OPTIMIZING THE ENVIRONMENTAL APPROVAL PROCESS THROUGH DIGITAL TECHNOLOGIES AND TERRITORIAL MODELING

Elena-Lavinia STOICESCU[1]

Rezumat. *Articolul analizează procesul de avizare de mediu pentru Planul Urbanistic General (PUG) al orașului Mioveni, propunând optimizarea acestuia prin intermediul tehnologiilor digitale și al modelării teritoriale GIS. Sunt identificate barierele administrative actuale, cum ar fi gestionarea fragmentată a datelor și lipsa de interoperabilitate, care cauzează întârzieri în aprobarea documentelor. Studiul demonstrează modul în care integrarea bazelor de date digitale și a simulărilor spațiale poate eficientiza procesul decizional, asigurând un echilibru între dezvoltarea economică și protecția mediului. Rezultatele converg către un model de optimizare care reduce timpii de procesare și sprijină dezvoltarea urbană durabilă a orașului Mioveni*

Abstract. *The article analyzes the environmental permitting process for the General Urban Plan (GUP) of Mioveni city, proposing its optimization through digital technologies and GIS territorial modeling. Current administrative barriers, such as fragmented data management and lack of interoperability, which cause delays in document approval, are identified. The study demonstrates how the integration of digital databases and spatial simulations can streamline the decision-making process, ensuring a balance between economic development and environmental protection. The results converge toward an optimization model that reduces processing times and supports the sustainable urban development of Mioveni city.*

Keywords: Environmental permit, digital technologies, territorial modeling, urban planning, General Urban Plan (GUP).

1. Introduction

Urban planning represents one of the main tools used in spatial organization and development, playing a key role in ensuring the efficient use of resources and aligning economic and social growth with environmental protection requirements. In the context of continuous urbanization and increasing pressure on both the built environment and natural resources, urban planning documentation has acquired an essential role in establishing development directions for localities and maintaining a balance between urban development and the protection of environmental factors.

The General Urban Plan constitutes the primary urban planning document at the local level, through which the medium- and long-term spatial and functional

[1] Economist, Mioveni City Hall , Mioveni, Romania, Master student at National University of Science and Technology POLITEHNICA Bucharest, Spl. Independentei 313, Zip Code 060042, Bucharest. E-mail: catrunaelenalavinia@yahoo.com

development directions of a locality are established. It regulates land-use, functional zoning, building conditions, and measures for territorial development and protection. The drafting and approval of a PUG involve a complex process of analysis and regulation, within which the environmental impact assessment holds a major position. [1]

Obtaining the environmental permit for urban planning documentation is a mandatory stage in the General Urban Plan approval process, aimed at ensuring the integration of sustainable development principles into decision-making. This procedure seeks to identify and assess the potential effects that the implementation of urban planning provisions may have on the environment, as well as to establish the necessary measures to prevent or mitigate negative impacts on environmental factors [6].

In practice, the process of obtaining the environmental permit is characterized by a high degree of complexity, driven by the large volume of analyzed data, the number of institutions involved, and the duration of the required administrative stages. Fragmented data management, a lack of interoperability between institutions, and the limited use of digital tools can lead to delays in the approval of urban planning documentation and difficulties in implementing spatial development projects.

In this context, the use of digital technologies and territorial modeling tools can significantly contribute to streamlining the environmental permitting process. Spatial analysis information systems, GIS platforms, digital databases, and territorial simulation tools enable more efficient data management and a more precise environmental impact analysis. Furthermore, the digitalization of administrative processes can lead to reduced processing times, increased transparency, and an improved decision-making process in the fields of urban planning and environmental protection [8].

The theme of this paper is justified by the need to modernize administrative procedures regarding the acquisition of environmental permits for urban planning documentation, as well as by the importance of implementing digital solutions within the urban planning process. The paper aims to highlight how the use of digital technologies and territorial modeling can contribute to optimizing the permitting process and supporting efficient and sustainable urban development.

2. Territorial framework and natural environment characteristics of Mioveni city

2.1. Characteristics of the Natural and Geographic Setting

Fig.1. Location of Mioveni City on the orthophotomap.
Source: https://earth.google.com

The city of Mioveni is located in the central part of Argeș County, in a favorable position regarding geography and accessibility, approximately 15 km from the municipality of Pitești and about 125 km from the country's capital (Fig.1). The locality is crossed by the DN 73 national road, which provides a direct connection between Pitești and Câmpulung Muscel, contributing to its integration into the regional transport network.

From a physical-geographical perspective, the city of Mioveni belongs to the Getic Subcarpathians unit, being included in the Getic Depression and situated at the contact zone with the Cotmeana Platform. This positioning provides the territory with specific relief and geological structure characteristics, influencing both land-use patterns and urban development directions.

The administrative territory of the city is bordered by several neighboring administrative-territorial units, namely the communes of Țițești and Davidești to the north, the town of Ștefănești to the southeast, Călinești commune to the east, Dârmănești commune to the west, as well as Micești and Mărăcineni communes in its proximity. This location facilitates economic and social cooperation relations with neighboring localities, alongside the functional expansion of the urban area. [1]

The administrative area of Mioveni City spans 5,097 ha and includes several component villages, namely Mioveni, Colibași, Racovița, Clucereasa, and Făget (Fig. 2). The spatial organization within these units reflects both the historical evolution of the settlement and its adaptation to existing natural conditions [2].

The delineation of the built-up area in relation to the non-built-up area represents an essential aspect of the urban planning process, carrying direct implications for land-use patterns, building regimes, and environmental protection. The expansion of the built-up area must be carried out in a controlled manner, taking into account the natural characteristics of the area, existing risks, and the need to ensure balanced development.

In this context, the location of Mioveni City and its territorial characteristics constitute a baseline element in the analysis of urban planning documentation and within the environmental impact assessment process, directly influencing decisions regarding the future development of the city.

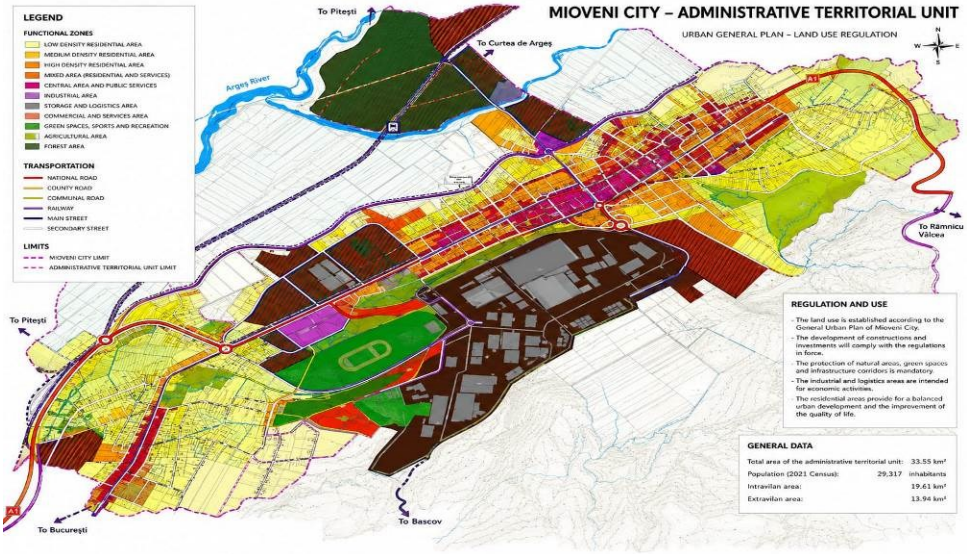

Fig. 2. Mioveni City and its component villages
Source: General Urban Plan – 2020, Mioveni Town

2.2. Geomorphological elements and geological structure

The relief of Argeș County exhibits a tiered organization, extending from the mountainous area in the north toward the plains in the south, which determines a high diversity of landforms and natural conditions. Within this context, the city of Mioveni is situated in the subcarpathian sector, characterized by hills of moderate elevation fragmented by wide valleys, creating a favorable framework for the development of human settlements and economic activities.The structure of the relief directly influences spatial organization, determining the distribution of urban functions and the siting of infrastructure. The subcarpathian zone where Mioveni City is located is characterized by a relative balance between terrain stability and accessibility; however, under certain conditions, specific

geomorphological processes can occur, such as surface erosion or landslides, particularly in areas with steeper slopes. From a geomorphological perspective, the territory consists of several distinct units, namely floodplains, terraces, and slopes. The floodplain represents the low-lying area situated along watercourses, characterized by fertile soils but also by a high vulnerability to flooding. Fluvial terraces are arranged across multiple levels and reflect the historical evolution of the hydrographic network, being generally considered favorable zones for construction due to the relative stability of the ground.

Water resources are of major importance for the city of Mioveni, being used for both population consumption and economic activities. At the same time, they influence the establishment of protection zones, building restrictions, and the measures necessary to prevent natural risks, especially floods. The relief, hydrography, and geomorphological characteristics of Mioveni City constitute essential factors in spatial organization and the urban planning process. The integrated analysis of these elements is necessary to substantiate development decisions and to assess environmental impact, with a view to ensuring sustainable and balanced development [3], [7].

2.3. Climatic features and the hydrographic network

The area of Mioveni City falls, from a climatic perspective, within the temperate-continental sector specific to southern Romania, with influences determined by its positioning in the subcarpathian zone. The particularities of the relief and the moderate elevation contribute to the formation of a hill-type climate, characterized by relatively balanced seasonal variations and favorable conditions for human activities.

The thermal regime is moderate, with annual mean temperatures hovering around 8.5–9°C. Summers are relatively warm, yet without major thermal excesses, while winters are generally milder compared to the mountainous areas, though they can record episodes of low temperatures. The mean temperature for July is around 22°C, whereas January temperatures frequently drop below the freezing point, reflecting the continental nature of the climate [5].

The precipitation regime is characterized by annual mean values ranging between 700 and 800 mm, with an uneven distribution throughout the year. A precipitation maximum is recorded during the warm season, particularly in the summer months, when rainfall can take on a torrential character. These episodes of intense precipitation can generate negative effects on terrain stability, promoting erosion processes or surface runoff. Over time, such phenomena have been recorded across several intervals, highlighting the area's vulnerability to extreme meteorological events.

During the cold season, the number of days with snowfall is relatively low, and the snow cover does not persist for long periods, which influences the hydrological regime and groundwater replenishment. Atmospheric circulation is dominated by western and northwestern directions, with wind speeds being generally moderate.

From a geological perspective, the territory of Mioveni City is characterized by the presence of sedimentary formations specific to the subcarpathian zone. These consist mainly of alternating sequences of sands, clays, and gravels deposited during various geological stages. The structure of these deposits influences the physical-mechanical properties of the soil, playing an important role in how the ground behaves in response to anthropogenic interventions.

Under certain conditions, the geological characteristics of the area can generate instability phenomena, such as landslides, particularly in zones where the strata are poorly consolidated or affected by water infiltration. Furthermore, soil composition influences drainage capacity and structural stability, serving as an essential factor in determining the siting conditions for urban developments.

The interaction between climatic and geological factors determines a series of natural processes that must be taken into account in spatial planning. Heavy precipitation can accelerate erosion processes and affect slope stability, while temperature variations contribute to soil degradation processes.

In conclusion, the climatic and geological conditions of Mioveni City represent determining factors in territorial development and environmental impact assessment. The analysis of these elements is necessary to substantiate urban planning decisions and to prevent risks associated with land use, thereby contributing to ensuring sustainable and balanced development [8], [9].

2.4. Population dynamics and relevant socio-economic aspects

The demographic evolution of Mioveni City aligns with the general trends manifested at the national level, characterized by a moderate population decline over the last few decades. Compared to the 2011 census data, which indicated a population of 31,998 inhabitants, the 2021 Population and Housing Census (conducted in 2022) highlights a decrease in population to 29,317 inhabitants (Fig. 3) [1].

This evolution is driven by factors such as external and internal migration, labor mobility, and structural updates within the population. Nevertheless, the city of Mioveni maintains a relative stability, primarily due to its economic and industrial role within Argeș County. The gender structure of the population is well-balanced, with 14,515 men and 14,802 women recorded, indicating a slight

predominance of the female population. This distribution is characteristic of urban areas and reflects general demographic trends (Fig. 4).

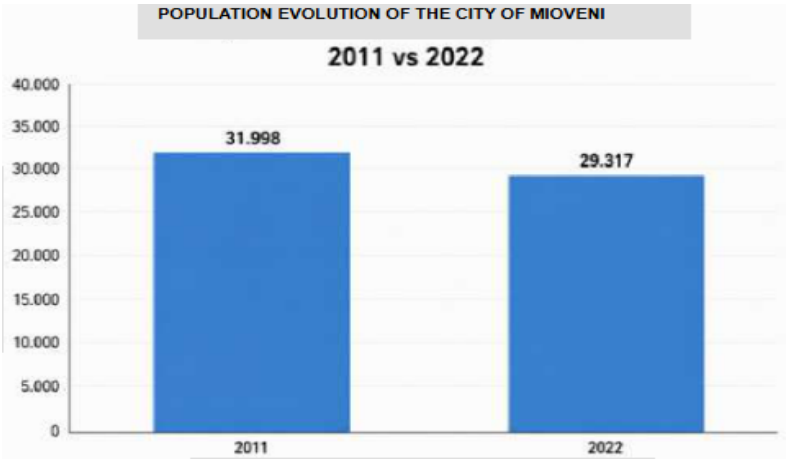

Fig. 3. Population evolution of Mioveni City (2011–2022).
Source: Argeș County Statistical Directorate

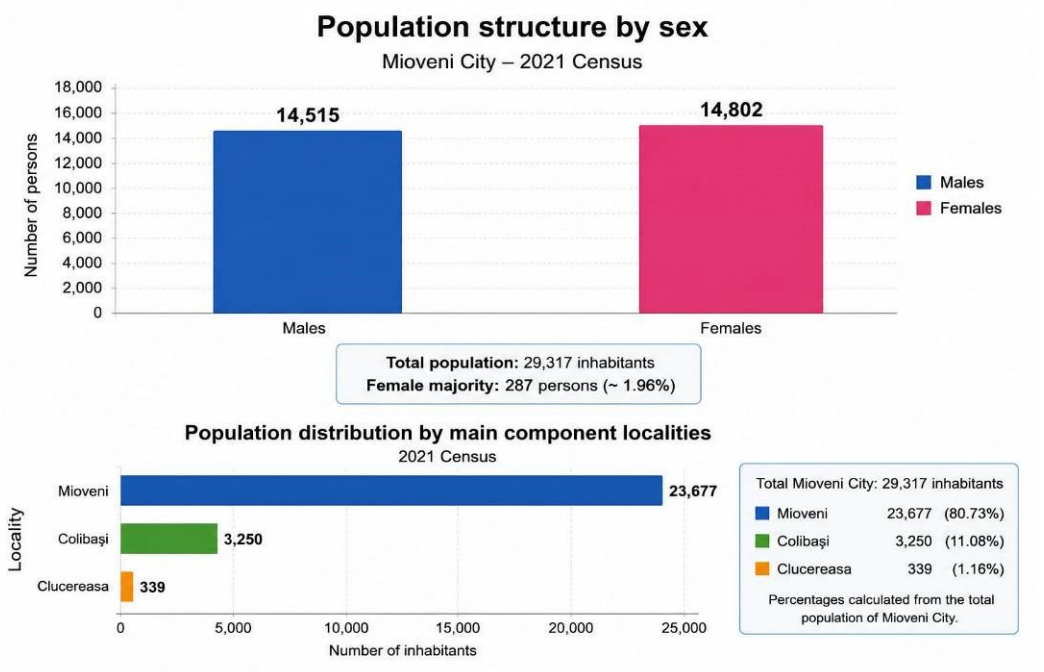

Fig. 4. Gender structure of the population of Mioveni City
Data source: Argeș County Statistical Directorate

From a socio-economic perspective, the city of Mioveni is characterized by a pronounced industrial profile, driven primarily by the presence of the Dacia Groupe Renault Romania industrial platform. This represents the main economic engine of the locality, generating a significant number of jobs and contributing to the development of related economic activities, such as transport, logistics services, trade, and the automotive components industry (Fig. 5).

Fig. 5. Main building of Dacia Renault Group

Another representative productive sector is RATEN – State Owned Company for Nuclear Energy Technologies, a reference technological unit in the field of nuclear power, which conducts research and development activities in collaboration with specialized nuclear institutions. The presence of these economic units provides the city with a high degree of economic and financial stability and contributes to strengthening its industrial role at both regional and national levels [5].

In addition to the automotive industry, the local economy includes other productive branches, such as the agri-food industry, light industry, and wood processing. Within the agri-food sector, there are production units specialized in manufacturing bakery products and alcoholic beverages, while light industry is represented by garment and knitwear manufacturing units, alongside small entrepreneurs engaged in wood processing and furniture production.

The service sector has experienced significant growth after 1990, driven by the expansion of private initiative and the diversification of economic activities. It is represented by firms specialized in construction, plumbing and sanitation installations, interior and exterior design, commercial services, passenger transport, and heavy-duty road freight transport, operating both domestically and internationally. The development of the tertiary sector has contributed to the diversification of the local economy and to increasing the employment rate.

Concurrently, public services play an essential role in the functioning of the city and in ensuring an adequate standard of living for the population. These include activities such as drinking water supply, sewerage, wastewater treatment, municipal waste management, sanitation, street and green space maintenance, as well as thermal energy production and distribution. The development and modernization of public utility infrastructure represent an important prerequisite for supporting the town's urban and economic growth.

According to data recorded by the Argeș Territorial Labour Inspectorate, approximately 400 economic units operate in the city of Mioveni, and the total number of jobs is around 20,000 (Fig. 6).

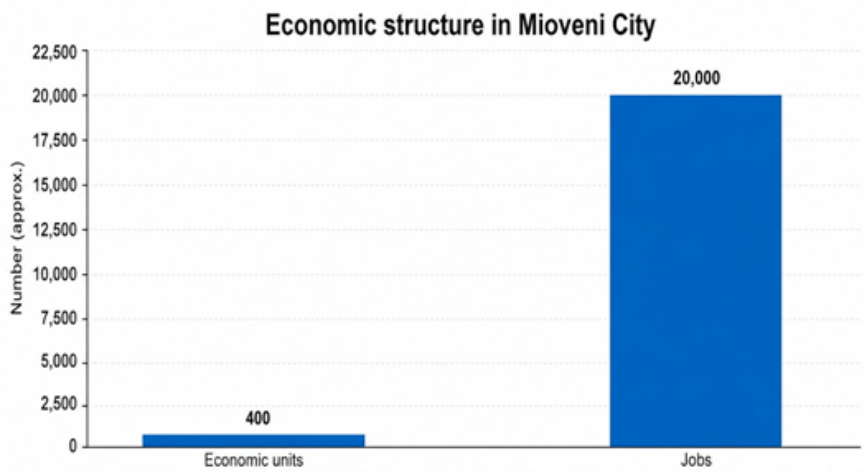

Fig. 6. Structure of economic activity in Mioveni City.
Source: Statistical data from the Argeș Territorial Labour Inspectorate

Agriculture plays a complementary role in the local economy, being practiced mainly at a subsistence and non-intensive household level. Agricultural activities are focused primarily on cereal cultivation, fruit growing, and livestock rearing for self-consumption. For this reason, agriculture's contribution to the local economy is low compared to the industrial and service sectors. [4]

The socio-economic structure of Mioveni City highlights a development model based on industrialization and the expansion of the service sector, supported by major investments and a well-developed economic infrastructure. These characteristics directly influence the organization of urban space, population mobility, and the need for public infrastructure expansion, serving as elements that must be correlated with environmental protection and sustainable development goals.

2.5. Considerations on urban planning within the context of environmental protection

Urban planning represents a set of activities and measures aimed at the organized and balanced development of localities from an economic, social, and technical perspective. In the specialized literature, it is defined as the totality of administrative, economic, and technical actions oriented toward ensuring the harmonious development of localities [1].

Urban planning holds the role of organizing the built environment and ensuring the correlation between economic development, social needs, and environmental protection by establishing land-use regulations and urban development directions.

At the same time, urban planning represents an essential component of spatial planning, having as its main object the organization of the space of localities and the zones necessary for their development. Through urban planning activities, the directions of evolution for localities are established by drafting short-, medium-, and long-term development strategies, as well as by regulating construction methods and land use. Urban development must respond both to the economic and social requirements of the population and to the necessity of protecting environmental factors and natural heritage.

The activity of urban planning possesses several defining characteristics. It holds an operational character through the concrete on-site implementation of the provisions of urban planning documentations; a coordinating character through the correlation of sectoral policies; and a normative character by establishing rules regarding land use, building regimes, and the development of public utility infrastructure. Concurrently, urban planning also has a strategic character, as it pursues the sustainable development of localities and the prevention of imbalances generated by the uncontrolled sprawl of built-up areas [2].

According to the provisions of Law No. 350/2001 on spatial planning and urbanism, the main purpose of urban planning activity is "to stimulate the complex evolution of localities by implementing short-, medium-, and long-term development strategies" [1]. Its objectives include improving the living conditions of the population, ensuring access to infrastructure and public services, efficient land use, the controlled expansion of built-up areas, protecting natural and built heritage, as well as preventing the effects generated by natural hazards. Therefore, urban planning directly contributes to the functional organization of localities and the creation of a balanced urban environment.

Spatial planning represents "a complex activity aimed at coordinating economic, social, cultural, and ecological policies in order to achieve a harmonious natural and built environment, in accordance with the general values of society" [2]. It aims at the organization of space at national, regional, and local levels and

contributes to the balanced development of different geographical zones by capitalising on natural and human resources under conditions of efficiency and environmental protection.

The main objectives of spatial planning include the balanced development of localities and regions, the reduction of territorial disparities, improving the living conditions of the population, protecting natural and built heritage, and the efficient and sustainable use of natural resources. Achieving these objectives is carried out through specific spatial planning and urbanism documentations, drafted on the basis of cadastral, statistical, geographical, and economic data. Spatial planning documentations serve to identify the development needs of a region and to establish the measures necessary for the efficient utilization of space.

Within the urban development process, urban planning documentations play an essential role in spatial organization and in preventing negative impacts on the environment. General Urban Plans (PUG), Zonal Urban Plans (PUZ), and Detailed Urban Plans (PUD) establish regulations regarding land use, building regimes, the protection of green spaces, and infrastructure development. Through these instruments, areas with natural hazards, lands with building restrictions, and areas requiring special protection measures are identified. At the same time, urban planning documentations contribute to traffic organization, the development of public utility networks, and ensuring a balanced ratio between built-up and green spaces.

The legislation in the field provides for the integration of environmental protection requirements into all stages of the urban and spatial planning process [10-13]. Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) represent instruments through which the effects that development plans, programs, and projects may have on environmental factors—such as air, water, soil, biodiversity, and public health—are analyzed. Through these procedures, the measures necessary to prevent or reduce negative environmental impacts are identified, ensuring a balance between economic development and the protection of natural resources [14], [15].

A fundamental principle underlying urban and spatial planning activities is that of sustainable development. This implies achieving economic and social progress without compromising the ability of future generations to meet their own needs. In this context, modern urban development policies promote the expansion of green spaces, energy efficiency, the development of green infrastructure, and the promotion of less polluting means of transport. Furthermore, sustainable development entails the responsible use of natural resources and reducing the impact of human activities on the environment [4].

Therefore, urban planning and spatial planning represent essential tools for the organization and development of localities, and correlating them with environmental protection requirements contributes to achieving a balance between economic development, social needs, and the conservation of natural resources [16-18]. Applying the principles of sustainable development and complying with environmental protection norms allow for the creation of modern, functional localities adapted to the current and future needs of the population [19-22].

3. Conclusions

This paper brings significant original contributions through the critical analysis of the current procedural workflow for environmental permitting, identifying the administrative bottlenecks between LEP Argeș and Mioveni City Hall caused by the lack of digitalization, and proposes an optimization model based on the use of an integrated GIS platform. This innovative methodological approach allows for the correlated modeling of the socio-economic data from the Dacia-Renault and RATEN platforms with the hydrographic factors of the Argeșel basin, facilitating the overlaying of thematic layers for a rapid impact assessment.

Concurrently, the paper provides a synthesis of sustainability indicators, adapting European standards to the specific industrial context of Mioveni City, thereby offering an efficient decision-making tool for sustainable urban planning.

R E F E R E N C E S

[1] Duțu, M., (2010). *Urban Planning Law, 5th edition*. Editura Universul Juridic, Bucharest;
[2] Duțu, M., (2014). *Environmental Law*. Editura Universul Juridic, Bucharest;
[3] Ioniță, S.E., (2019). *Sustainable Urban Planning*. Editura Universității din București, Bucharest;
[4] Mihai, L.A. (coord.), (2018). *Environmental Law and Environmental Protection*. Editura Universul Juridic, Bucharest;
[5] Motica, R., Trăilescu, A., (1999). *Land Law. Spatial Planning and Environmental Protection*. Editura Lumina Lex, Bucharest;
[6] Popescu, C., (2016). *Spatial Planning and Urbanism*. Editura Universitară, Bucharest;
[7] Radu, A., (2015). *Environmental Impact Assessment*. Editura Matrix Rom, Bucharest;
[8] Ionescu, G., (2018). *Environmental Public Policies*. Editura ASE, Bucharest;
[9] Wathern, P., (2016). *Environmental Impact Assessment: Theory and Practice*. Routledge, London.

Legal Acts and Official Documents

[1] National Environmental Protection Agency, [Environmental assessment for plans and programs], available online at: https://djmag.anmap.gov.ro/, accessed March 2026;

[2] Argeș County Council, [„Natural framework – Mioveni"], available online at: https://www.cjarges.ro/web/mioveni/cadrul-natural, accessed on May 8, 2026;
[3] Argeș County Statistical Directorate, *Statistical Database*, available online at: https://arges.insse.ro/wp-content/uploads/2023/01/Comunicat-presa-RPL-2021.pdf, accessed January 2026;
[4] Government of Romania, *Emergency Ordinance No. 195/2005 on environmental protection*, available online at: https://www.mmediu.ro/app/webroot/uploads/files/ordonanta-de-urgenta-nr-195-2005-privind-protectia-mediului.pdf, accessed February 2026;
[5] Government of Romania, *Decision No. 1076/2004 on establishing the procedure for carrying out the environmental assessment for plans and programs*, available online at: https://www.madr.ro/docs/fep/programare-2014-2020/manual-evaluare-de-mediu-pentru-planuri-si-programe.pdf, accessed February 2026;
[6] Ministry of Environment and Sustainable Development, *Order No. 1552/2008 on approving the list of localities by county where nitrate sources from agricultural activities exist*, available online at: https://legislatie.just.ro/Public/DetaliiDocument/100462, accessed February 2026;

Online Sources

[1] Argeș Environmental Protection Agency, *Documents on environmental and urban assessment*, available online at: http://apmag.anpm.ro/, accessed February 2026;
[2] Google Earth, *Satellite imagery used for the territorial analysis of Mioveni City*, available online at: https://earth.google.com/web/, accessed November 2025;
[3] Mioveni City Hall, *Information on local administration and urban development*, available online at: https://www.emioveni.ro/, accessed January 2026;
[4] Mioveni City Hall, *Data and information regarding local development*, available online at: https://miovenicity.ro/, accessed December 2025;
[5] Mioveni City Hall, *Data and information regarding water quality analysis*, available online at: https://emioveni.ro/utile/analiza-apa-potabila/1885-analiza-a-calitatii-apei-, accessed November 2025;
[6] European Environment Agency, *Transport and environment*, available online at: https://www.eea.europa.eu/ro/themes/transport/intro, accessed February 2026;
[7] Labour Inspection – *Argeș Territorial Labour Inspectorate*, *Institutional data and information*, available online at: https://www.inspectiamuncii.ro/web/itm-arges, accessed December 2025.