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SCIENTIFIC APPROACHES TO THE FORMATION OF GEO-INFORMATION SUPPORT FOR THE MANAGEMENT OF REGIONAL DEVELOPMENT AND POST-WAR RESTORATION OF TERRITORIAL COMMUNITIES IN UKRAINE

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Abstract. This article explores scientific approaches to developing geoinformation support for managing regional development and facilitating post-war restoration of territorial communities in Ukraine. The research focuses on leveraging geoinformation systems (GIS) to enhance decision-making processes in the aftermath of conflicts. The study delves into the conceptual foundations of GIS application, emphasizing their role in optimizing resource utilization, environmental rehabilitation, and strategic planning for regional growth. Additionally, the article examines international experiences in employing GIS for post-war reconstruction to draw valuable insights applicable to the Ukrainian context. The innovative aspect of the research lies in proposing practical recommendations for the widespread implementation of GIS technologies, contributing to the effective coordination of regional development initiatives and post-conflict recovery efforts. The findings aim to inform policymakers, planners, and researchers on the potential of geoinformation systems as instrumental tools for sustainable development and reconstruction, offering a comprehensive framework for future applications in Ukraine and beyond.

Through a review of current scientific methodologies and case studies, this article highlights the significance of integrating geoinformation approaches into regional management frameworks to enhance spatial understanding, resource allocation, and infrastructure development. Furthermore, it emphasizes the importance of collaboration between government agencies, academic institutions, and local communities in harnessing the full potential of geoinformation support for fostering resilience and prosperity in post-conflict and developing regions of Ukraine.

Key words: GIS; regional development; monitoring; evaluation; land management.

JEL code: R5, R58, C21

Introduction

The issue of Ukraine's regional development in the context of the large-scale armed aggression of the Russian Federation requires the development of completely new scientific approaches that should be based entirely on dynamic geographic information models, taking into account the constantly changing situation in both the economic and social spheres. In Ukraine, the main planning document in the field of regional development is the State Strategy for Regional Development, which was recently adopted for 2021-2027. However, given the dramatic change in the situation in Ukraine due to the full-scale invasion and the country's accession to the EU, the strategy needs to be significantly changed and updated. At the same time, a geographic information system for monitoring and evaluating the development of regions and communities should become the main driving mechanism for implementing the State Regional Policy.

The purpose of this article is to present scientific approaches to the formation of geoinformation support for the management of regional development and post-war reconstruction of territorial communities in Ukraine.

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To achieve this goal, the following tasks are planned to be solved:

1) to conduct a retrospective analysis of the regional development process in Ukraine;
2) to conduct a comprehensive analysis of the legislative, regulatory and methodological regulation of the principles of regional policy in Ukraine;
3) to develop the main priorities on which the geographic information system of regional development and post-war restoration of territorial communities in Ukraine should be based.

The main working hypothesis underlying the article is the assumption that the theoretical substantiation of scientific approaches to the formation of geoinformation support for regional development will create a conceptual basis for the transition to a qualitatively new modern world form of strategic management of socio-economic development and post-war recovery through decision-making based on geospatial data. At the same time, the advantage of our approach will be a significant reduction in the cost of work on the formation of regional development strategies at all levels with a gradual transition to a fully automated geographic information system.

The scientific basis of the study is the provisions and principles of the modern concept of sustainable development of rural areas, the results of research by domestic and foreign scientists, which reveal the institutional nature of modern geographic information support for the purposes of regional development, strategic planning and monitoring of these processes. In the course of the study, general scientific and special research methods were used, namely: dialectical - to identify the conditions in which the activities of participants in the process of regional development and territorial rehabilitation are carried out, their direction, effectiveness and efficiency; analysis - to highlight the role and place of strategic planning in the system of socio-economic relations; synthesis - to combine different doctrines on the formation of the institution of regional development and post-war rehabilitation; induction and deduction - to identify gaps in the normative framework.

One of the first European fundamental studies on improving the management process in the field of regional development was related to the widespread use of geographic information systems as a spatial tool for decision-making based on strategic planning data (Juliao, 1998). In turn, over the next decade, geodata processing tools and GIS models were developed to support regional environmental planning and management, which had a significant impact on the development of regional development processes and decision support systems (Schaller, Mattos, 2009). Also, a significant research contribution was made in the development of a geospatial database for rural areas, which significantly influenced their further development (Cano, Garzón, Sánchez-Soto, 2013).

The novelty of the proposed approach lies, unlike the existing ones, in the formulation of methodological approaches to the system of strategic planning and regional development adapted to modern Ukrainian conditions, the construction of the concept of a geographic information system for organising and managing the process of reconstruction and post-war recovery (organisation, administration, analysis, information identification, determination of the value of objects, management of the information base) at the level of territorial communities of Ukraine.

Research results and discussion

For more than thirty years, Ukraine has been in constant search of an effective model of regional development, as the country was formed within the territories that have long been part of different states and has 25 regions that differ in natural conditions, urbanisation, regional economic structure, language, history, religious preferences, and ethnic composition.

An important component of the state regional policy is the socio-economic development of the regions. The need to accelerate Ukraine's entry into the path of sustainable development, economic growth, and to create conditions for dynamic and balanced socio-economic development of Ukraine and its regions were defined and approved in the State Regional Policy Strategy. However, the implementation of reforms in Ukraine during 2007-2014 did not yield results, as the process of formulating and implementing strategies, which was dependent on changes in the socio-political situation in Ukraine, demonstrated low efficiency and the mostly declarative nature of most of the adopted legal acts (concepts, programmes etc.) related to regional development.

In 2014-2021, Ukraine's state regional policy reached a new level of development: The Law "On the Principles of State Regional Policy" was adopted and a fundamental reform of local self-government and territorial organisation of power was launched.

As part of the decentralisation reform, amalgamated territorial communities were formed in Ukraine, on the basis of which a new administrative and territorial structure was formed in 2020 and 1470 territorial communities were formed, which contributed to the balanced development of Ukrainian communities and regions, and thousands of horizontal links between communities and regions were created. intensification of decentralisation processes. At the same time, the implementation of the State Strategy for Regional Development and regional development strategies had very limited financial resources. The implementation of the State Strategy for Regional Development for 2021-2027 was based on an integrated territorial approach, which envisages "the use of special mechanisms and instruments of state support" depending on the type of functional territory characterised by a specific set of social, spatial, environmental and economic features (Zelenskyi, 2022; Law of Ukraine On the principles of state regional policy, 2013; On approval of the State Strategy for Regional Development for 2021-2027, 2020; Law of Ukraine On the regulation of urban development activities, 2011). Achieving the strategic goal of the state regional policy by 2027 involved the implementation of three strategic objectives.

- Formation of a cohesive state in the social, humanitarian, economic, environmental, security and spatial dimensions.
- Increasing the competitiveness of the regions.
- Building effective multi-level governance.

As of the beginning of 2022, out of the 1438 territorial communities in Ukraine that have joined the strategic planning process at the territorial community level: 617 (43%) had approved development strategies, 625 (44%) had a document under development, and 196 (13%) had not started work on their strategy.

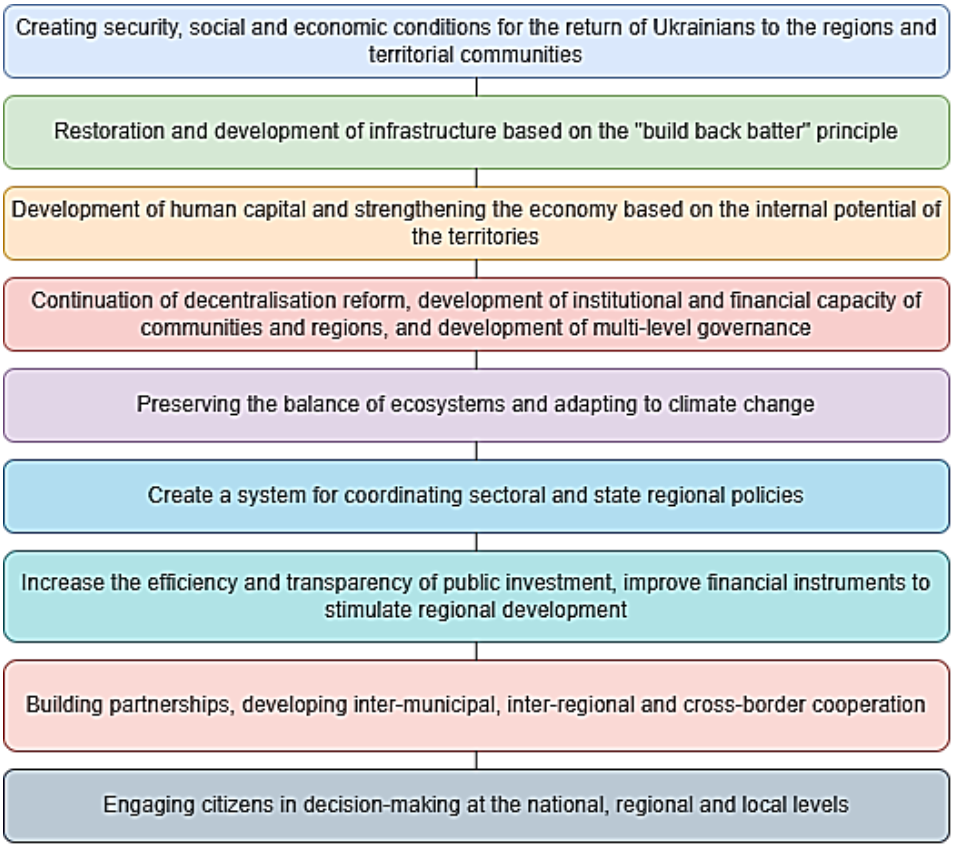
The full-scale invasion of Ukraine by the Russian Federation on 24 February 2022 exacerbated the situation in all dimensions - social, economic, and territorial. Therefore, the development of a new regional development policy requires a comprehensive analysis and assessment of the current situation related to the war and the situation in Ukraine as a whole, regions and territorial communities.

In order to adapt the legislation in the field of state regional policy to the situation that has developed as a result of large-scale armed aggression against Ukraine and to introduce special mechanisms and tools by executive authorities and local self-government bodies in the process of implementing the principles of state regional policy:

- the Law establishes functional types of territories: macro-region, micro-region or territorial community, which are characterised by a set of common social, spatial, environmental, economic, security and other features;
- introduces planning for the restoration of regions and territories affected by armed aggression against Ukraine;
- and develops programmes for the comprehensive restoration of the region and territory of a territorial community (part of it).

In the context of Ukraine's post-war recovery and preparation for accession to the EU (as required by Chapter 22 of the Acquis Communautaire), it is necessary to reform the state regional policy in the areas of legislative harmonisation, ensuring the establishment of relevant institutions at the central and regional levels with clear tasks and powers, administrative capacity, creating conditions for the formation of a sufficient number of regional development projects, developing operational programmes for regional development, monitoring and evaluation, financial management and control.

In the process of research, the main conceptual priorities that should be guided by the geoinformation system for regional development and post-war reconstruction based on the State Strategy for Regional Development of Ukraine for the period until 2027 were determined (Fig. 1)



Source: author's formation based on data of Ministry for Communities, Territories and Infrastructure Development of Ukraine

Fig. 1. **Priorities of strategic development and post-war reconstruction of Ukraine based on the geoinformation system**

Thus, based on the priorities presented in Fig. 1, the technical concept of a geographic information system for regional development, strategic planning and post-war recovery of territorial communities, including monitoring of relevant processes, should be developed.

In the legal context, the Cabinet of Ministers of Ukraine adopted Resolution No. 522 of 23 May 2023 "On Approval of the Procedure for the Functioning of a Unified Geographic Information System for Monitoring and Evaluation of the Development of Regions and Territorial Communities", which approves the Procedure for the functioning of the geographic information system for control, monitoring and development of regional policy. In particular, this Procedure defines the mechanism for creating, implementing and ensuring the functioning of a unified geoinformation system for monitoring and evaluating the development of regions and territorial communities. It is envisaged that the database of the geographic information system of regional development is a set of data on socio-economic processes and results of socio-economic development of regions and territorial communities (macro-regions, micro-regions, functional types of territories) and/or their parts (districts, cities, towns, villages), activities of central and local executive authorities, local self-government bodies to implement the goals and objectives of the state regional policy contained in the geographic information system of regional development.

According to the Procedure, the tasks of the geographic information system for regional development are as follows:

- integration of external information resources, in particular statistical, administrative information and geospatial data in the field of development of regions and territorial communities;
- creation and management of a data warehouse and thematic databases of socio-economic, budgetary and financial indicators established for the purposes of the state regional policy;
- modelling and analysing the socio-economic state of the objects of the state regional policy defined by the legislation, forecasting the socio-economic development of regions and territorial communities;
- preparation of proposals on the directions and methods of adjusting strategic planning documents and implementation of the state regional policy;
- automation of interaction between authorised and external users and provision of access to open data in the field of regional and territorial community development.
- The functions of the geographic information system of regional development are as follows:
- collection and processing of information received in the course of interaction with external information sources and activities of authorised users;
- systematisation, generalisation and verification of information in order to transform it into a data format suitable for further analysis and functioning of various modules;
- ensuring electronic interaction between data providers and authorised users;
- analysing and visualising geospatial information to support management decisions, in particular in the area of regional development and recovery planning;
- ensuring compatibility and electronic interaction of the regional development geographic information system database with external information sources in accordance with the current legislation;
- protection of data, including personal data, from unauthorised access, interference and destruction;
- ensuring the accuracy and integrity of data, including personal data;
- provision of different levels of access to authorised and external users to the information contained in the database of the regional development geographic information system in accordance with the established rights;
- possibility of registration and identification of authorised users, in particular, by means of electronic means of identification that ensure unambiguous identification of a person;
- performing other functions of the regional development geographic information system.

The state of regional development in Ukraine is characterised by different levels of economic and social development in different regions of the country. In order to balance these processes and the need for effective post-war reconstruction, the organisation of geoinformation space, collection and processing of geospatial data, analysis and visualisation of results, interactive access to data, as well as ensuring the security and confidentiality of information, are essential.

The following factors should be taken into account for the effective management of regional development and post-war reconstruction in Ukraine and for the purpose of monitoring and evaluating the effectiveness of strategic planning:

- economic potential of the region, including the availability of natural resources, infrastructure, level of entrepreneurship and other important economic indicators;
- social indicators, such as the level of education, healthcare, housing conditions and other aspects of life;
- transport infrastructure and accessibility of the region for investment and business development;
- environmental situation in the region and compliance with environmental safety standards;
- opportunities for the development of tourism and cultural heritage of the region;
- availability and quality of institutional support for the region's development and attractiveness for investment;
- peculiarities of the region's geographical location and its connection with other regions of the country and the world.

Important elements that substantiate the scientific novelty of the scientific article in comparison with the available data are the formation of methodology and methodological recommendations for the integration of information resources of monitoring subjects, including statistical and geospatial information; formation and maintenance of a data warehouse and thematic databases of socio-economic and budgetary-financial indicators established for the purposes of regional development and post-war reconstruction of the country; modelling and analysis of the socio-economic status of objects of the state regional strategy (Ben-David, Papell, 1998; Beugelsdijk, Klasing, Milionis, 2018; Crescenzi, Iammarino, 2017; Dijkstra, Poelman, Rodríguez-Pose, 2020; European Commission, 2022; Rodríguez-Pose, Ganau, 2022).

In this regard, it is important to research the development of conceptual foundations of a geographic information system for regional development for effective management of strategic planning and post-war reconstruction of territories in Ukraine, which will provide a modern level of digitalisation in monitoring and evaluating the development of regions and communities and will facilitate a full transition to decision-making based on geospatial and analytical data.

Regional development and post-war recovery are complex and multifaceted processes that require a comprehensive approach and the use of various tools. In this context, a geographic information system can become a powerful tool to support regional development and post-war reconstruction in Ukraine.

On the one hand, the use of a geographic information system will allow obtaining more accurate and complete information about the territories and their socio-economic features. This can help to address issues related to territorial development planning, monitoring and evaluation of strategic planning, efficient use of natural resources, environmental protection, etc.

On the other hand, the use of a geographic information system will allow for a quick and effective response to the negative effects of war and various natural and man-made disasters. In particular, it can be useful for planning recovery operations, monitoring and evaluating the effectiveness of strategic planning, and ensuring efficient allocation of resources for the restoration of infrastructure and the social sphere.

The objects of the geographic information system for monitoring and evaluation are socio-economic processes and results of socio-economic development of regions, and in cases specified by law – macro-regions, micro-regions, territorial communities, territories requiring special attention from the state, characterised by quantitative and qualitative, static or dynamic parameters.

The urgent issues addressed by the scientific approach are the formation of a mechanism for tracking regional development indicators based on geoinformation support, which is based on available official statistics, information from central executive authorities and local governments, as well as tracking and analysing territorial trends, dynamics and structural changes in accordance with the goals, directions and objectives of strategic planning at all levels.

Thus, the use of a geographic information system as a tool to support regional development and post-war reconstruction in Ukraine is an extremely important task that has great potential for improving the welfare of the population and ensuring sustainable development of the country as a whole. At the same time, the geographic information system of regional development in Ukraine is aimed at improving the efficiency of regional development management (analysis of the state of territories, their potential and problems) to develop and implement effective regional development strategies, ensure optimal use of resources, increase the competitiveness of regions and attractiveness for investors, ensure environmental safety, improve the welfare of the population and overcome territorial differences.

Conclusions, proposals, recommendations

1) Taking into account international experience, it is important for Ukraine to choose a model of regional policy that would take into account the basic legal, economic, social, environmental, humanitarian and organisational principles of the state regional policy as an integral part of Ukraine's domestic policy and the conditions of martial law.
2) Scientific approaches to the formation of geoinformation support for regional development and post-war reconstruction of territorial communities of Ukraine should include the possibility of collecting and systematising geospatial and semantic data on the socio-economic life of communities and regions, which, in turn, will allow identifying problems at the local level.
3) Development of the documents of the state regional policy system should be based on indicators of the socio-economic situation, and the decision-making process in this area will become reasonable, predictable and objective based on the use of geospatial data.
4) Establishing the relationship between strategic goals, objectives, measures and indicators will automate the assessment of strategic goals from the local to the state level, as well as monitoring and evaluation of the implementation of the state regional policy.
5) Based on the automated assessment of socio-economic development indicators in the geographic information system, it is possible to significantly improve the quality of further management decisions in the field of strategic planning and to promote investment potential through openness to investors, business and stakeholders of regional development and post-war restoration of territorial communities in Ukraine.

Bibliography

1. Juliao, R.P. (1998). "GIS and regional development: Examples of applications," ERSA conference papers ersa98p222, European Regional Science Association.
2. Schaller, J., & Mattos, C. (2009). GIS model applications for sustainable development and environmental planning at the regional level. In GeoSpatial Visual Analytics: Geographical Information Processing and Visual Analytics for Environmental Security (pp. 45-57). Springer Netherlands.

3. Cano, M., Garzón, E., & Sánchez-Soto, P. J. (2013). Historic preservation, GIS, & rural development: The case of Almería province, Spain. Applied geography, 42, 34-47.
4. Zelenskyi, V.O. (2022). Vidbudova Ukrainy bude naibilshym vneskom u pidtrymku hlobalnoho myru – promova Prezydenta na Mizhnarodnii konferentsii z pytan vidnovlennia Ukrainy v Luhano [The reconstruction of Ukraine will be the greatest contribution to the support of global peace - the President's speech at the International Conference on the Reconstruction of Ukraine in Lugano]. www.president.gov.ua. Retrieved from https://www.president.gov.ua/news/vidbudova-ukrayini-bude-najbilshim-vneskom-u-pidtrimku-globa-76261 [in Ukrainian].
5. Law of Ukraine On the principles of state regional policy February 05 2015, № 156-VIII. (2015, February 05). URL: https://zakon.rada.gov.ua/laws/show/156-19#Text [in Ukrainian].
6. On approval of the State Strategy for Regional Development for 2021-2027: Resolution of the Cabinet of Ministers of Ukraine № 695 (2020, August 05). URL: https://zakon.rada.gov.ua/laws/show/695- 2020-%D0%BF#Text [in Ukrainian].
7. Law of Ukraine On the regulation of urban development activities February 17 2011, № 3038-VI. (2011, February 17). URL: https://zakon.rada.gov.ua/laws/show/3038-17#Text [in Ukrainian].
8. Ben-David, D., and Papell, D. H. (1998). Slowdowns and meltdowns: Postwar growth evidence from 74 countries. Review of Economics and Statistics 80 (4): 561–71. doi: 10.1162/003465398557834.
9. Beugelsdijk, S., Klasing, M. J., and Milionis, P. (2018). Regional economic development in Europe: The role of total factor productivity. Regional Studies 52 (4): 461–76. doi: 10.1080/00343404.2017.1334118.
10. Crescenzi, R., and Iammarino, S. (2017). Global investments and regional development trajectories: The missing links. Regional Studies 51 (1): 97–115. doi: 10.1080/00343404.2016.1262016.
11. Dijkstra, L., Poelman, H., and Rodríguez-Pose, A. (2020). The geography of EU discontent. Regional Studies 54 (6): 737–53. doi: 10.1080/00343404.2019.1654603.
12. European Commission. (2022). Cohesion in Europe towards 2050: Eighth report on economic, social and territorial cohesion, ed. L. Dijkstra. Brussels, Belgium: European Commission, Directorate General for Regional and Urban Policy. https://ec.europa.eu/regional_policy/en/information/cohesion-report/.
13. Rodríguez-Pose, A., and Ganau, R. (2022). Institutions and the productivity challenge for European regions. Journal of Economic Geography, 22 (1): 1–25. doi: 10.1093/jeg/lbab003.