

Innovative Approaches to Regional Development in the Post-War Period: The Case of Ukraine

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Abstract

For modern Ukrainian territories, regional development is a multifaceted process that changes the social structure of the region, human behaviour, public institutions, as well as accelerates economic growth, reduces inequality and unemployment. The growing importance of Ukraine's regions in improving the efficiency of the country's socio-economic development is becoming more acute as the country's economy recovers from the destruction caused by the aggressor country during the full-scale invasion. Regional studies systematise and group the regions of the state according to the conditions and specifics of their current state and prospects for further development. Given the relevance of the chosen research topic, the purpose of the work can be defined as generalisation and clarification of theoretical and methodological foundations for determining approaches to the innovative development of Ukraine's regions in the post-war period. In order to achieve this goal, the following tasks need to be implemented: to analyse the current state of regional development in Ukraine; to group regions using the cluster analysis method; to formulate recommendations for stimulating and intensifying innovation activity in the regions. The study found that at the current stage of development, Ukraine's economy has quite significant imbalances associated with the uneven development of regions, which has been significantly exacerbated by the martial law. Accordingly, in the period of post-war recovery, regional authorities will need to focus on regional development and attracting investment in priority areas, taking into account the current state and potential capabilities of each region, according to its belonging to a particular cluster.

Keywords: Region, Regional Development, Innovation, Investment, Post-War Recovery, Cluster Analysis, Grouping

Introduction

The digital transformation of recent decades, which has been vigorously supported by governments in many countries, has led to the development of regional systems, including in the innovation sector, which is at the forefront of scientific and technological progress and

creates conditions for active economic growth. The systemic approach, combined with theories of open innovation and innovation systems, forms the theoretical and methodological basis for the study of national and regional innovation aspects of development. In recent years, the concept of innovation systems at the regional level has been actively promoted due to the growing amount of literature on this topic, aimed at finding business efficiency factors at both the micro and macro levels (Al-Hanakta et al., 2021; Wulandari et al., 2023). The development of innovation systems at the present stage should be viewed through the prism of digitalisation and investment interaction of participants. The low elasticity of the regional gross domestic product, economic growth rates in terms of government allocations for research and development, and insufficient return on investment in innovation activities noted in the literature determine the intensive search for organisational and economic tools to optimise links and models of interaction, improve the efficiency of the financing mechanism, which leads to the topic of regional innovation systems (Bordoloi et al., 2022). Despite the fairly high level of elaboration of the problem in scientific sources, approaches to the further development of innovative regional development in the context of post-war recovery in Ukraine require clarification.

The interest in the concept of the regional innovation development system that has increased significantly in recent years is related to the search for new forms of understanding the competitive environment that is changing under the influence of digital technologies (Chlebna et al., 2023; Prokop & Stejskal, 2019). Digital transformation is accompanied by the formation of flexible production networks and appeals to new forms of cooperation between all participants in regional innovation development. The definitions of approaches to regional innovation development vary in detail but are united in their interpretation of collective character as an identifying feature: participants in innovative regional processes depend on each other to create value through the pooling of competences, sharing of resources and redistribution of risks. They cooperate through interactive networks, performing various roles and functions in the joint creation of new values and joint interdependent development.

In Tödting&Tripl (2021), the issues of innovative regional development are defined as a set of activities, norms and institutions, as well as the relations between them that develop in the process of innovation.

In the domestic and foreign literature (Afanasieva, 2023; Blažek & Kveton, 2023; Strielkowski et al., 2022), innovative approaches to regional development are considered as “organisational integrity” and the environment of innovation activity at the current stage of economic development with its characteristic segmentation and determination of the direction of development of each particular region. In Ukraine, it is possible to achieve economic integrity in the process of regional development, but the process of innovative regional development at the present stage is complicated by the unevenness of the extent to which regions have suffered as a result of military operations and the amount of money needed to restore each region.

Moreover, it is crucial to ensure balanced regional development, without the emergence of regions of leaders and regions of outsiders. Disparities in the development of territorial systems are the most important problem of post-war regional development in Ukraine. Modern digitalisation processes, on the one hand, exacerbate inequalities, and on the other hand, are seen as a real opportunity to level the information space, provide communication, access to various services, distance education and remote employment, and other opportunities (Ahmad et al., 2020; Erdin&Ozkaya, 2020; Sydorenko, 2024). This is most relevant for peripheral areas remote from large cities and agglomerations, especially those that have suffered the most from hostile shelling. However, these advantages are limited by the still unevenly developed information infrastructure, the cost of its modernisation and expansion, the lack or poor quality of communication services, and the insufficient level of motivation and literacy of the population. This increases the relevance of monitoring the dynamics of innovative development in different territories of Ukraine.

Considering the problems of integrating spatial and socio-economic development of regions, researchers (Guo et al., 2022; Le et al., 2021; Mukhalchenko et al., 2023) note the

difference between the goals of spatial policy and socio-economic policy in regional subsystems. On the one hand, the objectives of spatial policy include the rational use of space, protection of the natural and cultural environment, and functional management of space. On the other hand, only at the level of the main territorial units, the objectives of socio-economic policy include the creation of optimal living conditions for the population of this territory, stimulation of economic and labour market development, entrepreneurship, innovation, and attractiveness of the territories.

The main problem of spatial differentiation is the growing inter-regional inequality. Spatial rebalancing is aimed at reducing the welfare gap between regions and reducing unemployment in poor areas. The spatially neutral approach aims to ensure aggregate economic growth through agglomeration economies and economic integration. The spatially oriented approach is to develop the potential of each individual region by creating a more sustainable and dynamic local economy.

Researchers (Hao et al., 2022; Leckel et al., 2020; Wagner et al., 2021) have explored the possibilities of reducing interregional inequality through financial transfers. According to the authors, the place of residence in the country determines the chances of employment, housing conditions, health care, environmental conditions, and social security measures. However, increased support for backward regions does not always stimulate economic growth and forces the population to migrate to regions that can provide employment opportunities. On the other hand, stimulating the development of territories can put a strain on infrastructure and increase its deterioration. Also, the authors (Bilan et al., 2019; Castro-Arce & Vanclay, 2020; Nilsen et al., 2023) point out that traditional indicators used to analyse the level of socio-economic development do not sufficiently characterise local features in terms of describing the characteristics of poverty.

Given the relevance of the research topic, the aim is to summarise and clarify the theoretical and methodological foundations for determining approaches to the innovative development of Ukraine's regions in the post-war period.

- To achieve the goal, the following tasks need to be implemented:
- to group regions using the cluster analysis method;
- identify promising areas for the development of individual regions;
- to formulate recommendations for stimulating and intensifying innovation activity in the regions.

Methodology

The completeness and objectivity of the proposed recommendations is ensured by the use of an integrated approach to the study of the specifics of regional development in Ukraine in the post-war period, and since the study focuses on the innovative component of regional development, the indicators related to capital investment at the regional level were selected for analysis, since these funds can become a source of innovative development. In general, the results were obtained through the use of a number of general scientific and special research methods: system analysis and synthesis, comparison and generalisation, cluster analysis.

The cluster analysis was used to group the regions of Ukraine according to their ability to develop innovations and the presence of prerequisites for innovation activity in the period of post-war recovery.

Regression analysis is used to identify the relationship between the amount of innovation capital concentrated in a region and the GDP generated in each region.

Due to the rapid changes in equipment, technology and production organisation, regional development management is becoming increasingly important, especially for Ukrainian regions in the period of post-war recovery, as the uniform development of all regions determines the possibility of uniform development of the entire country. Accordingly, the key problem is to develop directions for innovative development of Ukrainian regions, taking into account the specifics of financing and functioning of each of them. In this regard, it is logical to assume that the development of directions for innovative development of regions should take into account the current and potential for their further growth.

Results

The budget of Ukraine is the main material basis for the existence of the state with the form of implementation of its functions at the regional level, which is an effective tool for implementing socio-economic policy and ensuring regional development. Generating sufficient budget revenues and ensuring their efficient use requires special attention. But today, the country faces many problems: a threat to the territorial integrity and sovereignty of the country, political instability, outflow of population, and many others (Rudevska et al., 2024; Storozhyk, 2024). To maintain the balance of economic processes in the country,

the state budget is the main lever. One of the main macroeconomic factors affecting the level of budget revenues is the level of gross domestic product. Its dynamics reflects the efficiency of the financial system and the progressiveness of state regulation of social and economic indicators of the budget based on realistic forecasting of economic development, ensuring a direct relationship between the budget and the national economy to achieve optimal mobilisation of revenues to the budgets of Ukraine and determining the actual priorities in the process of their distribution and use. Table 1 shows the dynamics of changes in the gross domestic product for 2012-2023.

Table 1 - Gross Domestic Product of Ukraine from 2012 to 2023 (UAH million)

Year	Nominal GDP (in actual prices)	Real GDP (in prices of the previous year)	The difference (real - nominal)	
2012	1408889	1304064	-104825	-7.4%
2013	1454931	1410609	-44322	-3.0%
2014	1566728	1365123	-201605	-12.9%
2015	1979458	1430290	-549168	-27.7%
2016	2383182	2034430	-348752	-14.6%
2017	2982920	2445587	-537333	-18.0%
2018	3558706	3083409	-475297	-13.4%
2019	3974564	3675728	-298836	-7.5%
2020	4194102	3818456	-375646	-9.0%
2021	5459574	4363582	-1095992	-20.1%
2022	5191028	3865780	-1325248	-25.5%
2023	6537825	5518062	-1019763	-15.6%

Source: Ukraine economy. Statistics, 2024

Undoubtedly, in a time of war, ensuring GDP growth becomes an extremely difficult task, which can only be achieved if all regions use their potential to the maximum

extent possible. Accordingly, there is a need to determine the share of regional GDP in the total GDP of the state - Table 2.

Table 2 - Shares of regional GDP in the total national GDP in 2021

Region.	Share in GDP	Region.	Share in GDP	Region.	Share in GDP
Ukraine - 100.0					
M. Kyiv	23,4	Vynnytsia	3,1	Volynska	1,7
Dnipro	10,5	Cherkassy	2,5	Rivne	1,6
Kharkivska	6,3	Mykolaivska	2,3	Kherson	1,6
Donetsk	5,6	Zhytomyrska	2,1	Transcarpathian	1,4

Region.	Share in GDP	Region.	Share in GDP	Region.	Share in GDP
Ukraine - 100.0					
Kyiv	5,3	Ivano-Frankivsk	2,1	Ternopilska	1,4
Poltava	5,1	Khmelnyska	2,1	Luhansk	1,0
Odesa	5,0	Sumy	1,9	Chernivetska	1,0
Lviv	4,9	Chernihivska	1,9		
Zaporizhzhya	4,4	Kirovohradska	1,8		

Source: Ukraine economy. Statistics, 2024

According to the data in Table 2, there is a significant disproportion in the regional development of Ukraine's regions. Table 1 shows that Ukraine's GDP growth rate from 2012 to 2023 was variable. From 2017 to 2019, the growth rate increased by 2.5 per cent, which was due to economic reforms implemented by the government, which pushed for an increase in demand and, of course, supply. In 2020-2021, the GDP growth rate declined by 11.1%. The factors that contributed to the decline in GDP during this period include the global financial crisis, funds allocated for the latest technologies, innovations in various sectors of the economy were used irrationally, and the amount of these funds did not meet important needs. During this period, the bulk of GDP was generated in Kyiv and Dnipropetrovska and Kharkivska oblasts, which is related not only to the actual location of companies in these regions, but also to the location of their offices.

It should also be borne in mind that a significant portion of Ukraine's GDP growth in recent years has been driven by price increases, and that reserves are not fully utilised (Feng et al., 2023).

In the context of the innovative development of Ukraine's regions, it is first of all worth analysing the volume of capital investment in each region (Table 3) to understand the potential for innovative development of each administrative unit. It is worth noting that the period before the full-scale invasion was characterised by a steady increase in capital investment, while in 2022 the volume of such investments decreased from UAH 673899.3 million to UAH 409660.0 million, which is quite logical, since the main costs may be associated with financing current needs and restoration, rather than investing in capital projects.

Table 3 - Capital investments by regions for 2015-2022, mln UAH

Region	2015	2016	2017	2018	2019	2020	2021	2022
Ukraine	273116,4	359216,1	448461,5	578726,4	623978,9	508217,0	673899,3	409660,0
Vinnysia	7373,0	8301,9	11744,1	17626,5	15724,9	13601,5	16922,1	14122,1
Volyn	6166,8	6384,2	7041,9	8687,0	12664,0	9121,6	11718,3	9535,0
Dnipropetrovsk	25919,9	33169,0	42908,5	60288,6	66951,1	58601,4	78484,4	40477,9
Donetsk	8304,3	11902,2	17268,9	26979,4	30594,5	26597,8	32477,6	5564,9
Zhytomyr	4044,4	5573,5	7722,0	8742,3	8466,9	9270,2	11484,8	6113,2
Zakarpattia	3778,4	4663,0	5623,7	7500,6	9330,3	5081,0	9184,3	6818,0
Zaporizhzhya	7794,3	11039,7	15879,7	15732,0	14876,7	15495,0	21039,3	9312,5

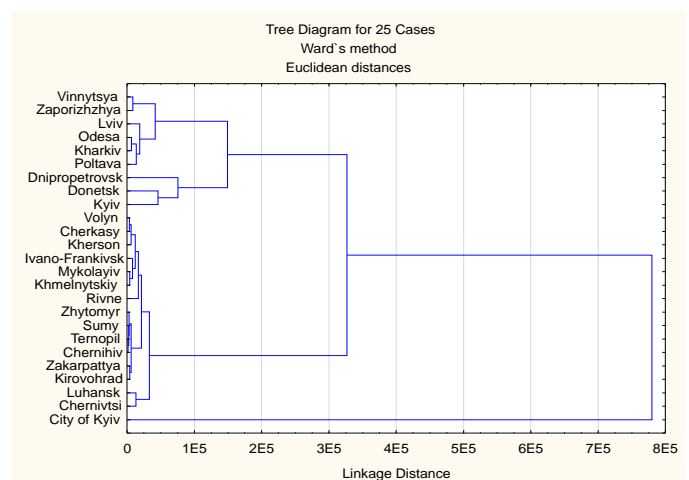
Region	2015	2016	2017	2018	2019	2020	2021	2022
Ivano-Frankivsk	9609,3	7947,6	9707,8	9393,7	9305,5	6338,0	12282,0	6851,5
Kyiv	24359,1	33411,4	34494,5	40713,4	50295,7	32760,0	44287,7	31168,6
Kirovohrad	4057,1	6355,3	7320,9	7181,5	7794,3	6746,0	8678,5	7096,7
Luhansk	2060,1	4122,2	3329,8	3219,3	3357,5	3259,1	4496,5	270,8
Lviv	13386,5	18605,2	24105,9	28995,5	31061,5	23641,5	31483,8	26161,4
Mykolaiv	5989,9	9730,2	11178,0	10099,2	12549,3	9504,9	12135,8	5008,6
Odesa	9983,5	16728,7	22299,7	23787,8	21080,1	21437,6	24149,5	13546,7
Poltava	8337,9	15265,1	15855,6	18636,7	23005,3	25156,9	28044,6	17537,6
Rivne	4334,2	4324,1	6126,8	7228,0	6729,2	5650,6	21469,4	12042,5
Sumy	3663,0	5762,6	6947,1	7749,9	7734,2	7200,1	10554,5	5498,0
Ternopil	3827,5	4888,2	7150,6	8375,0	9210,3	7296,8	10660,2	8501,8
Kharkiv	11246,7	16545,9	19361,7	23551,3	22874,6	20248,6	24647,7	9586,0
Kherson	3107,4	4591,3	7362,2	8853,2	12368,3	7199,1	14616,8	700,4
Khmelnytsky	6809,3	9123,3	10499,9	11274,9	10534,1	10617,0	13515,4	9753,2
Cherkasy	4485,8	6498,7	8144,2	11110,4	11385,5	9079,3	12299,8	9227,6
Chernivtsi	2789,2	2668,8	2992,1	3720,6	4096,8	3319,5	4289,6	3358,7
Chernihiv	3550,2	5318,5	7351,1	8971,3	8740,5	7957,1	10293,7	8305,9
City of Kyiv	88138,6	106295,5	136044,8	200308,3	213247,8	163036,3	204683,0	143100,4

Source: Ukraine economy. Statistics, 2024

According to the data presented in Table 3, it can be argued that the distribution of capital investments between regions is not uniform, and there is a disproportion between the ability of different regions to develop innovations based on the use of capital financing (Scott, 2019). Since there is a disparity in this issue, it is worth grouping the regions of Ukraine by the volume of capital investment to determine their potential for innovative development. The grouping can be implemented using cluster analysis, with a separate clustering based on data until 2022 and on capital investment in 2022.

Fig. 1 shows the results of clustering the regions of Ukraine by the volume of capital investment as a basis for innovative development in the period up to 2021.

Fig. 1. Results of clustering the regions of Ukraine by the volume of capital investment as a basis for innovative development in the period up to 2021



Source: compiled by the author

The results of the clustering indicate that there is in fact an imbalance in the distribution of opportunities for regional development. A summary of the clustering results is presented in Table 4.

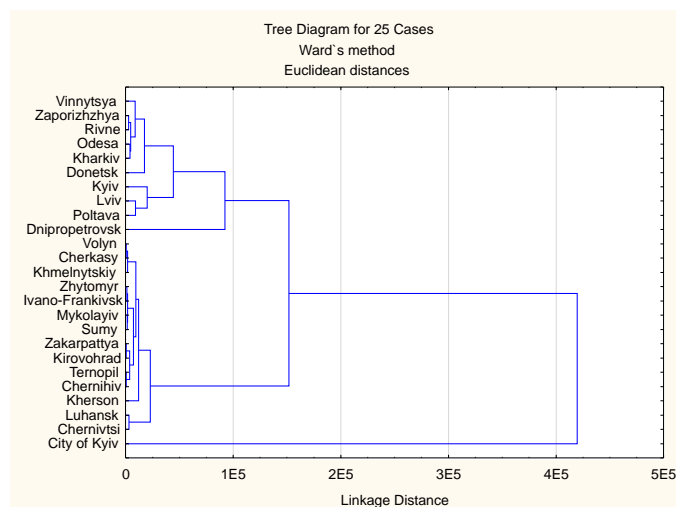
Table 4 - Structure and characteristics of clustering of Ukrainian regions by the volume of capital investments as a basis for innovative development in the period up to 2021

Cluster	Ingredients	Characteristics
Cluster of regions with medium-high potential for innovative development	Vinnytsia, Zaporizhzhia, Lviv, Odesa, Kharkiv, Poltava	The cluster's regions have large -scale production, a significant number of educational institutions, and a fairly strong infrastructure, as well as a developing service sector; the regions can be considered comprehensively developed, but there are areas for improvement and more efficient use of resources
A cluster of regions with high potential for innovative development	Dnipropetrovsk, Donetsk, Kyiv	The cluster's regions are home to large -scale production, companies that raise funds and generate high budget payments. The region also has a well -developed social sector and education. Services.
The cluster with the highest potential for innovative development	City of Kyiv	The capital region constitutes a separate cluster, as it is the capital where the main offices of companies, large capital and various types of resources are concentrated
Cluster of regions with medium-low potential for innovative development	Volyn, Zhytomyr, Zakarpattia, Ivano-Frankivsk, Kirovohrad, Luhansk, Mykolaiv, Rivne, Sumy, Ternopil, Kherson, Khmelnytskyi, Cherkasy, Chernivtsi, Chernihiv	The cluster's regions are mostly agrarian, with some manufacturing companies, but not too many of them, and a growing service and tourism industry

Source: compiled by the author based on (Fan et al., 2020; 12. Grillitsch & Sotarauta, 2020; Hervás-Oliver et al.)

The distribution presented in Table 4 was valid for the period up to 2022, i.e. before the full-scale invasion, after which some regions found themselves in a situation where they had to meet only current needs without focusing on long-term innovative development. Accordingly, there is an objective need to determine the distribution of regions into clusters based on 2022 data - Fig. 2.

Fig. 2. Results of clustering of Ukrainian regions by the volume of capital investments as a basis for innovative development in 2022



Source: compiled by the author

The results of the clustering based on 2022 data are presented in Table 5.

Table 5 - Structure and characteristics of clustering of Ukrainian regions by the volume of capital investments as a basis for innovative development in the period up to 2021

Cluster	Items	Characteristics
Cluster of regions with medium-high potential for innovative development	Vinnitsia, Zaporizhzhia, Rivne, Odesa, Kharkiv, Donetsk, Kyiv, Lviv, Poltava, Dnipropetrovsk	The cluster of central and eastern regions. The regions of the cluster have large -scale production, a significant number of educational institutions, and a fairly strong infrastructure, as well as a developing service sector; the regions can be considered comprehensively developed, but there are areas for improvement and more efficient use of resources. At the same time, some areas of the cluster have suffered significantly as a result of shelling and the occupation of part of the territories. However, production in the government -controlled areas continues to operate, and the potential for further innovative development remains.
Cluster with the highest potential for innovative development (Stolychnyi)	City of Kyiv	The capital region constitutes a separate cluster, as the capital is the place where the main offices of companies, large capital and various types of resources are concentrated, and the bulk of investments are distributed through the capital region
Cluster of regions with medium-low potential for innovative development	Volyn, Zhytomyr, Zakarpattia, Ivano-Frankivsk, Kirovohrad, Luhansk, Mykolaiv, Sumy, Ternopil, Kherson, Khmelnytskyi, Cherkasy, Chernivtsi, Chernihiv	The cluster of southwestern regions is mainly agrarian in nature, with some manufacturing companies, but not too many of them, and a growing service and tourism industry. Even with the relocation of production to the western regions and internal migration of the population, there has been no significant increase in investment activity in this region.

Source: compiled by the author

The updated composition of the clusters shows that there has been a redistribution of the occupancy of each of them, based on the fact that with the beginning of the full-scale invasion of Ukraine, some regions have become less attractive to investors, but it should be emphasised that they have not lost their potential for innovative development, as the prerequisites for the full functioning and further development of most areas remain in place in the country,

although resources are focused on ensuring the country's security.

To summarise the study, it is advisable to develop directions and innovative approaches to regional development in the post-conflict period, taking into account the specifics of the current state of each of the identified clusters and recommending certain measures separately for each of the identified clusters - Table 6.

Table 6 - Development of directions and innovative approaches to regional development in the post-conflict period for each cluster

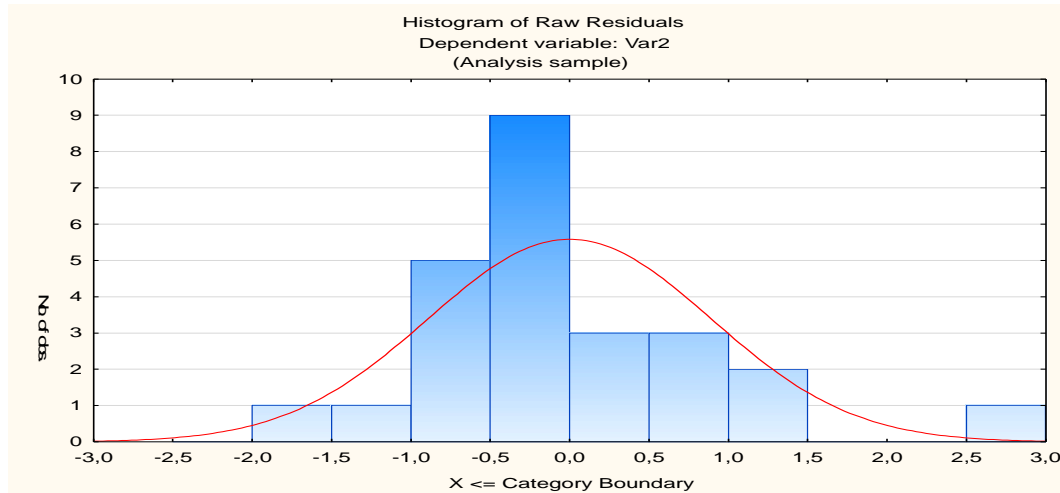
Cluster	Directions and innovative approaches to regional development
	1. First and foremost, the development of the cluster's regions will be associated with the restoration of housing stock, production facilities and energy infrastructure in the post-war period. Investments can be attracted for a long period of time from foreign partners.
Cluster of regions with medium-high potential for innovative development	<p>2. State funding should be directed not only to cover current needs, but also to develop long-term projects. For example, the further development of the IT cluster, which was actively formed in the period before the full-scale invasion.</p> <p>3. Attracting innovative investors to finance start-ups and new business projects of companies located in the cluster regions to create jobs and support the economic and financial potential of the cluster regions.</p> <p>4. Issue of municipal bonds with the help of the state to restore and develop the most important areas for the regions.</p>
Cluster with the highest potential for innovative development (Stolychnyi)	<p>1. The capital region performs a coordinating function and allocates resources to other regions.</p> <p>2. Attracting large amounts of international investment aimed at implementing long-term projects and developing infrastructure facilities.</p>
Cluster of regions with medium-low potential for innovative development	<p>1. For those regions most affected by the hostilities, the first cluster scenario is possible, but with an emphasis on the fact that investments will be mostly social in nature and may be partially funded by the state.</p> <p>2. For the regions that were less affected by the hostilities, the emphasis should be on developing existing potential, particularly in agriculture. However, the emphasis should be on selling finished products rather than raw materials to create additional jobs and generate domestic cash flows and more added value within the country.</p> <p>3. Many of the region's oblasts have significant tourism potential, which also needs to be developed and Ukrainian and foreign tourists to be interested in spending their holidays at Ukrainian resorts.</p> <p>4. Issuance of municipal bonds with the help of the state for the development of a particular area or industry in certain regions.</p>

Source: compiled by the author based on (Kuczabski et al., 2023; MacKinnon et al., 2022; Pan et al., 2022; Samara et al., 2022)

Since the importance of innovation development cannot be overestimated, it is advisable to assess how much the innovation activity of each region affects its ability to generate GDP. This can be done by building a pairwise correlation model, which allows us to determine the impact of one indicator on another. In this case, it will be determined how the innovation activity of regions (Table 3)

affects their ability to generate gross domestic product (Table 2). It is possible to build a pairwise correlation model using the Statistica software. But first, it is necessary to check whether the initial data are suitable for building a pairwise correlation model, whether the data conform to the normal law of data distribution - Fig. 3.

Figure 3. Checking the distribution of the initial data to build a pairwise correlation model for compliance with the normal distribution law



Based on the distribution shown in Fig. 3, it is obvious that the data follow a normal distribution law. Therefore, they can be used for further model development. The results of building such a model are shown in Fig. 4.

Fig. 4. The results of building a model of pairwise correlation of the dependence of the region's ability to generate GDP on the volume of innovation capital

Parameter Estimates (Spreadsheet1)										
Sigma-restricted parameterization										
Effect	Var2 Param.	Var2 Std.Err	Var2 t	Var2 p	-95,00% Cnf.Lmt	+95,00% Cnf.Lmt	Var2 Beta (?)	Var2 St.Err.?	-95,00% Cnf.Lmt	+95,00% Cnf.Lmt
Intercept	0.964125	0.221063	4.36132	0.000229	0.506822	1.421429				
Var1	0.000113	0.000005	24.29957	0.000000	0.000103	0.000122	0.981075	0.040374	0.897555	1.064595

Test of SS Whole Model vs. SS Residual (Spreadsheet1)											
Dependent Variable	Multiple R	Multiple R?	Adjusted R?	SS Model	df Model	MS Model	SS Residual	df Residual	MS Residual	F	p
Var2	0.981075	0.962508	0.960878	490,9755	1	490,9755	19,12451	23	0,831501	590,4693	0,00

According to the data presented in Fig. 4, it can be argued that there is a close connection between the innovation activity of the region and the GDP generated in it. This is confirmed by the Multiple R indicator, which reflects the closeness of the relationship between the variables. In the above model, it can be stated that the innovation activity of a region has a 98.11% impact on the region's GDP. Accordingly, in order to develop production in the region and to stimulate economic growth in the country as a whole, it is necessary to find opportunities for the development of innovation activity in each specific region.

In general, the regions of Ukraine in the period of post-war recovery are characterised by certain disparities in the current state of affairs in the regions and in their potential for further development. Accordingly, for each of the clusters identified in the study, separate recommendations were formulated, including a focus on the specific situation in each region, as well as proposals to resume the practice of issuing municipal bonds, which could become a source of post-war recovery and budgeting for the implementation of critical projects for certain regions.

Conclusion

Economic growth and balanced regional development are closely linked. However, the last few years of full-scale invasion of Ukraine have seen different regions suffer to varying degrees from enemy shelling and the destruction of residential and infrastructure facilities. Accordingly, the imbalance in the development of different regions, which was present in the Ukrainian economy even before the war, has intensified.

The study analysed statistical data and identified which regions account for the largest share of the country's GDP and ensure the development of certain sectors and industries. Next, the regions were clustered to determine the specifics and composition of each cluster. It is established that with the beginning of the full-scale invasion, all regions of Ukraine can be divided into three groups:

1. A cluster of regions with medium-high potential for innovative development. The cluster of central and eastern regions. The regions of the cluster have large-scale production, a significant number of educational institutions, and a fairly strong infrastructure, the service sector is developing, and the regions can be considered comprehensively developed, but there are areas for improvement and more efficient use of resources. At the same time, some areas of the cluster have suffered significantly as a result of shelling and the occupation of part of the territories. However, production in the government-controlled areas continues to operate, and the potential for further innovative development remains.

2. The cluster with the highest potential for innovative development. The capital region constitutes a separate cluster, as the capital is home to the main offices of companies, large capital and various types of resources, with the bulk of investment being distributed through the capital region.

3. A cluster of regions with medium-low potential for innovative development. The cluster of southwestern regions. The regions of the cluster are mainly agrarian in their development, with some manufacturing companies,

but not too many of them, and a growing service and tourism industry. Even with the relocation of production to the western regions and internal migration of the population, there has been no significant increase in investment activity in this region.

Recommendations for further development and innovative growth have been developed for each of the clusters, based on the need to attract investment for recovery, which can be done primarily through the issuance of municipal bonds.

Also, by building a pairwise correlation model, it is proved that there is a dependence between the amount of innovation capital concentrated in a region and the GDP generated in each region.

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