

# A Conceptual Approach to the Development of the Cross-Border Model of Sustainable Development of Regions in Times of War

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## Abstract

In the context of the war in Ukraine, the author defines the cross-border model of sustainable development of regions as an effective one, which can be used to adopt the EU's progressive experience in achieving the Sustainable Development Goals, adapt it, and timely transfer it to the internal regions in the post-war recovery of our country. According to the conceptual approach, the ER-cross-border model of sustainable development of regions is developed based on the analysis of the subject area of sustainable regional development, cross-border cooperation of regions for sustainable development, and cross-border cooperation of regions for sustainable development in times of war.

## Keywords

cross-border cooperation of regions, cross-border model of sustainable development of regions, ER-cross-border model

## Introduction

Against the backdrop of current events – the escalation of the Russian-Ukrainian war – the issue of Ukraine's integration into the EU is becoming particularly relevant. It is important to use all opportunities to get closer to the civilised world, thus distancing ourselves from barbaric Russia. In this case, regional cooperation with European countries can also be useful. It is well-known that cross-border cooperation (CBC) of regions at its very origins, as a special form of international interregional cooperation, was considered as a testing ground for economic integration of countries, and, therefore, it is the cross-border regions that can be considered as pioneers in adopting progressive practices in various sectors of the economy and for sustainable development in particular.

The EU, as a leader in the global processes of greening the economy, is a valuable source of experience as well as financial, institutional, and moral support for Ukraine in implementing the concept of sustainable development as a global one, declared in the final document of the 70<sup>th</sup> session of the UN General Assembly in New York in 2015, *Transforming our World: The 2030 Agenda for Sustainable Development* (United Nations, 2015), the intention to implement which is also declared in Ukrainian general strategic documents at the national level. The search for new effective mechanisms, models, and means of intensifying the Ukrainian-European cross-border cooperation of regions in the field of sustainable development is of great scientific interest today for researchers who are trying to make their professional contribution to the development of Ukraine as an independent progressive state, to the approaching victory over the enemy and the prospects of joining the EU in the near future.

Focusing on cross-border models of sustainable development of regions is justified in terms of the level of probability of the effectiveness and speed of achieving the goal, since it is the western border regions of Ukraine, as participants in CBC, that are geographically closest to the EU and separated from the combat zone, which increases their chances – compared to other Ukrainian regions – to quickly and effectively gain the necessary experience of implementing the concept of sustainable development by European countries, adapt it, as well as implement and extend it to the most affected regions after the victory, which, in turn, will allow Ukraine to immediately start on the path of recovery and transformation into a powerful, legal, innovative, green state in the world.

The purpose of this study is to develop a cross-border model of the sustainable development of regions that would be justified by the current level of research on this issue and effective in the context of war.

## Literature review and methodology

A number of Ukrainian and foreign scholars have studied models of sustainable regional development. Econometric models based on the interdependence between the volume of investments in the regional socioeconomic system and the level of population welfare are often found in the economic literature (Reutov, 2010; Shlafman & Umanets, 2015). However, the authors focused in this case only on two dimensions of sustainable development – namely economic and social – ignoring the environmental one, which contradicts the theoretical foundations of the concept of sustainable development according to the report of the World Commission on Environment and Development (Brundtland Commission) “Our Common Future” (1987), which can be considered as fundamental, where economic, social, and environmental dimensions are declared as equal and mutually irreplaceable foundations of sustainable development, achieved in a balanced and comprehensive manner. Thus, Soltysik (2010) also believes that the system of sustainable development models should be reflected in the form of a synthesis of models of socio-ecological and economic development of the region, economic growth of the region, integrated characteristics of production efficiency, based on the analysis of macroeconomic indicators in the regional aspect, such as gross added value in relation to such factors of production as labour and capital. The author emphasises the need for a balanced synthesis of all three subsystems – social, economic, and environmental – when developing a model of sustainable development of a region, since there are stable direct and reverse links between them and the dominance of one over the others reduces the chances of sustainability. It is proposed that a level specific to each of the subsystems is provided that is most important in terms of sustainable development.

Some scholars, depending on the specifics of the subject matter of the study, as well as a peculiar grouping of the 17 Sustainable Development Goals, take a somewhat broader approach to defining the range of indicators within the framework of modelling sustainable regional development, focusing – in addition to the classical dimensions of sustainable development – also on providing the region with effective public and corporate management and innovative resources, the achievement of which depends to a large extent on the level of scientific and technological progress and the advanced progressive outlook of the leadership of the state, region, and enterprise (Tomareva-Patlahkova, 2013). A similar originality can be traced in the works of Majumder and others (2023), who additionally propose to include the so-called human-physical sustainability in the construction of a model of sustainable regional development, which, according to the authors, is ensured by improving the quality of human resources through better education and training, adapting and familiarising the population with modern technologies, ensuring gender equality in each sector, and prioritising first aid and health care development. In the classical theory of sustainable development, the listed aspects of human-physical sustainability are included in the social dimension of sustainable development, but we believe that the researchers rightly identified this separately in the light of the specifics of the development of the regions of India that were the object of their study, given the relevance of the problem of socioeconomic contrasts in the country, as well as the impressive gap between India’s powerful technology sector and the sometimes unsatisfactory living conditions of the population.

There are also approaches to modelling sustainable development of regions in which the environmental dimension, along with others, somewhat dominates, as the goal of sustainable development is interpreted by the authors mainly as an environmental one. For example, Cai and others (2022) based the modelling of sustainable regional development on a spatial correlation analysis of the effectiveness of green development of the regional economy, as well as the indicators of the level of economic development of the region, energy structure, industrial structure, the intensity of environmental management, digital economy, the degree of urbanisation, technological development, and economic openness. Researchers have shown a positive correlation between the effectiveness of green development in a region and such factors as a high level of economic development of the region, its industrial structure, a high share of alternative energy in the consumption

structure, the digitalisation of the economy, and the urbanisation of the region's territories. At the same time, the researchers agree with the opinion of Xia and others (2022) that green and sustainable development provides for the effective synergy of economic development with the ecological environment, although it is green development that is able to achieve ecological civilisation and is a precondition for economic and social development. We conclude that the social dimension of sustainable development in this case is rather placed in the background. A similar opinion is shared by Honcharenko (2014), who believes that natural capital is crucial and, accordingly, sustainable development cannot be ensured without the imposition of certain restrictions on activities related to the depletion of natural capital. At the same time, the author emphasises the direct proportional relationship between innovation potential and the sustainable development of the region, which depends on the set of conditions for the development of socioeconomic processes, the so-called organisational and economic factors, as well as institutional features (management culture at various levels).

Thus, given the wide variability of indicators within the framework of building models of sustainable development of regions, as well as the lack of information on the experience of developing cross-border models, we suggest that one should focus on the conceptual approach to modelling, since it is the conceptual model that is designed to provide an understanding of "how the real system works" (Brooks, 2007, p. 3), "to formalize current understanding of system processes and dynamics" (Gross, 2003, p. 2), thereby serving "as a tool for creative exploration, as a thinking aid to try out different directions and further ideation before choosing a definite path" (Guenther, 2013, p. 83), while mathematical models may be ineffective at the current level of study of this issue.

As a cross-border model of sustainable development of regions, we have chosen such a conceptual type of model as the ER-model, which is "a theoretical and conceptual way of showing data relationships in software development", using the concepts of "entity", "relationship", "attribute" (Entity-Relation, 2017), which made it possible to base the modelling both on the concept of sustainable development adapted to the regional level and on the theory of cross-border cooperation of regions, based on the very essence of the complex concept and its logical understanding. As a web-based database modelling tool, we used the ERDPlus web resource (ERDPlus Data) Such a model can serve as a basis for modelling sustainable development within cross-border regions in the future.

To achieve the stated research objective, in the course of building the ER-model, it is necessary to analyse the subject area of the sustainable development of the region on the basis of the conceptual foundations of sustainable development; the subject area of the region's CBC for sustainable development, based on the theoretical foundations of cross-border cooperation; of the subject area of regional CBC for sustainable development in wartime based on the identification of the impact of objective conditions in wartime on the constructive change of the established practice of implementing regional CBC to ensure the model's effectiveness in current circumstances.

To analyse the subject area, we used the following research methods: the deductive method to move from the general global Sustainable Development Goals to their specific manifestations at the regional level; an inclusive approach, providing for equal access of society to sustainable development processes within the framework of the cross-border model; the principle of subsidiarity, focusing on the EU regional policy, which provides for the management of society from the bottom up, based on efficiency issues; the method of analogies to adapt the goals of regional CBC at all levels of its implementation to the field of sustainable development; and the method of empirical observation to determine the specific motives for implementing CBC for sustainable development. Also, to define the dominant motive for the implementation of regional CBC for sustainable development in the relevant conditions, the hygienic-motivational theory of Frederick Herzberg was applied.

## Research results

### An analysis of the subject area of sustainable development of regions

According to the concept of sustainable development, the cross-border model of a region implies a stable interdependence between the economic, social, and environmental dimensions of sustainable development of the region. In this case, it is important to apply the provisions of the global

concept in the regional plane to ensure maximum efficiency and objectivity of the cross-border model at the regional level. The use of the deductive method, inclusive approach, subsidiarity principle, and empirical observation made it possible to translate the global Sustainable Development Goals in all three of its dimensions into the regional level and draw the following conclusions in the context of the current study:

- the goal of sustainable development in the regional plane remains unchanged: according to the definition of sustainable development given in the report of the World Commission on Environment and Development (1987), it is supposed to be “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. And although it may seem that in the case of a region it is about meeting the needs of the local population, it is important to note that a region is an integral territorial unit of the state that functions within the framework of the national socioeconomic strategy and is a link in a single national economic and legal mechanism for sustainable development, and, therefore, national interests will dominate over local ones, and the latter cannot contradict the general strategic goal.
- according to the inclusive approach based on the principle of subsidiarity, which provides for equal participation of the population in socioeconomic activities at all levels with the distribution of the share of participation of these levels depending on where these tasks will be performed most effectively, the economic dimension of sustainable development, implying economic growth in the context of resource constraints in the global dimension, at the regional level should pursue the solution of the following: the task of “responsible production” (Korolchuk, 2021, p. 3) from local businesses (the optimisation of production through the introduction of the latest technologies, the implementation of resource conservation and energy efficiency policies at enterprises, the introduction of eco-innovations, closing the production cycle, etc.), as well as the task of “responsible consumption” (Korolchuk, 2021, p. 3) from consumers (the formation of demand for environmental products, economical consumption of goods and energy at the household level, eco-responsible waste management, etc.)
- the deductive method and the use of inclusion in transferring the social dimension of sustainable development to the regional plane, along with maintaining the stability of social and cultural systems at the global level, allowed the local society to set the task of preserving its physical and mental health, thus cultivating a healthy lifestyle, respect for fundamental human rights and freedoms, law-abidingness, the development of empathy and care for the world around us, cultural education and participation in cultural activities, national self-determination, etc.
- the environmental dimension of sustainable development, which at the global level is aimed at preserving our planet for us and future generations of humanity, should, on the principle of subsidiarity at the regional level, provide for a micro-manifestation of this goal with the active involvement of local communities in the processes of preserving and restoring local ecosystems by cultivating an environmental culture, organising and popularising public work in the field of environmental protection, greening everyday life, etc.

Thus, the analysis of the subject area of sustainable development in the regional plane has shown that the main provisions of the concept of sustainable development for the region are the same as at the global level and, therefore, the goal and economic, social, and environmental dimensions of sustainable development will be included in the ER-cross-border model of sustainable development of regions in war as its key entities.

### **An analysis of the subject area of CBC of regions for sustainable development**

To achieve the purpose of our study, in the course of analysing the subject area, it was also important to study the foundations of cross-border cooperation in order to identify the goals of cross-border cooperation at all levels of such implementation, to determine the priorities for all CBC participating border regions in interregional cooperation for sustainable development, paying special attention to key trends in global politics and economics, given the international nature of cross-border cooperation between border regions of neighbouring states.

It is known that CBC is implemented at the local, regional, national, and European levels. Our previous scientific research on regional CBC, based on the study of the nature of its institutional,

legal, and financial support, allowed us to identify the objectives of CBC at all levels (Herasymchuk & Korolchuk, 2009, p. 40), which we adapt to the field of sustainable development in the context of the current study using the method of analogies. On the basis of empirical observation of many years of experience in implementing the concept of sustainable development in the world, we will determine the specific motives for the implementation of the CBC for sustainable development, which stimulate such cooperation at each level of its implementation:

1. At the local level, the level of local initiatives, CBC for sustainable development is carried out with the aim of implementing cross-border sustainable development projects (economic, social, or environmental) in the border regions, the motive for which is the expectation of a visible short- and medium-term practical result that will bring concrete benefits to the community of the region.
2. At the regional level, where regional authorities acting within the framework of regional development strategies are involved in cross-border cooperation in order to improve the level of socioeconomic development of the region and ensure harmony between humans and nature, the main motive for CBC is to try to solve urgent common problems of adjacent border regions of neighbouring states through joint efforts. As a rule, such problems are primarily environmental ones that require the consolidation of efforts due to the adjacent nature of their localisation, as well as sociocultural to preserve the authenticity of the integrated culture of local communities and economic, the solution of which is in the common interest of all CBC member regions to improve the well-being of the population of remote regions.
3. At the state level, CBC for sustainable development is implemented within the framework of national strategies of the socioeconomic development of neighbouring states in order to achieve the Sustainable Development Goals and solve the problems of border regions that are of national importance while being motivated by issues of national security, the effectiveness of the implementation of the concept of sustainable development, foreign economic policy, and foreign policy course, overcoming the problem of the economic peripherality of regions remote from the centre in order to balance regional development.
4. At the Pan-European level, the CBC of regions for sustainable development is intended to promote integration processes in Europe, where sustainable development has long been the basis of national strategies and the EU as a whole. Cooperation with the border regions of the EU countries provides unlimited opportunities for adopting progressive experience in implementing the concept of sustainable development, participating in sustainable development programmes financed from EU funds, as well as implementing joint projects and adapting to the social, economic, and environmental standards of the Union. The main motive in this case is geopolitical, and given the latest trends in the political life of the international community, namely the full-scale war unleashed by Russia against Ukraine and the entire civilised world, it is clear that the mutual desire of the EU and Ukraine to formally join the democratic community by making it a full member of the EU and NATO stimulates the development of all forms of international cooperation in priority areas that would contribute to the maximum economic convergence of these countries.

Therefore, the analysis of the subject area of the region's CBC for sustainable development has shown that the ER-cross-border model of sustainable development of regions should include motives at all levels of implementation of such cooperation as key entities.

### **An analysis of the subject area of CBC of regions for sustainable development in times of war**

At this stage of our research, it is important to take into account the fact that such identification of the motives for cross-border regional cooperation for sustainable development may be biased in the conditions in which the regions of Ukraine at war and the regions of the EU countries along its eastern border, which are also under tension due to their geographical proximity, and, in addition, have taken on the main burden of helping Ukrainian refugees. Under the force *majeure* conditions created by the Russian-Ukrainian war, when mortal danger looms and the issue of physical survival is becoming more urgent, when there is no certainty about the near future, the motivation of CBC participants at all levels can change unpredictably depending on the situation at the front and the political and economic consequences that follow. Since it is impossible to predict the duration of the

war and the exact course of events, it is necessary to adapt to the current conditions and identify the strongest motive dominant in the relevant conditions, which will not lose its relevance even after Ukraine's victory and is distinguished from others by its particular strength and stability, which will guarantee the effectiveness of the cross-border model of sustainable development of regions in the current environment.

To this purpose, we propose to turn to the theory of motivation. In our opinion, the motivational-hygienic theory of Frederick Herzberg (Kurt, 2022), which is based on the ranking of stimulating factors into two groups: hygienic, which do not motivate, but their failure to provide has a demotivating effect; motivational – dominant, which encourage intensification of activity. The application of this theory will allow us to identify the strongest motive that is stable in war conditions, which, when taken into account when building a cross-border model of the sustainable development of regions, will ensure its effectiveness in the current conditions. To do this, we will group the above motives for implementing CBC for sustainable development, similar to Herzberg's theory, into two groups of factors: hygienic – those that allow maintaining CBC for sustainable development at a viable level, do not intensify cooperation, do not encourage its growth, but their dissatisfaction will lead to disappointment and loss of interest; and motivational, which allow participants of CBC for sustainable development to be satisfied with the results and contribute to the intensification of cooperation, and motivate to new achievements.

Herzberg called hygienic factors external, which form the context of activity; based on the lexical meaning of the word "context" (Lisovyi & Encyc, 2014), in the framework of our study, these are the circumstances of the implementation of the CBC for sustainable development, on which the actual meaning of such cooperation depends. We will try to adapt the hygienic factors in the enterprise environment defined by the author of the theory to the field of CBC for sustainable development as fundamental circumstances for ensuring the effective functioning of such cooperation. The logic and procedure for adapting hygienic factors in the enterprise environment according to Herzberg's theory to the sphere of regions' CBC for sustainable development are illustrated in Table 1.

**Table 1.** Logical scheme of determining the hygienic factors of the implementation of the regions' CBC for sustainable development in war conditions based on the motivational-hygienic theory of F. Herzberg

Hygienic factors in the enterprise environment (according to F. Herzberg)	Adapting hygiene factors to the field of CBC for sustainable development	Matching hygiene factors with the motives for implementing CBC for sustainable development	Relevant objective of CBC implementation for sustainable development	Appropriate level of objective realization
Pay	Achievements of the CBC	Opportunity to obtain practical results from CBC for sustainable development	The implementation of cross-border projects on sustainable development	Local
Status	Improving the living standards of CBC participants			
Working conditions	Terms of CBC implementation	Opportunity to solve urgent common problems of the adjacent border regions of neighboring states by joint efforts	Improving the level of socioeconomic development of the region, ensuring harmony between humans and nature	Regional
Fringe benefits	Additional benefits of CBC			
Policies and admin practices	Opportunity to adopt the experience of progressive communities			
Interpersonal relationships	International good neighbourly relations			

Table 1. – cont.

Hygienic factors in the enterprise environment (according to F. Herzberg)	Adapting hygiene factors to the field of CBC for sustainable development	Matching hygiene factors with the motives for implementing CBC for sustainable development	Relevant objective of CBC implementation for sustainable development	Appropriate level of objective realization
Security	Ensuring national economic and environmental security of regions	The ability to resolve issues of national security, the effectiveness of the implementation of the concept of sustainable development, foreign economic policy and foreign policy course, overcoming the problem of economic peripherality of regions remote from the center to balance regional development in the country.	Achieving the Sustainable Development Goals and solving the problems of the border regions that are of national importance	National

Source: Own elaboration.

As can be seen from Table 1, the hygienic factors of implementing the regions' CBC for sustainable development correlate with the motives that ensure the achievement of the objectives of this type of international interregional cooperation at the local, regional, and national levels. Therefore, according to the theory, such motives cannot be decisive and serve as powerful catalysts for the activation of the regions' CBC for sustainable development, especially in force *majeure* conditions of war. None of them can withstand the impact of war. Thus, the benefits of CBC – the economic, social, or environmental effect of implementing cross-border projects, as well as the improvement of the living standards of its participants – ensure the achievement of the objective of the local level of CBC implementation, although the implementation of local cross-border sustainable development initiatives in the context of a full-scale war may be suspended at any time for objective reasons, such as the militarisation of all sectors of the economy and mobilisation in Ukraine, unpredictable events, the need for physical survival, etc.

For their part, the terms of CBC implementation – such as the possibility of financing sustainable development projects under EU programmes and funds, additional benefits, such as expanding employment opportunities and self-realisation of citizens on both sides of the border, the opportunity to adopt the experience of progressive communities in achieving the Sustainable Development Goals, as well as maintaining good neighbourly relations with communities in border regions of neighbouring countries through joint cultural events, educational environmental events to promote sustainable development, trainings on eco-business, green management, internships for teachers on greening education, etc. – contribute to improving living standards and sustainable development in the CBC member regions as part of regional strategies that may be suspended due to the war or postponed indefinitely.

In our opinion, the hygienic factors of the implementation of regions' CBC for sustainable development, which ensure the achievement of the objective of cross-border cooperation of regions at the national level, are also not characterised by sustainability in war. Thus, ensuring the national economic and environmental security of the regions by means of CBC – namely, the development of border infrastructure, the increase of border crossing points, joint exercises of border services, the installation of treatment facilities on water bodies shared by the bordering countries, the development of a joint strategy for the socioeconomic development of the cross-border region, etc. – may be suspended, modified, and transferred to the competence of the central authorities exclusively under the influence of war.

Thus, according to Herzberg's theory of motivation, the hygienic factors of implementing regions' CBC for sustainable development identified above do not motivate participants in cross-border cooperation of regions to intensify this process in the field of sustainable development, and, therefore, are not decisive and can be ignored in the process of developing an effective cross-border model of sustainable development of regions, but it should be taken into account that, on the other hand, their provision is crucial, otherwise the mechanism of demotivation and stopping

CBC will be launched. For example, the suspension of funding for local cross-border sustainable development initiatives under EU programmes and funds during the war is a reasonable decision in such circumstances, but it may cause the Ukrainian side to feel isolated, alone in its struggle, with the lack of support, uncertainty about the future, frustration, and a loss of interest in cooperation.

**Table 2.** Logical scheme of determining the motivational factors for the implementation of the regions' CBC for sustainable development in war conditions based on the motivational-hygienic theory of F. Herzberg

Motivational factors in the enterprise environment (according to F. Herzberg)	Adapting motivational factors to the field of CBC for sustainable development	Matching motivational factors with the motives for implementing CBC for sustainable development	Relevant objective of CBC implementation for sustainable development	Appropriate level of objective realization
Meaningful work	Cooperation for a high goal	Opportunity for Ukraine to join the democratic community by becoming a full member of the EU and NATO	Promoting integration processes in Europe	Pan-European level
Challenging work	Assigning particularly challenging tasks to border regions			
Recognition of accomplishments	Recognising the high significance of the results			
Feeling of achievements	Feeling of high significance of the results			
Increased responsibility	The delegation of a special mission to the border regions			
Opportunities for growth	The prospect of moving to a qualitatively new stage of cooperation			
The job itself	Voluntary active participation of all CBC participants for sustainable development			

Source: Own elaboration.

In turn, motivational factors are defined by Herzberg as internal factors that form the very content of the activity; according to the interpretation of the word "content" (Dictionary of the Ukr., 2018), in the plane of our study, it is the very essence of the regions' CBC for sustainable development, its internal feature, its main purpose. We will adapt the motivational factors in the conditions of an enterprise identified by the author of the theory to the sphere of the regions' CBC for sustainable development as its essential purpose, based on the fundamental nature of this process, which is to promote European integration by bringing together the economies of adjacent border regions of neighbouring countries, levelling the barrier function of the border between them. The logic and order of the adaptation of motivational factors in the conditions of an enterprise according to the theory of Herzberg to the sphere of the regions' CBC for sustainable development is illustrated in Table 2.

As can be seen from Table 2, the motivational factors for the implementation of CBC for sustainable development correlate with the motive to achieve the objective of this type of international interregional cooperation at the pan-European level. According to the theory, it is the possibility of Ukraine's joining the democratic community by becoming a full member of the EU and NATO that will serve as a powerful motive for intensifying CBC for sustainable development. Ukraine's integration into these alliances is a high goal that the Ukrainian border regions participating in the CBC are striving for as part of our country's Euro-Atlantic geopolitical policy and its struggle against its barbarian neighbour, as well as the border regions of neighbouring European countries that are our loyal allies, trying to help us in every way possible in our defence of European democratic values, whose governments have already openly stated their approval of Ukraine's initiative to access the EU.

There is no doubt that the spirit of resistance in the Ukrainian society, as well as the amount of assistance from the European side, is powerful without any exaggeration and will not fade away no matter how long the war lasts until the enemy is driven from Ukrainian lands, and since Ukraine's integration into the EU is also a kind of struggle that can separate the civilised and the savage world



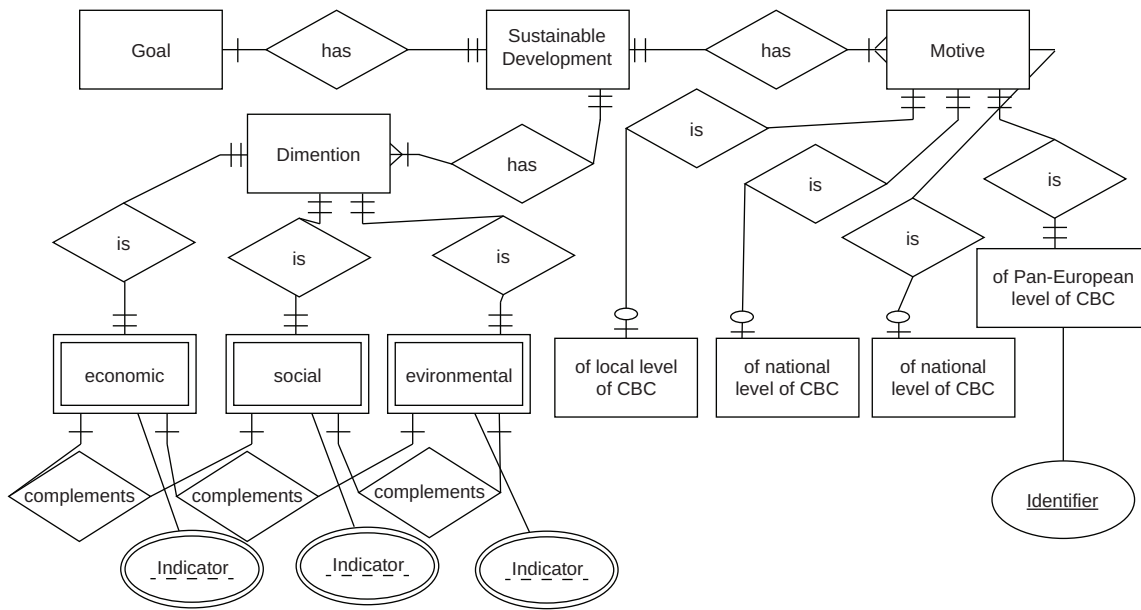
forever, it can be argued that CBC of regions for sustainable development, which can contribute to this, will be relevant regardless of the development of events.

Thus, such a motivating factor for activating the regions' CBC for sustainable development as the possibility of Ukraine's joining the democratic community by making it a full member of the EU and NATO will not lose its stimulating effect and will be sustainable even in the face of war. Moreover, Ukrainian communities will be happy to engage in the processes of rapprochement with civilised Europe through joint actions to achieve the Sustainable Development Goals, as the only true way of life defined by the progressive world in the face of the depletion of our planet's resources, provided that an effective public awareness campaign is conducted. Therefore, it is this motivational factor that should be taken into account when developing an effective cross-border model of the sustainable development of regions. However, it should not be forgotten that, according to the motivational-hygienic theory, hygienic factors should also be ensured; the motivational factor alone does not reduce the level of dissatisfaction of CBC participants with inappropriate external circumstances.

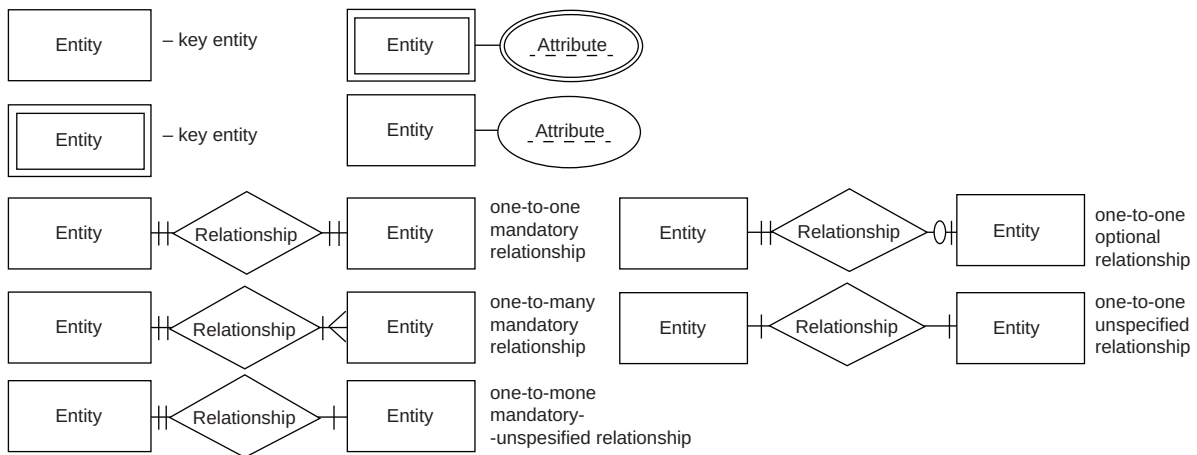
The analysis of the subject area of the region's CBC for sustainable development in the context of war has revealed that among the stated motives in the ER-cross-border model of sustainable development of regions, only the motive of the Pan-European level is the strongest one and can be recognised by an attribute-identifier that will allow to distinguish this particular instance of the entity from all others.

### **The description of the ER-cross-border model of sustainable development of regions**

The analysis of the subject area of the regions' CBC for sustainable development allowed us to develop an ER-cross-border model of sustainable development of regions, which is shown in Figure 1. Thus, the key entities of the model are sustainable development, its goal, dimensions, and motives for implementing CBC for sustainable development. According to the analysis in section 3.1, sustainable development has one main goal, inherent only to it; the connection is mandatory. Such a goal may also be driven by specific local interests, so the link between goal and sustainable development is not mandatory in this case, but unspecified. Sustainable development also has three dimensions; the connection is mandatory. These include the economic, social, and environmental dimensions, which are designated as weak entities that complement each other and cannot exist separately. These entities are characterised by such multi-valued attributes as an indicator, which, although describing each of them, form part of a single comprehensive integrated indicator of the level of sustainable development. In turn, the analysis in section 3.2 has shown that the entity "motive" for implementing CBC for sustainable development also has a mandatory connection with the entity "sustainable development". Each of the CBC levels is dominated by its own motive, but, as can be seen from Figure 1, these entities are independent, as they not only are related to the motives for implementing CBC for sustainable development, but also characterise cross-border cooperation of regions in all other possible areas. Following the analysis in paragraph 3.3, the model provides for the consideration of motives at all levels of CBC, and the connection is mandatory. The connection between the entities of the local, regional, and national levels of CBC and the motives is optional, since the implementation of CBC at these levels can be carried out not only for the sake of sustainable development. On the other hand, CBC at the European level is essential to ensure the sustainable development of the CBC participating regions, since the concept of sustainable development is a general one in the EU and permeates all sectors of the Union's economy. Integration processes in the cross-border regions on the border with the EU will definitely contribute to the achievement of the Sustainable Development Goals by the Ukrainian border regions, and, therefore, the link is mandatory. In addition, only the motive of the Pan-European level is described by an attribute-identifier, which, unlike the others, is a key unique characteristic that distinguishes the relevant entity from others. This means, as our study proves, that this motive stimulates the most and, therefore, should be taken into account when selecting the performance indicators of CBC for sustainable development, while the goals of other levels of CBC should be met by default.



Legend:



**Figure 1.** The ER-cross-border model of sustainable development of regions in times of war

Source: Own elaboration.

## Discussion and conclusion

The development of the ER-cross-border model of sustainable development of regions made it possible to organise a large body of theoretical knowledge in the field of sustainable development, regional economy, and CBC in the light of current political events in the world, as well as to trace the interrelationships between the main concepts and place emphasis. The compact visual layout of the model at this stage of the study allows for an objective approach to the selection of indicators in the construction of econometric models of sustainable regional development in the future, as well as to the planning of cross-border regions involving the border regions of Ukraine in the context of war.

Thus, the conceptual approach to modelling has revealed that an effective cross-border model of sustainable development of regions in wartime should be characterised from two aspects: first, by the economic, social, and environmental dimensions of sustainable regional development; second, by the intensification of integration processes within the framework of the sustainable development of the cross-border region. It means that this model should reflect the interdependence between the complex integrated indicator of the sustainable development of the region and the indicator of convergence of economies of the CBC member regions in the field of sustainable development.

European experience shows that CBC has proven to be effective in promoting integration processes. The emergence of Euroregions involving the border regions of Western Europe in the late 1950s initiated the practice of interstate cooperation at the regional level to address common problems of these territories, as well as to increase the mobility of people, goods, and capital, and the prospects of the fifth EU enlargement have significantly revitalised the creation and operation of Euroregions in Central and Eastern Europe. A striking example in this case is Poland, where the flourishing of CBC dates back to the 1990s, when such Euroregions were created as: Euroregion “Pro Europe Viadrina” (Germany–Poland), Euroregion “Spree–Neisse–Bober” (Germany–Poland), Euroregion “Neisse–Nisa–Nysa” (Germany–Poland–Czech Republic), Euroregion “Pomerania” (Germany–Sweden–Poland), and Euroregion “Baltic” (Sweden–Poland–Russia–Lithuania–Latvia–Denmark). For comparison, there are only three active Euroregions on Ukraine’s western border today: “Carpathian”, “Lower Danube”, “Upper Prut”; and one “Bug” – partially functioning. However, the model we have developed is supported by a survey of Ukrainians on the direct proportional relationship between the activities of Euroregions and Ukraine’s accession to the EU, according to which the majority of respondents believe that the development of Euroregions contributes to our country’s accession to the Union (Shcherba, 2008, p. 22).

In addition, our conclusions about the priority of the goal of accelerating EU accession through the intensification of CBC compared to others that encourage border regions to international cooperation correlate with the results of studies by such scholars as Sokyrka, Mikula, Abrudan, Puscas, and Codruta, who believe that regional CBC is the way to EU accession (Sokyrka, 2021), Euroregions are basic platforms in the processes of European integration (Mikula, 2004, p. 214). In particular, border regions contribute to the preparation for the accession of countries to the European Union (Abrudan et al., 2012, p. 85).

Nevertheless, the results of this study should be interpreted in the light of certain limitations. First, the lack of previous research studies on the topic has led us to develop an ideal model based on the fundamental concepts of the theory of sustainable development and CBC, which may somewhat restrict its practical value. At the same time, we believe that such a limitation opens wide opportunities for further research in this area. Thus, focusing on modelling, we did not pay attention to such key issues of CBC as diffusion, implementation, mobility, etc., the investigation of which in the future will significantly enrich the scientific results in the context, e.g. the study of the relationship between the cross-border mobility of people, which increased significantly during the war, and the diffusion of eco-innovations, which accompanies the process of greening the economy for sustainable development, as well as regarding the implementation of appropriate strategies and programmes to bring the cross-border labour market into compliance with new realities. Second, there is a methodological limitation in determining the specific motives for the implementation of CBC for sustainable development: it would be more reliable to confirm the empirical data with a relevant sociological survey, although such a method requires a lot of time due primarily to technical difficulties associated with the presence of a border between communities whose opinion is of scientific interest, which significantly complicates the process of sample formation and data collection during the survey. We assume that such an improvement of research methodology in the field of cross-border cooperation for sustainable development can be not only a perspective for further research, but also a subject for international cooperation of regions within the framework of cross-border projects.

Further practical implementation of the results of our research, in addition to motivated local cross-border initiatives, is ensured by the instruments of the European Neighbourhood Policy, namely the Instrument for Pre-Accession Assistance (IPA), which Ukraine can access as a candidate country for EU membership. IPA-III for 2021–2027 aims to support those reforms that contribute to sustainable socioeconomic development and bring the recipient country closer to EU values and standards. The five thematic areas of the programme include green transition and sustainable interconnections, as well as territorial and cross-border cooperation (Bohdan, 2022).

As can be seen from the above, the cross-border model of sustainable development of regions allows for planning the activities of existing cross-border regions on the western border of Ukraine: developing joint cross-border strategies, roadmaps, and programmes aimed at achieving the Sustainable Development Goals, based on EU standards. Effective in this case will be measures

to benchmark progressive practices of greening the economy; developing eco-innovations; franchising between eco-oriented enterprises and cultural, educational, and scientific events of direct interaction between local elites; the professional development of educators in the field of education for sustainable development; exchange of personnel; and the promotion of an eco-responsible and empathetic lifestyle, uniting local communities in the border regions around achieving the Sustainable Development Goals through joint efforts, as well as an informational campaign aimed at convincing them of the reasonableness of such actions in the light of the war, etc.

We believe that it is the cross-border model of sustainable development of regions that can be effective in the current circumstances, because in this case, the disorienting impact of the war is to some extent levelled, and instead it stimulates the struggle, one of the forms of which is the acceleration of integration processes with the EU and the sustainable development of Ukraine along with other civilised countries. The so-called “green Euroregions” along the eastern border of the Union will be able to serve as laboratories for sustainable development, the achievements of which will be actively disseminated to the whole of Ukraine for its rapid recovery and prosperity.

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