



Cross-border innovation clusters as a tool for sustainable development of territorial communities: Management and legal aspects

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Abstract. The relevance of the study is due to the need to find effective tools for ensuring sustainable development of territorial communities, in particular in the context of European integration and the growing role of cross-border cooperation. The aim of the article was to study the management and legal aspects of the formation and functioning of cross-border innovation clusters as a tool for stimulating regional development. The methodological basis was an interdisciplinary approach using comparative, institutional analysis and the case study method. As a result of the study, it was established that cross-border innovation clusters act as an effective mechanism for integrating economic, innovative and social resources of border territories, ensuring the formation of network interactions between business, science, and government. An analysis of European experience showed that the success is based on a combination of institutional support, a developed regulatory framework and the active participation of public administration bodies. The generalisation of practical cases made it possible to identify the key effects of cross-border projects, in particular economic, innovative, infrastructural, social and institutional. At the same time, it was established that in Ukraine the majority of cross-border cluster initiatives are of a project-based nature and are not transformed into stable institutional

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structures, which limits the long-term impact. It was revealed that the main restraining factors are the fragmentation of legal regulation, insufficient coordination between institutions and limited financial resources. The need to develop effective management mechanisms, harmonisation of the regulatory framework and strengthening the participation of territorial communities in international cooperation programmes is substantiated. The practical value of the study lies in the possibility of using the obtained results to improve state regional policy and form effective models of management of cross-border cluster initiatives

■ **Keywords:** regional investment policy; cross-border cooperation; Euroregions; innovation ecosystems; legal regulation

■ Introduction

In the current conditions of globalisation, strengthening of international economic integration and transformation of the public administration system, the search for effective tools for ensuring sustainable development of territorial communities is of particular relevance. An important place among such tools is occupied by cross-border innovation clusters (CICs), which contribute to the activation of the economic potential of border territories, the development of innovative activity, the deepening of interregional cooperation and the formation of new models of economic interaction. Modern scientific research confirms that cluster approaches are an important factor in increasing the competitiveness of regions through the concentration of resources, the development of the innovation environment and the strengthening of institutional interaction (Ketels & Protsiv, 2021).

The main principle of international cross-border cooperation (CBC) is the establishment of relationships and the conclusion of contractual relations between border regions for the joint solution of urgent problems. In particular, the creation of Euroregions is carried out by concluding partnership agreements between local governments of neighbouring border territories. These agreements become the basis for the formation of associations of administrative-territorial units of both municipal and regional levels, which are interested in the joint implementation of various projects within a certain border zone. Ukraine has significant potential in the field of CBC, including the development of clusters as modern tools for introducing innovations into regional policy. At the same time, the implementation of this potential remains insufficiently effective. In this context, N. Danko & O. Izmailov (2025) focused on the feasibility of using cluster models of cross-border interaction as a tool for adapting the national economy to the conditions of European integration.

In modern Europe, CBC is considered one of the key mechanisms for reducing socio-economic disparities between regions, increasing the competitiveness of territories and stimulating innovative development. In particular, J.A.R. Borges *et al.* (2021) emphasised that in this context the cluster approach plays an important role, as it ensures effective interaction between public authorities, business, scientific institutions and the public sector, creating a favourable environment for generating and implementing innovations. At the same time, B. Derudder & X. Liu (2025) emphasised the importance of cross-border regional innovation systems as a new paradigm for the development of

border territories, based on the integration of economic, institutional and technological processes.

The role of cross-border clusters in sustainable development is based on several key aspects: economic modernisation, scientific and applied development, sharing of infrastructure and knowledge, which reduces costs and increases production efficiency, and attracting investment. Such structures are a key tool for the structural transformation of regions, ensuring the long-term economic, social and environmental development. At the same time, as noted by V. Liashenko & N. Trushkina (2021), the effectiveness of the functioning of cross-border clusters is largely determined by institutional conditions, in particular the level of policy coordination, regulatory support and infrastructure development

The study of CICs acquires particular importance in the context of the implementation of Ukraine's European integration course. Deepening cooperation with European institutions, harmonisation of national legislation with European Union law and increased participation of Ukrainian regions in CBC programmes open up new opportunities for the development of border territories. In this context, territorial communities become important subjects of international interaction, capable of implementing joint innovation projects, attracting investments and forming competitive economic environments.

At the same time, modern transformations of territorial development are taking place under the influence of digitalisation and new security challenges, which necessitates the rethinking of public administration instruments. As noted by O. Sydoruk *et al.* (2024), spatial development, in particular in the context of the formation of "smart" territories, is accompanied by the growth of complex threats that arise at the intersection of technological, social and economic processes, which requires integrated management solutions. In this context, cluster approaches are considered as an effective tool for coordinating economic activity and strengthening the institutional capacity of territorial communities, in particular in the cross-border dimension.

Meanwhile, the effectiveness of the functioning of CICs largely depends on proper management support, coordination of the activities of various institutional actors and the formation of an appropriate legal environment that regulates the mechanisms of cross-border interaction. Despite the growing scientific interest in the issues of cluster development and CBC, the issues of management mechanisms



and legal regulation of the functioning of CICs in the context of sustainable development of territorial communities remain insufficiently researched. The aim of the article was to study the management and legal aspects of the functioning of CICs as a tool for ensuring the sustainable development of territorial communities in the context of Ukraine's European integration.

■ Materials and Methods

The methodological basis of the study was an interdisciplinary approach that combined tools of public administration, regional economics and law, which allowed for a comprehensive analysis of the functioning of CICs in the context of ensuring the sustainable development of territorial communities. The object of the study was the processes of formation and functioning of CICs, and the subject was the management and legal mechanisms of the development in the context of the European integration of Ukraine. The empirical basis of the study was scientific publications on the issues of cluster development and CBC, legal and regulatory acts of the European Union and Ukraine, analytical reports of international organisations, as well as materials on the practical functioning of cross-border clusters in the EU countries and Ukraine. The use of diverse sources allowed for the comprehensiveness of the analysis and the implementation of the principle of methodological triangulation.

The study was carried out using a qualitative research strategy that included a combination of comparative analysis, institutional analysis and case studies. This approach was chosen due to the complexity of the research object, which simultaneously covered the management, economic and legal aspects of the functioning of cluster entities in a cross-border environment. Comparative analysis was used to compare models of functioning of cross-border clusters in the countries of the European Union and in Ukraine. The comparison was carried out according to the following criteria: institutional management structure, level of participation of public authorities, funding mechanisms, degree of integration into regional innovation systems, as well as the presence of regulatory and legal support. This made it possible to identify differences in approaches to organising cluster interaction and determine the factors of the effectiveness.

Institutional analysis was used to study the legal environment of functioning of CICs. Within the framework of this method, regulatory and legal acts of the European Union and Ukraine regulating CBC, cluster development and regional policy were analysed. Particular attention was paid to assessing the coherence of legal norms, the level of the implementation and the impact on the effectiveness of managing cluster initiatives.

The case study method was used for an in-depth analysis of the practices of cross-border clusters. The selection of cases was carried out on the principle of representativeness and theoretical relevance and included examples of clusters in the EU countries and Ukraine, demonstrating different

models of organising cross-border interaction. The analysis of cases was carried out according to the following parameters: industry specialisation of the cluster, form of management, sources of funding, level of innovative activity, participation of public authorities, as well as the results of functioning from the point of view of economic and social effect. To generalise the results of the study, the methods of analysis, synthesis, systematisation and generalisation were used, which made it possible to form a holistic idea of the role of CICs in ensuring the sustainable development of territorial communities and to identify the key management and legal factors of the effective functioning.

The obtained results of the study directly reflect the application of the specified methods. In particular, the results of the comparative analysis of cross-border interaction models were systematised in the corresponding analytical generalisations, which made it possible to identify differences between the European and Ukrainian approaches. Institutional analysis was implemented through a study of the regulatory environment of cluster functioning, which was reflected in the conclusions regarding the role of legal regulation and public policy coordination. The case study method was reflected in the presented examples of cross-border cluster functioning, which made it possible to specify the influence of management mechanisms on the effectiveness. The generalisation of the research results was carried out by systematising the data obtained, which ensured the formation of a holistic vision of the role of CICs in ensuring the sustainable development of territorial communities.

■ Results and Discussion

Cross-border clusters in the system of sustainable development and regional policy of the EU

In modern conditions of globalisation, a special feature of the development of state regional and foreign economic policy is CBC, aimed at strengthening relations and creating conditions for closer coordination of actions in the field of integration of the economies of neighbouring countries. CBC in the most integrated form is implemented through the creation of cross-border clusters, which are an innovative element of cooperation that ensures the dynamic and sustainable development of cross-border regions. CICs contribute to sustainable development by connecting science, business, and public authorities across borders to accelerate the implementation of innovations. Such clusters contribute to economic growth, the development of local communities through job creation, technology transfer and infrastructure modernisation. Research in this area focuses on mechanisms for CBC, the formation of an environmentally sound economy, and increasing the competitiveness of regions through the sharing of infrastructure and knowledge, which ensures economic, environmental, and social sustainability (Derudder & Liu, 2025). The main aspects of research on CICs and sustainable development can be summarised in several key domains (Table 1).

Table 1. Key aspects of research on CICs and sustainable development

Research aspect	Content
Theoretical foundations	Studying the impact of cluster theory (e.g., Michael Porter) on sustainable development in a cross-border context
Management mechanisms	Analysis of tools that facilitate interaction between companies, educational institutions and government bodies of different countries
Greening of clusters	Research into the role of innovation in reducing the environmental footprint and transitioning to a green economy
Sustainability and risks	Assessing the sustainability of cross-border value chains vis-à-vis external economic and environmental partners
Development of local communities	Clusters help overcome the peripherality of border areas by strengthening the involvement of local actors (small and medium-sized enterprises, non-profit organisations, universities) in global value chains.
<i>Key research areas</i>	
Development of innovation infrastructure in border regions	
The relationship between sustainable development and cross-border projects	
Assessment of cluster effectiveness based on sustainability indicators (ESG – environmental, social, governance)	

Source: compiled by the authors

T. Makkonen & S. Rohde (2016) and A. D'ambrosio *et al.* (2017) expressed the authors' opinion that the phenomenon of cluster formation is associated with a paradigm shift, adaptation to the conditions of globalisation and a significant increase in the dynamism of the environment. In other words, the economy is moving into a new network order that combines the functional synthesis of hierarchical and market models. At the same time, the world economy and its components are stratified into cluster-network structures. These structures are much more flexible than traditional hierarchical models, and at the same time better integrated compared to classical market models. As a result, the modern economy is transformed into an extremely flexible network system with horizontal connections.

In this context, the development of multi-level partnerships between different groups of stakeholders, which ensure effective coordination of interaction within cluster systems, becomes important. As B. Singh & S. Chandra (2025) noted, the formation of sustainable partnerships between business, local communities, government institutions and other stakeholders contributes to the achievement of sustainable development goals, in particular by increasing the level of trust, inclusiveness and shared responsibility. In addition, such partnerships, including public-private and cross-sectoral cooperation, create the prerequisites for pooling resources, developing innovations and introducing modern technologies, which enhances the effectiveness of cluster-network structures (Zhao *et al.*, 2024). It was also argued that clusters will gradually become the main structural link in the global market space, performing the organising role that industries previously performed.

At the turn of the 1980s and 1990s, clusters were perceived as an advanced type of industrial agglomerations (hence the term "industrial clusters"), which allow participants and the territories where the participants are based to achieve special competitive advantages. Later, the factor of territorial localisation of clusters was added (hence the term "regional clusters"), as well as the description as network and non-hierarchical formations (Hardi *et al.*, 2021).

Sociological studies of the 2000s attributed clusters to innovation ecosystems where collaboration mechanisms are formed (Liashenko & Trushkina, 2021). This gave rise to the concept of innovation clusters, whose participants develop a shared vision of future actions and the possibility of co-creation of values, relying on the mechanisms of production (co-production) and co-specialisation (co-specialisation) (Rácz, 2017).

CBC with the formation of cross-border clusters is widely represented in Europe. The EU pursues a targeted policy of cluster development by – creating and providing access to a database of clusters containing information on the number, geographical location and success stories; developing training platforms to provide member states and the regions with up-to-date information on key areas of cluster policy implementation; supporting pilot projects and activities aimed at developing effective tools for identifying and forming cluster initiatives.

Among the most effective tools for stimulating cluster development in the EU are:

1. The European Cluster Collaboration Platform (ECCP), n.d., functions as an information platform that provides a wide range of services. Among the main services, it is worth noting the cluster mapping, which provides access to up-to-date cluster maps in Europe and allows for comparative analysis of clusters by key competitiveness indicators. In addition, the observatory generates reports on cluster trends in Europe, focusing on internationalisation, global megatrends in industrial transformations, as well as identifying common interests and potential areas for cooperation.

2. The European Cluster Achievement Initiative aims to develop an indicative methodology for the creation and effective organisation of clusters, as well as to improve internal management processes. Currently, it is being implemented by the European Cluster Analysis Secretariat and the European Cluster Achievement Foundation. These organisations conduct specialised training and develop educational materials. In addition, this initiative serves as a funding programme for various projects.



3. The European Cluster Cooperation Platform provides companies with the opportunity to present the activities, share experience and find partners for cooperation both within the EU countries and beyond the borders. Within the framework of this platform, the concept of strategic cluster partnerships is implemented, the funding of which is provided through the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) programme (Regulation (EU) No. 1287/2013, 2013). Such partnerships are aimed at stimulating the joint work of clusters in Europe, the formation of a strategic vision and joint plans for integration into external markets. This allows strengthening the competitive position of small and medium-sized enterprises on a global scale.

4. The CluStrat (n.d.) project (Boosting innovation through new cluster concepts in support of emerging issues and cross-sectoral themes) focuses on supporting leading-edge industries and cross-sectoral cooperation. Within the framework of this initiative, 18 partners from Austria, the Czech Republic, Germany, Hungary, Italy, Poland, Slovakia, and Slovenia developed a joint strategy for the introduction of advanced technologies and the stimulation of new industries. The project includes proposals for joint actions at the transnational and macro-regional levels, the implementation of pilot initiatives, as well as detailed reports for each participating country of the consortium. These reports summarise best practices and key results of cluster activities.

5. The Vanguard Initiative (n.d.) aims to stimulate new growth through smart specialisation mechanisms. Its main goal is to transform regional partnerships and clusters, defined by strategic priorities of smart specialisation, into globally competitive associations. Regions participating in this initiative seek to promote the internationalisation of the cluster projects by developing cross-border and network connections and scaling the activities to strengthen the positions at the international level.

Although clusters in Europe develop independently, the state provides these clusters with significant financial and economic support. According to various sources, including C. Ketels & S. Protsiv (2021), about 30% of funding comes from national public funds, 25% are membership fees of participants in innovative industrial clusters, and 20% are funds from regional public funds. In general, in Europe, about 50% of funding sources are somehow related to the participation of state authorities at the national and regional levels. This plays an important, and in many cases, a key role in ensuring sustainable socio-economic development. Thus, the positive impact of innovative industrial clusters on the regional economy is ensured based on the formation of the brand of the industrial territory. As a result, this leads to an active growth of innovative activity of organisations of related industries, and inter-industry technological chains are formed.

Best practices and effects of the functioning of cross-border clusters in Europe

In the current conditions of European integration, the study of practical experience in the functioning of cross-border

clusters as a tool for regional development is of particular importance. Analysis of successful cases enables identifying effective mechanisms of interaction between state institutions, business and scientific institutions within the cross-border space. This, in turn, creates a basis for generalising best practices and adapting these practices to the conditions of development of territorial communities.

The Medicon Valley cluster, which unites regions of Denmark and Sweden, began to take shape in the 1990s, and a significant impetus for its development is associated with the opening of the Øresund Bridge in 2000, which provided intensive integration of Copenhagen and Malmö (Cooke, 2004). The cluster specialises in life sciences, in particular research in the field of oncology, neurology and diabetes, and unites a wide network of companies, universities, hospitals, and research centres (Medicon Valley Alliance). The Scandinavian model of cluster development is characterised by a high level of interaction between the state, business and scientific institutions, which corresponds to the concept of the “knowledge triangle” and contributes to the innovative development of the region (OECD, 2011).

An example of a cross-border cluster initiative is the Bio-Based Industries Cluster (BIG-Cluster) (ECCP, 2025), which brings together cluster organisations from the Netherlands, Belgium, and Germany. The main goal of the cluster is to develop the bioeconomy by integrating the industrial, scientific and innovative resources of the cross-border region and forming competitive bio-based industries (BIG-Cluster). The cluster members implement joint projects aimed at introducing biorenewable materials, developing innovative technologies and supporting entrepreneurial initiatives in the bioeconomy. The cluster activities are also focused on strengthening cooperation between business, scientific institutions and the public sector, which is in line with modern approaches to the formation of cross-border innovation ecosystems.

Another example of a cross-border cluster is BioValley, located in the Upper Rhine region, which brings together participants from France, Germany, and Switzerland (BioValley Basel, n.d.). The cluster includes companies, research institutions, economic development bodies and other institutional structures cooperating in the field of biotechnology, pharmaceuticals and medical technologies. The developed innovation infrastructure, in particular science parks, technology platforms and knowledge transfer networks, contributes to the active exchange of information and the implementation of innovative solutions. The cluster demonstrates a high level of entrepreneurial activity, in particular through the support of start-ups and the development of innovation ecosystems, which is a characteristic feature of cross-border innovation systems in Europe.

Poland is one of the leading countries in Central Europe in the field of cluster policy, which is confirmed by its active participation in the formation of national and European cluster initiatives (Kowalski, 2020). A significant part of the clusters operate in border regions and are focused on international cooperation, which promotes integration into

the European economic space. Regional government bodies, scientific institutions and enterprises play an important role in the development of clusters, which corresponds to the model of interaction “business – science – government” (OECD, 2011). An example of effective cluster development is the Aviation Valley aviation cluster in the Podkarpace Voivodeship, which unites over 160 aviation enterprises and actively cooperates with European partners (Aviation Valley Association). The cluster plays an important role in the development of high-tech production and helps attract investments to the region.

The benefits of CBC for local communities are clearly demonstrated within the framework of the Interreg South Baltic Programme, which is aimed at developing the economic, social and territorial cohesion of the region (Interreg South Baltic Programme, n.d.). In particular, the Umbrella project was focused on attracting new participants

to CBC and provided for training events, development of management competencies and support for micro-initiatives aimed at strengthening interregional ties. The programme implemented a number of projects in the fields of tourism, ecology, innovation and transport integration, in particular Biking South Baltic, Interconnect, Live Lagoons and South Coast Baltic, which contribute to the development of infrastructure, innovative solutions and sustainable use of resources. As shown by the study of cross-border innovation systems conducted by T. Makkonen & S. Rohde (2016), such initiatives contribute to the formation of sustainable interregional ties, increasing institutional capacity and developing the innovative potential of territories. To systematise the results of the implementation of cross-border projects, it is advisable to distinguish the main types of effects of the impact on the development of territories (Table 2).

Table 2. Types of effects of cross-border projects (using the example of the South Baltic programme)

Effect type	Effect content	Implementation tools	Project examples
Economic	Growth of economic activity, development of small and medium-sized businesses, attraction of investments	Support for cluster initiatives, grant programmes, entrepreneurship development	SB Food INNO, Interconnect
Innovative	Development and implementation of new technologies, stimulation of scientific and practical cooperation	Joint R&D projects, technology transfer, development of innovation ecosystems	BioBIGG, FOCUS
Infrastructure	Development of transport, tourism and environmental infrastructure	Investments in infrastructure facilities, creation of joint routes and services	South Coast Baltic, Biking South Baltic
Environmental	Improving the environment, introducing resource-saving technologies	Environmental projects, natural resource management, monitoring	Live Lagoons
Social	Strengthening social cohesion, forming regional identity	Educational programmes, training activities, micro-projects (“people-to-people”)	Umbrella, CaSYPoT
Institutional	Developing the capacity of authorities and organisations for cross-border interaction	Project management training, partnership building, policy coordination	Umbrella, DUNC
Cultural	Preservation and popularisation of cultural heritage, development of tourism	Joint cultural initiatives, branding of territories	BalticMuseums, DUNC

Source: compiled by the authors

The presented systematisation shows that cross-border projects have a complex impact on the development of territories, combining economic, innovative, social and institutional effects. The effectiveness is due to the integration of various public policy instruments and active interaction between actors from different countries, which ensures a synergistic result and strengthens the sustainable development of regions. An example of effective implementation is the Attractive Hardwoods project (2025), which brought together partners from Poland, Lithuania, and Sweden to develop ecotourism and jointly solve the problems of natural resource management. Within the framework of the project, a study of tourist flows was conducted, information materials were developed, and national development strategies were formed, which confirms the effectiveness of the cross-border approach to solving common challenges (Interreg South Baltic Programme, n.d.).

The BioBIGG (Bioeconomy Innovation for Growth in the South Baltic Area) project (n.d.) is based on the concept

of efficient use of biological resources, a significant part of which is traditionally considered waste, although it has the potential for reuse within the bioeconomy. In particular, it concerns by-products of agricultural production, which can be involved in the creation of new types of products, which corresponds to the approach of “transforming waste into a resource” (Bioeconomy Strategy, n.d.). The BioBIGG project aims to identify such opportunities, reduce the environmental burden and support the development of small and medium-sized enterprises through the implementation of innovative solutions. The project involves cooperation between universities, enterprises and local governments, which contributes to the formation of innovation ecosystems and the development of cross-border connections. The project involves partners from Denmark, Poland, Sweden and Germany, in particular research institutions and organisations working in the field of renewable resources. An important element of the activity is the exchange of knowledge, conducting training activities and developing



the competences of participants, which makes it possible to increase the efficiency of the implementation of innovative solutions in the field of bioeconomy (BioBIGG, n.d.).

Summarising the above examples, it should be noted that cross-border clusters in Europe are an effective tool for integrating the economic, innovative and institutional resources of border areas. The development is based on a combination of a cluster approach, intersectoral interaction and support from supranational programmes, which ensures the formation of sustainable innovation ecosystems. An important characteristic of such clusters is the ability to generate synergistic effects, which are manifested in the growth of regional competitiveness, the activation of entrepreneurial activity and an increase in the level of socio-economic cohesion. Thus, cross-border cluster initiatives can be considered as a key tool for implementing the policy of sustainable development of territorial communities in the context of European integration.

Specifics and challenges of cross-border innovation cluster development in Ukraine

In Ukraine, CBC is considered in two key aspects: as a mechanism for the development of border regions and as a tool for implementing the country's European integration aspirations. At the same time, the development of CBC between border regions of Ukraine and neighbouring states is limited due to excessive ambition, political conditions and insufficient clarity of the functions of Euroregions. Although these regions declare the readiness to jointly solve urgent problems in various spheres of public life, the lack of a strategic approach makes it difficult to achieve results. Regional cooperation projects in Ukraine are most often implemented on the basis of accumulated practical experience, without the necessary theoretical and methodological foundation. This creates a critical need to develop scientifically sound frameworks that would optimise the processes of cooperation between border regions of Ukraine and EU countries. Such frameworks can become a driving force for innovative interaction, strengthening ties and knowledge exchange between regions, ensuring more effective use of existing opportunities. Issues arising in the field of CBC are related to the lack of activity of its participants in the implementation of relevant projects. The main reasons for this are the limited availability of sustainable sources of funding and the low quality of project management observed at the level of local executive authorities and self-government.

N. Reznikova *et al.* (2020) studied innovation clusters in the context of CBC. In the authors' work, the researchers identified different types of cluster formations that can be effectively adapted to implement cross-border interaction. This, in turn, made it possible to identify economic policy instruments aimed at stimulating the deepening of integration processes in regions located near the borders. As key criteria for distinguishing between the concepts of "innovation cluster in CBC" and "cross-border innovation cluster", the authors noted specialisation and methods of

achieving competitiveness through the use of new comparative advantages. N. Danko & O. Izmailov (2025) analysed the cluster model of cross-border interaction between Ukraine and Poland in the context of European integration processes. The paper proposes a conceptual model of cyclical cluster cooperation, which includes five key phases: project initiation, harmonisation of the regulatory space, creation of cluster associations, project implementation, and evaluation of the results obtained. According to the authors, such a model is a universal tool for deepening strategic integration between countries, capable of increasing the competitiveness and promoting sustainable development of trade and economic cooperation. However, despite the rationality of the main idea, the model itself does not have a sufficient level of scientific novelty, looks somewhat declarative and disconnected from the realities of the dynamic environment of CBC. This is especially true of its application in the context of sustainable development and taking into account the interests of territorial communities.

S. Stegnyy (2025) studied the impact and prospects of CBC between Ukraine and the European Union countries in the context of the intensification of European integration processes, taking into account the specifics of the regions, current challenges and strategic directions for the development of border areas. The author emphasised the importance of taking into account the social aspects of CBC, which go beyond purely economic tasks and cover such aspects as cultural exchange, population mobility, joint use of natural resources and strengthening the social capital of border communities. The scientist showed that the social consequences of such cooperation are manifested in increasing the accessibility of education, medicine and administrative services, deepening intercultural communication and activating civic initiatives. For example, thanks to joint projects of Lviv, Volyn and Zakarpattia regions with Polish partners, social assistance centres were created, joint historical and cultural routes were introduced and primary medical care conditions were improved. There is also a noticeable positive impact on the development of human capital: cross-border projects often include educational programmes, advanced training of local government employees, and support for youth initiatives.

Thus, CBC has a comprehensive socio-economic effect, covering not only the development of infrastructure and economic interaction, but also the formation of social capital and human potential of border areas. Achieving such results requires proper management support, capable of coordinating the interaction of participants and guaranteeing the sustainability of the implementation of joint initiatives. In this regard, the analysis of the practice of managing cross-border clusters as a key factor in the effectiveness and long-term development is of particular importance. The experience of European countries shows that the effectiveness of such clusters is determined primarily by the quality of the established management mechanisms that ensure the coordination of the interests of participants, the definition of strategic priorities and the creation of

appropriate institutional structures for the implementation of joint projects. An important role in this process is played by local governments, which initiate partnerships between entities of different states and provide institutional support for cluster initiatives.

One of the main aspects of managing CICs is the use of network models built on the principles of partnership, cooperation and shared responsibility. This approach contributes to increasing the flexibility of management processes, rapid adaptation to changes in the economic environment and effective coordination of innovation activities. At the same time, the implementation of strategic planning for cluster development plays a key role, which includes defining long-term goals, creating the necessary infrastructure to support innovation, as well as attracting investment resources. The legal aspect of the functioning of CICs is no less important. The effective implementation of cluster initiatives requires a clearly defined regulatory and legal environment that regulates the mechanisms of CBC, the legal status of cluster participants, the procedure for implementing joint projects and funding innovation activities. In Ukraine, the legal principles of CBC are determined by legislation in the field of local government, regional development and CBC.

The key regulatory act that defines the modern legal principles of CBC is Law of Ukraine No. 3668-IX (2024). This law establishes the legal, economic and organisational principles of international cooperation between regions and territories of Ukraine and other states, aimed at ensuring balanced socio-economic development of territories. The law defines: subjects of international territorial cooperation (local governments, regional authorities, legal entities); mechanisms for concluding agreements between territories of different states; forms of state support for such initiatives; participation of Ukrainian territorial communities in international development programmes. The adoption of this law was an important stage in the modernisation of the legal regulation of CBC and the approximation of Ukrainian legislation to European standards. A critical role in the formation of cross-border clusters is played by the legal regulation of the activities of territorial communities. The main regulatory act in this area is Law of Ukraine No. 280/97-VR (1997). The law defines the powers of local governments regarding the development of territories, participation in international cooperation and the conclusion of partnership agreements with foreign municipalities. It is local governments that often initiate cross-border cluster projects aimed at the development of innovative infrastructure and attracting investments. In addition, Law of Ukraine No. 156-VIII (2015) is of great importance, which defines the mechanisms for forming regional development strategies and supporting innovative activity in the regions. Within the framework of the implementation of the state regional policy, it is envisaged to stimulate cluster initiatives, develop interregional cooperation and integrate Ukrainian territories into the European economic space.

The functioning of CICs is also based on regulatory acts regulating innovation activity. Among these acts, Law of Ukraine No. 40-IV (2002) is of key importance. This law defines the legal and economic principles of state support for innovation processes, mechanisms for funding innovation projects, as well as incentives for the development of scientific and technological partnerships between enterprises and scientific institutions. In the context of cross-border clusters, the provisions of this law create legal prerequisites for the implementation of joint innovation projects between Ukrainian and foreign participants. In addition, CBC is considered in Ukraine as an important tool of European integration. This is confirmed by the recommendations of the parliamentary hearings of the Verkhovna Rada of Ukraine on the role of CBC in the development of regions and the deepening of European integration processes (Resolution of the Verkhovna Rada of Ukraine No. 1242-V, 2007).

Thus, the legal support of CICs in Ukraine is at the stage of active transformation and is gradually adapting to European standards of regional policy. However, despite the formation of a sufficiently developed regulatory framework, the analysis of the legislation enables determining a number of problems in the field of legal support of CICs. In particular: (1) fragmentation of regulatory regulation – cluster policy is not directly enshrined in a special law; (2) insufficient institutional coordination between state authorities and local governments; (3) limited financial mechanisms for supporting cross-border innovation projects; (4) differences in the legal systems of partner states, which complicates the implementation of joint projects.

Meanwhile, at the international level, an important legal document that defines the basic principles of CBC between territorial communities and authorities is the European Outline Convention (1980), adopted by the Council of Europe. This convention establishes legal mechanisms for cooperation between border regions of different states, determines the possibilities of concluding interregional agreements, creating joint organisational structures and implementing joint economic and social projects. It is on the basis of this convention that Euroregions and cross-border economic initiatives began to form in many European countries, which became a platform for the development of cluster models of cooperation. An important tool for the legal support of cross-border clusters in Europe is also the creation of special institutional forms of cooperation, in particular the European Grouping of Territorial Cooperation (EGTC) (n.d.). This legal mechanism allows local governments, regional authorities and other entities of different states to create joint organisations for the implementation of cross-border projects. Such structures can manage joint infrastructure, innovation and economic programmes, which contributes to the development of cluster initiatives at the interstate level. In addition to supranational legal acts, an important role in the development of cross-border clusters is played

by the national legislation of individual states, which regulates cluster policy and regional cooperation. Many European countries adopted special strategies and programmes to support clusters aimed at stimulating innovative activity, developing entrepreneurship and forming network forms of interaction between business, scientific institutions and authorities. Such programmes provide for financial support for cluster initiatives, developing innovation infrastructure and deepening cooperation between border regions (European Commission, 2016).

In Ukraine, cross-border cluster initiatives are mainly represented in border regions. The most active are the clusters of the Carpathian region (Ukraine, Poland, Slovakia, Hungary, Romania), which specialise in woodworking, ecotourism and the agricultural sector. In the Danube region (Ukraine, Moldova, Romania), cluster development is associated with logistics, shipping and maritime tourism. In the western direction (Ukraine – Poland), IT clusters and logistics centres operate, integrated into pan-European transport corridors, in particular the Gdańsk – Odesa direction. A separate group is made up of woodworking and tourism clusters of the Transcarpathian and Chernivtsi regions, which form partnerships with participants from Romania and Hungary (Ukrainian Cluster Alliance, n.d.).

The development of such structures contributes to the reduction of economic inequality in border areas and the intensification of European integration processes (Kotyhoroshko, 2017). At the same time, a significant part of cluster initiatives is at the stage of project implementation or strategic planning. Thus, the cross-border innovation cluster “Volyn – Chełm” functions as a platform for cooperation between business and universities, but its activities are mostly limited to individual projects without the formation of a fully developed cluster ecosystem (Interreg NEXT Poland-Ukraine, n.d.). Similarly, the Carpathian cross-border cluster (Ukraine – Poland – Slovakia – Hungary), formed within the Carpathian Euroregion, covers the areas of tourism, woodworking, green energy and creative industries, but functions mainly as a network of projects and platforms, and not as an institutionally structured cluster (Carpathian Euroregion, n.d.). In general, a characteristic feature of the development of cross-border clusters in Ukraine is the project-based nature, which determines dependence on external funding, in particular EU programmes. Only a small part of the clusters has a developed business ecosystem and stable management mechanisms. A summary of the main cross-border clusters of Ukraine and an assessment of the status are given in Table 3.

Table 3. Main cross-border clusters of Ukraine and the status of these clusters

Cluster	Year of creation	Regions / countries	Domain	Status
Bieszczady Cross-Border Tourism Cluster	2004	Poland (Bieszczady), Ukraine (Lviv region, Sambir and Turkiv districts)	Tourism, recreation	Partially active
Scientific-Information and Statistical Cluster “Infostat Ukraine-Poland”	2013	Ukraine (Lviv), Poland (Rzeszow)	Statistics, analytics, scientific research	Active (scientific)
Cross-Border Innovation Cluster (Poland-Ukraine)	2015	Poland (Chelm), Ukraine (Lutsk)	Innovation, business cooperation	Partially active
Dnister International Agricultural Cluster	2018	Ukraine (Vinnytsia region), Moldova	Agricultural sector, processing	Promising
Carpathian tourism and recreation cluster initiatives	2010	Ukraine, Poland, Slovakia, Hungary	Tourism, green economy	Project format

Source: compiled by the authors

One example of international cluster cooperation with the participation of Ukraine is the ITBridge: EU-Ukraine IT cluster (2025) project, which unites such organisations as Kharkiv IT Cluster, IT Dnipro Community, Odesa IT Family, as well as Transilvania IT Cluster and Digital Cluster of Catalonia. The project is aimed at integrating Ukrainian IT companies into the European market, developing digital innovations and expanding international partnership in the field of information technologies. At the same time, an analysis of the content of the project’s activities shows that its main focus is on economic and technological aspects of cooperation, while the issue of sustainable development of territorial communities is not a central element of its strategic agenda.

The experience of European countries shows that the effective development of cross-border clusters requires comprehensive institutional support, a clear legal framework

and a coordinated state policy. The active participation of business, the presence of a developed innovation infrastructure and access to international financial resources are crucial. For Ukraine, borrowing such experience is especially important in the context of European integration and post-war economic recovery. The development of CICs can be an effective tool for including regions in the European economic space, stimulating innovation and increasing the competitiveness. At the same time, the realisation of this potential requires improving the regulatory environment, strengthening the institutional capacity of territorial communities and intensifying Ukraine’s participation in EU CBC programmes.

The effective formation of cross-border regional business clusters should be based on the coordination of interests of all key stakeholders and taking into account the role in the development of cluster initiatives. Particular

attention should be paid to the involvement of participants with high innovation potential, who can act as drivers of development, but currently do not have a sufficient level of influence to implement the own initiatives. In this context, it is advisable to highlight the following strategic directions for the formation of effective CICs:

1. Reducing legal and regulatory uncertainty. It is advisable to create interregional bi- and multilateral working groups aimed at harmonising approaches to the formation of public-private partnerships (PPPs), special purpose vehicles (SPVs), investment platforms and financial instruments, as well as unifying financial reporting standards. Such an approach will contribute to increasing legal certainty through the coordination of regulatory procedures and dispute resolution mechanisms.

2. Strengthening policy coordination and stakeholder interaction. The formation of a coordinated policy based on a comprehensive analysis of network relationships will make it possible to increase the efficiency of the use of regional potential and contribute to the achievement of the goals of socio-economic cohesion. Institutionalised interaction between state and non-state actors, ensured through permanent coordination mechanisms, creates the prerequisites for the development of open partnership and deepening integration processes.

3. Development and implementation of long-term development programmes. Increasing the effectiveness of cross-border clusters requires the implementation of comprehensive strategic programmes integrated into the national regional development policy. Coordination of economic, legal and budgetary instruments creates favourable conditions for the implementation of infrastructure and innovation projects that ensure sustainable development of territories.

The results obtained in this study showed that the effectiveness of CICs is largely determined by the level of institutional coordination and the ability to form sustainable network relationships between participants. This is consistent with the findings of T. Makkonen & S. Rohde (2016), who underscored the role of cross-border interactions in shaping the innovation potential of regions, as well as with the approach of J. Kurowska-Pysz *et al.* (2018), which substantiated the importance of strategic planning of CBC as a basis for the formation of sustainable partnerships and the development of border areas. At the same time, the results of the study confirmed the importance of developing partnerships between business, state institutions and communities, which corresponds to the approach proposed by B. Singh & S. Chandra (2025), where the emphasis is on multi-level cooperation as the basis of sustainable development. In addition, the results obtained are consistent with the provisions of O.A. Luhova & D.M. Gumenyuk (2012), which consider cross-border clusters as a tool for economic modernisation, development of applied research, sharing of infrastructure and attracting investment, which together ensure the structural transformation of regions and increase the competitiveness.

The analysis of practical cases also showed that the key factor in the success of clusters is access to financial

resources and support from the state, which correlates with the results of C. Ketels & S. Protsiv (2021), who noted a significant share of public funding in the structure of European cluster systems. At the same time, the results obtained revealed that in Ukraine, cross-border cluster initiatives are often project-based and do not form fully developed innovation ecosystems, which partially confirms the conclusions of N. Reznikova *et al.* (2020) regarding the need to clearly distinguish between types of cluster formations and mechanisms for the functioning. In addition, it was found that the effectiveness of clusters increases under the conditions of integration of innovative technologies and the development of digital interaction platforms, which corresponds to modern trends described by Y. Zhao *et al.* (2024). Thus, the results of the study confirmed global approaches to economic clustering, while at the same time revealing specific institutional and management limitations to the development of cross-border clusters in Ukraine.

■ Conclusions

As a result of the study, it was found that CICs are an important tool for ensuring the sustainable development of territorial communities, especially in border regions, which are characterised by limited development resources, peripheral location and the need to intensify economic activity. The cluster approach contributes to the formation of effective network interactions between enterprises, scientific institutions, authorities and the public sector, which creates the prerequisites for increasing the innovative capacity of territories. An analysis of international experience showed that the development of cross-border clusters in the world is based on a comprehensive regulatory and legal framework, which includes international agreements, regional cooperation programmes and national strategies for supporting cluster development. A special role in the formation of such mechanisms is played by EU institutions, which provide financial and institutional support for cross-border initiatives through territorial cooperation programmes, in particular Interreg. An important legal instrument for the development of CBC is also the European Outline Convention on Transfrontier Cooperation, which created a legal basis for interaction between regions of different states.

The study showed that in European countries, cross-border clusters function as effective innovation ecosystems that combine research institutions, enterprises, innovation centres and regional government bodies. Such a model contributes to the development of an innovative economy, increasing the competitiveness of regions and implementing the principles of sustainable development at the local level. At the same time, an analysis of the current state of development of cross-border clusters in Ukraine indicates the presence of significant potential for the formation, in particular in border regions with European Union countries. However, the effectiveness of the functioning is limited by a number of factors, including the fragmentation of the regulatory framework, insufficient coordination between institutions, limited financial



resources and an insufficient level of business involvement in cluster initiatives.

A particularly important result of the study is the establishment that the majority of cross-border cluster initiatives in Ukraine are project-based and do not transform into stable institutional structures, which limits the long-term impact on the development of territories. The conducted systematisation of clusters showed that only a small part of these clusters functions as fully developed innovation ecosystems, while the vast majority is at the stage of partial activity or depends on external funding. The results obtained make it possible to clarify the role of cross-border clusters in the public administration system as a tool, the effectiveness of which is determined not only by the availability of resources, but also by the level of institutional integration and the quality of management mechanisms. In this context, an important direction for further development is to improve

the legal support for cluster policy, create effective mechanisms for managing cross-border cluster structures, as well as increase the participation of territorial communities in international cooperation programmes. The implementation of these measures will contribute to the formation of innovation ecosystems in border regions, strengthen the economic integration of Ukraine with the European space and ensure the sustainable development of territorial communities.

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Транскордонні інноваційні кластери як інструмент сталого розвитку територіальних громад: управлінський та правовий аспект

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■ **Анотація.** Актуальність дослідження зумовлена необхідністю пошуку ефективних інструментів забезпечення сталого розвитку територіальних громад, зокрема в умовах євроінтеграції та зростання ролі транскордонного співробітництва. Метою статті було дослідження управлінських і правових аспектів формування та функціонування транскордонних інноваційних кластерів як інструменту стимулювання регіонального розвитку. Методологічну основу становить міждисциплінарний підхід із використанням порівняльного, інституційного аналізу та методу кейс-стаді. У результаті дослідження встановлено, що транскордонні інноваційні кластери виступають ефективним механізмом інтеграції економічних, інноваційних і соціальних ресурсів прикордонних територій, забезпечуючи формування мережевих взаємодій між бізнесом, наукою та владою. Аналіз європейського досвіду показав, що їх успішність базується на поєднанні інституційної підтримки, розвиненої нормативно-правової бази та активної участі органів публічного управління. Узагальнення практичних кейсів дозволило виокремити ключові ефекти транскордонних проєктів, зокрема економічний, інноваційний, інфраструктурний, соціальний та інституційний. Водночас встановлено, що в Україні більшість транскордонних кластерних ініціатив має проєктний характер і не трансформується у сталі інституційні структури, що обмежує їх довгостроковий вплив. Виявлено, що основними стримуючими факторами є фрагментарність правового регулювання, недостатня координація між інституціями та обмеженість фінансових ресурсів. Обґрунтовано необхідність розвитку ефективних управлінських механізмів, гармонізації нормативної бази та посилення участі територіальних громад у міжнародних програмах співробітництва. Практична цінність дослідження полягає у можливості використання отриманих результатів для вдосконалення державної регіональної політики та формування ефективних моделей управління транскордонними кластерними ініціативами

■ **Ключові слова:** регіональна інвестиційна політика; транскордонне співробітництво; євро регіони; інноваційні екосистеми; правове регулювання