokalnych, GUS.

Such trends restrict residential mobility and exacerbate the difficulties entrepreneurs are faced with in securing adequate workspaces, propelling them further to seek work from home, which in turn diminishes the importance of a potential business location in favour of the residential location.

Discussion and conclusion

The intertwined relationship between residential and business locations in Poland lays bare the complex dynamics that increasingly shape entrepreneurial practices. The rise in misclassification of workers, where individuals are pushed into self-employment as a tax optimisation strategy, often leads to forced entrepreneurship, distorting the traditional understanding of entrepreneurship. This trend also underscores the growing importance of residential addresses, which frequently double as business locations, particularly among small-business owners. However, this alignment comes

with its limitations; while residential locations may lower costs and provide logistical benefits, they at times might not reflect the operational realities of the business. For instance, mobile work—despite being registered at a home address – is often conducted outside the residence.

However, the visible shift towards more home-based work coincides with significant challenges in Poland's housing market, which directly influence the feasibility of home-based work for entrepreneurs, as a significant portion of Poles live in overcrowded conditions. This overcrowding creates a substantial barrier for those looking to establish a functional workspace within their homes. Simultaneously, rising property prices driven by increased investment activity limit housing affordability and mobility. Since the pandemic, the soaring property prices, combined with the flexibility and cost-effectiveness of home-based work, increasingly shift the focus from business location to residential location, albeit with notable trade-offs. This shift necessitates a re-evaluation of urban policies to better support the dual role of homes as both living and working spaces, ensuring that entrepreneurs can effectively navigate these overlapping spheres without compromising their business operations or, perhaps more importantly, their quality of life.

The analysis of Warsaw's entrepreneurial landscape also offers valuable insights for the Polish-Ukrainian borderland and beyond. In particular, examining entrepreneurship patterns in the capital helps identify strategies to promote business activity, especially by improving housing conditions, which can indirectly foster entrepreneurship. This is especially relevant given the wider trend of home-based work, thus suggesting that residential factors play an increasing role in business location decisions.

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COMPETITIVENESS AND RESILIENCE OF THE POLISH-UKRAINIAN BORDERLAND

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THE EVALUATION OF THE COMPETITIVENESS AND RESILIENCE OF BORDER REGIONS IN THE CONTEXT OF THE EUROPEAN UNION REGIONS

Introduction

Competitiveness and resilience of regions are fundamental issues in contemporary regional policy. In the face of dynamic socio-economic, technological, and environmental changes, regions must not only compete for resources, investments, and talent, but also effectively adapt to external challenges such as economic crises, climate change, and digital transformation. Border regions play a particularly significant role in this context due to their unique characteristics resulting from their geographical location, cross-border accessibility, and diverse social, economic, and cultural conditions. This chapter presents an analysis aimed at assessing the level of competitiveness and resilience of Polish regions bordering Ukraine. The study is embedded in a broader comparative context, encompassing regions of the European Union. The analysis covers key socio-economic factors as well as aspects related to the transition toward a green and digital economy. The main objective of this chapter is to identify the development potential of the analyzed areas and to diagnose the barriers limiting their competitiveness and capacity to effectively respond to contemporary challenges and threats.

The concept of competitiveness and resilience

Competitiveness, widely recognized as a measure of economic development, constitutes a crucial factor driving contemporary economic processes. The literature on the subject reveals significant interpretative diversity regarding this concept (Garelli 2014, Huggins *et al.*, 2021, Ketels 2016). Competitiveness is characterized by conceptual imprecision, ambiguity, and definitional diversity, with its interpretations varying depending on the functions or processes to which it refers. It is perceived both as a set of specific characteristics, potentials, and attributes, and as a cause, condition, or outcome of socio-economic development (Doyle & Perez-Alanis 2017).

Civilizational, geopolitical, and climate transformations, alongside the digital transition, generate numerous socio-economic challenges, including the necessity to shift the paradigm of competitiveness. The evolution of research on the competitiveness of territorial systems is reflected in the redefinition of existing concepts, the modification of research approaches, and the inclusion of a more diversified set of factors influencing competitiveness. The interdisciplinary nature of competitiveness research determines the diversity of applied methodological approaches. The literature distinguishes various analytical perspectives. The behavioral approach focuses on analyzing market competition mechanisms, emphasizing participants' strategies and behaviors (Cyert & March 1963, Solek 2016). The functional approach highlights the role of competition as a driving force for economic development (Kaczmarek-Kalisz & Guliński 2010). The institutional approach underlines the significance of legal frameworks, regulations, and institutional structures that condition competitiveness growth by creating a favourable environment for economic activity (Szpringer 2006). The systemic approach views competitiveness as a result of mutual interactions between various elements of the economic ecosystem (Bochańczyk-Kupka, 2006). The historical approach examines the development of competitiveness in the context of changing political, social, and economic conditions (Borowski, 2015). The geographical approach emphasizes the role of spatial factors, such as location, market access, and transport infrastructure, in shaping regional competitiveness (Szafranek, 2010). Additionally, the literature increasingly highlights the climate approach, which focuses on the ability of economies to achieve and sustain competitive advantage through adaptation to climate change, aiming to ensure long-term economic and social development (Karman *et al.*, 2024, Bronisz, 2024).

The concept of competitiveness is highly context-dependent, shaped by underlying assumptions and specific research objectives. Its definition is influenced by the dynamic nature of the phenomenon, diverse conditions, the unique characteristics of individual regions, and the scope of the analysed factors. Scholars emphasize various aspects, such as socio-economic balance and quality of life, resource optimization and utilization of territorial capital, adaptation to technological, climatic, and social changes, as well as

long-term stability and innovativeness. Moreover, definitions of competitiveness have evolved from simple references to economic efficiency and innovativeness toward more comprehensive approaches (Cetindamar & Kilitcioglu 2013).

In contemporary discourse, regional competitiveness is primarily analysed in the context of challenges arising from climate change, digitalization processes, and the need to build resilience against external threats. Regarding climate change, competitiveness is interpreted as an economy's ability to achieve sustainable growth by minimizing the negative environmental impact of economic activities and adapting to climate-related challenges (OECD, 2021). It is also understood as a region's capacity to operate effectively and maintain a competitive advantage under constraints resulting from climate change (World Bank, 2021–2022). The priority in this context is to balance economic, environmental, and social goals while enhancing the capacity to respond effectively to the challenges posed by climate transformation. Considerations of regional resilience focus on factors determining their ability to withstand and recover from external shocks. Key elements influencing resilience include the quality of regulations (Ezcurra & Rios, 2020), the level of human capital (Simoes et al., 2022), and the degree of digital development (Reveiu et al., 2022). In the context of advancing digitalization processes, regional competitiveness is closely linked to the ability to leverage digital technologies to improve economic efficiency, enhance the quality of life for residents, and strengthen a region's position relative to other areas (Łaźniewska, 2022). The paradigm of competitiveness is undergoing significant changes alongside the green and digital transformation. New conceptual frameworks, research methods, and evaluation approaches are emerging to better capture the complexity of this phenomenon. Recommended reforms include redefining and improving the measurement of well-being, development, and competitiveness by more closely linking these categories with sustainable development indicators and environmental metrics. As a result, the focus of competitiveness research is increasingly shifting towards the environmental component, as well as technological and digital advancement. This shift emphasizes the integration of sustainable economic growth with environmental objectives, highlighting the necessity of aligning economic development strategies with ecological sustainability and technological innovation.

In the literature, quite traditionally, border location is often seen as obstacle to development and as factor that hinders regional competitiveness (Miszczuk, 2013). National borders can negatively influence the growth of border regions by restricting their sphere of influence and raising transaction costs, which in turn hampers trade and production (Anderson et al., 2003). Border regions primarily face challenges related to efficiency, as their proximity to the border limits their ability to utilize resources as effectively as other regions (Capello et al., 2018). Recent studies also highlight that legal and administrative barriers are among the primary factors hindering competitiveness of border regions (Camagni et al., 2019). While borders

are often seen as obstacles to development, they can also serve as potential drivers of growth and sources of competitive advantage (*Anderson & O'Dowd, 1999*). Nonetheless, the impact of borders on regional competitiveness varies depending on the context, with the specific characteristics of the border playing a significant role, and studies on state borders have long acknowledged the shifting nature of their functions and changing impact on border areas.

Border regions are also exposed to the adverse impact of various external shocks, and their long-term competitiveness depends on resilience (*Hippe et al., 2023*), i.e., the ability “to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions” (*Rigaud et al., 2020*). In general, the literature suggests that border regions are less capable of responding effectively to shocks and transitioning to more efficient development models. Additionally, it is noted that EU external border regions (as Lubelskie and Podkarpackie Voivodeships), which face greater exposure to various external shocks, exhibit lower resilience compared to internal border regions (*Pascariu, Kourtiti, & Tiganasu, 2020*).

Research Framework

The primary objective of the conducted study was to assess the level of competitiveness of the Polish-Ukrainian border regions in comparison to the regions of the European Union, taking into account the conditions resulting from climate change and digital transformation. The analysis focused exclusively on the Polish border regions, specifically the Lubelskie Voivodeship and the Podkarpackie Voivodeship, in relation to the regions of the EU member states classified at the NUTS 2 level. The scope of the study was limited due to the unavailability of statistical data for Ukrainian regions, which prevented their inclusion in the comparative analysis. To achieve the research objective, a competitiveness model was developed, consisting of three components: the socio-economic component, the green economy component, and the digital economy component (Fig. 1). Each of the three components was defined by a set of diagnostic factors (table 1), further characterized through indicators selected for their spatial variability and informational significance. The research procedure involved the calculation of indicators for three components of regional competitiveness.

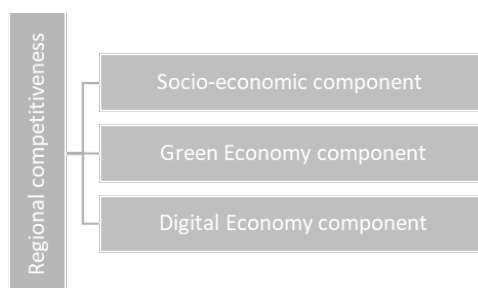


Fig.1 Regional competitiveness model

Source: Own study.

These indicators were computed as the arithmetic mean of the variables describing each component, following prior data transformation and standardization. A significant challenge encountered during the calculations was the presence of missing data. In cases where the proportion of missing data was low, positional imputation based on the median was applied. Missing values were replaced with the median calculated from a group of neighbouring regions belonging to the same country. However, in situations where a substantial amount of data was missing for a given country, the missing values were not imputed to avoid distorting the study results. Data gaps were identified for the following variables: x6 (for Cyprus, Lithuania, Latvia, Luxembourg, and Slovakia), x7 (for Cyprus, Greece, Hungary, and Slovakia), x9 (for Cyprus, Greece, Malta, Slovakia, and Hungary), x11 (for Malta), x12 (for Malta), x15 (for Portugal), and x16 (for Ireland). The synthetic indicator of regional competitiveness was calculated as the arithmetic mean of the three distinguished components.

Table 1. Components of Regional Competitiveness

Component	Diagnostic Indicators
Socio-economic	x1 GDP per capita x2 Population with higher education x3 Employment rate x4 Life expectancy x5 Perceived quality of life
Green Economy	x6 Eco-innovations x7 Share of green jobs in total employment x8 Energy productivity x9 Production volume of environmental goods x10 Material circularity rate x11 Agricultural productivity index x12 Newly registered electric vehicles
Digital Economy	x13 Internet access x14 Enterprises with online purchasing systems x15 Employment in knowledge-intensive sectors x16 Research and development expenditures

Source: Own study.

The socio-economic component encompasses a wide range of indicators that reflect both the well-being of residents and the developmental potential of regions. This component includes key aspects such as gross domestic product per capita (GDP per capita), which serves as a fundamental measure of economic growth and the wealth of inhabitants. It also incorporates the percentage of the population with higher education, indicating the level of human capital and the region's capacity to adapt to changing market conditions. Additionally, the employment rate is considered a crucial factor for ensuring social and economic stability. Moreover, this component accounts for life expectancy, serving as an indicator of quality of life and the efficiency of the healthcare system, as well as perceived quality of life, which reflects the subjective well-being of residents. Collectively, these indicators provide a comprehensive assessment of a region's socio-economic resilience and its ability to sustain long-term development.

The green economy component focuses on factors related to ecological transformation and the promotion of sustainable development. It encompasses indicators such as the level of eco-innovation, which reflects the capacity of regions to develop and implement environmentally friendly solutions, and the share of green jobs in total employment, indicating the extent to which sustainable development principles are integrated into the labour market. Additionally, the component includes energy productivity, measuring the efficiency of energy resource utilization, and the production volume of environmental goods, which serves as an indicator of a region's ability to produce low-environmental-impact products. This component also considers the material circularity rate, agricultural productivity, and the number of newly registered electric vehicles, providing a comprehensive perspective on the regions' progress in the green transformation process. These indicators collectively illustrate the degree to which regions are transitioning towards sustainable economic models that align with environmental objectives.

The digital economy component emphasizes the technological and innovative aspects of regional competitiveness. Its indicators include Internet access, which is a fundamental prerequisite for participation in the digital world, and the share of enterprises utilizing online purchasing systems, reflecting the degree of digital technology adoption in business operations. Employment in knowledge-intensive sectors highlights the development of technologically advanced industries, while expenditures on research and development (R&D) represent investments in innovation and the future growth potential of regions. Collectively, these factors provide a comprehensive picture of a region's digital readiness and its capacity to compete in a modern, technology-driven economy.

Analysis and Results

The socio-economic component constitutes a fundamental element in the assessment of regional competitiveness, reflecting both the level of residents' well-being and the developmental potential of regions. In the regional competitiveness ranking based on the socio-economic component, the highest positions were occupied by regions of Scandinavian countries and Luxembourg (LU00) (Tabl. 2). These areas are distinguished by a high level of advancement in socio-economic development. Conversely, the lowest positions in the ranking were held by regions in Bulgaria, Romania, and Hungary, which may indicate their relatively low developmental potential.

Table 2. Regions with the highest and lowest values of the Index of Regional Competitiveness of the socio-economic component

NUTS2	Value	NUTS2	Value
LU00 Luxembourg	1,097651	BG31Severozapaden	-1,61223
SE11 Stockholm	1,08718	BG32Severen tsentralen	-1,28871
FI20 Åland	1,070585	BG34 Yugoiztochen	-1,28359
IE06 Eastern and Midland	1,043637	BG33 Severoiztochen	-1,2702
IE05 Southern	1,009544	BG42 Yuzhen tsentralen	-1,24487
SE23 Västsverige	0,966796	RO22 Sud-Est	-1,235
SE21 Smaland med öarna	0,952113	RO42 Vest	-1,17926
SE33 Övre Norrland	0,937882	RO12 Centru	-1,15304
DK01 Hovedstaden	0,929515	RO31Sud – Muntenia	-1,15115
DK04 Midtjylland	0,852863	HU31 Észak-Magyarország	-1,07177

Source: Own study.

The analysis of results for the Lubelskie (PL81) and Podkarpackie (PL82) Voivodeships in comparison to NUTS 2 regions of the European Union (Fig. 2) indicates their low socio-economic competitiveness.

The Lubelskie Voivodeship ranked 184th out of 240 NUTS 2 regions, while the Podkarpackie Voivodeship ranked 171st. These results place both regions in the lower segment of the ranking, suggesting a limited capacity to compete in terms of key socio-economic indicators.

In comparison to the most developed EU regions, such as Luxembourg (LU00) and Stockholm (SE11), the Lubelskie and Podkarpackie Voivodeships demonstrate significant developmental delays. Notably, the Polish-Ukrainian border regions align more closely with the performance of the EU's least developed regions, such as Severozapaden in Bulgaria (BG31) and Sud-Est in Romania (RO22). This positioning underscores their low socio-economic competitiveness relative to other EU regions.

In comparison to other Polish regions, the Lubelskie and Podkarpackie Voivodeships demonstrate weaker performance (Table 3). The highest-ranking Polish region is the Warszawski Stołeczny Region (PL91), positioned 63rd, clearly highlighting

the developmental disparities between the country's central and peripheral areas. Better results were also recorded by the Małopolskie Voivodeship (PL21), ranking 145th, and the Pomorskie Voivodeship (PL63), ranking 136th. Comparable results to the Polish-Ukrainian border regions were observed in the Warmińsko-Mazurskie Voivodeship (PL62), ranking 188th, and the Świętokrzyskie Voivodeship (PL72), ranking 177th, suggesting shared developmental challenges typical of peripheral regions.

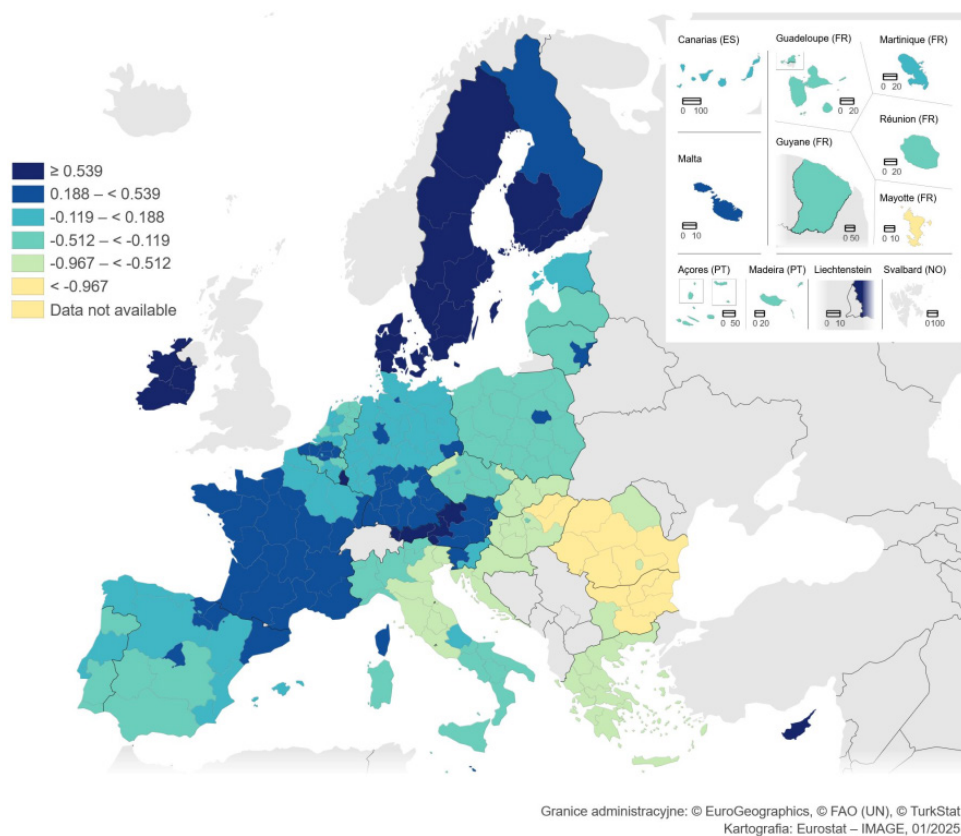


Fig. 2. Index of socio-economic component of Regional Competitiveness

Source: Own study.

Table 3. The Position of Polish Regions in the Regional Competitiveness Ranking – socio-economic component

Region	Value	Position (na 240)
PL21 Małopolskie	-0,18063	145
PL22 Śląskie	-0,3761	178
PL41 Wielkopolskie	-0,17448	144
PL42 Zachodniopomorskie	-0,36772	175
PL43 Lubuskie	-0,37058	176
PL51 Dolnośląskie	-0,21194	152
PL52 Opolskie	-0,297	162
PL61 Kujawsko-Pomorskie	-0,36352	174
PL62 Warmińska-Mazurskie	-0,44857	188
PL 63 Pomorskie	-0,14222	136
PL71 Łódzkie	-0,27986	160
PL72 Świętokrzyskie	-0,37566	177
PL81 Lubelskie	-0,39968	184
PL82 Podkarpackie	-0,33244	171
PL84 Podlaskie	-0,26149	159
PL91 Warszawski stołeczny	0,263168	63
PL92 Mazowiecki regionalny	-0,39061	181

Source: Own study.

The green economy component reflects the capacity of regions to achieve goals related to ecological transformation and the implementation of sustainable development principles. The regional competitiveness ranking within the green economy component exhibits greater variation. Leading positions in the ranking are occupied by regions from Scandinavian countries, as well as from Germany, Austria, and Italy (Tabl. 4). Conversely, the lowest positions are held by Latvia and regions in Bulgaria and Romania, which may indicate challenges these regions face in addressing climate-related issues and advancing the green transition.

Table 4. Regions with the Highest and Lowest Values of the Regional Competitiveness Index – green economy component

NUTS2	Value	NUTS2	Value
DK01 Hovedstaden	1,574218	LV Latvia	-1,28377
AT13 Wien	0,933992	BG32 Severen tsentralen	-1,228
DE11 Stuttgart	0,833859	BG31 Severozapaden	-1,22543
SE11 Stockholm	0,809535	RO22Sud-Est	-1,19269
FI1B Helsinki-Uusimaa	0,798934	BG34 Yugoiztochen	-1,17752
ITC4 Lombardia	0,730911	BG33 Severoiztochen	-1,1254
DE21 Oberbayern	0,710772	BE34 Prov. Luxembourg	-1,03867
NL32 Noord-Holland	0,707305	ES23 La Rioja	-1,02625
ES30 Comunidad de Madrid	0,70062	PT20 Regiao Autónoma dos Açores	-1,00324
NL33 Zuid-Holland	0,678086	RO41 Sud-Vest Oltenia	-0,98966

Source: Own study.

In comparison to EU regions, the Lubelskie Voivodeship ranked 188th, while the Podkarpackie Voivodeship ranked 191st (Fig. 3).

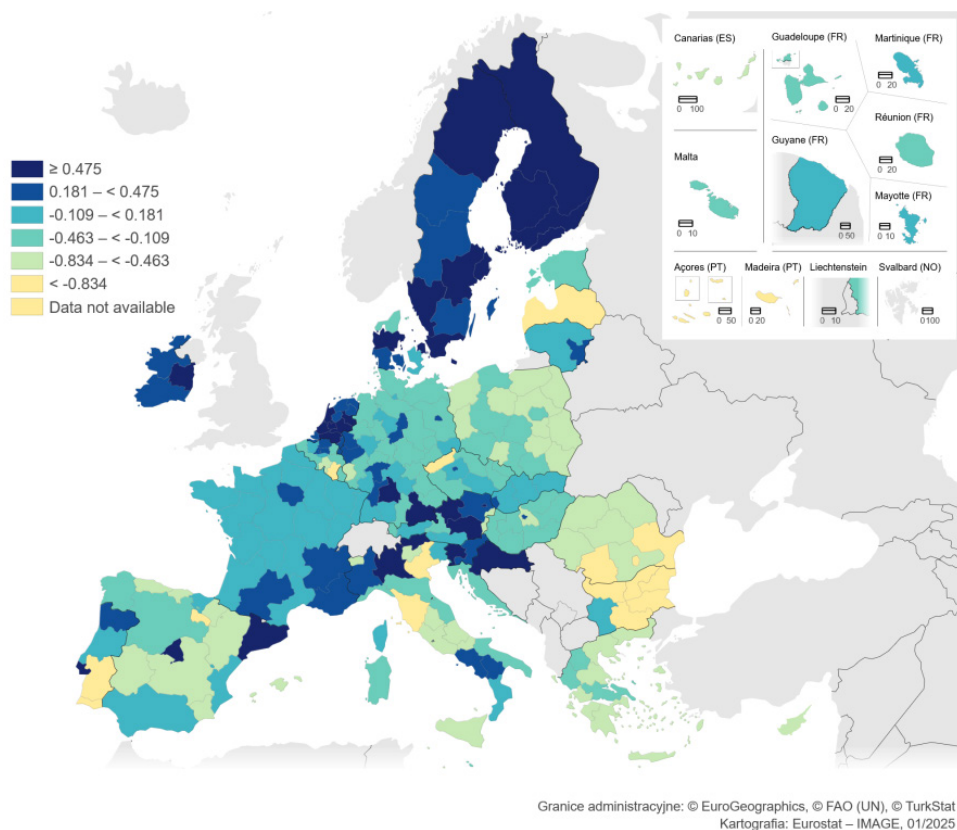


Fig. 3. Index of green economy component of Regional Competitiveness

Source: Own study.

These results are comparable to those of the least developed regions in terms of the green economy, such as Latvia (LV) and the Bulgarian regions Severen Tsentralen (BG32) and Severozapaden (BG31). The analysis of the green economy component indicates that the Lubelskie and Podkarpackie Voivodeships have a limited capacity to achieve ecological transformation goals. Their low ranking stems from insufficient investments in eco-innovations, a low share of green jobs, and poor energy efficiency.

The analysis of results for the Lubelskie (PL81) and Podkarpackie (PL82) Voivodeships, in comparison to other Polish regions, revealed their low competitiveness in the green economy sector (Table 5). Both border regions exhibit a comparable level

of advancement in the transition towards sustainable development, similar to other less developed Voivodeships such as Podlaskie (PL84), Świętokrzyskie (PL72), and Lubuskie (PL43). At the national level, central voivodeships and metropolitan areas demonstrate a significantly higher level of competitiveness in the green economy, clearly surpassing the performance of peripheral border regions.

Table 5. The Position of Polish Regions in the Regional Competitiveness Ranking – green economy component

Region	Value	Position
PL21 Małopolskie	-0,37019	166
PL22 Śląskie	-0,33368	159
PL41 Wielkopolskie	-0,4306	172
PL42 Zachodniopomorskie	-0,56518	190
PL43 Lubuskie	-0,59921	197
PL51 Dolnośląskie	-0,34475	162
PL52 Opolskie	-0,64657	202
PL61 Kujawsko-Pomorskie	-0,50645	179
PL62 Warmińska-Mazurskie	-0,6191	199
PL 63 Pomorskie	-0,41536	170
PL71 Łódzkie	-0,39253	168
PL72 Świętokrzyskie	-0,68454	209
PL81 Lubelskie	-0,54853	188
PL82 Podkarpackie	-0,56608	191
PL84 Podlaskie	-0,68863	210
PL91 Warszawski stołeczny	-0,17989	125
PL92 Mazowiecki regionalny	-0,51734	180

Source: Own study.

The digital economy component represents a crucial element in the assessment of regional competitiveness, reflecting the degree of technological advancement and the capacity to implement innovative digital solutions. In the regional competitiveness ranking based on the digital economy component, the highest positions were occupied by regions in Denmark, Sweden, and Germany (Table 6), indicating their high levels of innovation and technological development. Conversely, the lowest positions were held by regions in Bulgaria and Greece, which may suggest their relatively limited potential for adapting to and implementing solutions associated with the digital transformation.

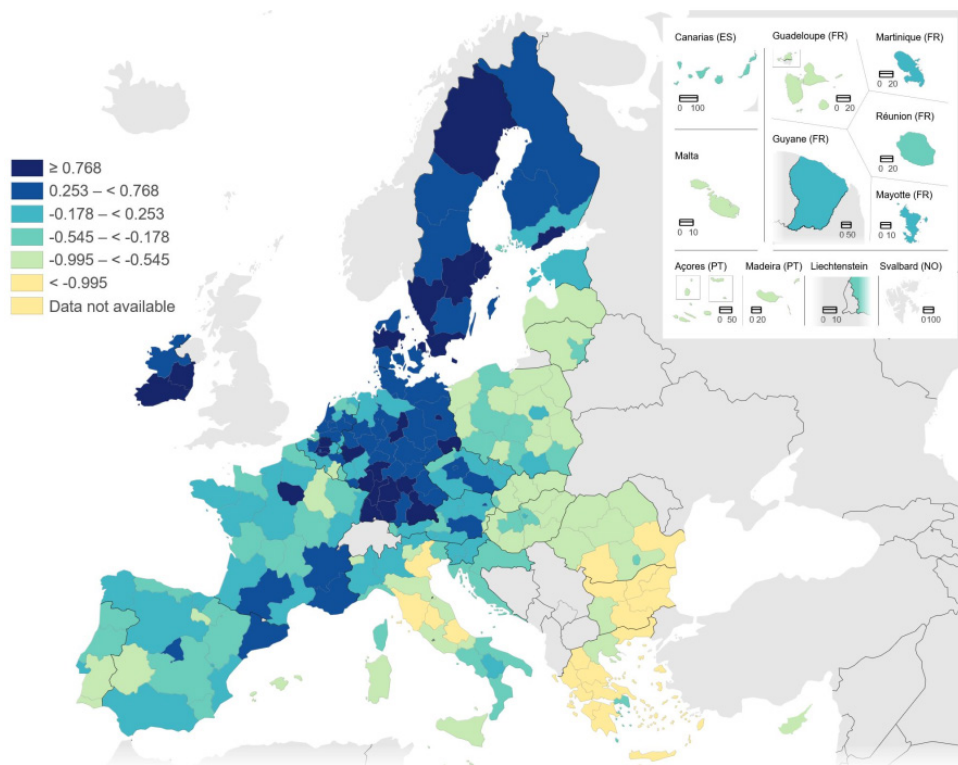
Table 6. Regions with the Highest and Lowest Values of the Regional Competitiveness Index – digital economy component

NUTS2	Value	NUTS2	Value
DK01 Hovedstaden	1,624854	BG34 Yugoiztochen	-1,5447
SE11 Stockholm	1,49879	EL42 Notio Aigaio	-1,538
SE23 Västsverige	1,491942	BG31 Severozapaden	-1,51322

NUTS2	Value	NUTS2	Value
DE11 Stuttgart	1,393132	EL65 Peloponnisos	-1,46615
SE12 Östra Mellansverige	1,332646	EL62 Ionia Nisia	-1,46151
SE22 Sydsvrige	1,256593	EL64 Sterea Ellada	-1,45857
DE21 Oberbayern	1,236586	EL53 Dytiki Makedonia	-1,44381
DE12 Karlsruhe	1,192434	BG33 Severoiztochen	-1,3943
DE91 Braunschweig	1,176497	BG32 Severen tsentralen	1,38464
DE14 Tübingen	1,082113	EL51 Anatoliki Makedonia, Thraki	-1,37076

Source: Own study.

In comparison to other regions of the European Union, the Lubelskie (PL81) and Podkarpackie (PL82) Voivodeships rank in the lower segment of the competitiveness ranking (Fig. 4), indicating a limited level of digital technology adoption and low intensity of innovative activities.



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Fig. 4. Index of digital economy component of Regional Competitiveness

Source: Own study.

Among Polish regions, only the Warszawski Stołeczny Region (PL91) was included in the top 100 of the ranking, highlighting significant disparities in digital advancement between central and peripheral regions. The Lubelskie Voivodeship ranked 173rd, while the Podkarpackie Voivodeship placed 162nd. In the context of EU regions, both voivodeships are characterized by low accessibility and limited utilization of digital infrastructure, which constitutes a significant barrier to enhancing their competitiveness.

In the analysis of the digital economy component, the Lubelskie (PL81) and Podkarpackie (PL82) Voivodeships achieved results indicating a moderate level of digitalization development compared to other Polish regions (Tabl. 7). However, their positions are noticeably lower in comparison to more advanced regions such as the Warszawski Stołeczny Region (PL91), Pomorskie Voivodeship (PL63), and Dolnośląskie Voivodeship (PL51). A comparison between the Lubelskie and Podkarpackie Voivodeships reveals a slightly higher level of digitalization in Podkarpackie, which may be attributed to a stronger emphasis on the development of the IT sector and initiatives supporting technological innovation.

Table 7. The Position of Polish Regions in the Regional Competitiveness Ranking – digital economy component

Region	Value	Position
PL21 Małopolskie	-0,03392	112
PL22 Śląskie	-0,3912	150
PL41 Wielkopolskie	-0,48961	165
PL42 Zachodniopomorskie	-0,74321	198
PL43 Lubuskie	-0,87812	212
PL51 Dolnośląskie	-0,22447	131
PL52 Opolskie	-0,92708	214
PL61 Kujawsko-Pomorskie	-0,61528	180
PL62 Warmińska-Mazurskie	-0,79905	207
PL 63 Pomorskie	-0,18381	126
PL71 Łódzkie	-0,42381	152
PL72 Świętokrzyskie	-0,9826	217
PL81 Lubelskie	-0,56525	173
PL82 Podkarpackie	-0,47512	162
PL84 Podlaskie	-0,82667	209
PL91 Warszawski stołeczny	0,233121	79
PL92 Mazowiecki regionalny	-0,76082	201

Source: Own study.

In the synthetic regional competitiveness ranking, the highest positions were occupied by regions from Denmark, Sweden, Ireland, and Germany (Table 8). These regions are characterized by a high level of socio-economic development, dynamic growth in the green economy, and advanced digital transformation, indicating their ability to comprehensively leverage innovative solutions to strengthen their competi-

tive advantage. In contrast, the lowest positions in the ranking are held by regions from Bulgaria, Romania, and Greece, which face significant developmental challenges that limit their capacity to compete effectively in the modern economic environment.

Table 8. Regions with the highest and lowest values of the overall Index of Regional Competitiveness

NUTS2	Value	NUTS2	Value
DK01 Hovedstaden	1,376196	BG31 Severozapaden	-1,45029
SE11 Stockholm	1,131835	BG34 Yugoiztochen	-1,33527
SE23 Västsverige	1,027573	BG32 Severen tsentralen	-1,30045
SE12 Östra Mellansverige	0,903431	BG33 Severoiztochen	-1,2633
IE06 Eastern and Midland	0,885015	RO22 Sud-Est	-1,23072
SE22 Sydsverige	0,873195	BG42 Yuzhen tsentralen	-1,11035
DE11 Stuttgart	0,871177	RO41 Sud-Vest Oltenia	-1,01561
DK04 Midtjylland	0,847141	EL51 Anatoliki Makedonia, Thraki	-1,00909
DE21 Oberbayern	0,802867	RO31 Sud – Muntenia	-0,9734
SE33 Övre Norrland	0,800701	EL42 Notio Aigaio	-0,9404

Source: Own study.

The analysis of the overall Regional Competitiveness Index indicates that the Lubelskie and Podkarpackie Voivodeships occupy low positions compared to other regions of the European Union (Fig. 5).

These results reflect the limited capacity of these regions to compete in the socio-economic, green economy, and digital economy dimensions. The Lubelskie Voivodeship ranked 180th among NUTS 2 EU regions, while the Podkarpackie Voivodeship achieved a slightly better result, ranking 173rd.

In comparison to the most competitive regions, such as Hovedstaden (Denmark) and Stockholm (Sweden), both voivodeships exhibit significant gaps in socio-economic, environmental, and digital development. This considerable disparity underscores the need to intensify efforts aimed at fostering innovation, advancing technological development, and promoting sustainable growth in these regions. It is also worth noting that the Lubelskie and Podkarpackie Voivodeships performed better than the least developed EU regions, such as Severozapaden and Yugoiztochen in Bulgaria. However, this difference is insufficient for these regions to effectively compete with the more developed areas of the European Union.

In comparison to other Polish regions, the situation of the Lubelskie and Podkarpackie Voivodeships is also relatively unfavourable (Tabl. 9).

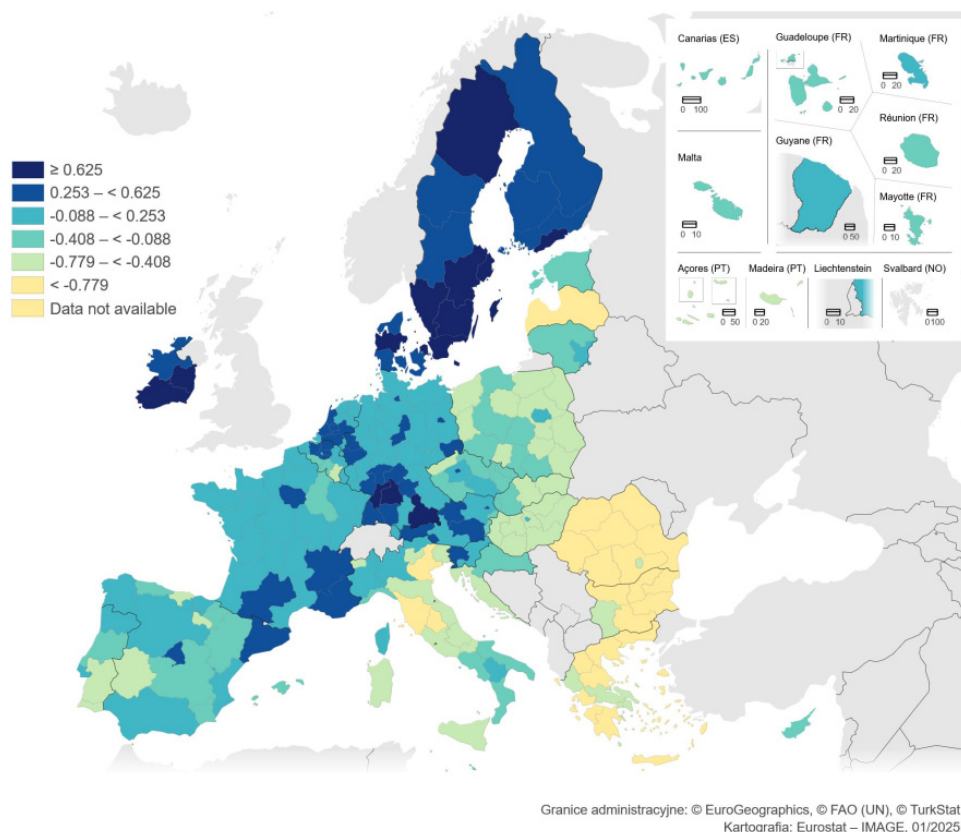


Fig. 5. Index of Regional Competitiveness

Source: Own study.

Table 9. The Position of Polish Regions in the Regional Competitiveness Ranking

Region	Value	Position
PL21 Małopolskie	-0,19491	145
PL22 Śląskie	-0,36699	164
PL41 Wielkopolskie	-0,36489	162
PL42 Zachodniopomorskie	-0,55871	192
PL43 Lubuskie	-0,61597	202
PL51 Dolnośląskie	-0,26039	153
PL52 Opolskie	-0,62355	204
PL61 Kujawsko-Pomorskie	-0,49509	178
PL62 Warmińska-Mazurskie	-0,62224	203
PL 63 Pomorskie	-0,24713	151
PL71 Łódzkie	-0,3654	163
PL72 Świętokrzyskie	-0,68093	209
PL81 Lubelskie	-0,50449	180

Region	Value	Position
PL82 Podkarpackie	-0,45788	173
PL84 Podlaskie	-0,59226	200
PL91 Warszawski stołeczny	0,105467	85
PL92 Mazowiecki regionalny	-0,55625	190

Source: Own study.

The Podkarpackie Voivodeship, ranking 173rd, is positioned higher in the overall ranking than the Lubelskie Voivodeship, which ranked 180th. Both regions outperform voivodeships such as Świętokrzyskie (209th), Lubuskie (202nd), and Warmińsko-Mazurskie (203rd). However, their results are significantly weaker compared to the Warszawski Stołeczny Region, which ranked 85th, highlighting a pronounced disparity in the level of development and competitiveness.

Conclusion

Contemporary development processes are increasingly characterized by intensified spatial polarization, leading to a distinct division between dynamically developing growth areas and stagnant regions, often referred to as peripheral areas. The Lubelskie and Podkarpackie Voivodeships, as border regions, exhibit characteristics of peripheral areas both in geographical and socio-economic terms. Their location along the Polish-Ukrainian border, marked by a high degree of impermeability and limited cross-border integration, further exacerbates challenges related to economic and social integration. These factors contribute to their lower level of socio-economic development, confirming their marginalization in the context of growth dynamics and competitiveness when compared to more centrally located regions.

The Lubelskie and Podkarpackie Voivodeships consistently demonstrate a relatively low level of overall competitiveness, both in comparison to other regions of the European Union and within the context of other Polish voivodeships—a condition that has persisted for many years (*Jakubowski, Bronisz, 2017*).

An analysis of their performance across key components of competitiveness—namely the socio-economic, green economy, and digital economy—reveals significant deficits that hinder their ability to compete effectively at both national and international levels. Low efficiency in the area of human capital, limited implementation of environmentally friendly solutions, and an insufficient degree of digital transformation highlight the urgent need for comprehensive and targeted development initiatives. Enhancing the competitiveness of the Lubelskie and Podkarpackie Voivodeships is essential for their long-term development and for reducing existing disparities relative to more developed regions of Poland and the European Union.

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COMMON SECURITY CHALLENGES AND MEASURES TO ENHANCE THE RESILIENCE OF THE POLISH-UKRAINIAN BORDER ECONOMY

In 2003, in preparation for EU membership, Poland and Ukraine began working together to launch a joint cross-border programme that would stabilise and bring the resilience of the two countries' neighbouring areas closer together. The programme for 2021–2027 was initially prepared in a trilateral format, as a continuation of previous fruitful and successful cross-border cooperation. However, due to the use of migrants by the Belarusian authorities at the EU's external borders and Belarus' further involvement in the military aggression against Ukraine, cross-border cooperation with Belarus was suspended in 2022. Thus, the Programme for 2021–2027 is bilateral.

The Interreg NEXT Poland-Ukraine 2021–2027 programme was adopted by the European Commission on 30 November 2022. Its overall objective is to support cross-border development processes in the border area between Poland and Ukraine. The programme is aimed at the Polish and Ukrainian border regions and all non-profit institutions operating in the region. The European Union has allocated 235.9 million euros for its implementation (including at least 214.4 million euros for projects), and the total budget is over 262 million euros. Among the programme's objectives, there is an area related to environmental stabilisation (Fig. 1).

The programme area is focused on the border regions of Poland and Ukraine and covers NUTS3 units (sub-regions) on the Polish side and oblasts in Ukraine: Poland: Podlaskie, Mazowieckie (only Ostrołęka and Siedleckie sub-regions), Lubelskie and Podkarpackie Voivodeships; Ukraine: Volyn, Lviv, Zakarpattia, Rivne, Ternopil and Ivano-Frankivsk Oblasts.

The above clearly defines that both parties (as stated in the programme document) consider the goals of achieving resilience of environmental security, sustainability, inextricably linked to the neighbouring territories.

It is worth noting that programmes to build resilience of territories and communities in Poland have been in place for a long time and, according to official reports, have had some success. Back in 2022, Poland proposed to the official Brussels a plan to restore communities and achieve their resilience, which was supposed to make a significant contribution to accelerating the country's economic recovery and environmental safety, and guarantee a green, digital, inclusive and sustainable future. Built around community resilience, the plan provides a targeted response to Poland's structural challenges.

Thus, since 2022, 56 investment flows and 55 reforms have already provided up to 50% of the plan to support the resilience of territories and communities. The plan supports the green transition by increasing the share of renewable energy in the energy mix.

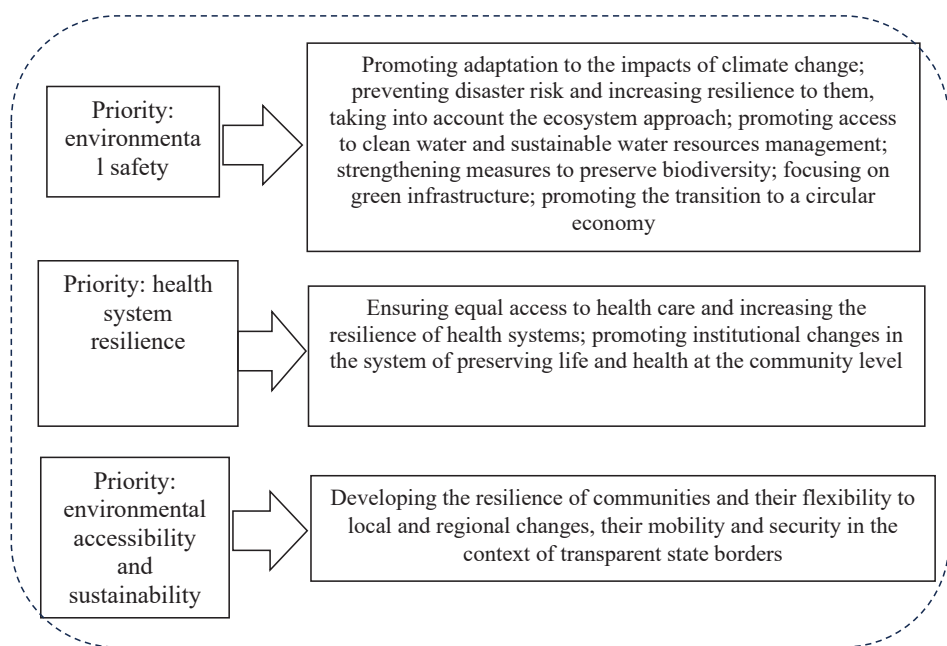


Fig. 1. Formation of priorities and tasks for the implementation of joint projects in the border areas

Source: developed by the author on the basis of (Interreg NEXT Poland – Ukraine 2021–2027, 2024; Poland's recovery and resilience plan, 2024).

This includes more than €5.1 billion in infrastructure funding, as well as key regulatory changes to facilitate the construction of onshore wind farms. The programme also includes reforms to remove bottlenecks to electricity imports. In addition, EUR 3.5 billion is allocated for energy-efficient renovation of buildings and EUR 800 million to support the development of green hydrogen technologies (*Analysis of the recovery and resilience plan of Poland*, 2024).

According to previous reports on the implementation of community resilience support programs in Poland, experts conclude that the examined areas continue to experience the impacts of climate change. In particular, the persistent rise in average temperatures and the increasing intensity and frequency of extreme weather events exert ongoing pressure on natural resources, the economy, and community well-being. Adaptation to climate change and enhancing the resilience of the economy to its consequences, both in the short and long term, remain the primary challenge for Polish communities. The development of cities and infrastructure within communities must be adjusted in consideration of the expected effects of climate change, such as heatwaves or floods.

Similarly, agricultural practices and land management in rural areas must avoid exacerbating the already existing consequences of climate change, such as droughts. Rural areas of Poland, much like those in Ukraine, face challenges in ensuring sustainable water supply and sanitation. Water resources are becoming increasingly scarce. Water retention in agricultural lands is low, primarily due to existing inadequate drainage systems, which increase water runoff and exacerbate the effects of drought.

Problems related to the presence of pollutants and hazardous waste accumulated in the past in such a way that they threaten human life or health still exist in communities. In fact, the waste management system is far from perfect. Finally, to support the green transition and avoid potential bottlenecks in its achievement, there is a need to improve the development of relevant skills and promote climate literacy among the community population. Poland, like Ukraine, is gradually moving away from the dominance of the general ideology of achieving sustainable development goals (Brodny & Tutak, 2023; Węziak-Białowska, 2016).

Since the 2010s, the concept of resilience has been increasingly applied in the strategic documents of international organizations as a new security interpretation in situations of shocks. Thus, resilience was mentioned in the new 2016 strategy, the UN Sustainable Development Goals until 2030, the 2015 UN Paris Climate Agreement, and NATO documents. The term itself is used as a designation of a new approach to ensuring the stability of national economies in the context of the world entering an era of complexity, nonlinearity, and radical uncertainty. It is the ability of a system to flexibly regroup its elements and key resources to achieve dynamic stability at a new level of development in response to sudden internal or external disturbances.

According to the World Bank's approach, the resilience of an economic system at the macro level is defined as a combination of (1) immediate resilience, meaning the ability to limit the magnitude of immediate income losses for a given level of capital losses; and (2) dynamic resilience, meaning the ability to recover quickly. In other words, it is a combination of the absorptive capacity of the system, meaning the ability to quickly absorb shocks, and the system's recovery capacity.

Any approach aimed at assessing resilience requires the integration of ideas from social and environmental sciences and a focus within the framework of «humans as part of the ecosystem.» For example, a network perspective that has gained strength in modern social sciences and is relevant to these interdisciplinary efforts is the actor-network theory (ANT), proposed by Latour B. ANT outlines the interaction of networks based on the experience of the participants in the interaction, without reproducing the disciplinary division between social and natural sciences (*Latour, 2005*). Given this, it can be assumed that resilience is the result of local processes, in particular, the experiences and responses of actors who face social and/or environmental disruptions. The actors then respond by absorbing, adapting, or transforming the disruptions. In this sense, the concept of resilience serves as a connecting concept between natural and social sciences (see Fig. 2).

Given the further policy of aligning border territories, there is an urgent need for continued coordination of efforts from both sides in responding to common security challenges and developing measures to enhance the resilience of the Polish-Ukrainian border economy.

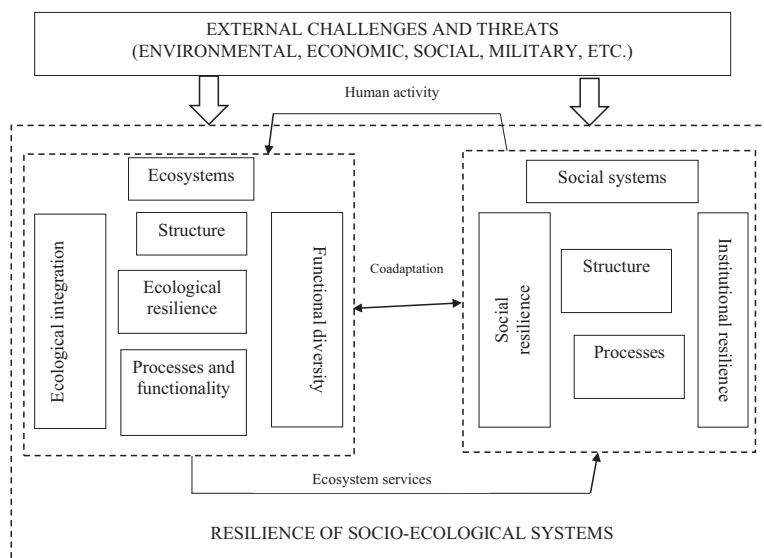


Fig. 2. Resilience as a response of socio-ecological systems to external challenges

We suggest focusing efforts on five subsystems, the coverage of which will enable an adequate response to the common threats we have outlined above. In this regard, the Ukrainian side can gain institutional experience by utilizing the achievements of the Polish side. Thus, resilience should include work on at least five subsystems: economic, society and social capital, critical infrastructure, supply chains, and institutional. For each subsystem, the following characteristics and indicators can be considered. Economic subsystem. The resilience of the economy is characterized by both the volume and diversity of resources, as well as the evenness of their distribution. This depends on the interaction between people and companies in the production, distribution, and consumption of goods. To construct a regional index, the following components are used: income equality, measured by the Gini coefficient; economic diversification by employment structure; housing affordability, measured by the share of households spending less than 35% of their income on housing; business climate, characterized by the share of small businesses, the number of newly created and dissolved enterprises, the prevalence of high-speed internet, and the size of venture capital.

Subsystem of society and social capital. This is ensured by the presence of informal neighborhood connections between people and businesses, communication channels for gathering and disseminating information, forms of mutual assistance, and willingness to take joint action regardless of official authorities. The indicators are as follows: education level, health level (the proportion of the population without disabilities), level of «non-poverty» (the proportion of the population with income above the poverty line), medical insurance, civil society infrastructure — the number of non-profit organizations per 10,000 residents, homeownership, and electoral activity. Critical infrastructure (roads, water supply, communication, energy, healthcare, etc.). It is characterized by the availability of infrastructure and the ability of its owners and managers to ensure its operation in emergency situations. There must be a reserve housing stock, reserve hospitals, backup sources of electricity and water supply, and backup communication channels. Subsystem of supply chains. The ability of supply chain operators to ensure interaction with partners, as well as the availability of reserve stocks, flexibility of businesses in readiness for emergency events, and the number of links and nodes in the supply chain, their connections, and geographic distribution. The interaction of businesses with government authorities in the exchange of information and the establishment of legal norms, contracts, and forms of cooperation is of great importance.

Institutional subsystem. It depends on the ability of the local community to engage local residents and businesses in mitigating the consequences of a shock, to create organizational connections, and to support local social systems. Key factors include the ability for inter-agency interaction, trust in the authorities, the adequacy of authority powers in emergency situations, and the volume and effectiveness of

budgetary expenditures for ensuring security and the operation of relevant emergency services.

Considering the border location and possible directions of cooperation, it is important to take into account the synergetic approach to forming resilience. This is both an interdisciplinary scientific direction, which implies the need to consider the patterns of problem emergence along the way of implementing the management system; the formation and development of this system, the characteristic features of which are openness, self-organization, and nonlinearity, as well as a process of interaction between the resources and opportunities of the territories of both countries. During the application of levers, a bifurcation process may occur (a qualitative transition of the system from a state of equilibrium in resilience to chaos or to organization at a higher level). The application of levers aims to prevent imbalance in the relationship between nature and socio-economic development, between natural and socio-economic systems. Organizational and managerial levers for the implementation of the resilience system will be complex due to ongoing processes of legislative approximation and the overall socio-ecological-economic instability in Ukraine. However, they should be based on the following management principles: goal setting (priority of goals in the goal tree, goal adaptation, continuity of goals, strategic planning); adherence to form (systematicity, tolerance, constructiveness, hierarchy, universality); content (leading link, necessary diversity, necessity and sufficiency, reservation and duplication, unity of form and content); interconnection (linearity and functionality, parallelism and sequence, distribution and specialization, optimal number of links, feedback); interaction (operationality and flexibility, continuity and rhythmicity, distribution of cooperation, and the adequacy of actions).

In the current conditions of environmental unpredictability, the system of levers has many management tools, mechanisms, instruments, reactions, and is capable of anticipating events in both the external and internal environments. Levers are the system of key elements that regulate the process of developing and implementing managerial decisions (*Lysyuk & Derkach, 2020*). The action of levers is related to the consideration of economic laws, business processes reflecting the harmonization of economic relations over a long-term strategic period, which operates within the framework of the general mechanism and is aimed at organizing the achievement of strategic goals in the process of system development. In this case, levers are a set of principles, methods, and tools (Fig. 3). If we analyze publications on the processes of implementing the resilience system both in Poland (*Kimhi et al., 2023*) and in Ukraine (*PyrozHKov et. al., 2021*), it is clear that strategies as a lever of influence are mentioned in almost all publications dedicated to resilience issues. The most successful is recognized the resilience strategy aimed at anticipating challenges and threats. Such a strategy allows for timely awareness and preparation to minimize losses, which could be catastrophic for the country and its regions.

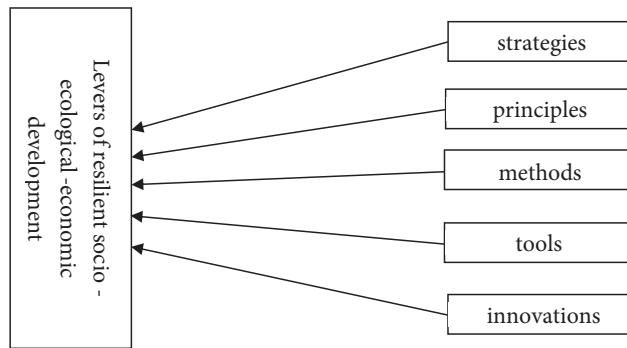


Fig. 3. Structure of levers for resilient socio-ecological-economic development of adjacent territories considering the state of their natural-resource complex

The strategy includes a whole set of operational goals, each of which is associated with specific programs for preventing environmental threats and risks. Based on the results of grouping regions by their resilience index, it is possible to identify which areas of environmental protection activities require urgent targeted development programs. First of all, this will be the sphere of water supply and wastewater treatment, waste management, and others. For example, programs for the implementation of regional waste management plans and investment in the process of commissioning additional purification measures to prevent the emission of hazardous substances into the atmosphere have made it possible to maintain the Dnipropetrovsk region's position in the high and sufficient resilience groups.

The choice of strategy should not be made at the expense of discriminating against specific regions, but should be implemented in accordance with globally recognized principles of parity, including: prioritization, systemic approach, commonality, integration, equality of stakeholders, and others. Another important principle for resilience is the principle of systemic complexity and uncertainty (the qualitative and quantitative parameters of ecological resilience can vary significantly depending on the territorial entity, which affects the environmental consciousness of the community, the adequacy of perceiving environmental threats, and the public reaction in preventing and mitigating ecological risks), as well as the preservation of biodiversity and ecological goods over time (ecological resilience should become a constant universal good and an integral component of life support; on the other hand, it necessitates strict adherence to the principle of equal rights for generations to a safe environment).

In conclusion, it is important to emphasize that to ensure the resilience of communities, utilizing the full range of available institutional regulators, it is necessary to achieve a productive balance between stability and flexibility. Institutional tools and the corresponding structures for their implementation must be stable enough

to support constructive, democratic decision-making, but also flexible enough to facilitate adaptations (for example, introducing innovations in the energy sector, regulating land or forest use based on conservation and restoration of natural resource potential, etc.). Furthermore, for different territorial communities, the set of tools will be individualized, based on the results of the assessment of ecological resilience (in general or by specific components such as water resources, land, forest, and available investments). Institutional work in this dynamic context is the active labor of all administrative levels under the control of the community or a third party to whom such powers are delegated. In the long term, it will be important to study how different tools interact at various scales and time frames and what the outcome of their work is.

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DIRECTIONS OF DEVELOPMENT OF LUBELSKIE VOIVODESHIP IN THE CONTEXT OF CONTEMPORARY CHALLENGES

Introduction

Dynamic changes in the socioeconomic environment have significantly influenced priorities for development policies pursued by the local government authorities in recent years. Globalization, threats related to climate change, increased and uncontrolled migration, insecurity, unfavorable demographic processes are the new challenges, along with health care, digitalization, labor market or education, which European regions nowadays need to firmly focus on.

In this context, the development challenges of the Lubelskie Voivodeship have also changed. The directions of development and the new priorities are set by the Development Strategy of the Lubelskie Voivodeship until 2030¹ (Polish abbreviation: SRWL 2030), also a basis for other sectoral policies and operational activities.

External conditions

1. Global conditions

According to the White Paper of the European Commission² the role and significance of digitalization, automation, artificial intelligence, deepened specialization and the use of endogenous development potentials are assumed to increase. The brusque pace of technological change and the expansion of knowledge and information resources lead to changes in social attitudes, as well as in the structure of the economy

¹ Resolution No. XXIV/406/2021 of the Regional Assembly of the Lubelskie Voivodeship of 29.03.2021

² White Paper on the Future of Europe. Reflections and scenarios for the future of the EU-27 by 2025

(development of some industries, decline of others) and the labor market (demand for new skills and competences, decline of demand for others). Such processes **strongly encourage regional development strategies to be based on endogenous potentials**, which could lead to the creation of new products and innovative services and thus enrich the global market.

Depletion of natural resources, especially energy, the unstable political situation in strategic areas with land rich in raw materials all create a pressure and lead to the growth of their prices, and thus the costs of energy production. This implies the need to dynamize processes related to the **search for new energy sources and their diversification**. Another significant challenge is the observed climate change, which will be increasingly felt by societies and economies (by limited access to water, more frequent occurrence of extreme weather phenomena, etc.).

Agreements included in the Multiannual Financial Framework³ (MFF) of the EU, with particular emphasis on the objectives of the Cohesion Policy after 2020, are going to be of great importance for supporting and implementing development processes in the regions, including the Lubelskie Voivodeship, in the perspective of 2030.

In the scope of Cohesion Policy for 2021–2027 the European Commission has defined 5 new objectives⁴. These are:

A smarter Europe through innovation, digitalization, economic transformation and support for small and medium-sized enterprises,

A greener, low-emission Europe by promoting clean and fair energy transition, green and blue investments, circular economy, climate change adaptation and risk management and prevention,

A more connected Europe through increasing mobility and improving regional ICT connections with strategic transport infrastructure and digital networks,

Europe with a stronger social dimension by implementing the European Pillar of Social Rights and investing in quality employment, education, skills, social integration, equal access to healthcare, strengthening the role of culture and tourism in economic development, social inclusion and social innovation,

Europe closer to its citizens through supporting sustainable and integrated development of urban, rural and coastal areas thanks to bottom-up development strategies.

The currently implemented **Cohesion Policy maintains investments in all regions**, while differentiating the intensity of support depending on the level of development

³ Council Regulation (EU, Euratom) 2020/2093 of December 17, 2020 laying down the multiannual financial framework for the years 2021–2027 (OJ L 433 I, 22.12.2020).

⁴ Regulation of the European Parliament and of the Council laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund and the European Maritime and Fisheries Fund and financial rules for those and for the Asylum and Migration Fund, the Internal Security Fund and the Border Management and Visa Instrument COM(2018).

of the regions⁵. Investments in development are clearly focused on Objectives 1 and 2. Cohesion policy continues to support the bottom-up approach, which is expressed through the continuation of the “**community-led local development**” mechanism and strengthening of the urban dimension.

The **idea of reducing regional differences and catching up on development backlogs** plays a special role in the EU cohesion policy of the current perspective. Over the next decade, the cohesion policy shall be supporting regions in modernizing industry, investing in innovation and moving to a low-emission economy, as well as one that meets the circular economy standards.

European Green Deal⁶ responds to climate and environmental challenges. This **new growth strategy** aims to transform the EU into a land of modern, resource-efficient and competitive economy, with net zero greenhouse gas emissions by 2050, including those from animals (CO₂ and methane) and with economic growth that is decoupled from the exploitation of natural resources. The Deal also aims to protect, preserve and enhance the EU's natural capital and protect the health and well-being of citizens against environmental risks or impacts. Its implementation is expected to entail profound changes. An active public involvement and societal trust will be crucial for the eventual effectiveness and acceptance of new policies.

Recovery and Resilience Facility⁷ is one of the pillars for the recovery of European economies hit by the crisis related to the impact of the COVID-19 pandemic. The financial mechanism of the Facility includes grants and loans through the implementation of national recovery and resilience plans developed in line with the objectives of the European Semester, also with regard to the green and digital transitions and the resilience of national economies. The Recovery and Resilience Facility was established within the ECI with a budget of EUR 672.5 billion, of which EUR 312.5 billion are to be allocated in grants and EUR 360 billion in loans for the recovery of EU economies hit by the crisis caused by the COVID-19 pandemic.

Among the most important processes that make for the external conditions, it is worth to enlist the following geopolitical changes:

- Russian **Invasion** against Ukraine and full-scale war;
- Growth of **global tensions** which grow into **real armed conflicts**. The ongoing conflict in the Gaza Strip between Israel and Palestine, in which the

⁵ In the method of allocating funds, in addition to GDP per capita, new criteria were introduced-youth unemployment, low education levels, climate change and activities related to the reception and integration of migrants.

⁶ On December 11, 2019, the European Commission published a communication on the European Green Deal.

⁷ Recovery and Resilience Facility (RRF) – presented by the European Commission (EC) on May 27, 2020

same countries that help Ukraine (USA, NATO countries) are often directly or indirectly involved, also leaves an impact on the situation in our region;

- **A new balance of power in the global dimension**, which is determined primarily by the rivalry between the United States and China. China, as an important distributor of products and technologies, as well as a powerful sales market, plays a key role in shaping global economic relations;
- Changes in the security architecture in Europe, i.e. the enlargement of NATO to include Finland and Sweden alters the geostrategic situation in the Baltic Sea region along with the increase in the military and economic presence of the United States in Europe;
- Processes of change in the European Union, including the expansion of the EU by new Member States (including Ukraine) and the internal EU reforms.

2. National conditions

During the period of work on the SRWL 2030, the most important development policy document on the country level continued to be the Strategy for Responsible Development until 2020 (with a perspective until 2030)⁸. In the system of programming documents, it plays the role of the country's medium-term development strategy.

The SRD is based on the assumption of sustainable development where needs of the current generation are met without reducing the opportunities of future generations. The document defines the **doctrine of the state's regional policy**, based on a functional understanding of cohesion. According to the model adopted in the document, justifying an allocation of aid funds will no longer be solely based on the level of development or the occurrence of certain unfavorable issues, but also on the **predetermined determination to use endogenous potentials**, which in the long term should generate an added value and help in establishing self-financing sources of development. As the new policy development model increases the participation of state institutions in shaping economic, social and territorial processes. Responsible state intervention that sees both quantitative (macroeconomic growth indicators) and qualitative effects (human and social capital) requires the use of an **integrated approach**. Such an approach should also be applied to the regional development policy conducted by the Voivodeship Self-Government, which already translated into the provisions of the *SRWL 2030*.

The National Strategy for Regional Development 2030⁹ (NSRD) develops the provisions of the Strategy for Responsible Development, specified in the pillar of socially sensitive and territorially sustainable development. The NSRD is the basic

⁸ In (Polish) abbreviation SOR, adopted by the Council of Ministers on February 14, 2017.

⁹ Resolution No. 102 of the Council of Ministers of September 17, 2019 on the adoption of the "National Strategy for Regional Development 2030"

strategic document of the state for regional policies in the perspective until 2030, which designates the Areas of Strategic Intervention. In both perspectives, at the national level and in relation to the Lubelskie Voivodeship, ASIs were indicated (cities of concentrated negative socio-economic phenomena).

In accordance with the **principle of territorial concentration**, the following Areas of Strategic Intervention (ASIs) have been defined at the national level¹⁰:

- areas at risk of permanent marginalization,
- medium-sized cities losing their socio-economic functions,
- Eastern Poland Plus,
- Silesia.

In the state's regional policy, there is a clear **shift away from the concepts of competitiveness and efficiency towards equality and justice** (i.e. paying equal attention to developed and marginalised areas) and focusing on competitive advantages, local resources and internal values.

In accordance with the assumptions of the state policy, **ASI defined at the national level are covered with tailored support**, e.g. within the framework of national Operational Programs and other instruments. In case of ASI in Eastern Poland, this translates into the continuation of a targeted macro-regional program dedicated to five voivodeships, including the area of Lubelskie (Fig. 1). Areas at risk of permanent marginalisation (Fig. 2) and medium-sized cities losing their socio-economic functions (Fig. 3) will be supported obligatorily at the national and regional levels using specially dedicated instruments.



Fig. 1. Territorial scope of the Eastern Poland+ Program

Source: (European Funds for Eastern Poland 2021–2027 Program. Summary of the project for consultation (of 5 March 2021), Ministry of Development Funds and Regional Policy, 2021).

¹⁰ Areas of particular interest to the state have been identified in the SOR

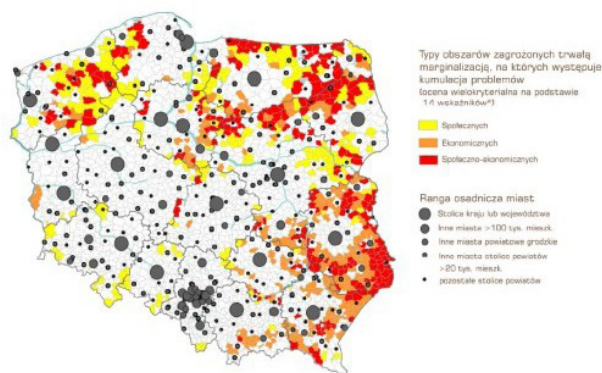


Fig. 2. Areas at risk of permanent marginalization

Source: (Strategy for Responsible Development, p. 179, 2017).

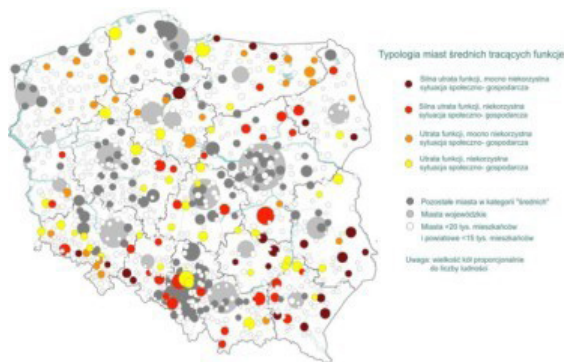


Fig. 3. Medium-sized cities losing their socio-economic functions

Source: (Strategy for Responsible Development, p. 177, 2017).

Their obligatory inclusion in the development strategies of voivodeships is related to the need to define the scope of support at the regional level. In addition to the above-mentioned ASIs, within the framework of activities aimed at the renewal of villages, it is also possible to support the degraded areas requiring revitalisation or restoration of their socio-economic functions. The adopted development model increases the participation of state institutions in shaping economic, social and territorial processes. Also the Strategy for Responsible Development is a document that indicates an integrated approach to the implementation of development policy.

Currently, Poland is in the process of preparing new editions of program documents, both for the long-term and the medium-term national development strategies. In the near future, sectoral strategies are also aimed to be updated. These alterations shall also be a premise for verifying the provisions in the adopted documents at the regional level, including voivodeship development strategies.

Internal conditions

The **level of the development** and its position for the Lubelskie Voivodeship are influenced by, i. a.: the condition and competitiveness of the region, low level of urbanisation, relatively poor infrastructure, large share of traditional sectors (including agriculture) generating low added value per employee, low investment attractiveness, migration outflow and geographical and geopolitical factors, including the so-called peripherality but well – developed public research and development sector.

Also crucial for the development of the Voivodeship are the strategic intentions of other regions (especially neighboring regions) and those located in countries directly bordering the voivodeship.¹¹ Also of great importance are the innate potential, policies and development intentions of the core cities in the region, especially Lublin and sub – regional cities such as Zamość, Biała Podlaska, Chełm, Puławy, as well as regions aspiring to perform sub – regional functions, including: Biłgoraj, Hrubieszów, Janów Lubelski, Kraśnik, Łuków and Włodawa.¹²

The diagnosis of the socio – economic situation of the region, as well as analysis of occurring changes in Europe and in the world indicate points for special focus on the Lubelskie Voivodeship's development path. They are to concern both the points of issue of the region itself and global phenomena, as well as, e. g., a release of productive energy potential from stakeholders, socio – economic entities, scientific communities and residents to utilize arising opportunities in the area of societal and technological modernization.

The proposed development goals of the Lubelskie Voivodeship are connected to the identified development challenges. They create a coherent and mutually complementary system, in which the effects of a set of goals generate and reinforce the effects of implementing other goals. The overarching idea is to use the development potentials, modernize the economy, innovate and improve the quality of life of the residents.

Development goals have been defined taking into account the adopted vision that the region intends to implement. They are also linked to the potentials and conditions identified in the diagnosis, as well as the needs and expectations resulting from the implementation of the Strategy (Fig. 4).

The architecture of goals presented in the *SRWL 2030* also contained territorially sustainable development, based on the use of local and regional potentials and the identification of regional specializations, the role and importance of which was

¹¹ To be taken into account during works on the *SRWL* until 2030 project.

¹² Spatial Development Plan of the Voivodeship (Resolution No. XI/162/2015 of the Regional Assembly of the Lubelskie Voivodeship of October 30, 2015).

elaborated on in the Regional Innovation Strategy of the Lubelskie Voivodeship until 2030, complementary to the *SRWL 2030*.¹³

The functional and spatial structure model of the Lubelskie Voivodeship included in the *SRWL 2030* defines the spatial framework for planned development activities in the region. The Strategy constitutes a platform for coordinating projects in two interpenetrating functional systems, i.e. the natural system and the anthropogenic system.¹⁴ Taking into account the state of development and existing resources and potentials, the *Spatial Development Plan of the Lubelskie Voivodeship*¹⁵ indicates the basic elements of the functional and spatial structure connected to its development priorities.

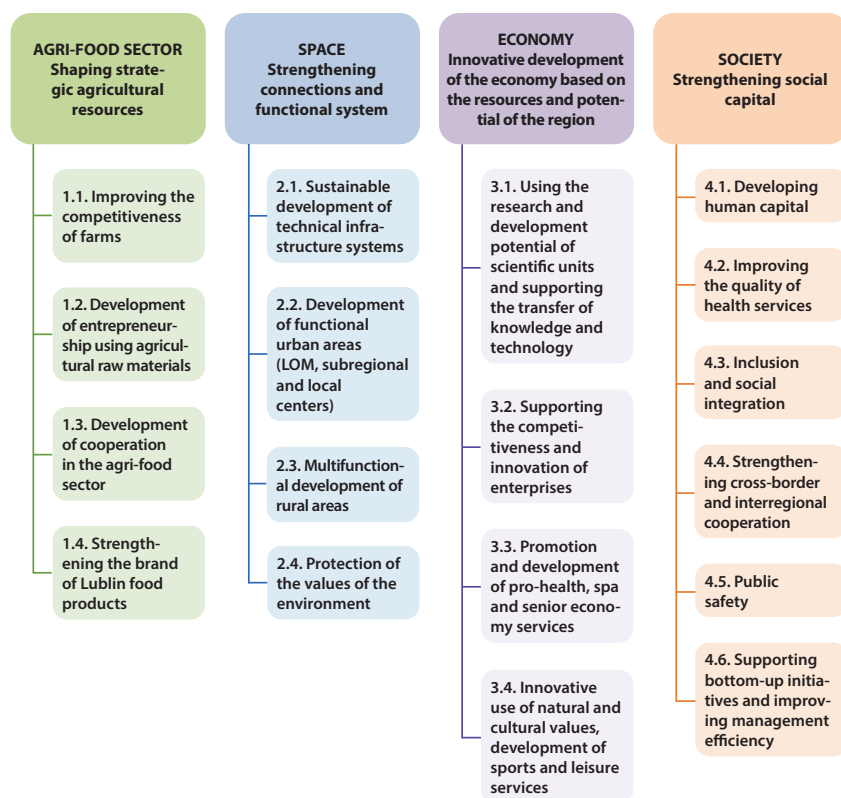


Fig. 4. Architecture of strategic and operational goals of the *SRWL 2030*

Source: (SRWL 2030, p. 59).

¹³ Resolution No. XXIV/407/2021 of the Regional Assembly of the Lubelskie Voivodeship of 29.03.2021

¹⁴ The act on voivodeship self – government (Art. 11 item 1c, sub-item 4)

¹⁵ Resolution No. XI/162/2015 of the Regional Assembly of the Lubelskie Voivodeship of 30.10.2015

These are differentiated and indicate actions aimed at maintaining and strengthening the basic (leading) functions of: **crisscrossing elements of anthropogenic system** – intensive socio-economic development along with ensuring the proper functioning of local natural systems that determine the quality of the living spaces in relation to:

- basic elements of the **settlement network** – concentration of urbanization (including economic development) and its progression in suburban areas of organized spatial systems,
- places that constitute **transport service links** – for spatial and infrastructural development in the vicinity of invested areas,
- places under the **development of non – agricultural entrepreneurship** and the concentration of investment in organized economic activity zones,
- existing **large industrial plants** and preferred growth of industrial investment in the vicinity of the plants.
- **linear elements of the anthropogenic system** – development of transport infrastructure ensuring efficient communication connections, minimizing threats to public safety and collisions with elements of the regional ecological network,
- **crisscrossing elements of the natural system** – subordination of all activities to the preservation of natural values,
- elements for integrity and spatial **continuity of the natural system** – subordination of activities aimed at maintaining the continuity of ecological connections,
- **areas of interpenetration of natural and anthropogenic systems** – multifunctional development of rural areas, preservation of the natural values of agricultural production space resources and sustainable development of agricultural economy and the accompanying functions.

The Areas of Strategic Intervention (ASI) were designated as a reflection on the need for special support for implementation of selected directions of *SRWL 2030*:

- Urban Functional Areas (designated for the voivodeship centre area, sub-regional centres and district towns),
- sub-regional ASI, i.e.: Roztocze, Powiśle, Polesie, Podlaski and Żywicielski.

The strong and effective networks of socio – economic connections and relations within the framework of territorial cooperation of local government units lead to the use of financial and other mechanisms aimed at the sustainable development. The territoriality of development processes leads to growing inter dependencies between entities and the territories themselves.

At the operational level, the territorial approach focuses on three fundamental elements:

- creation and deployment of regional assets and conditions (specific endogenous resources, internal social and economic connections, cooperation networks, informal institutions);

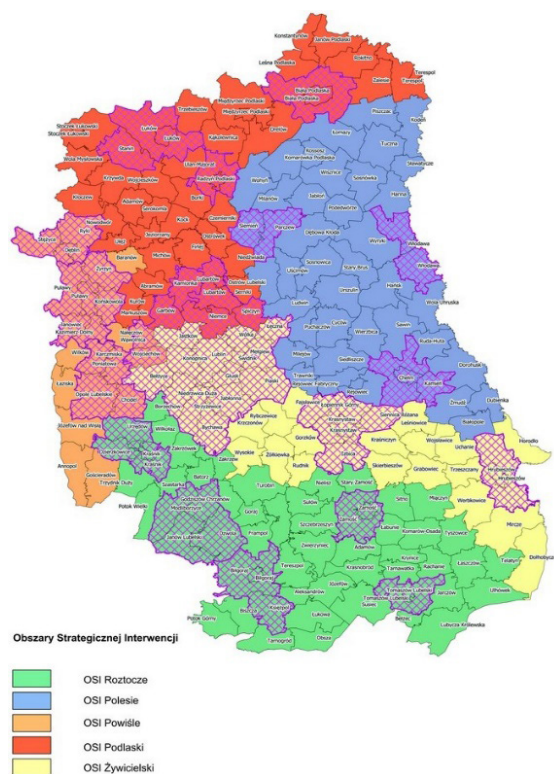


Fig. 5. Regional ASI in the SRWL 2030

Source: (SRWL 2030, p. 94).

- integration of activities undertaken in various institutional systems and strengthening participation, partnership and cooperation to build foundation for socio – economic development;
- dynamics of development mechanisms in functional areas, creating coherent territories regardless of the political – administrative system.

Therefore, it should be pointed out that the territorial development model is often referred to be functioning on the distinct – area – basis and shaping an integrated development approach as the most effective at various levels of programming (local, regional and national).

Moreover, given the **strategic partnership** between Poland and Ukraine and their important role in international and cross-border cooperation, *SRWL 2030* also defined the long-term framework of cooperation. The Lubelskie Voivodeship actively cooperates with **8 regions** of Ukraine under partnership agreements (Fig. 6):



Fig. 6. Partner Regions of the Lubelskie Voivodeship

Source: Own study by the (DSD, Lublin, 2024).

- Luhansk Oblast (11.09.2003)
- Lviv Oblast (16.06.2004)
- Volyn Oblast (16.06.2004)
- Odessa Oblast (15.04.2005)
- Rivne Oblast (23.03.2011)
- Ternopil Oblast (15.11.2018)
- Khmelnytskyi Oblast (12.12.2023)
- Zakarpattia Oblast (agreement of 13.02.2024)

In the long perspective of cooperation with the regions of Ukraine, nature and directions of the cross – border cooperation should be redefined, accenting the strength of cooperation and opening of the Ukrainian border. During the anticipated normalization of the political situation accompanied by the Ukraine closer on the path to the European Union, the expected phenomena include an intensification of business contacts, as well as an increase in the activity of Polish companies towards operating and investing in Ukraine.

The impact of the war in Ukraine on the Lubelskie Voivodeship condition

Russian aggression and the resulted full – scale war on the Ukrainian grounds have significantly influenced and stirred new processes throughout Europe, bringing a strategic significance to Poland, including the directly bordering the conflicted site of Lubelskie Voivodeship. The impact and consequences of Russia's attack on

Ukraine, as well as the largest migration of people in Europe since World War II, have caused a number of problems and threats, as well as social and economic challenges, not only on the scale of our country and in the regional dimension, but also in the international system.

Due to their proximity to the place of the outbreak of the hostilities, eastern Poland voivodeships, i.e. Podkarpackie, Lubelskie, Podlaskie, Warmińsko-Mazurskie and Świętokrzyskie were affected with the strongest impact wave. Additionally, the enlisted voivodeships are characterized by specific structural development limitations and a threat of marginalization due to the so – called peripheral location along the eastern border of the EU. The roots of these challenges can be traced back to long periods of under investment and the unstable situation in Eastern Europe.

The **Association Agreement between the European Union and Ukraine** has been in force since September 2017¹⁶, the aim of which is to establish deeper political ties, closer economic relations and propagate respect for common values. The outbreak of war significantly **accelerated actions and decisions** aimed at **integrating Ukraine with the European Union**. In February 2022, Ukraine applied for EU membership and in June 2022, the European Council granted the country a **status of a candidate**¹⁷. Observably, the significant efforts to achieve the goals that constitute the basis for achieving a candidate status undertaken by Ukraine under very difficult conditions were appreciated.

In this context, the direct **challenge** for Polish country and individual, especially **border regions** is to actively support Ukraine on the road to being granted a full EU membership by:

- assisting in introduction of necessary social and economic reforms;
- ensuring the participation of Polish regions experienced after the accession process and providing broad support and assistance in adapting Ukrainian regions to the requirements and standards set by the European Commission for the accession process.

The conditions resulting from the border location, as well as the crisis caused by the ongoing war in Ukraine imply the **new points of focus** for the Lubelskie and Podkarpackie Voivodeships. These include:

- participation of regional economies in the Ukraine Reconstruction Plan¹⁸,
- social affairs (including social care, medical assistance, education, housing),

¹⁶ Decision (EU) 2017/1247 and Decision (EU) 2017/1248 on the conclusion, on behalf of the EU, of the Association Agreement with Ukraine.

¹⁷ European Parliament resolution of June 23, 2022 on granting to Ukraine, the Republic of Moldova and Georgia the candidate country status (2022/2716(RSP)).

¹⁸ On April 21, 2022, President Volodymyr Zelensky established the National Council for the Reconstruction of Ukraine from the Consequences of War, which included, i. a., Ministers, the Governor of the Central Bank and about 2.5 thousand experts. The Council prepared a draft National Reconstruction Plan of Ukraine and presented it at the international conference in Lugano (July 4–5, 2022).

- labour market (providing qualification opportunities, propelling employment), ensuring public security and border protection,
- modernization and development of transport and logistics border infrastructure,
- development regional economies and entrepreneurship,
- redefining directions and nature of cross – border cooperation,
- ensuring energy security,
- supporting and building systemic support for Ukraine in its efforts to integrate with the European Union.

A very important challenge is developing a substantial offer to engage the Polish regions in participation in the **reconstruction of Ukraine**. In June 2022, the President of Ukraine approved the **National Plan for the Reconstruction of Ukraine** (after the war), which assumes, i. a., full access to the EU and G7 markets to include Ukrainian producers in global supply chains, creation of logistics routes to the West, transfer of technologies for economic sectors or advancing development of processing in industries that provide the highest income from exports. Due to the geopolitical location and previous history of cooperation, Lubelskie Voivodeship stands to assume a special, strategic role.

In order to determine the possibilities of participation and the scope of involvement of the economic and social potential of the Lubelskie Voivodeship in the process of reconstruction of Ukraine, within the scope of operations of the Marshal Office of the Lubelskie Voivodeship in Lublin, the Department of Strategy and Development has developed the “Assumptions of the Participation of the Lubelskie Voivodeship in the Plan for the Reconstruction of Ukraine”. Therein, potential areas of cooperation, et. al., are indicated (Fig. 7).

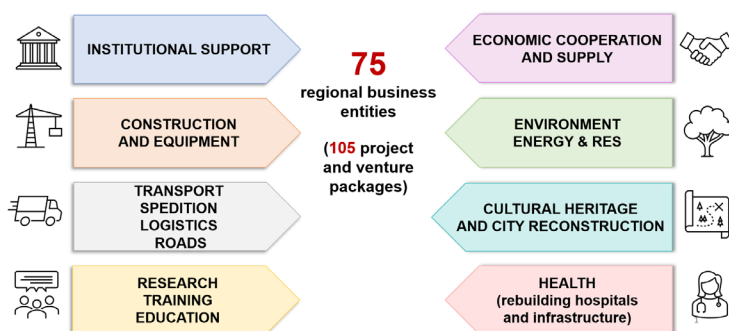


Fig. 7. Main areas of socio-economic cooperation identified during work on the “Assumptions of the Participation of the Lubelskie Voivodeship in the Plan for the Reconstruction of Ukraine”.

Source: Own study by the (DSD, Lublin, 2024).

The above mentioned document is formulated in the following framework:

- directions of activities and policies for Poland,
- directions and priorities contained in the National Plan for the Reconstruction of Ukraine,
- policy defined in the Development Strategy of the Lubelskie Voivodeship until 2030 (SRWL 2030),
- Polish and Ukrainian institutions, social and economic entities, administrative and local government units.

Additionally, the work of “Assumptions of the Participation of the Lubelskie Voivodeship in the Plan for the Reconstruction of Ukraine”:

- is aimed at achieving common benefits and synergy effects,
- was developed in cooperation with interested social and economic entities,
- is a balanced and diversified offer of activities in specific thematic areas,
- identifies current potential sources of financing,
- specifies effective use of funds dedicated to projects and tasks related to the reconstruction of Ukraine,
- is flexible and open.

Conclusion

1. In the context of conditions and problems resulting from ongoing geopolitical and other mentioned processes, it can be stated that Poland, along with the Lubelskie Voivodeship are met with the fundamental challenge of ensuring multidimensional security encompassed by the below: national, military, energetic, food, and demographic security.

With regard to the necessary security measures, what should be pointed out is that the growing threats to border security make it necessary to strengthen military potential, while uncontrolled migrations threaten stability and may have negative consequences in both the social and economic dimensions.

2. The ongoing war in Ukraine has a relatively large impact on the socio – economic situation of border regions since its eruption in 2022, including the region of Lubelskie Voivodeship. Its effects are most noticeable in the following sectors: entrepreneurship, energy security, labor market, social services (health care, education, social assistance).

3. Potential domestic and foreign investors, due to the location in the vicinity of Ukraine and Belarus, tend to overlook the Lubelskie Voivodeship as a region framed into a category of staying at an increased risk of doing business (the number of private entities from the Lubelskie Voivodeship that deregistered their business in 2023 increased by approx. 2.3 thousand compared to 2020). The impact of the

war in Ukraine on key areas of business activities is felt regardless of their scope. The war has led to an increase in the prices of supply and investment goods, higher operating costs and a higher risk ranking.

4. One of the effects of the outbreak of war is an increased outflow of entrepreneurs to the esteemed as safer, other regions of the country. The inhibition of the inflow of new investments and a significant decrease in the development of existing companies directly translates into lower GDP growth and indirectly, into a decrease in the income of local government units. Therefore, it becomes necessary to provide systemic and financial support, including from EU funds and in particular for border regions, addressed to both enterprises and local government units. Still, a burden in form of requiring the implementation of projects (using financial instruments) considered profitable should be avoided.

5. Another unfavorable result can be seen in the reduction of energy resource imports due to the severance of a previous energy cooperation between the European Union countries and Russia, as well as the destruction of critical energy infrastructure and the Ukrainian infrastructure as a whole. In order to counteract the deepening energy poverty of the region, it is necessary to strive to intensify actions aimed at improving energy efficiency and increasing the use of energy from renewable sources.

6. Due to the geopolitical location and cooperation history, Poland should support actions aimed at stabilizing the situation in Central and Eastern Europe. What may be of key importance is:

- helping Ukraine end the war;
- participation in the planned reconstruction of Ukraine;
- supporting Ukraine's accession processes to the EU and NATO;
- supporting processes for a free and democratic Belarus;
- ensuring an effective system of public services for migrants from Ukraine (education, health and social care) and assistance in entering the Polish labour market.

7. In the cross – border dimension and in view of the prospect of Ukraine's post-war reconstruction and accession to the EU, developing a collaborated document identifying the main problems, challenges and development proposals in the cross – border area of Poland and Ukraine is deemed as necessary. The delimitation of the area of concern could be considered in two variants (Fig. 8).

The first variant covers 5 regions directly bordering each other, i.e. on the Ukrainian side: Volyn, Lviv and Zakarpattia Oblasts; on the Polish side: Lubelskie and Podkarpackie Voivodeships.

The second variant is considered more broad and to be based on previous experience in implementing the Poland – Ukraine Cross – Border Cooperation Program, i.e. taking into account the Rivne, Ternopil and Ivano-Frankivsk Oblasts. In both variants, the axis of delimitation (cooperation) is the Polish – Ukrainian border and the both sides of directly neighboring regions.



Fig. 8. Polish – Ukrainian cross – border region (two delimitation variants)

Source: (B. Kawałko, Wybrane problemy polsko-ukraińskiej współpracy transgranicznej, Barometr Regionalny, 2 (2011), p. 39).

PAWEŁ WAIS

ANNA KIEŁBASA

Marshal Office of Podkarpackie Voivodeship in Rzeszów

DEVELOPMENT DIRECTIONS OF THE BORDER AREA OF POLAND AND UKRAINE IN THE LIGHT OF THE STRATEGIC DOCUMENTS OF THE PODKARPACKIE VOIVODESHIP

The basic task of the voivodeship government is to define the development strategy for the voivodeship, which is a tool for conducting development policy at the regional level. The Podkarpackie Voivodeship has already developed five generations of strategic documents. The dynamic changes taking place in the region, as well as the changes in its surroundings, including the ongoing war in Ukraine and Ukraine's pro-European aspirations, are a premise for starting work on the next generation of the voivodeship's development strategy. In the new strategy, the dimension of relations with Ukraine should be presented even more broadly, taking into account Ukraine's European aspirations.

On 1 May 2004, Poland became a member state of the European Union and since then has been using the instruments supporting regional development available to EU member states, primarily the structural funds and the cohesion fund. In the financial perspective for 2000–2006, Poland participated only to a limited extent, but this was the time of implementing institutional solutions enabling efficient implementation of development policy. Poland has been using the instruments of the EU cohesion policy only since 2004, and before that it used aid programmes, and since the announcement of Agenda 2000, the pre-accession programmes, which were: Phare (mainly Phare Social and Economic Cohesion), ISPA and SAPARD. They were to prepare Poland and its regions for participation in the instruments of the EU cohesion policy.

Currently, Poland is one of the main beneficiaries of the European cohesion policy and actively participates in its creation in subsequent programming periods of the European Union budget, and Polish experience in implementing regional policy instruments is widely recognised.

The institutional system introduced in Poland is based on the division of competences between the government and voivodeship government administration, and a special position in this respect is assigned to the voivodeship government. At the same time, it should be pointed out that the constitutional position of the voivodeship government is special here, because it has been equipped with tasks in the scope of the so-called *providing administration* to a small extent, but its main task is to conduct the development policy of the voivodeship (Kieres, 1999; Kudłacz, 2001), i.e. to shape the conditions for socio-economic development in the region. This is a very important and responsible task, which constitutes the intraregional dimension of regional policy and must remain in integral relations with its national and community dimension¹. The adoption of this model required the construction of a system for steering development processes, an important element of which was building a strong position of Polish voivodeships as active participants and partners of the government, capable of taking responsibility for shaping the face of the regions. The decentralization model adopted in Poland, as well as the shaping of development policy, was built with the perspective of our country's accession to the European Union, which was associated with taking into account the mechanisms developed in the course of the development of the European cohesion policy (Szlachta, 2011).

At the level of the European Union, cohesion policy is often identified with regional policy². For example, on the official website of the European Union: <https://eur-lex.europa.eu>, there is the following entry: *To emphasize the importance of regional policy, the Treaty on the Functioning of the European Union (EU) devotes five articles to «economic, social and territorial cohesion» (Articles 174-178)*³. And further, *EU cohesion and regional policy strengthen economic, social and territorial cohesion in the Member States and regions of the EU through job creation, competitiveness, economic development, higher quality of life and ecological and digital transformation*⁴

Regional policy in the European Union is one of the most important policies implemented at the community level. Its beginnings date back to the Treaty of Rome, in the preamble of which, as one of the main intentions of the EEC, it was indicated that the Member States establish the European Economic Community *in order to strengthen the unity of their economies and ensure their harmonious development*,

¹ See Art. 11 et seq. of the Act of 5 June 1998 on voivodeship government (consolidated text: Journal of Laws of 2013, item 596, as amended).

² Cohesion policy emphasises the objective of the policy pursued, while regional policy emphasises the subject and object of influence, while structural policy refers in particular to the financial instruments of the policy pursued.

³ See https://eur-lex.europa.eu/summary/chapter/regional_policy.html?root_default=SUM_1_CODED%3D26&%3Blocale=en&locale=pl on 16/01/2025.

⁴ See Ibid.

*by reducing the differences existing between individual regions and the delays of less favoured regions*⁵.

The basic legal act that defines development policy in Poland is the Act of 6 December 2006 on the principles of development policy (Journal of Laws of 2021, item 1057, hereinafter referred to as the Act), which provides its definition and indicates the entities conducting this policy. According to the wording of art. 2 of this Act, development policy is understood as a set of interrelated actions undertaken and implemented in order to ensure the lasting and sustainable development of the country, socio-economic, regional and spatial cohesion, increasing the competitiveness of the economy and creating new jobs on a national, regional or local scale⁶. This definition results in the holistic nature of this policy, of which regional policy is a very important element.

Regional policy is understood in turn as the conscious and purposeful activity of central public authorities aimed at regulating interregional development proportions. It has several dimensions and levels of implementation. It can be an intraregional policy, i.e. implemented in the region and on its behalf by regional authorities. It can also be an interregional policy, i.e. implemented by central authorities in relation to regions. Regional policy is therefore implemented at the level of the region, at the level of the state and also at the level of the integration grouping such as the European Union.

The provisions of the Act on the principles of conducting development policy indicate that its scope has been defined broadly, includes and integrates other policies, including cohesion policy, regional policy, and spatial policy. Development policy is therefore integrative in nature and is a public policy aimed at ensuring the development of the country and all its territories in a specific, usually medium- and multi-year period of time.

According to the provisions of the aforementioned act, development policy is conducted by:

- 1) the Council of Ministers;
- 2) the voivodeship government;
- 3) metropolitan associations;
- 4) the district and municipal government.

The Act therefore sets three basic levels of development policy, which are: the national level, the regional level and the local level, with the emerging metropolitan associations gaining a special position at the local level (*Komornicki, et. al., 2013*).

⁵ Preamble to the Treaty establishing the European Economic Community. Polish text from <http://eur-lex.europa.eu/pl/treaties/index.htm#founding> dated 10/07/2009.

⁶ Art. 2 of the Act of 6 December 2006 on the principles of development policy (Journal of Laws of 2021, item 1057).

It should be emphasized at the same time that the role of the coordinator of development policy, implemented with the participation of state budget funds, development funds from the European Union and other external sources, is entrusted by the act to the minister for regional development. In turn, in light of the provisions of the act, the activities of the voivodeship government side are coordinated by the voivodeship government through the creation and implementation of strategic and program documents relating to the entire voivodeship (*Kudelko, 2005*). The provisions of the act, in relation to the management of development policy, were developed in the document *The management System for the development of Poland*, which the Council of Ministers adopted on 29 October 2018.

The Act on the principles of conducting development policy indicates that local government units implement tasks in the field of development policy based on strategic documents, i.e. in particular based on the development strategy. Thus, the system of national programming documents is supplemented by the development strategies of the voivodeships. They are perceived as an important element of the country's development programming system, and their task is to define the objectives of regional development, at the level of individual voivodeships – regions. The development strategies of voivodeships in Poland must be consistent with strategic documents at the national level, in particular with the medium-term development strategy of the country, as well as with the national strategy of regional development. The aim of this is to ensure the coherence of objectives and actions within the framework of the national development policy.

It is worth noting that the Act of 5 June 1998 on the Voivodeship Government (Journal of Laws of 2022, item 2094, as amended, hereinafter referred to as the Voivodeship Government Act), already in Article 11 indicates that the voivodeship government determines the development strategy for voivodeships⁷, and the indication of the remaining tasks of the voivodeship government is found in Article 14 of this Act. As you can see, this is one of the basic and most important tasks, and at the same time, competences of the regional level government in Poland

The voivodeship government is responsible for the broadly understood development of the region. This results from legal regulations (the act on voivodeship government, the act on the principles of conducting development policy), as well as from program documents adopted by the voivodeship government (voivodeship development strategy, development programs, regional operational program, other voivodeship programs).

According to art. 11 sec. 1e of the Act of 5 June 1998 on the Voivodeship Government, the Voivodeship Development Strategy is subject to update if the social, eco-

⁷ See Article 11 of the Act of 5 June 1998 on the Voivodeship Government (consolidated text: Journal of Laws of 2022, item 2094, as amended)

nomic or spatial situation of the voivodeship requires it or if it is necessary to maintain its coherence with the medium-term national development strategy or the national regional development strategy. The document update process is specified in the provisions of the Rural Development Act and the Act of 6 December 2006 on the principles of development policy. These provisions also impose the obligation to maintain programming coherence between regional strategies and national strategic documents (art. 11 sec. 1d of the Rural Development Act and art. 13 of the Rural Development Act). This means that any change in the national concept and priorities results in the obligation for voivodeship governments to take action to adjust regional strategies.

The Podkarpackie Voivodeship government has developed the following generations of regional strategic documents since its establishment:

- 1) *Development Strategy of the Podkarpackie Voivodeship for the years 2000–2006* – adopted by Resolution of 27 March 2000, No. 108/554/2000),
- 2) *Development Strategy of the Podkarpackie Voivodeship for the years 2007–2020* – adopted by Resolution No. LXIII/790/06 of the Voivodeship Assembly of the Podkarpackie Voivodeship of 20 October 2006 on the adoption of the Development Strategy of the Podkarpackie Voivodeship for the years 2007–2020,
- 3) *Development Strategy of the Podkarpackie Voivodeship for the years 2007–2020. Update 2010* – adopted by Resolution No. L/932/10 of the Voivodeship Assembly of the Podkarpackie Voivodeship of 23 August 2010 on the update of the Development Strategy of the Podkarpackie Voivodeship for the years 2007–2020,
- 4) *Development Strategy of the Podkarpackie Voivodeship – PODKARPACKIE 2020* – adopted by Resolution No. XXXVII/697/13 of the Podkarpackie Voivodeship Assembly of 26 August 2013 on the update of the Development Strategy of the Podkarpackie Voivodeship for the years 2007–2020,
- 5) *Voivodeship Development Strategy – PODKARPACKIE 2030* – adopted by the Podkarpackie Voivodeship Assembly on 28 September 2020 by Resolution No. XXVII/458/20 on the adoption of the Voivodeship Development Strategy – Podkarpackie 2030⁸.

It can therefore be responsibly said that the Podkarpackie Voivodeship government, like all voivodeship governments in Poland, has extensive experience in creating a voivodeship development strategy. Five generations of strategic documents have allowed us to acquire the skills of defining the most important strategic goals, indicating development directions, and finally, programming activities. It should be emphasized that the strategic thinking in voivodeship governments in Poland is currently mature, and the instruments for its creation, monitoring and evaluation are constantly

⁸ Voivodeship Development Strategy – PODKARPACKIE 2030 (adopted by the Voivodeship Assembly of the Podkarpackie Voivodeship on 28 September 2020 by Resolution No. XXVII/458/20 on the adoption of the Voivodeship Development Strategy – Podkarpackie 2030).

being developed. Similarly, when it comes to the instruments for implementing the development strategy. Voivodeship governments in Poland are an important element of the system for implementing the instruments of the European Cohesion Policy, but they also develop instruments for influencing the economic, social and other areas⁹. This can be seen, for example, by reviewing the annually presented reports on the state of the voivodeship.

Analyzing the strategic documents of the Podkarpackie Voivodeship, one can notice, firstly, that these are strategies of the entire voivodeship and not strategies of the Marshal's Office and the voivodeship government alone. They are written from the perspective of the entire region and are addressed to the entire regional community, all three levels of local government, entrepreneurs, government administration and finally civil society and its organizations. Secondly, the voivodeship development strategies try to provide answers to the most important challenges facing the local government community, therefore, as the main goal, they indicate the need to build the competitive position of the voivodeship and the well-being of society. The table below presents a summary of the main goals of all the development strategies of the Podkarpackie Voivodeship (Tabl. 1).

The currently applicable *Development Strategy of the Podkarpackie Voivodeship 2030* (SRWP 2030) was adopted by the Regional Assembly of the Podkarpackie Voivodeship by Resolution No. XXVII/458/20 on 28 September 2020. SRDPV 2030 was developed in accordance with the country's development policy specified in the *Strategy for Responsible Development until 2020 (with a perspective until 2030)* and the *National Regional Development Strategy 2030*.

SRDPV 2030, taking into account the correction of development policies at the national and regional level, as well as conclusions from the diagnosis of socio-economic conditions, indicates areas requiring support, and also assumes the search for new development impulses in order to increase the territorial and socio-economic cohesion of the entire area of the voivodeship.

Table 1. Summary of the main objectives of the development strategy of the Podkarpackie Voivodeship.

No.	Strategy name	The main goal indicated in the strategy
1.	DEVELOPMENT STRATEGY OF THE PODKARPACKIE VOIVODESHIP FOR THE YEARS 2000 – 2006	<i>Priorities adopted:</i> – multifunctional development of rural areas – development of entrepreneurship – development of the tourist product

⁹ See Report on the condition of the voivodeship, adopted by Resolution No. 7/141/24 of the Podkarpackie Voivodeship Board in Rzeszów of 28 May 2024, available at: Report_o_stanie_województwa_podkarpackiego_za_2023_r._PLIK_DOCX_421_MB.docx on 10 January 2025.

No.	Strategy name	The main goal indicated in the strategy
2.	DEVELOPMENT STRATEGY OF THE PODKARPACKIE VOIVODESHIP FOR THE YEARS 2007 – 2020.	<i>Raising the national and international competitiveness of the region's economy by increasing its innovativeness and thus efficiency, which will create conditions for increasing employment and increasing the income and standard of living of the population.</i>
3.	DEVELOPMENT STRATEGY OF THE PODKARPACKIE VOIVODESHIP FOR THE YEARS 2007 – 2020. Update 2010.	<i>Raising the national and international competitiveness of the region's economy by increasing its innovativeness and thus efficiency, which will create conditions for increasing employment and increasing the income and standard of living of the population.</i>
4.	VOIVODESHIP DEVELOPMENT STRATEGY – PODKARPACKIE 2020.	<i>Effective use of internal and external resources for sustainable and intelligent socio-economic development as a way to improve the quality of life of residents.</i>
5.	VOIVODESHIP DEVELOPMENT STRATEGY – PODKARPACKIE 2030	<i>Responsible and effective use of the region's endogenous and exogenous resources, ensuring lasting, balanced and territorially even economic development and high quality of life for the voivodeship's inhabitants.</i>

Source: own work.

SRWP 2030 also constitutes a framework for the regional operational program European Funds for Podkarpackie Voivodeship 2021 – 2027, and development programs.

The *Podkarpackie Voivodeship 2030 Strategy* was created by including a wide range of stakeholders in the process of its creation and implementation through social consultations with the widest possible group of recipients: society, institutions, entrepreneurs. It is therefore a document that is an expression of a regional compromise, and its recognition is significant¹⁰.

SRDPV 2030 is a guideline for actions taken by regional authorities at every level of development management, including local governments. It indicates areas requiring support and also assumes searching for new development impulses in order to increase the territorial and socio-economic cohesion of the entire voivodeship area. It is expanded upon by documents in the nature of development programs, including:

- 1) *Regional Innovation Strategy of the Podkarpackie Voivodeship for 2021–2030*¹¹,
- 2) *Strategic Transport Development Programme of the Podkarpackie Voivodeship 2030*¹²,
- 3) *Bieszczady Strategic Development Program*¹³,

¹⁰ See *Report on the implementation of the Development Strategy of the Podkarpackie Voivodeship 2023*. Geoprofit, Warsaw, October 2024.

¹¹ Adopted by Resolution No. 351/6976/22 of the Podkarpackie Voivodeship Board in Rzeszów on January 11, 2022, available at: Regional Innovation Strategy of the Podkarpackie Voivodeship on January 10, 2025

¹² Adopted by Resolution No. 570/12169/24 of the Podkarpackie Voivodeship Board in Rzeszów of 23 February 2024, available on the website at: <https://www.podkarpackie.pl/index.php/rozwoj-regionalny/regionalny-plan-transportowy> on 14 January 2025.

¹³ Adopted by Resolution No. 64/1534/24 of the Podkarpackie Voivodeship Board in Rzeszów on December 30, 2024. Available at: Podkarpackie Voivodeship Government Portal – Adoption of the

4) “The Blue San” Strategic Programme ¹⁴,

5) *Roztocze Development Program* ¹⁵.

Obviously, the fact of the border location was clearly indicated in the Podkarpackie Voivodeship 2030 Strategy. The Podkarpackie Voivodeship, as a region bordering Ukraine, has unique features and development potential resulting from its location. The state border, which is also the eastern border of the EU, is both a challenge and an opportunity for the development of the region. Many social, economic and political processes in the region are shaped by its border character.

The border location of the voivodeship on the external border of the European Union, combined with the proximity of Ukrainian regions with a relatively lower level of development, constitutes a major challenge for conducting regional policy. This situation encourages the search for non-standard solutions to overcome development barriers and limitations resulting from the peripheral location. Cross-border relations are key in this context, which, as emphasized by the *Development Strategy of the Voivodeship – Podkarpackie 2030*, are an important factor in the development of the region, which, thanks to its strategic location, has the chance to become a leader in the area of international cooperation in Central and Eastern Europe. Using this potential requires coordinated actions in the field of infrastructure, environmental protection, social and economic cooperation, while taking into account contemporary challenges and changes in EU policy.

In principle, all strategic documents of the Podkarpackie Voivodeship, including SRDPV 2030, in the area of economy indicate that the proximity of the border is conducive to the development of trade and economic exchange, especially in the transport, logistics and export sectors. In this context, it is important to promote economic cooperation, which will, among other things, facilitate the expansion of small and medium-sized enterprises (SMEs) into the markets of neighboring countries, including support in the field of export and promotion. They also indicate the development of smart specializations with cross-border partners, including the creation of economic clusters. Priorities include, among others, aviation and space science, as well as information and communication technologies. In the context of the development of the region's economy and international cooperation, the exchange of knowledge and experience in the process of mutual learning is also important, as

Bieszczady Strategic Development Program along with the Environmental Impact Forecast on January 10, 2025.

¹⁴ Adopted by Resolution No. 64/1533/24 of the Podkarpackie Voivodeship Board in Rzeszów of December 30, 2024. Available at: Podkarpackie Voivodeship Government Portal – Adoption of the Błękitny San Strategic Program together with the Environmental Impact Forecast on January 10, 2024.

¹⁵ Adopted by Resolution No. 64/1533/24 of the Podkarpackie Voivodeship Board in Rzeszów of December 30, 2024. Available at: Podkarpackie Voivodeship Government Portal – Adoption of the Błękitny San Strategic Program together with the Environmental Impact Forecast on January 10, 2024.

well as participation in international organizations and establishing partnerships in order to strengthen the competitive position of the region.

A huge capital that should be developed and used is the network of cross-border partnerships and contacts between local and regional authorities. Local governments, cultural institutions, universities, non-governmental organizations from Podkarpackie Voivodeship have been cooperating with partners from Ukraine for years in the areas of economy, tourism, education, culture, science and others. Participation in economic events, fairs, trainings and workshops organized on both sides of the border is of great importance for the development of mutual relations.

The importance of cross-border cooperation is particularly evident in the development of transport infrastructure. The voivodeship strategy emphasises that the region plays a key role in trans-European transport corridors (e.g. Via Carpatia), which connect Central and Eastern Europe with Ukraine and further with Asia, and indicates the need to increase communication accessibility in border regions, which will strengthen trade and tourism. The chapter on transport indicates key investments in transport infrastructure, such as the development of connections with Ukraine (e.g. LHS broad-gauge line) and the modernisation of border crossings. These investments are of key importance for increasing the accessibility of the region and strengthening its economic competitiveness.

Another priority of cross-border relations is environmental protection and management of natural heritage resources. The Podkarpackie Voivodeship's membership in the Carpathian Macroregion creates unique opportunities for international cooperation and implementation of joint projects with partners from Ukraine. SRWP 2030cz draws attention to the need to protect biodiversity and develop renewable energy sources in cooperation with neighboring regions.

The Podkarpackie Voivodeship Development Strategy 2030 also indicates the need for effective use of available EU funds, while emphasizing the role of EU programs, such as Interreg, which enable the implementation of cross-border projects in the field of infrastructure, environmental protection and innovation.

In the context of external conditions and current geopolitical challenges, SPDV 2030 emphasizes the importance of border stability and security, with particular emphasis on migration and humanitarian aid. Podkarpackie Voivodeship, as a border region, plays an important role in implementing these activities. The document draws attention to, among other things, the need to secure cross-border health and economic infrastructure.

Cross-border relations also have a socio-cultural dimension. The strategy document emphasizes the importance of educational and cultural projects that build trust and bonds between communities on both sides of the border. Joint initiatives in the field of social capital and civil society are an important element in strengthening integration and supporting social development.

Poland played a significant role in initiating cooperation within the Euroregions, and the Podkarpackie Voivodeship joined in the creation of the Carpathian Euroregion. It was established in 1993 as the second in Poland. The premise for its creation was primarily to initiate, organize and coordinate activities for the development of multilateral cooperation between members of the Association in the fields of economy, ecology, tourism, culture and education, to support specific projects and plans of common interest, including projects financed from the European Union budget and to develop good neighborly relations between the regions.

The Euroregion covers five countries: Poland, Romania, Slovakia, Ukraine and Hungary. The current geopolitical situation and the issue of Ukraine's aspirations to integrate with the European Union (i.e. the only country belonging to the Carpathian Euroregion outside the EU) create an opportunity for the indicated Euroregion to contribute to strengthening cooperation and become a platform for European integration. Euroregional cross-border cooperation is financed from EU funds. The instrument supporting the development of cross-border cooperation are Interreg programs.

In the financial perspective 2021–2027, the Interreg NEXT Poland-Ukraine 2021–2027 Programme is being implemented in the Polish and Ukrainian border areas. This is the fourth edition of the programme supporting development processes on the border of Poland and Ukraine by co-financing various projects. The implementation of joint projects promotes the economic development of the areas included in the Euroregion and improves the living conditions of its inhabitants.

It is worth noting that the Association of the Carpathian Euroregion Poland initiated the creation of new organizational, legal and functional solutions supporting international cooperation in the Carpathians at the local and interregional level. Such a solution is the Cross-Border Functional Areas, the so-called CFAs. To date, three Cross-Border Functional Areas have been established, i.e. CFA Kremenaros, CFA Beskid Niski and CFA Brama Przemyska. The purpose of CFAs is to act in the interest and for the benefit of border communities, by initiating international cooperation of entities, environments and residents¹⁶.

The Podkarpackie Voivodeship, as a border region, attaches great importance to cooperation with regions of neighbouring countries, but also actively participates in a number of initiatives implemented together with regions of EU countries, and especially regions of Central European countries. The Three Seas Initiative is of great importance for the voivodeship, which serves to strengthen ties in the broader region of Central Europe (between the Baltic, Adriatic and Black Seas), creating lasting

¹⁶ Information on the website of the Carpathian Euroregion Association at: Cross-border Functional Areas | karpacki.pl available on 10/01/2025.

foundations for economic development, including in the field of energy, transport, digital communication and economy.

The priority for the Three Seas Initiative is to build a coherent and well-integrated infrastructure in Central Europe, which will make it possible to make up for the development delays resulting from historical events. Thanks to this, the infrastructural and economic inequalities of the common European market will be reduced, which will limit the division of the EU into less and more developed areas of integration. The most important added value of the Initiative is to ensure political support at the highest level of state authorities for investments that have not been implemented so far. The Three Seas Initiative aims, among others, to expand the transport, energy and telecommunications infrastructure on the North-South line, by supporting cross-border and macro-regional projects of strategic importance for the countries of the region. The Three Seas Initiative and the functioning of the Visegrad Group (in the extended V4+2 formula) as regional models of cooperation strengthen the common identity of Central Europe.

On July 3, 2018, the Podkarpackie Voivodeship hosted the 1st Three Seas Regions Forum, with the participation and under the patronage of the President of the Republic of Poland, Andrzej Duda. It was the first event at the local government level, organized as part of the Three Seas Initiative as support for previous activities with a regional aspect, which is to serve to strengthen the Three Seas idea at the level of European regions. During the event, the Declaration for the establishment of the Three Seas Regions Observatory was signed. The document was signed by the authorities of the University of Rzeszów, the Statistical Office in Rzeszów and the Marshal of the Podkarpackie Voivodeship. The Observatory is formed by the University of Rzeszów, the Statistical Office in Rzeszów and the Podkarpackie Voivodeship Government, and the initiative is open to cooperation with similar institutions from other Three Seas countries.

Considering the international dimension, the Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) is very important for the Podkarpackie Voivodeship. It is the second multilateral international agreement on a single mountain region (after the Alpine Convention), established on the basis of international law treaty principles. It was adopted on 22 May 2003 in Kyiv and entered into force on 4 January 2006¹⁷. The parties to the Carpathian Convention are seven countries of the Carpathian region: the Czech Republic, the Republic of Poland, Romania, the Republic of Serbia, the Slovak Republic, Ukraine and Hungary. So far, the European Union has not become a party to the Carpathian Convention.

¹⁷ The Republic of Poland ratified the Carpathian Convention on 27 February 2006. On 19 June 2006 it entered into force in our country.

The Carpathian Convention is an international agreement, a multi-level governance mechanism covering the entire Carpathian area, enabling cross-sectoral integration and broad participation of various stakeholders from different levels (national, regional, governmental, non-governmental, etc.), and therefore can be used as a preparatory stage and then an integral part of a macro-regional strategy for the Carpathians. The aim of the Carpathian Convention is international cooperation and the implementation by the States Parties to it of a comprehensive policy for the protection and sustainable development of the Carpathian region, in order to improve the quality of life, strengthen the local economy and local communities, and preserve the natural, landscape and cultural heritage of the Carpathians.

The Podkarpackie Voivodeship is strongly involved in the initiative to create a *Macro-regional Strategy for the Carpathian region*. The authorities of the region believe that it is necessary to articulate the specific needs of the Carpathian mountain areas and to use the specific endogenous potentials of the macro-region. The establishment of partnership cooperation by the Carpathian countries will allow for better adjustment of activities to these specific conditions and development needs resulting from social, historical, infrastructural and geopolitical conditions. The growing importance of macro-regional strategies in the EU regional development policy and in the process of European integration means that macro-regional strategies can become an important element of coordination of European instruments and funds.

The local government authorities of the Podkarpackie Voivodeship are of the opinion that being included in a common macro-regional strategy provides the opportunity to jointly plan and conduct “tailor-made” activities, adjusted to the specific needs and possibilities of the macro-region. On the one hand, ensuring concentration on the problems faced by the macro-region, and on the other hand – creating an opportunity to use the specific cultural and environmental potentials of the Carpathian countries. Participation in a common strategy provides the opportunity to implement flagship projects, including in the areas of transport, energy, environmental strengthening of territorial cohesion, stimulating economic growth and healthy development of the region.

The proposed territorial scope includes countries such as: Czech Republic, Slovakia, Hungary, Romania, Ukraine, Poland, Serbia and Moldova. So both countries that are in the European Union and those that are currently outside it. It is therefore a good instrument for building partnerships with countries that are candidates for the European Union and promoting European values.

The involvement of the representatives of the voivodeship in the activities aimed at creating this macro-regional strategy is significant. During the plenary session of the European Committee of the Regions in December 2019, an own-initiative opinion (CDR 3425/2019) of the COTER Commission (Commission for Territorial Cohesion Policy and the EU Budget) was adopted on the *Macro-regional Strategy*

for the Carpathian Region, whose rapporteur was the Marshal of the Podkarpackie Voivodeship, Władysław Ortyl. This is the first official EU document mentioning the Carpathian Strategy by name¹⁸.

All the above-mentioned areas of activity are strongly anchored in the Podkarpackie Voivodeship Development Strategy 2023, as well as in the program documents that develop and detail its provisions. However, all these documents, similarly to national strategies or European assumptions, did not assume a quick perspective of the European Union's enlargement to the east.

On February 24, 2022, the aggression of the Russian Federation against Ukraine began, which turned into a full-scale war, and the armed conflict continues to this day. Since the beginning of the war, the Ukrainian population has been moving from the east to the west of the country (including entrepreneurs), and a significant part of it has crossed the eastern border of the European Union. Poland, and in particular the Podkarpackie Voivodeship as a region bordering Ukraine, has played and continues to play an important role in helping the Ukrainian nation. According to data obtained from the Border Guard, from February 24, 2022 to September 12, 2023, the Polish-Ukrainian border (along its entire length) was crossed by 15.63 million refugees from Ukraine, mainly women and children. From the first days of the armed conflict in Ukraine, to facilitate crossing the border, pedestrian checks were made possible at four border crossings operating in the Podkarpackie Voivodeship. Six reception points have been set up in the region, where Ukrainian residents have received and are receiving first aid from the Polish state.

The Podkarpackie Voivodeship, as a border region, participated in numerous actions providing assistance to Ukraine and refugees located in the Voivodeship¹⁹. These were one-off actions, such as transferring equipment or food and basic necessities to partners on the Ukrainian side, as well as projects with a longer implementation period²⁰.

¹⁸ Opinion on the Macroregional Strategy for the Carpathian Region, European Committee of the Regions, COTER-VI/057.

¹⁹ As an example, it can be indicated that, by Resolution No. XLVII/780/22 of 28.03.2022, the Voivodeship Assembly of the Podkarpackie Voivodeship, acting in a sense of solidarity, transferred funds in the amount of PLN 1.5 million on the scope of assistance from the Podkarpackie Voivodeship to Ukrainian citizens in connection with the armed conflict on the territory of that country. Nearly PLN 400,000 was allocated for a summer holiday organized in Rymanów-Zdrój for Ukrainian children staying in the Podkarpackie Voivodeship and for children who came to the colony directly from Ukraine, including from the Lviv, Ivano-Frankivsk and Zakarpattia regions.

²⁰ The implementation of the following projects can be cited as examples: Together We Can Do More – nearly PLN 850,000 from the Labor Fund reserve, implemented as part of the Departmental Activation Program for Foreigners 2022–2025 or the Podkarpackie Center for the Integration of Foreigners – PLN 30 million (PLN 25 million after adjusting the costs and changing the application), of which 85% is co-financed from EU funds, RPO WP 2014–2020.

In the context of the activities resulting from the war, in addition to humanitarian activities, the transport infrastructure connecting Poland and Ukraine turned out to be very important. An important element of the transport network of the Podkarpackie Voivodeship are the road border crossings on the border with Ukraine: Budomierz-Hruszew, Korczowa-Krakowiec (located in the TEN-T core network), Medyka-Szeginie and Krościenko-Smolnica. On December 21, 2024, another road border crossing was launched, Malhowice-Niżankowice. There are 3 railway border crossings in the Podkarpackie Voivodeship: Werchrata-Rawa Ruska, PrzemyślMościska (TEN-T core network) and Krościenko-Chyrow.

There are two air border crossings in the Podkarpackie Voivodeship. A Border Guard Border Checkpoint was established at the Rzeszów-Jasionka Airport. Border checks are also carried out at the airport in Mielec. As a result of the war in Ukraine, since February 2022, the Airport has become the main hub for aid, diplomatic and humanitarian activities. It currently serves as an international logistics center, and since the outbreak of the armed conflict in Ukraine, it has recorded increased cargo traffic related to international humanitarian and military aid for Ukraine. The role that the airport continued to play as a result of Russia's aggression against Ukraine has posed a huge number of challenges, including humanitarian and aid. The statistics of air operations (almost 21 thousand take-offs and landings) include over 1.1 thousand medical evacuation planes, which transported sick and injured soldiers from Jasionka to hospitals and clinics in Western Europe as a result of the war in Ukraine²¹.

In July 2023, the Podkarpackie Voivodeship Government developed a document entitled: *Concept for logistics and transport solutions and opportunities to support the reconstruction and development of the Ukrainian economy – from the perspective of the Podkarpackie Voivodeship*. The document was created in response to the growing needs related to freight and humanitarian transport caused by the armed conflict and the blockade of the Black Sea ports, which increased the need for effective cross-border infrastructure. The concept was submitted to the Ministry of Funds and Regional Policy of the Republic of Poland and to the Ukrainian ambassador to the EU.

The above document, based on the analysis of communication infrastructure, including road, rail, air and intermodal, indicates the possibility of improving communication links between Poland and Ukraine, not only in an ad hoc manner, but also taking into account plans for the reconstruction of Ukraine and future membership in European structures.

²¹ See the Report on the condition of the voivodeship for 2023, Podkarpackie Voivodeship Board, available at: [Report_on_the_state_of_the_Podkarpackie_voivodeship_for_2023_DOCX_FILE_421_MB.docx](#) on 10/01/2025

The concept indicates that a significant challenge facing the Ukrainian state is to maintain or even increase the level of export. The document assumes that Ukraine and the EU are to be connected by standard gauge corridors:

- 1) from Lviv via Kraków and Katowice towards the Polish seaport complexes Szczecin-Świnoujście and towards the Polish border with Germany (Zgorzelec), as well as Brno, Prague, Vienna and Bratislava;
- 2) from Kiev via Warsaw towards Polish seaports (Gdańsk, Gdynia, Szczecin-Świnoujście) and other international cargo hubs (Hamburg, Bremerhaven, Rotterdam) and the Baltic countries (Klaipėda).

Ukrainian exports to target countries should be supported by using rail routes and the hinterland that rail terminals located on the lines connecting Poland with Ukraine can provide. Yards at rail sidings and stations located near the Ukrainian border can serve as new transshipment points or temporary intermodal platforms. Modernization of rail connections on the Polish-Ukrainian border will enable the flow of goods from Ukraine to Western Europe and to Polish seaports on the Baltic Sea.

The Podkarpackie Voivodeship, due to its border location, can be an excellent base for the activities of both Ukrainian entrepreneurs who are temporarily unable to conduct business in their country, as well as entities from Europe and the USA who will participate in the reconstruction of Ukraine. In order to ensure the best possible conditions, our region is intensifying its activities related to servicing foreign entrepreneurs and collecting information on available investment locations.

Taking the above into account, it should be pointed out that the diagnosed new challenges in the social, economic, environmental and spatial dimensions (e.g. long-term effects of the COVID-19 pandemic, demographic crisis and climate change) as well as the effects of Russia's aggression against Ukraine, which is related to the prospect of Ukraine's membership in the EU, make it necessary to verify the provisions of the currently applicable *Voivodeship Development Strategy – Podkarpackie 2030*.

The issue of relations with Ukrainian partners will certainly be even more present in the new strategic document of the Podkarpackie Voivodeship, which will translate into the structure of activities and projects. Considering the aspirations for integration with the European Union reported by the Ukrainian side, it is worth noting that Polish experience from the pre-accession period and then as an EU member can be very helpful for Ukraine and its local governments. It seems that, similarly to previous enlargements, the process of Ukraine's accession to the EU structures will be a complicated process and will require time. The local government of the Podkarpackie Voivodeship postulates the establishment of pre-accession instruments for Ukraine by the EU, so that it can prepare to use financial instruments after its accession. The experience of jointly implemented projects under the Interreg initiative is an important element and shows that Poland is an important partner

for Ukraine. Moreover, for the Podkarpackie Voivodeship, an important topic is the establishment of a macro-regional strategy for the Carpathian area, where partners from Ukraine are already present.

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DIRECTIONS OF DEVELOPMENT OF THE BORDER REGION IN THE CONTEXT OF UKRAINIAN STRATEGIC DOCUMENTS

The full-scale aggressive war in Ukraine triggered the most pessimistic scenario for its development, overturning all hopes for the accelerated recovery of the national economy, improving the population's standard of living, and addressing environmental issues in the coming years, which were initially laid out in most strategies, programs, and plans at all levels of state, regional, and local governance.

Although the regions in Western Ukraine bordering Poland (Volyn, Lviv, and Zakarpattia Oblasts) are relatively far from the combat zones, they have still felt the negative consequences of the war, especially after the full-scale invasion of the aggressor in February 2022. On one hand, these regions provided temporary housing and humanitarian aid to internally displaced persons (IDPs) and offered spaces for the relocation of businesses from war-affected and frontline areas suffering from constant shelling of civilian infrastructure. On the other hand, these border regions became logistical hubs for receiving and distributing military and humanitarian aid from EU countries, as well as ensuring the export of most goods and services during the blockade of Ukrainian ports by the aggressor. These regions also accelerated the development of the agricultural sector to maintain food security, promoted the use of alternative energy sources to ensure energy security, and established military training centers, ranges, and defense industries to support Ukraine's defense capabilities.

It is evident that the strategic documents established at all levels before the full-scale war needed to be updated, considering the new realities of Ukraine and its regions during the war, as well as significant changes in legislation (*Ukraine's Plan, 2024; Budget Declaration, 2024; Action Plan, 2023; National Income Strategy, 2023; Action Plan for the Implementation, 2024; Action Plan for the Reform, 2024*). Therefore, it is important to examine in detail what changes have been made to strategic documents at the national and regional levels in Ukraine, particularly in the border

regions, as a result of the war, and to identify whether further updates are needed in line with existing and potential threats, as well as contemporary global challenges.

At the national level in Ukraine, an important regulatory strategic document that defines the foundations of regional policy is the State Strategy for Regional Development for 2021–2027 (*State Strategy for Regional Development*, 2024). The first version of this document was adopted by the Verkhovna Rada of Ukraine during the COVID-19 pandemic and before the start of the full-scale war in Ukraine, on August 5, 2020 (*State Strategy for Regional Development*, 2020). The revised version, taking into account the consequences of the full-scale war in Ukraine, was adopted on August 13, 2024 (Fig. 1).

The comparison of these versions of the strategy shows changes in the formulation of its goal and all operational objectives.

While the wording of the three goals set in 2020 remains unchanged, the new strategic goal focuses on new key terms such as «strengthening socio-humanitarian, economic, and spatial cohesion», «citizen security», «infrastructure restoration and economic modernization», and «development of a democratic, decentralized, and inclusive multi-level governance system».

The previous strategy's key terms like «citizens' well-being» and «internal potential of territories» also remain. Thus, the new strategy is more focused on addressing the negative consequences of the war, but it does not exclude improving citizens' well-being and utilizing the internal potential of territories.

As for the operational objectives, in the August 5, 2020 edition, they were formulated quite broadly, covering a wide range of development areas from economic to social and cultural. However, in the August 13, 2024 edition, the number of operational objectives for each of the three strategic goals decreased, but the objectives became more specific and oriented towards solving pressing issues. New objectives emerged related to recovery, security, and adaptation to new realities, indicating that the new edition is more adapted to current conditions and focused on achieving concrete results quickly. In particular, the first goal accounts for the need to provide social protection for war veterans and their families, internally displaced persons, and other vulnerable groups. The realization of the second strategic goal, «Increasing the competitiveness of regions», is expected to be achieved through the development of infrastructure resilient to security, social, and economic challenges, as well as the formation of a strong, capable, and competitive regional economy. The implementation of the third strategic goal involves the development of various forms of cooperation and effective management of public investments.

Thus, the new edition of the State Regional Development Strategy of Ukraine for 2021–2027 has become more specific, goal-oriented, and focused on addressing current issues. The focus has shifted from long-term development to rapid recovery and adaptation to new conditions. The goals have become more practical and

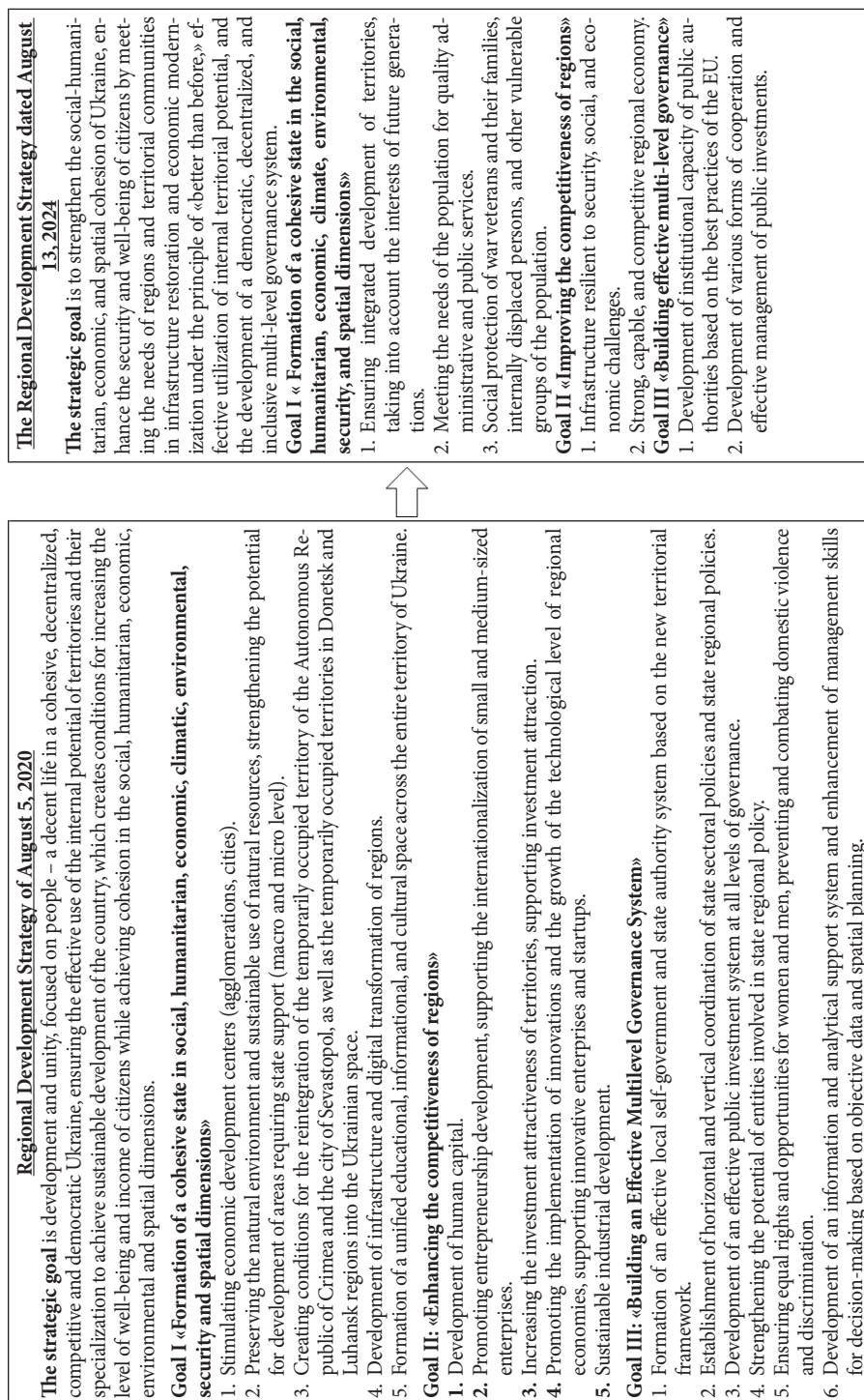


Fig. 1. Comparison of the goals and objectives of the State Regional Development Strategy of Ukraine for 2021–2027 before and after the full-scale war. Source: Constructed based on (State Regional Development Strategy, 2020) and (State Regional Development Strategy, 2024)

action-oriented. Overall, the changes in the formulation of the goal and objectives reflect the new challenges faced by Ukraine and the need to adapt the development strategy to these challenges.

Another important regulatory act that defines the main legal, economic, social, environmental, humanitarian, and organizational foundations of state regional policy as part of Ukraine's domestic policy, and establishes the features of the restoration of regions and territories affected by armed aggression against Ukraine, is the Law of Ukraine «On the Principles of State Regional Policy» (*On the Principles of State Regional Policy*, 2015). After the start of the full-scale war, amendments were made to this regulatory document to adapt state regional policy to new realities and ensure effective recovery and development of regions affected by the war.

In particular, this law was supplemented with concepts of functional types of territories, such as «recovery territories», «regional growth poles», «territories with special conditions for development», and «sustainable development territories». This allowed for a clearer definition of priority areas of state policy in regions that were most affected by the war. For the territories that suffered from Russian aggression, a new strategic planning document – the recovery and development plan – was introduced. This made it possible to develop individual plans for each of these territories, taking into account their specific needs. The law grants more powers to local self-government bodies in the development and implementation of regional policy. This contributes to the decentralization of power and increases the responsibility of local communities for the development of their territories. Amendments were made to the mechanisms for financing regional development, which allowed for the attraction of more funds for the recovery and development of affected regions. The law also envisions more active cooperation with international organizations and donors to attract investments and technologies for Ukraine's recovery. However, there is currently no official designation of the Ukrainian border regions to any of the defined functional types of territories, which limits the definition of their development priorities in line with national priorities.

In the future, it is important to examine in more detail the changes that occurred in the formulation of goals and objectives of regional development strategies for Ukraine's border regions before and after the beginning of the full-scale war in Ukraine.

Among the Ukrainian border regions, active work on updating strategic documents has been carried out in Lviv Oblast. The first version of the Lviv Oblast Development Strategy for the period 2021–2027 was approved by the Lviv Regional Council Decision No. 948 on 24.12.2019. Given the new challenges of the full-scale war, the Lviv Regional Military Administration issued Order No. 1066/0/5-23VA on 09.11.2023, «On the Update of the Lviv Oblast Development Strategy for the period 2021–2027 and the Development of the Action Plan for its Implementation in 2024–2027». As a result, updated strategic and operational goals and tasks were defined for the Lviv Oblast

Development Strategy for the period 2021–2027. The comparison of the changes in this strategic document, particularly in the context of new challenges related to the war and the need for post-war recovery, is presented in Figure 2.

Among the key changes, a new priority was formed – security and preservation of demographic potential. The full-scale war became the main challenge for Ukraine, so issues of security and preserving people's lives came to the forefront. Accordingly, a new block of goals related to defense support, healthcare development, rehabilitation, and psychological support for the population appeared. Other new priorities included the enhancement of the role of the social sector. Since the war led to a significant increase in the need for social protection, especially for internally displaced persons, veterans, and other vulnerable groups of the population.

Therefore, the block of goals related to social protection, inclusivity, and support for public initiatives has been expanded. The emphasis has been placed on the restoration and development of infrastructure. The war has caused significant damage to infrastructure, making its restoration one of the key tasks. Accordingly, goals related to the restoration of road, transport, energy, and other infrastructures have been detailed.

An important area of change is supporting the economy in wartime conditions, as there was an acute need to maintain economic activity in the region and create new jobs. Goals related to entrepreneurship, innovation, and investment attraction have also been preserved, but with a focus on adapting to new conditions.

The environmental component has been updated as well, as environmental preservation remains a key task, albeit with consideration of new challenges. In this context, goals have been added related to reducing the negative impact of coal extraction and thermal generation on the environment, as well as the revitalization of post-industrial areas.

Thus, the update of the Lviv Oblast development strategy reflects the new realities faced by Ukraine. The main changes are aimed at ensuring security and protecting the population, the rapid restoration of damaged infrastructure, supporting the economy, creating new jobs, developing the social sector, ensuring social protection, preserving the environment, and transitioning to a green economy.

Also, considering the negative consequences of the war in Ukraine, strategic documents in the Zakarpattia Oblast have been updated. The first version of the Zakarpattia Oblast development strategy for 2021–2027 was adopted by the decision of the Zakarpattia Regional Council on December 20, 2019, No. 1630 (*Real Zakarpattia Oblast Strategy, 2019*). The updated version of this strategy was adopted by the decision of the Zakarpattia Regional Council on December 19, 2024, No. 1216 (*Zakarpattia Oblast Development Strategy, 2024*). The updated version significantly reduced the number of strategic goals (from 5 to 3), and the number of corresponding operational goals was also reduced, with their content presented more concisely. A comparison of these changes in the strategic documents is shown in Figure 3.

The first version of the Lviv Oblast Development Strategy for 2019			The updated version of the Lviv Oblast Development Strategy for 2024		
Strategic goals	Operational goals		The strategic goal	Operational goal	
1. A competitive economy based on smart specialization	1.1. Stimulating innovative types of economic activity with high added value		1. Security and preservation of the nation's demographic potential in the context of war and post-war reconstruction	1.1. Support for the country's defense capability and the security sector	
	1.2. Investment attractiveness			1.2. Development of emergency and highly specialized medical services	
	1.3. Energy self-sufficiency			1.3. Rehabilitation, recovery, physical and spiritual restoration	
	1.4. Scientific and technological development			1.4. Development of the nation's educational and spiritual potential	
2. Quality of life	2.1. Healthy population			1.5. Inclusive society	
	2.2. Inclusive society			2.1. Development of smart specialization in the region	
	2.3. Educated communities			2.2. Development of entrepreneurship and investment attractiveness of the region	
	2.4. Safe and barrier-free environment			2.3. Modernization of road, border, logistics, production, digital, and critical infrastructure	
3. Balanced spatial development	3.1. Development of territorial communities infrastructure		2. Increasing the region's competitiveness in the context of European integration.	2.4. Workforce training in line with current labor market needs	
	3.2. Road transport, logistics, cross-border, and information-communication infrastructure			2.5. Comprehensive spatial planning and efficient territorial management	
	3.3. Stimulating economic development of rural and mountain areas			3.1. Energy security and self-sufficiency of the region	
4. Clean Environment	4.1. Prevention of water pollution and air quality degradation			3.2. Prevention of water resources and air pollution	
	4.2. Formation of ecological awareness among the population and the development of an integrated waste management system			3.3. Establishment of a waste management system and promotion of environmental awareness among the population	
	4.3. Preservation of biodiversity and development of protected areas			3.4. Conservation of biodiversity and development of protected areas	
5. Tourism attractiveness	5.1. Enhancing the attractiveness and infrastructure support for tourism, resorts, wellness, sports, and recreation		3. Environmental protection and green transition	3.5. Reduction of the negative impact of coal mining and thermal power generation on the environment	
	5.2. Improving the quality of regional tourist products and their promotion				



Figure 2. Comparison of strategic and operational goals of the Lviv Oblast Development Strategy for the period 2021–2027 before and after the full-scale war.
Source: constructed based on (Lviv Region Development Strategy, 2019) and (Project of the Updated Lviv Region Development Strategy, 2024).

The analysis of two versions of the Zakarpattia Oblast development strategy revealed significant changes related to the new context formed by the full-scale war in Ukraine. These changes reflect new priorities and challenges faced by the region.

Among the main differences, one can highlight the shift of focus to security and humanitarian aspects. In 2019, the emphasis was on economic development, innovation, and cooperation with neighboring countries, while in 2024, goals related to security, population protection, support for internally displaced persons (IDPs), and social services development were added. This is linked to the need to ensure the security of infrastructure and support the population in wartime conditions. There has also been a strengthening of the social component. In 2019, the social sector was viewed as one of many areas of development, while in 2024, the social component has moved to the forefront, with new goals related to education, healthcare, and social protection. This reflects the growing social needs of the population in wartime conditions.

Moreover, the focus has shifted towards restoration and adaptation. While the 2019 Strategy was aimed at long-term development, in 2024 the focus has shifted to short- and medium-term goals related to the restoration of damaged infrastructure, adaptation to new conditions, and ensuring sustainable development. The new Zakarpattia Oblast Development Strategy reflects an increased role for local self-government. In 2019, the role of local self-government was important but not as clearly defined, while in 2024 the importance of decentralization and strengthening the role of communities in solving local issues is emphasized.

Greater attention is also given to the environmental component, which, although present in 2019, was not a priority. In 2024, environmental goals remain, but they are adjusted to account for new challenges, such as the restoration of damaged ecosystems and ensuring sustainable development in rural and mountainous areas. It is important to note that the updated version of the Strategy specifies an operational goal aimed at addressing the socio-economic development disparities between mountainous and rural areas, which is a key characteristic of this region, especially in the context of the Polish-Ukrainian border area. The state border in Zakarpattia runs through the mountainous Carpathian region, and the borderlands on both sides are designated as protected natural areas, highlighting the importance of addressing joint environmental protection issues and ensuring sustainable development in the region.

Based on the analysis of both strategies, the following key development directions for Zakarpattia Oblast can be identified:

- human capital – investments in education, healthcare, social protection, and workforce qualification enhancement;
- economic development – support for small and medium-sized businesses, development of tourism, agriculture, industry, and innovation; – infrastructure – restoration and development of transport, communal, and energy infrastructure;

The first version of the Development Strategy of the Zakarpattia Oblast for 2019		Updated version of the Development Strategy of the Zakarpattia Oblast for 2024	
Strategic goals	Operational goals	Strategic goals	Operational goals
1. Preservation and development of human and social capital	1.1. Slow down and stop the marginalization and decrease in the active population.	1. Development is people-centered	1.1. High-quality and innovative Ukrainian schools, oriented towards demographic forecasts.
	1.2. Consolidate positive demographic development trends and human-centered urbanization. Significantly improve the health parameters of the population and increase the average life expectancy.		1.2. Development of culture and preservation of cultural heritage objects in the region based on the principles of inclusion.
	1.3. Preserve and enhance intellectual and spiritual potential, strengthen the sustainability of humanistic principles and universal values, as well as interethnic and interfaith harmony and tolerance.		1.3. Creation of accessible, inclusive, health-preserving spaces for physical recovery and personal development.
	1.4. Renovate the region as a new creative center for international, interregional, and multinational multilateral cooperation.		1.4. Ensuring the development of high-quality and accessible social services according to individual needs, supporting internally displaced persons (IDPs).
2. Accelerating the achievement of competitiveness and innovation of the regional economy	2.1. Active and systematic support for the growth of the regional economic system's structure, focusing on the share of innovative economy, creative industries, entrepreneurship, and services, attracting investments, and cross-border cooperation in the region.	2. Increasing the competitiveness of the region.	1.5. Formation of a cohesive, patriotic civil society based on Ukrainian national identity and social inclusion.
	2.2. Supporting the implementation of highly efficient technologies of the 4th to 6th technological revolutions in all sectors at the regional and local levels.		1.6. Development of security and civil protection infrastructure.
	2.3. Implementation of cluster initiatives in automotive assembly, forestry, agro-industrial, tourism and recreation, medical tourism, environmental protection, information and communication technologies (ICT), scientific-educational, and congress industries.		2.1. Development of the knowledge economy and support for the infrastructure of investment and innovation activities.
	2.4. Significant renewal of all types of infrastructure in Transcarpathia: transport and road, communal and border, environmental, energy, industrial and communication, social, and tourism infrastructure based on EU standards and norms.		2.2. Support for unique economic activities in the region.
2.5. Ensuring sustainable energy development in all energy consumption sectors and its preventive adaptation to global climate change.		3. Environmental protection and balanced development of mountainous and rural areas of the region.	2.3. Development of tourism and wellness sectors.
			2.4. Balancing the labor market according to the needs of the regional economy.
			2.5. Development of transport and logistics infrastructure and sustainable mobility in the region.
			2.6. Ensuring the resilience and efficiency of regional public governance and partnerships.
			2.7. Energy sustainability of the region in the context of the «green» transition.
			3.1. Preservation and restoration of biological and landscape diversity, natural complexes, water, land, and forest resources, expansion of the regional ecological network.
			3.2. Environmentally friendly space of the region.
			3.3. Balancing the socio-economic development disparities of mountain and rural areas.



The first version of the Development Strategy of the Zakarpattia Oblast for 2019	
3. Building local knowledge economies and smart specialization	3.1. Identifying the unique functions and assets of the region, highlighting the competitive advantages of the relevant sectors of the regional economy.
	3.2. Activating structural changes in the regional economy, forming and developing regional capacity for effective functioning.
	3.3. Implementing the provisions of the Association Agreement with the European Union, as well as economic integration with the EU single market and ensuring inclusion in global value chains.
	3.4. Participating in the implementation of Ukraine's smart specialization strategy as proposed by the European Commission, as well as joining Ukraine in the European Smart Specialization Platform.
4. Ensuring environmental protection, ecologically balanced and rational natural resource management, and spatial harmony	4.1. Adhering to the balance between industrial development and the preservation of unique natural resources through the implementation of corporate, state, and international investment, infrastructure, and cross-border projects that significantly impact the competitiveness of the national and regional economies.
5. Ensuring sustainable development of rural and mountainous areas in the context of systemic reforms	5.1. Shifting the focus from sectoral to spatial development as a defining opportunity and main pathway for transitioning from a mono-sectoral structure of rural economies to multifunctional development of rural areas.
	5.2. Utilizing socio-economic and managerial levers aimed at achieving a qualitatively new level of rural development.

Fig. 3. Comparison of strategic and operational goals of the Zakarpattia Oblast Development Strategy until 2027 before and after the full-scale war
Source: constructed based on (Zakarpattia Oblast Development Strategy, 2019) and (Zakarpattia Oblast Development Strategy, 2024).

- social sphere – ensuring social protection for vulnerable groups, creating affordable housing, and developing social services;
- ecology – preservation of natural resources, development of ecotourism, and implementation of environmentally clean technologies;
- international cooperation – attracting investments, technologies, and expertise from international partners.

The economic growth opportunities for the Zakarpattia Oblast are linked to the development of tourism, agriculture, energy, innovation, and the use of its geographic location for cross-border cooperation.

Thus, the updated strategy for Zakarpattia Oblast, adopted in 2024, reflects the new reality in which this region finds itself. It demonstrates flexibility and the ability to adapt to changing conditions. The key changes focus on ensuring the security of infrastructure, social protection of the population, addressing the economic development disparities between mountainous and rural areas, and adapting to new challenges, particularly environmental ones.

Next, we will examine the changes that occurred in the formulation of the Volyn Oblast's development strategy. The first version of the Volyn Oblast's development strategy for the period until 2027 was adopted by the decision of the Volyn Regional Council on 12.03.2020 No. 29/16 (*Volyn Oblast Development Strategy, 2020*). The updated version of this strategy was developed by the ZRNGO «Volyn Resource Center» within the framework of the USAID «GOVERLA» project (*Volyn Oblast Development Strategy, 2024*).

In the updated version of the strategy, the number of strategic goals remains unchanged (five), with only the wording of strategic goal 5 clarified, as well as refinements to some operational goals under strategic goals 1, 2, 3, and 5. A detailed comparison of changes to this strategic document is presented in Figure 4.

Both versions of the strategy have a similar structure and focus on several key areas. Economic development aims to enhance competitiveness, support the development of small and medium-sized businesses, the agro-industrial sector, and innovation. Social development focuses on human capital development and improving the quality of life. The infrastructure and environment-related section emphasizes infrastructure development, rational use of natural resources, and ecological safety. The international aspect maintains its focus on cross-border cooperation.

Key differences between these strategic documents include a certain broadening of the focus. The updated version places more emphasis on the region's cultural potential, waste management, and digital transformation. There has also been a shift in priorities, with the addition of a new strategic direction related to climate change.

The analysis of operational goals also indicates certain changes. The updated version of the Strategy details some operational goals, for example, adding a point about enhancing the capacity of government bodies on a new territorial basis. Ad-

The first version of the Volyn Oblast Development Strategy 2020		The updated draft of the Volyn Oblast Development Strategy 2024	
Strategic goals	Operational goals	Strategic goals	Operational goals
1. Increasing the competitiveness of the regional economy	1.1. Increasing investment attractiveness	1. Increasing the competitiveness of the regional economy	1.1. Increasing investment attractiveness
	1.2. Enhancing tourism and recreation potential		1.2. Expanding the tourism, recreational, and cultural potential of the region
	1.3. Developing small and medium-sized businesses		1.3. Development of small and medium-sized businesses
	1.4. Effective regional energy management		1.4. Increasing the productivity of the agro-industrial sector
	1.5. Increasing productivity in the agro-industrial sector		1.5. Supporting promising types of agricultural production
2. Development of human capital and improvement of the quality of life of the population	1.6. Supporting promising types of agricultural production	2. Development of human capital and improvement of the quality of life of the population	2.1. Preservation and development of human capital
	2.1. Preservation and development of human capital		2.2. Creating conditions for comfortable and safe living for residents
3. Development of the innovative economy (based on smart specialization)	2.2. Creation of conditions for comfortable and safe living for residents		2.3. Improving waste management
	3.1. Increasing the added value of industrial products in the smart specialization sectors		2.4. Increasing the capacity of state authorities and local governments on the new territorial basis
	3.2. Development of innovation infrastructure	3. Development of the innovative economy (based on smart specialization)	3.1. Increasing the added value of industrial products in smart specialization sectors
	3.3. Development of human resources in the smart specialization sectors		3.2. Developing innovation infrastructure
4. Development of cross-border cooperation	4.1. Infrastructure support for cross-border cooperation		3.3. Developing human resources in smart specialization industries
	4.2. Stimulating cross-border cooperation in the region		3.4. «Digital transformation»
5. Rational use of natural resources and environmental security	5.1. Protection and rational use of water resources and reduction of negative impact on the atmosphere	4. Development of cross-border cooperation	4.1. Infrastructure support for cross-border cooperation
	5.2. Improvement of waste management		4.2. Stimulating cross-border cooperation
	5.3. Conservation of biological and restoration of landscape diversity in the region	5. Rational use of natural resources, environmental safety, reduction of impacts and consequences of climate change	5.1. Protection and rational use of water resources and reducing negative impacts on the atmosphere
			5.2. Conservation of biological and restoration of landscape diversity in the region



Fig. 4. Comparison of strategic and operational goals of the Volyn Oblast Development Strategy for 2027, before and after the full-scale war. Source: constructed based on (Volyn Oblast Development Strategy, 2020) and (Volyn Oblast Development Strategy, 2024).

ditionally, new operational goals have emerged related to digital transformation, climate change, and waste management. It is worth noting that some operational goals have been merged or reworded for a clearer expression of strategic directions.

Among the shortcomings of the Strategy, it should be noted the absence of both strategic and operational goals related to the security of people's lives, infrastructure, and protection of territories in the northern part of the Volyn Oblast, which borders Belarus – a country that supports Russia's aggressive war against Ukraine. Furthermore, the updated Strategy gives little attention to the identification of goals and measures to stimulate and support the development of rural areas, particularly in the northern part of the region. Additionally, as in other Ukrainian border regions, the Strategy does not specify operational goals related to improving social support for war veterans and their families, as well as internally displaced persons and relocated businesses from other regions of Ukraine.

Therefore, it is important to continue focusing on the need to further address these and other important areas in the formulation of an action plan for the implementation of the Strategy.

Thus, the updated development strategy for the Volyn Oblast also demonstrates efforts to adapt the region to new challenges and opportunities. Key trends include strengthening the innovative component with a focus on digital transformation and the development of innovative infrastructure, increasing the social dimension with greater attention to quality of life, waste management, and human capital development. It should also be noted that the ecological focus of the Strategy has been enhanced, as more attention is given to the rational use of natural resources. The Strategy also takes into account the new territorial formations resulting from decentralization processes and adjusts operational goals accordingly. Overall, the updated version of the Volyn Oblast development strategy demonstrates a more comprehensive and balanced approach to regional development, considering economic, social, and ecological aspects.

The updating of development strategies for Ukraine's border regions in the context of Russian aggression and Eurointegration processes provides an opportunity to analyze the priorities for regional development and their potential for cooperation with Polish partners. This analysis focuses on comparing the target objectives of the strategies for the Lviv, Zakarpattia, and Volyn Oblasts, with an emphasis on prospects for cooperation with neighboring Polish regions (Tabl. 1).

In terms of content, many common provisions can also be identified in the strategies of Ukraine's border regions across key areas:

1. Security and Defense Capability – all three strategies identify security and defense capability as priority areas, especially in the context of war.
2. Human Capital Development – the strategies explicitly or implicitly envisage improvements in the quality of education, healthcare, and social services, which is an important component of all the strategies.

3. Economic Development – the development of small and medium-sized businesses, innovation, tourism, and investment attractiveness are key areas for all three regions.
4. Eurointegration – all strategies aim to integrate the regions into European structures and standards.
5. Environmental Protection – the conservation of natural resources, the development of a «green» economy, and adaptation to climate change are important aspects of these strategies.

Table 1. Analysis of Differences Between the Development Objectives of Ukraine's Border Regions and Their Potential for Cooperation with Poland

<i>Aspect</i>	<i>Lviv Oblast</i>	<i>Zakarpattia Oblast</i>	<i>Volyn Oblast</i>	<i>Potential for Cooperation with Poland</i>
<i>Geographical Location</i>	Central position in western Ukraine, developed infrastructure	Mountainous region with unique nature, developed tourist infrastructure	Northwestern part of Ukraine, agricultural region	High potential for transit logistics, tourism, and joint investment projects
<i>Economic Specialization</i>	Industry, agribusiness, IT sector	Tourism, agriculture, light industry	Agribusiness, forestry	Cooperation in the agribusiness sector, tourism, joint manufacturing projects
<i>Cultural Ties</i>	Historical and cultural ties with Poland	Strong Ukrainian-Polish cultural ties, shared history	Historical and cultural ties with Poland	Joint cultural projects, experience exchange in culture and education
<i>Cross-border Cooperation</i>	Active development of cooperation with Polish regions	Significant potential for cooperation with Polish regions	Potential for cooperation in agribusiness, tourism	Joint projects in infrastructure, environmental protection, tourism, culture

Source: constructed by the author.

The analysis of the comparison of the development strategies for the Lviv, Zakarpattia, and Volyn Oblasts reveals a number of key common features that enhance the potential for cooperation with Poland (Tabl. 2).

The analysis of the provisions of the updated development strategies for the Lviv, Zakarpattia, and Volyn Oblasts leads to the conclusion that these border regions demonstrate a high level of readiness for cooperation with Poland. Shared interests and development directions create a solid foundation for further deepening bilateral relations and implementing joint projects.

The prospects for cooperation between Ukraine's border regions and the corresponding Polish regions envisage the activation of interaction in the following areas:

- joint projects within European programs – participation in EU cooperation programs, such as Interreg, for funding joint projects;
- infrastructure – joint construction and modernization of roads, railways, and border crossing points;

- tourism – creation of joint tourist routes, development of cross-border infrastructure;
- agribusiness – joint investments in agricultural product processing, development of organic farming;
- energy – cooperation in the field of renewable energy sources;
- education – student and faculty exchanges, joint educational projects;
- culture – joint cultural events, exchange of experiences in cultural heritage preservation;
- science and Innovation – creation of joint research centers, exchange of experiences in technological innovations.

Table 2. Key Features of the Development Strategies for the Lviv, Zakarpattia, and Volyn Oblasts that Enhance the Potential for Cooperation with Poland

Key Feature	Content	Description of Cooperation Potential with Poland
1. Eurointegration Focus	Alignment with European standards	All three strategies are aimed at harmonizing regional development with European standards and norms, creating a favorable foundation for cooperation with EU countries, particularly Poland
	Infrastructure development	Emphasis on modernizing transport, logistics, and other infrastructures, which are key prerequisites for enhancing cross-border connections
	Business support	Creating a favorable climate for investment and entrepreneurship, making the regions attractive for Polish businesses
2. Cross-border Cooperation as a Priority	Development of cross-border infrastructure projects	Plans to develop transport, energy, and communication infrastructures linking Ukrainian and Polish regions
	Support for joint projects	Emphasis on the need to attract EU and other international donor funds for implementing joint projects
	Cooperation in culture, education, and science	Recognition of the importance of cultural exchanges, joint scientific research, and educational programs
3. Focus on Human Capital Development	Staff qualification improvement	Investments in education and vocational training to ensure competitiveness in the European labor market
	Development of research centers	Creating conditions for conducting joint scientific research and innovation
	Support for youth	Encouraging youth involvement in education, entrepreneurship, and public activities
4. Environmental Protection and Sustainable Development	Transition to a „green” economy	Emphasis on the development of renewable energy sources, energy efficiency, and the preservation of natural resources
	Cooperation in waste management	Development of joint waste management programs and environmental protection initiatives
	Climate change adaptation	Joint actions to adapt to the consequences of climate change
5. Support for Small and Medium-sized Enterprises	Creating a favorable business climate	Simplification of administrative procedures, providing financial support, and developing infrastructure for businesses
	Export support	Encouragement of export of goods and services to the Polish market
	Cluster development	Creation of clusters in various sectors to strengthen the competitiveness of the regional economy

Source: constructed by the author.

Thus, the development strategies for the Lviv, Zakarpattia, and Volyn Oblasts demonstrate common trends and priorities, as well as differences related to geographical location and economic specialization. There is significant potential for cooperation between these regions and the Polish border regions in various areas. The implementation of joint projects will contribute to the economic development of the regions, strengthening neighborly relations, and furthering Ukraine's Eurointegration.

The joint development and implementation of a cross-border development strategy for the Polish-Ukrainian border regions is an extremely important step for enhancing cooperation, socio-economic development, and the European integration of both countries. Therefore, taking into account the provisions of the updated development strategies for the Lviv, Zakarpattia, and Volyn Oblasts, which align with the strategies of the corresponding Polish border regions, is a key factor for the success of this process.

Since the beginning of the full-scale war, regional development priorities in Ukraine have significantly changed. Despite being far from the active combat zones, Ukraine's border regions play a vital role as a reliable rear for ensuring the country's economic, social, food, energy, military, and environmental security. The role of these regions will remain crucial during the rebuilding and post-war recovery period of Ukraine. Considering all the negative consequences of the war, other contemporary challenges, and the focus on European integration, Ukraine's border regions have updated the target objectives of their development strategies until 2027. The updated strategies of the regions include a number of important provisions that could be used for their integration into a joint cross-border development strategy for the Polish-Ukrainian border, as they address current issues such as security, «green», digital, and intellectual transformation, which are also essential for accelerating Ukraine's European integration process.

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A NEW CROSS-BORDER DEVELOPMENT STRATEGY FOR THE POLISH-UKRAINIAN BORDER REGION – AS AN INSTRUMENT OF UKRAINE’S INTEGRATION INTO THE EU

Introduction

The Polish-Ukrainian borderland has acquired a new geopolitical significance since the independence of Ukraine on 24 August 1991. Poland was the first – along with Canada – to recognise the independence of the new state on 2 December 1991. At the same time, on 16 December 1991, an association agreement was concluded between Poland and the European Communities, which led to Poland’s membership of the EU on 1 May 2004. It was then that the Polish-Ukrainian border took on the character of an external EU border. Earlier, on 12 March 1999, Poland became a member of NATO. In turn, Poland joined the Schengen Area on 21 December 2007. All of these activities resulted in an increase in restrictions on crossing the Polish-Ukrainian border after an initial increase in permeability in the 1990s. This was fostered by Ukraine’s indecision on European integration issues. It was not until the Orange Revolution (from 22 November 2004 to 23 January 2005), associated with multi-day mass public protests against the falsification of the presidential election results by the then prime minister, and the Revolution of Dignity (from 30 November 2013 to February 2014) against the refusal of the then Ukrainian authorities, to sign the Association Agreement with the EU, that the consciousness of Ukrainian society changed. Russia’s aggression against Crimea (2014) and the full-scale war against Ukraine launched by Russia on 24 February 2022 also

contributed to this. The war, which has been going on for three years, proved that peace for Ukraine could be ensured by NATO membership and the prosperity of its citizens by EU membership.

As early as the mid-1990s, initiatives for cross-border Polish-Ukrainian regional cooperation were taken. Following the experience of Western European countries, cross-border associations (euroregions) were established: Carpathian (1993) and Bug (1995). Their activities were supported by the PHARE CBC pre-accession programme and, since 2004, by the INTERREG cross-border cooperation programmes and the European Neighbourhood Instrument. Among other things, they initiated the creation of strategic documents for the Polish-Ukrainian border area, which will be synthetically presented in the presented study, with particular emphasis on the Cross-border Cooperation Strategy of the Lubelskie Voivodeship, Volyn Oblast, Lviv Oblast and Brest Oblast for 2014–2020.

The first strategic document concerning the Polish-Ukrainian borderland was prepared – on the Polish initiative – by Polish and Ukrainian experts. It was entitled Strategy for the Development of the Euroregion BUG (1997). It was a summary effect of the realisation of the PBZ-059-01 ordered project, which had been realised since the moment of the creation of the Cross-Border Association Euroregion BUG, and even before its formal establishment. Within the project 16 volumes of studies of the Euroregion BUG series were published in 1994–1997. They constituted a unique, and one of the first so comprehensive, source of information on the Polish-Belarusian-Ukrainian cross-border region. It is worth noting that intensive cooperation, initiated by the implementation of the aforementioned project and later independent of it, between the statistical offices in Lublin, Brest, Lviv and Lutsk, resulted in numerous statistical publications on the borderland.

Another document developed after the administrative reform and the creation of 16 new voivodeships to replace the previous 49 was the Joint Polish-Ukrainian Cross-border Cooperation Strategy: Lubelskie, Podkarpackie, Volyn, Lviv 2005–2015 Together towards the future (2005). It was initiated by the Association of the European Centre for Integration and Local-Governmental Cooperation “House of Europe”, established, inter alia, by the Self-Government of the Lubelskie Voivodeship. The strategy concerned the four regions forming the Polish-Ukrainian border area.

The weakness of both these documents was the fact that they were created on the Polish initiative, with no real (and not only formal) involvement of the authorities on the Belarusian and Ukrainian sides, they formulated quite general directions of activity, at the same time not including elements of the implementation system, i.e. entities of implementation, monitoring system and sources of funding.

The passivity of the Belarusian (large) and Ukrainian authorities (slightly smaller) resulted from geopolitical conditions, as the state border separating the Lubelskie Voivodeship from the Brest, Lviv and Volyn Oblasts took on the character of an

external border of the EU and the Schengen Area, which reduced its permeability, especially for the citizens of Belarus and Ukraine.

Institutional distance, related to the inadequacy of competences of the neighbouring administrative regions and Polish, Belarusian and Ukrainian sub-regional units, was also a significant obstacle. In this situation, the mentioned studies did not become documents officially adopted by regional authorities of border regions.

1. Cross-border Cooperation Strategy of Lubelskie Voivodeship, Volyn Oblast, Lviv Oblast and Brest Oblast for 2014–2020.

The possibility of obtaining EU funding for cross-border projects of a strategic nature became an incentive for the effort to create a new document for the cross-border region, i.e. the *Cross-border Cooperation Strategy of the Lubelskie Voivodeship, Volyn Oblast, Lviv Oblast and Brest Oblast for 2014–2020* (2014). The impulses for developing this document were:

- the initiative of the Cross-Border Association ‘Euroregion BUG’, which took the form of a relevant resolution in 2012, to proceed with the development of the strategic document,
- adoption in 2013 of the *Lubelskie Voivodeship Development Strategy for 2014–2020* (with an outlook to 2030) (2013), which identified the border area of strategic intervention as requiring socio-economic activation,
- a pilot project of the *Ministry of Foreign Affairs of the Republic of Poland, implemented in 2013, entitled: Building partnerships for the development of the Cross-border Strategy 2014–2020*.

The tasks of this document were:

- working out and agreeing on the strategic objectives of the cross-border region,
- to work out development priorities and a catalogue of projects leading to a wider openness to cross-border cooperation and mutual benefits,
- dynamising and stimulating development processes in the Polish-Belarusian-Ukrainian border region,
- to promote good neighbourly relations in the cross-border region and to improve its promotion and ability to attract external investment,
- preparing tasks and priorities for the new European Neighbourhood Policy and the *Cross-border Cooperation Programme Poland-Belarus-Ukraine 2014–2020*.

The process of developing the Strategy document was based on five main principles, which were:

- the partnership principle, meaning joint and equal involvement of Polish, Belarusian and Ukrainian partners,
- the principle of coherence with other strategic documents developed at the regional, national and European level,

- the flexibility principle, meaning adaptation to the changing external conditions and endogenous potentials, which implies the necessity to monitor the implementation of the document and, depending on the needs, to update it,
- the principle of thematic concentration, meaning the selection of a few areas which are most important for the functioning of the cross-border region,
- the principle of reliability of data used in the process of document elaboration, both from statistical and other sources.

A SWOT analysis was developed for the cross-border area, consisting of one Polish, two Ukrainian and one Belarusian regions. The strengths of the Polish-Belarusian-Ukrainian cross-border area include:

- significant natural values and a relatively low degree of their degradation,
- fairly well preserved multicultural heritage,
- lack of significant language barriers,
- relatively high level of education of the population,
- well-developed higher education base,
- high availability of science and research centres,
- creation of incentives for investors,
- openness of companies, institutions and individuals to cross-border cooperation,
- location of modern airports,

while weaknesses (weak points):

- low level of socio-economic development,
- outdated economic structure (high share of agriculture),
- negligible use of natural and cultural potential for tourism development (no significant cross-border tourism products),
- low level of development of road infrastructure, especially in the border zone,
- low level of development of railway infrastructure, especially in the border zone,
- low utilisation of railway lines that do not require track gauge changes (LHS, Chełm-Kowel, Zamość -Rawa Ruska),
- low diversification of border crossings (lack of tourist pedestrian crossings),
- little use of airports,
- lack of cargo airports.

Analysing the environment of the cross-border region, the following opportunities were identified:

- increasing importance of the European Neighbourhood Policy towards Eastern Europe,
- transit location between Western and Eastern Europe, at the crossroads of trans-European road and rail routes,
- possibility to increase external transport accessibility through better use of air infrastructure,

- increase in quality and mobility of labour resources,
- increased interest in cross-border partnerships,
- increased activity and growing role of NGOs in international relations, including cross-border relations,

but also threats in the form of:

- strengthening of the EU external border barrier,
- increasing transit importance of competitive transport routes, especially in the south of Poland (A 4) and Europe,
- divergence of the level of economic development in Europe and in individual countries,
- significant institutional distance of public administration, resulting from system differences and different models of the state,
- unfavourable demographic trends (depopulation, population ageing),
- crime related to the functioning of the external EU border.

As a result of the SWOT analysis, four areas for strategic action were identified, i.e.:

- economic cooperation, understood as creating conditions for the development of entrepreneurship and investment by external capital,
- environment, culture and tourism,
- communication and border infrastructure,
- science and higher education.

The joint objective of the Strategy was formulated as follows Increasing the socio-economic competitiveness of the cross-border area in the European, national, regional and local dimensions through effective use of endogenous potentials and mitigating the constraints arising from the functioning of the EU external border.

Objectives were also identified for the individual fields of strategic action. For *Economic cooperation* these are:

1. providing complete and up-to-date information on business conditions and economic actors in the cross-border region,
 2. creation of further business incentives,
 3. support of specialisation of the existing business environment institutions towards servicing companies interested in co-operation in the cross-border area,
 4. integrated economic promotion of the cross-border region,
- with regard to the *Environment, culture and tourism*:
1. cross-border cooperation of emergency management services,
 2. stimulating activities for the establishment and coordination of cross-border protected areas,
 3. stimulating cross-border actions for cleanliness of waters of the Bug river basin,

4. development of cross-border tourist products,
5. cross-border activities for the protection of world cultural heritage,
6. support and coordination of cross-border cultural events,
7. creation of cross-border cooperation networks of institutions and organisations dealing with environment, culture and tourism,

in the field of *Communication and border infrastructure*:

1. increasing the permeability of the Polish-Belarusian and Polish-Ukrainian borders through the opening of new border crossings, including pedestrian and tourist crossings,
2. improved road accessibility of border crossings,
3. increasing the number of cross-border transport links,
4. extension of the local border traffic zone,
5. revitalisation of cross-border railway infrastructure,
6. supporting airports towards opening new connections, including cross-border ones,

with regard to *Science and higher education*:

1. dissemination of the Bologna System in all universities of the cross-border region,
2. adaptation of the educational offer of universities to the changing requirements of the knowledge-based economy, with particular emphasis on the cross-border economy,
3. creation of inter-university partnerships to absorb external funds for research.

At the same time, a set of indicators was developed for each area of strategic activities, which are the basis for monitoring the progress of the Strategy (Table 1).

On 30 April 2014, the Sejmik of the Lubelskie Voivodeship adopted a resolution on the adoption of the Cross-border Cooperation Strategy of the Lubelskie Voivodeship, Lviv Oblast, Volyn Oblast and Brest Oblast for 2014–2020, and on 7 May 2014 an agreement on the implementation of the Strategy was signed with the representatives of the regions mentioned in the title of the Strategy. It can be concluded, the Cross-Border Cooperation Strategy was – so far – the best and most methodologically advanced strategic document concerning the Polish-Ukrainian borderland.

Despite attempts to update it twice (including extending its scope to include the Podkarpackie Voivodeship), actual implementation has not taken place. The last such attempt at an update was made in connection with the EU financial perspective 2021–2027, but before the outbreak of war in Ukraine. Russia's aggression against Ukraine, carried out with the support of Belarus, ultimately buried hopes of the Strategy becoming a reality.

Table 1. Indicators monitoring the implementation of the Cross-border Cooperation Strategy of Lubelskie Voivodeship, Volyn Oblast, Lviv Oblast and Brest Oblast for 2014–2020

Areas	Indicators
Economic cooperation	<ul style="list-style-type: none"> – number of companies, including those with foreign capital per 10,000 inhabitants, – value of exports from each part of the cross-border region in total and per capita USD, – investment expenditures per capita, – value of GDP per capita
Environment, culture and tourism	<ul style="list-style-type: none"> – cleanliness indicators for the Bug River (based on the monitoring system in place), – particulate and gaseous pollutants per 1km², – number of tourists and nights spent
Communication and border infrastructure	<ul style="list-style-type: none"> – waiting time to cross the border by individual border crossing points, – average travel time between Lublin and Brest, Lublin and Lutsk and Lublin and Lviv, number of regular cross-border bus, train and flight connections, – average travel time to Brest, Lutsk, Lviv and Lublin from selected European cities
Science and higher education	<ul style="list-style-type: none"> – number of students in technical subjects, – share of foreigners in the total number of students, – number of students participating in the Erasmus + programme in the cross-border region, – number of international research teams

2. New Challenges as Prerequisites for a New Cross-border Strategy in the Polish-Ukrainian Borderland

Under the current geopolitical conditions, a new cross-border socio-economic development strategy is needed in the Polish-Ukrainian border region (covering the Lubelskie and Podkarpackie Voivodeships and Volyn, Lviv and possibly Zakarpattia Oblasts). There are several reasons for this. Firstly, the Russian-Ukrainian war has radically changed the economic significance of the Polish-Ukrainian borderland, as the regions forming it – previously peripheral from a socio-economic perspective – have become leading in the functioning of Ukraine's economy, which also means that the Polish border voivodeships may become the backbone of Ukraine's reconstruction, just as they are now the logistical backbone of the war effort.

Secondly, war damage represents an opportunity to rebuild the economy in a modern way, taking into account energy resilience, climate adaptability and digital transformation.

Thirdly, there is a growing opportunity to break down a barrier – the external border of the EU, which is the biggest impediment in the Polish-Ukrainian border region, due to the determination of the Ukrainian authorities to pursue European integration.

Fourthly, there has been local government reform in Ukraine which has strengthened the competences of both the local and regional levels.

It seems necessary for the new strategy to take a scenario-based approach to the future of Ukraine, and thus to the Polish-Ukrainian border region. For the question arises whether Ukraine after the war will return to its borders from before the annexa-

tion of Crimea by Russia in 2014, or to the borders from before the war, whether it will give up part of the oblasts in the east and occupy part of the area of southern Russia, etc.

Among the various scenarios for the end of the war in Ukraine, which have been actively discussed at various levels since the beginning of the war, only pessimistic scenarios, in particular those that envisage capitulation and change of political power, administrative and territorial structure and governance system in Ukraine at the request of the aggressor, with the rejection of further European integration, can have a significant negative impact on the prospects for the future integrated economic development of the regions of the Polish-Ukrainian borderland. This threatens that the Ukrainian government may lose political and economic control over all regions, including the EU border regions, which will automatically negate all previous results of cross-border cooperation on the Polish-Ukrainian border. We believe that such a pessimistic scenario is unlikely, as the US, EU and other developed donor countries have invested significant resources in supporting Ukraine, the European Council has recognised Ukraine's European perspective (The European Council, 2022), so of course they will not agree to a pessimistic scenario of the end of the war, as it would also mean the loss of democratic societies to totalitarian ones, and would open a kind of Pandora's Box for other dictators, which would lead to a global catastrophe in the long run.

Among other scenarios, significant security losses for Ukraine, and to a lesser extent for Poland, could be caused by those that involve a complete or temporary long-term rejection of Ukraine's accession to NATO. However, even such scenarios would not impede the integrated development of the Polish-Ukrainian borderland, and would mainly contribute to increased investment from the EU and both countries in security and defence. On the other hand, scenarios that envisage a rapid end to active hostilities in Ukraine and a diplomatic resolution of the conflict are very important for Ukraine and the EU. This will allow Ukraine's budget to be balanced, and donor countries will be able to redirect investments to rebuild the lost infrastructure and stimulate Ukraine's economy. Accordingly, there will be additional financial opportunities for economic development in the regions of the Polish-Ukrainian border.

It should also be borne in mind that rebuilding the destroyed regions is a long process, so even if we assume a quick end to the war, Ukraine's reconstruction may take more than 5-10 years. Therefore, it seems a rational decision for Ukraine to develop the regions of the conditional home front alongside rebuilding what has been destroyed in order to support its economy and compensate for the budget deficit, which is an important argument for further intensifying cross-border cooperation on the Polish-Ukrainian border.

Thus, virtually all scenarios, except for the most pessimistic one, do not negate, but rather confirm the rationality for the EU, Poland and Ukraine of the decision to intensify cross-border cooperation on the Polish-Ukrainian border, which requires

the development of a joint integrated development strategy taking into account current challenges.

In the process of formulating a new cross-border strategy, it is important to use external (global) factors to the maximum benefit of the development of the Polish-Ukrainian borderland. There are a number of promising trends and opportunities:

- the war in Ukraine may result in reforms of the global security system, energy, goods, services and capital markets;
- the leading countries of the world, in view of Russia's blackmail, will actively reduce their dependence on China and other Asian countries in all markets;
- there will be a need to replace cheap Chinese manufacturers with more reliable producers – preferably European countries with relatively cheap labour and natural resources;
- Polish-Ukrainian border regions, which are peripheral in their respective countries, can use opportunities to attract investors and multinationals to build new modern factories for the EU and US markets;
- the competitive advantage of the Polish-Ukrainian border regions will be the proximity of logistics, availability of educated and cheap labour, and the possibility of training workers to meet the needs of a particular manufacturer.

From the perspective of taking into account the interests of the EU, both countries – Poland and Ukraine, as well as the population of the border areas, the key advantages of forming a new integrated strategy for the development of the Polish-Ukrainian borderland include the following:

1. Parallel solution to the problem of levelling the level of socio-economic development of EU member states and candidate countries.
2. Facilitating the acceleration of Ukraine's European integration by accelerating the economic recovery of the western Ukrainian economy to compensate for the losses of the eastern Ukrainian economy.
3. Raising the living standards of the border population, which will facilitate the return of refugees to the Ukrainian border and reduce internal and external labour migration from the Polish border.
4. Increasing the security and resilience of the Polish-Ukrainian borderland through strengthening the economic development of the region.
5. Formation of a modern, energy efficient, environmentally friendly and socially oriented economy of the Polish-Ukrainian borderland.

Taking into account current global challenges and common concepts of further development of human civilisation, it is possible to identify priorities for the development of the Polish-Ukrainian border in the wartime and post-war periods:

- security (resilience, sustainability) of territories and people's lives by strengthening air security systems, improving military training, developing the military-industrial complex and strengthening the border with Russia and Belarus;

- full digitalisation of the economy and everyday life of people in leading business sectors, in urban agglomerations and rural areas, in the areas of administrative services, education and science, social protection, and everyday life;
- “green” transformation of the economy, primarily in the areas of energy, agriculture, mining and processing, construction, and utilities;
- intellectual transformation of the economy by enhancing the role of education and science in schools, universities, research institutes, companies, and government agencies through effective management of artificial intelligence.

In order to further substantiate the basic provisions of the new strategy, it is important to highlight the main scenarios of integrated economic development of the Polish-Ukrainian borderland (Fig. 1).

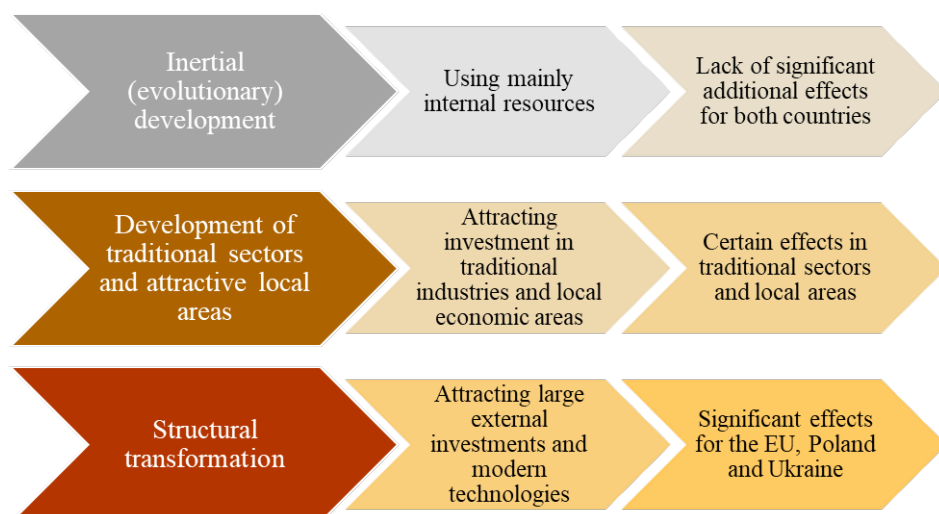


Fig. 1. Scenarios of integrated development of the Polish-Ukrainian borderland in the long term

Source: compiled by the authors.

It is proposed to consider three main scenarios for the integrated development of the Polish-Ukrainian borderland in the long term: inertial development, development of traditional sectors and structural transformation. Each of these scenarios has its own advantages and disadvantages, which need to be considered in detail.

The advantages of the Inertial Development scenario include the absence of the need to make significant investments and implement radical reforms. This scenario may be more stable in the short term. However, its disadvantages include the lack of significant economic growth and increased competitiveness of the region. Preserving traditional industries may lead to lagging behind modern technological trends and loss of markets.

The accelerated 'Development of Traditional Sectors' scenario has the advantages of preserving jobs in traditional industries and agriculture, as well as the possibility of obtaining some economic benefits through investments in modernisation. On the other hand, its disadvantages include limited opportunities for economic diversification and job creation in high-tech sectors, as well as the risks of dependence on global commodity markets.

The Structural Transformation of the Economy scenario has the advantage of achieving significant economic growth through the development of new technologies and innovations, as well as the creation of new jobs in high-tech sectors, and is aimed at increasing the region's competitiveness in the global market. Among its disadvantages are high investment costs and the need for large-scale structural reforms, as well as the risk of additional social tension due to job losses in traditional sectors.

The choice of a particular scenario for the development of the Polish-Ukrainian borderland depends on many factors, such as the availability of resources (financial, human, natural), political will (readiness of governments and local authorities to implement reforms), social consent (support of the population and business), and global trends (changes in global markets, technological innovations).

The best option may be a combination of different scenarios, which will help maintain stability in the economy and ensure its dynamic development. Successful implementation of the chosen scenario requires close cooperation between Ukraine and Poland, as well as international assistance. However, from the perspective of ensuring accelerated economic development in all regions of the Polish-Ukrainian border, the most acceptable scenario is the one that involves structural transformation.

The main goal of the new cross-border strategy should be the structural transformation of the economy of the Polish-Ukrainian borderland as a response to the common challenges of security, green, digital and intellectual transformation in the context of achieving the UN Sustainable Development Goals and accelerating Ukraine's integration into the EU in order to significantly increase the share of these regions in the GDP of both countries.

The main goal will be to solve the following main tasks:

- forming the architecture of an interregional security and defence system against real and potential threats from neighbouring aggressor states (Russia and Belarus), stimulating the development of the territorial defence industry, improving the system of military training, organising joint military exercises, etc;
- substantiating the priority areas and economic incentives for accelerating green transformation, primarily in the areas of energy, agriculture, mining and processing, construction, housing and utilities, and transport in accordance with the UN Sustainable Development Goals, the European Green Deal, national and regional strategies and programmes;

- development of the concept of digital transformation in leading business areas, in urban agglomerations and rural areas, in the areas of administrative services, education and science, social protection, and everyday life, by creating modern platforms (digital hubs, centres, laboratories) for the implementation of innovative ideas, start-ups based on the integration of efforts of representatives of education, science and business with the wide involvement of young people;
- development of the concept of increasing the intellectual capital of the Polish-Ukrainian borderland in accordance with the current and future needs of the labour market, taking into account the clarification of regional development priorities in connection with the structural transformation of the economy towards the development of production, green and digital technologies.

Based on the above, the basic principles of the Strategy for Integrated Development of the Regions of the Polish-Ukrainian Borderland can be defined (Fig. 2).

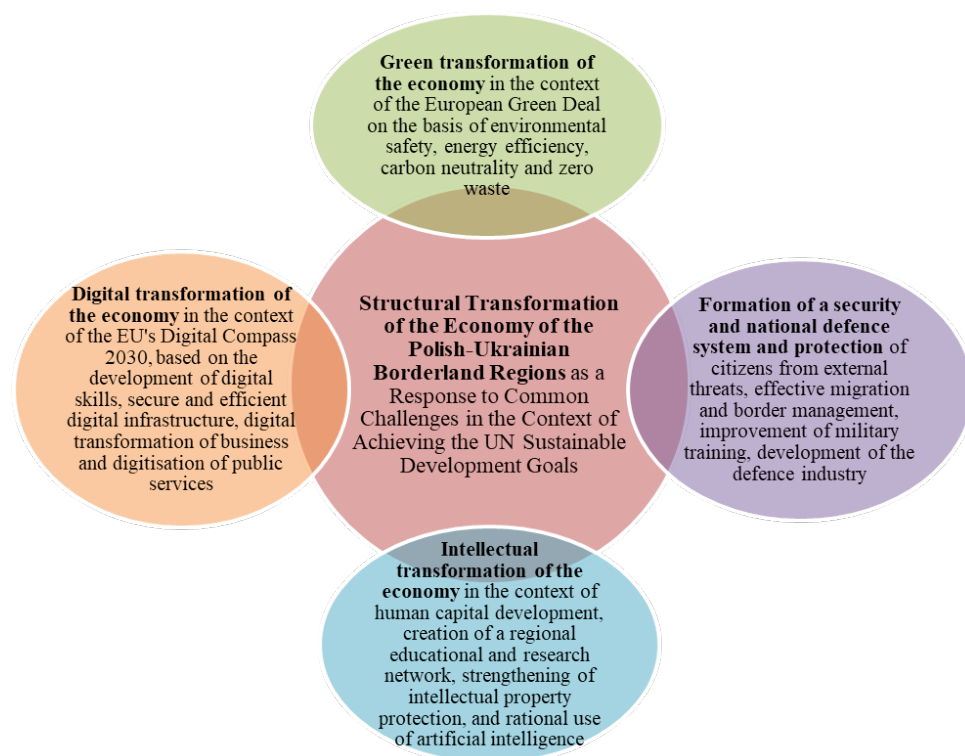


Fig. 2. Basic principles of the Strategy for Integrated Development of the Regions of the Polish-Ukrainian Borderland

Source: compiled by the authors.

The strategy for the integrated development of the Polish-Ukrainian borderland should also be based on the provisions of the EU's financial assistance programme for Ukraine – Ukraine Facility (*Ukraine Facility, 2024*), which provides for the allocation of EUR 50 billion from the EU in 2024–2027 to finance the state budget, stimulate investment and provide technical support for the implementation of the programme, as detailed in the Ukraine Investment Framework (*Ukraine Investment Framework, 2024*), and take into account the national programmes set out in the Ukraine Recovery Plan (*Ukraine Recovery Plan, 2024*).

In particular, the “green” transformation of the Polish-Ukrainian border area should be based on the provisions of the *European Green Deal* (2020), the *European Climate Law* (2021), the *Paris Agreement* (2015) and other EU regulations and include the implementation of measures in the following areas:

- construction of small hydropower plants on mountain rivers in the Carpathian zone and study of the possibility and feasibility on other small rivers (*Bug, Styr, Turia, Bystrytsia, Guchva, San, etc.*);
- construction of solar and wind power plants on land unsuitable for agriculture near towns and villages, in the mountain valleys of the Carpathian zone;
- construction of plants for the production of photovoltaic panels and energy storage systems (in the border area near the border crossing);
- providing loans to agricultural enterprises for the installation of biogas and biodiesel plants from agricultural waste;
- development of bioethanol production based on local agricultural raw materials (corn and wheat grain, sugar beet);
- construction of waste recycling plants near each settlement to ensure the processing of household and industrial waste;
- installation of a digital environmental monitoring system near industrial and municipal facilities.

Digital transformation in the Polish-Ukrainian borderland should be based on the provisions of the 2030 Digital Compass the European (*Digital Compass, 2021*), A Digital Single Market Strategy for Europe (*Digital Single Market Strategy, 2015*) and is associated with the implementation of a number of measures:

- development of cross-border digital transformation policies and strategies in key business sectors and public institutions;
- creation of interregional modern digital platforms (R&D centres, digital hubs, business incubators, accelerators, laboratories) for the implementation of innovative ideas and start-ups based on the integration of efforts of representatives of education, science and business in the border regions with the mandatory involvement of young people;
- creation of an interregional cybersecurity system for the Polish-Ukrainian border regions;

- creation of high-tech factories for the production of smartphones, TVs, household appliances, computer equipment, and smart home systems of world-famous brands;
- establishing plants for the production of microchips and microcircuits for modern electronic household and industrial equipment;
- development of 5G networks in all settlements of the border regions;
- stimulating the introduction of smart home systems, Internet of Things (IoT) technologies, etc. in everyday life and at work.

It is also important to use the capabilities of the education and science system of the Polish-Ukrainian borderland to ensure intellectual transformation in accordance with the *EU Artificial Intelligence Act* (2024), using all the opportunities of the Horizon Europe programme (*Horizon Europe*, 2021). After all, the leading universities of the Polish-Ukrainian borderland (primarily in the cities of Lublin, Rzeszów, Lutsk, and Lviv) should become educational and scientific centres for training and retraining personnel in accordance with the long-term needs of the regional economy. These universities can create educational consortia to prepare joint educational programmes and implement educational and research projects important for joint development.

First of all, it is important to improve the level of basic training in schools in such subjects as mathematics, physics, chemistry, biology, as well as in universities in the areas of applied mathematics, biophysics, biochemistry, artificial intelligence, etc.

It is also necessary to strengthen the practical training of students in the following economic sectors of the Polish-Ukrainian borderland: computer science, energy, transport and logistics, information technology, robotics, food technology, woodworking, light industry, chemical industry, construction and architecture, etc.

In the coming years, it is very important to ensure an increase in the level of military security of the Polish-Ukrainian border, taking into account the *Strategic Compass for Security and Defence* (2022), the *European Economic Security Strategy* (2023) and other EU and NATO security documents. To achieve this, a number of measures need to be taken to strengthen the defence capability of the border areas:

- installing additional and upgrading existing air defence systems;
- establishing additional military units and defence structures on the border with Belarus;
- modernisation of existing (Rzeszów, Lublin, Lutsk) and construction of new military airfields;
- arrangement of joint military training grounds and involvement of foreign instructors for training and retraining of army personnel in all types of modern NATO weapons.

It is also important to intensify activities to develop the military-industrial complex in the following key areas:

- construction of factories for the production of ammunition, missiles, precision guidance systems for various types of modern NATO weapons;
- construction of new plants for the production and repair of heavy military equipment in the border area;
- stimulating the activities of design bureaus (including non-governmental ones) to develop new types of weapons and defence systems, as well as to improve existing models;
- construction of factories for the production of unmanned aerial and ground vehicles.

It is also advisable to make use of the geographical and logistical potential of the Polish-Ukrainian border economy. In particular, within the framework of The Three Seas Initiative (3SI) (*Three Seas Initiative*, 2016), we can propose:

- involvement of the border regions of Ukraine in cooperation projects;
- construction of new border crossings on the Polish-Ukrainian border (separately for freight and passenger transport);
- construction of railway lines on Ukrainian territory in accordance with European standards;
- construction of new road and railway bridges across the Bug River;
- construction of new logistics centres for storage, packaging and loading of agricultural and industrial products (for further shipment to the ports of the Baltic Sea or other European countries);
- construction and conversion of existing petrol stations into charging stations for electric vehicles;
- complete transition to electric or other technologies in large cities;
- creating opportunities to intensify local border traffic for the development of joint small businesses.

There are three main instruments for implementing the Strategy for Integrated Development of the Regions of the Polish-Ukrainian Borderland (Fig. 3).

These three instruments are interrelated and complementary. Establishing joint institutions will facilitate more efficient distribution of investments and coordination of efforts of various stakeholders. The reorientation of foreign investments will provide financial resources for the implementation of joint projects, and the creation of joint ventures will contribute to the development of specific sectors of the economy in the regions of the Polish-Ukrainian borderland.

The implementation of the Strategy for Integrated Development of the Polish-Ukrainian Borderland is a complex and multifaceted process that requires the use of various instruments. The proposed instruments can be effective if they are applied in a comprehensive manner and take into account the specifics of each region.

The war in Ukraine has significantly changed the priorities and prospects for economic development of the Polish-Ukrainian border regions, as they have been

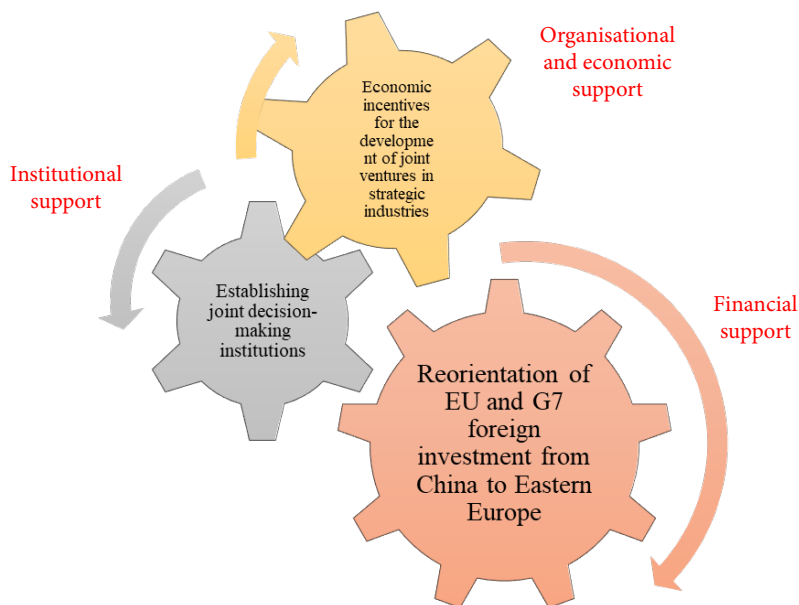


Fig. 3. Main instruments for implementing the Strategy for Integrated Development of the Polish-Ukrainian Borderland Regions

Source: compiled by the authors.

assigned many additional functions: transport and logistics, humanitarian, social, economic, military, industrial, etc.

In order to support the implementation of these functions, it is very important to attract additional investments into the economy of these regions, including the so-called “alternative investments”.

The main arguments in favour of increasing EU investment in the regions of the Polish-Ukrainian borderland can be identified:

1. Natural resource potential – the Polish-Ukrainian borderland is rich in natural resources that can be used to provide raw materials for new production facilities in the areas of food industry, construction materials, chemical industry, forestry, light industry, military-industrial complex, etc.;
2. Logistical advantages – proximity to the EU as the main market and to the war-torn territories of Ukraine, which will require infrastructure restoration and implementation of the Trilateral Initiative;
3. Concentration of additional labour force – refugees from Ukraine (near the border with Poland), migrants from the destroyed regions (near the border with Ukraine);
4. The presence of powerful classical and technical universities and research institutes that can train the necessary specialists for the development of new economic sectors in the region;

5. Developed cultural ties and mental proximity of the population of the Polish-Ukrainian borderland, which will facilitate the development of joint economic activities.

Alternative investments in the economy of the Polish-Ukrainian border region can be divided into two groups.

The first group is the possibility of partially redirecting existing investments from the EU, the USA, Canada and the UK to the economies of China and Hong Kong (as countries supporting the aggressor country) in order to build a modern (energy-efficient, environmentally friendly and socially responsible) economy in the Polish-Ukrainian border regions, which have strong potential in terms of natural resources and labor. This will allow to simultaneously solve the systemic problems of the regions on both sides of the Polish-Ukrainian border.

On the one hand, accelerated economic development of relatively safe Ukrainian border regions will allow to more quickly compensate for the loss of about 30% of GDP and about 50% of Ukraine's budget deficit due to the destruction of the economy in the east, and will also facilitate the return of refugees by improving the well-being of the population.

On the other hand, for Polish border regions, the reorientation of global investments will provide a unique opportunity to move away from their peripheral status at the level of Poland as a whole and to receive additional benefits from the post-war reconstruction of Ukraine and the implementation of the Trilateral Initiative.

The second group of alternative investments includes investment opportunities in the following promising projects:

- venture business (in particular, in factories engaged in the development and serial production of modern, war-tested, weapons and defense equipment);
- investments in the construction of logistics hubs, the creation of new and modernization of existing transport corridors (in particular, railways in accordance with the European gauge standard);
- investments in the development of educational and research centers to increase the intellectual potential of the region's population and the accumulation of qualified labor for the development of the Polish-Ukrainian border region.

The greatest effect for investors and the economy of the Polish-Ukrainian border regions will be achieved by combining alternative investment instruments from private, municipal, state and international sources on a partnership basis into green, digital and intelligent transformation projects taking into account security challenges.

Conclusion

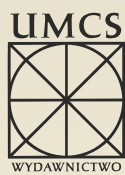
Thus, before the start of the full-scale war in Ukraine, attempts were made to form strategic documents that defined a joint development strategy for the regions of the Polish-Ukrainian border region. But unfortunately, without proper institutional, legislative, organizational, economic and financial support, these documents remained mainly the intentions of the interested parties. It is obvious that the full-scale war and other modern global challenges have significantly reformatted the development priorities of the regions of the Polish-Ukrainian border region. Therefore, the new strategy for the integrated development of the Polish-Ukrainian border region should be aimed at the structural transformation of the economies of the relevant regions as a response to the common challenges of security, green, digital and intellectual transformation in the context of implementing the UN Sustainable Development Goals and accelerating the process of Ukraine's integration into the EU. To gain the right to life, the strategy must go through all stages of public discussion and clarification, approval by the European Commission, the Governments and regional authorities of Poland and Ukraine, receive institutional management bodies and appropriate funding from EU funds, national and local budgets, and other available sources.

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