UNIVERSITY OF PETROȘANI

DOCTORAL SCHOOL
MINES, OIL & GAS INDUSTRY

DOCTORAL THESIS ABSTRACT

CONDUCĂTOR DE DOCTORAT:

Prof. univ. dr. Lazăr Maria

STUDENT DOCTORAND:

Grigorescu Paul Leonard

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LEGISLATIVE AND ENVIRONMENTAL ISSUES OF THE EXPLOITATION AND PROCESSING OF GOLD-SILVER DEPOSITS IN ROMANIA

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ABSTRACT OF THE DOCTORAL THESIS

The exploitation of mineral resources is one of the most complex challenges of contemporary public policies, as it involves reconciling economic, social, legal and environmental interests that are often in conflict. In Romania, this issue is illustrated in an exemplary way by the evolution of projects for the exploitation of gold-silver deposits, where the richness of natural resources contrasts with the difficulties generated by the current legislative and institutional framework.

The doctoral thesis entitled **"Legislative and environmental problems of the exploitation and processing of gold-silver deposits in Romania"** analyzes, in an interdisciplinary manner, the relationship between the exploitation of mineral resources, the legislative framework, environmental protection, the preservation of cultural heritage and sustainable development. The research starts from the premise that the exploitation of gold-silver resources is a strategic area for Romania, but the implementation of mining projects is influenced not only by technical and economic considerations, but also by the complexity of legal norms, the functioning of institutional mechanisms and the relationship between the public interest, environmental protection and the rights of local communities.

The importance of the theme is determined by the existence of significant mineral resources on the territory of Romania, concentrated especially in the Apuseni Mountains, more precisely in the Gold Quadrilateral, as well as by the difficulties encountered in the last decades in capitalizing on them. Although Romania has some of the most important gold-silver deposits in Europe, many mining projects have been suspended or abandoned amid legal controversies, complex administrative procedures, conflicts over the protection of the environment and cultural heritage, and the lack of an integrated legislative vision. In this context, the research aims to identify the causes of these bottlenecks and formulate solutions capable of ensuring a balance between the responsible exploitation of natural resources and compliance with the principles of sustainable development.

The motivation for choosing the theme is based both on the scientific interest in the field of mineral resource exploitation and on the need to analyze a topical topic, located at the confluence between mining engineering, law, environmental protection and public administration. The research represents a continuation and deepening of the concerns developed in the previous studies, being oriented towards identifying the vulnerabilities of the legislative and institutional framework applicable to the exploitation of gold-silver deposits. At the same time, the paper aims to answer essential questions regarding the clarity and predictability of mining legislation, the efficiency of competent institutions, the relationship between the exploitation of mineral resources and environmental protection, as well as the possibility of achieving a balance between economic interests, the preservation of cultural heritage and the development of local communities.

The general objective of the research is the critical analysis of the legislative and institutional framework regarding the exploitation and valorization of the gold-silver deposits in Romania, as well as the formulation of proposals for its improvement in accordance with the

principles of sustainable development and the requirements of European law. In order to achieve this objective, several specific objectives have been set, including the analysis of the historical evolution of gold mining, the examination of the geological framework of the deposits, the evaluation of national and European legislation, the analysis of modern mining and processing technologies, the identification of the economic, social and environmental impact of mining activities, the evaluation of the role of civil society in the decision-making process and the formulation of proposals for legislative reform and institutional.

The scientific approach is built around a general hypothesis according to which the current legislative and institutional framework applicable to the exploitation of gold-silver resources presents vulnerabilities and regulatory mismatches that affect the efficiency of the authorization and monitoring process of mining activities, generate legal uncertainty and favor the emergence of economic, social and environmental conflicts. This assumption is complemented by four specific assumptions relating to the fragmentation of legislation, the distribution of competences between authorities, the integration of economic, social and environmental dimensions into the decision-making process and the need to strengthen the legislative and institutional framework. The verification of these hypotheses is the guiding thread of the entire research and substantiates the conclusions and proposals formulated in the final part of the thesis.

The methodology used reflects the interdisciplinary nature of the research and combines methods specific to law, mining engineering, economics, public administration and environmental sciences. The normative and institutional analysis is complemented by documentary research, comparative analysis, case study, jurisprudential analysis and empirical research carried out through the application of questionnaires and direct observation within the community of Roșia Montană. The choice of the case study is justified by the legal, economic, social and environmental complexity of the Roșia Montană project, which is the most relevant example for assessing how legislative and institutional deficiencies influence the implementation of mining projects in Romania.

The structure of the thesis is designed in such a way that each chapter contributes to the verification of the hypotheses formulated and to the achievement of the objectives of the research. The analysis starts from the presentation of the geological and historical context of the exploitation of gold-silver resources, continues with the examination of the legislative framework and mining technologies, assesses the economic, social and environmental impact of the exploitation activities, develops the case study on Roșia Montană and ends by identifying legislative vulnerabilities and formulating proposals for a ferenda law. Overall, the research aims to demonstrate that the responsible development of the mining sector depends on the existence of a coherent, predictable and adapted regulatory framework adapted to the requirements of sustainable development, capable of reconciling economic interests with environmental protection, the preservation of cultural heritage and the public interest.

Chapter I. Gold-silver deposits – geological and historical context

The first chapter begins with an analysis of the historical evolution of gold and silver mining worldwide, highlighting the role that these metals had in the development of civilizations and in the formation of the first economic and commercial systems. The main stages of the development of gold mining are presented, from the rudimentary exploitations practiced in Antiquity to the emergence of modern technologies, demonstrating that technical

progress has been permanently influenced by the need to efficiently capitalize on mineral resources and by the strategic importance of gold and silver in the economy of states.

Next, the evolution of the exploitation of gold-silver ores on the territory of Romania is analyzed, where the existence of important mineral resources favored the development of a mining tradition with an age of over two millennia. The main historical stages of gold mining are presented, starting with the Dacian and Roman periods, continuing with the exploitations of the Middle Ages and the period of the Habsburg administration and reaching the development of the modern mining industry. At the same time, the transformations produced after the restructuring of the mining sector are highlighted, as well as the economic and social effects generated by the reduction of exploitation activities in many mining communities.

The central part of the chapter is devoted to the analysis of the gold-silver deposits in Romania. The geological framework of the gold mineralizations, the genetic processes that led to their formation, the geographical distribution of the main deposits and their typology are presented. The analysis highlights the main metallogenetic provinces of Romania and demonstrates that the national mineral heritage is characterized by a special geological diversity and by the existence of resources with high economic and strategic value. Special attention is paid to the Gold Quadrilateral of the Apuseni Mountains, recognized as the most important gold province of the country, as well as other areas with gold potential, such as the Baia Mare district. The geological characteristics of these regions and their contribution to the development of Romanian mining are highlighted.

In the final part, the economic and strategic importance of gold-silver resources and their role in the current context of economic security and European policies on critical raw materials are analyzed. Research shows that the value of these resources goes beyond the strictly economic dimension, being closely linked to industrial development, security of supply and national interest.

The conclusions of the chapter highlight the fact that Romania has a mineral heritage of strategic importance, the result of an exceptional historical and geological evolution. These resources have contributed significantly to the country's economic development and continue to represent an important potential for the future. At the same time, the analysis demonstrates that the mere existence of valuable mineral resources does not guarantee their efficient recovery. Their exploitation depends on the existence of a coherent legislative framework, modern technologies and institutional mechanisms capable of balancing economic interest, environmental protection and heritage preservation. This conclusion is the starting point for the following chapters, dedicated to the analysis of the normative and institutional framework that regulates mining activities in Romania.

Chapter II. National and international legislative framework on the exploitation of gold-silver deposits

Chapter II is dedicated to the analysis of the legislative and institutional framework that regulates the activities of exploration, exploitation and exploitation of gold-silver deposits in Romania. It follows the evolution of mining regulations, identifies the main institutions involved in the management of mineral resources and highlights the relationship between mining legislation, environmental legislation and rules on the protection of cultural heritage. The main normative acts that regulated the mining activity are analyzed, from the centralized system existing before 1990 to the current legislative framework built around the Mining Law no. 85/2003 and subsequent amendments.

The analysis demonstrates that the development of mining legislation has been influenced both by the transition to the market economy and by the process of harmonization with European Union law, with the aim of moving from a regulation oriented exclusively to the exploitation of resources to a system that integrates the requirements for environmental protection, preservation of cultural heritage and sustainable development. The attributions of the competent authorities involved in issuing the licenses, approvals and authorizations necessary to carry out mining activities are also presented, as well as the existing relations between the institutions responsible for the administration of mineral resources, environmental protection, cultural heritage and territorial planning. At the same time, the main elements of the fiscal policy in the field of mineral resources are presented, with a focus on mining royalties and their role in capitalizing on the state's mineral heritage.

A separate section is dedicated to the European legislative context and its influence on national legislation. The European directives and regulations applicable to the exploitation of mineral resources, environmental impact assessment procedures, mining waste management and the protection of cultural heritage are analyzed. The research highlights how the principles of European law have been transposed into Romanian legislation and demonstrates that the development of mining projects involves the simultaneous application of a large number of regulations belonging to different legal fields. In this context, the legislation specific to surface mining projects is also analyzed, highlighting the particularities of the administrative procedures and the complexity of the authorization process.

The conclusions of the chapter demonstrate that the current legislative framework applicable to the exploitation of gold-silver deposits is the result of the overlapping of several regulations belonging to distinct fields of law, which gives it a high degree of complexity. Although national legislation is, to a large extent, harmonized with European norms, many vulnerabilities persist generated by the lack of correlation between normative acts, the distribution of competences between multiple authorities and the absence of effective institutional coordination mechanisms. These findings confirm the first specific hypothesis of the research and justify the need for an in-depth analysis of how the technical particularities of mining activities influence the application of the legislation. Consequently, the next chapter is devoted to examining the methods and technologies of mining and processing gold-silver ores, highlighting the link between technical solutions and the legal framework governing them.

Chapter III. Methods and technologies for the exploitation and processing of gold-silver ores

Chapter III presents the evolution of the methods of exploitation and processing of gold-silver deposits, from the traditional techniques used since Antiquity and perfected in the medieval period, to the modern technologies applied in the contemporary mining industry. The classic methods of underground exploitation, specific tools and equipment are analyzed, highlighting their contribution to the development of mining communities, but also the limits regarding productivity, work safety and the degree of recovery of useful metals. Next, modern mining technologies are presented, with a focus on the differences between underground and surface mining, as well as on the technical and economic criteria that determine the choice of the optimal method, depending on the geological characteristics of the deposit, the depth of mineralization, the metallic content, the sterile-ore ratio and environmental protection requirements. At the same time, the main technologies for processing and recovery of gold and silver are analyzed, namely gravitational separation, flotation, cyanidation, as well as modern

hydrometallurgical, pyrometallurgical and ion exchange processes on resins, highlighting the operating principles, advantages and limits of each technology.

An important part of the chapter is dedicated to the analysis of the main gold mining projects in Romania, namely Roșia Montană, Certej and Rovina. For each project, the geological characteristics of the deposits, the proposed technological solutions and the particularities of the exploitation and processing processes are presented. The benchmarking highlights the differences between these projects in terms of mineral reserves, technologies used and implementation conditions, demonstrating that the choice of technological solution directly influences permitting requirements, environmental protection and investment costs.

The chapter also looks at the main obligations regarding the management of mining waste, the restoration of affected land and the monitoring of the impact on environmental factors. The technical measures necessary to prevent pollution and ensure safe exploitation are highlighted, highlighting the importance of complying with European standards and good practices in the mining field. The analysis shows that technological development allows mining activities to be carried out in much safer conditions than in the past, but the efficiency of these solutions depends on compliance with legislative requirements and the existence of effective control and monitoring mechanisms.

The conclusions of the chapter highlight that technological progress allows the efficient exploitation of gold-silver resources, but the success of a mining project depends on the integration of technical solutions into a coherent legislative and institutional framework. While modern technologies can significantly reduce environmental impact and increase the economic efficiency of exploitation, their application must be supported by effective control, monitoring and accountability mechanisms, as well as compliance with criteria of economic efficiency, operational safety, environmental protection and social acceptability. These conclusions constitute the starting point for the analysis in the next chapter, dedicated to the assessment of the economic, social and environmental impact of the exploitation of gold-silver deposits, as well as the effects generated on local communities and the environment.

Chapter IV. Economic, social and environmental impact of the exploitation of gold-silver deposits

Chapter IV has the role of analyzing the consequences of the exploitation and processing of gold-silver deposits on the economy, environment and local communities, demonstrating that the evaluation of a mining project must be carried out through an integrated approach. The chapter highlights the relationship between the economic benefits generated by the valorization of mineral resources and the obligations regarding environmental protection, conservation of natural heritage and sustainable development, preparing the theoretical foundation for the Rosia Montana case study presented in the next chapter.

The chapter begins with the analysis of the economic role of the exploitation of gold-silver deposits, highlighting the contribution of mining activities to the development of the national and regional economy. The direct and indirect effects generated by the mining industry on employment, infrastructure development, investment attraction and exploitation of mineral resources are presented. The analysis demonstrates that the exploitation of mineral resources is an important factor of economic development, especially for mono-industrial communities, where mining activity has been the main source of employment and income. At the same time,

the economic consequences produced by the closure of mining operations are highlighted, reflected in the decrease in investments, the reduction of jobs, the depopulation of mining areas and the accentuation of regional disparities.

Next, the effects of mining activities on the environment are analyzed, presenting the main sources of impact on air, surface and groundwater, soil, biodiversity and landscape. The research examines the risks associated with the exploitation and processing of gold-silver ores, including tailings management, chemical use, and long-term effects on ecosystems. The technical and legislative measures aimed at preventing and reducing the impact on the environment are analyzed, as well as the obligations regarding the monitoring and restoration of the land affected by mining activities. The analysis highlights that the development of modern technologies and the strengthening of the legislative framework have contributed to the significant reduction of environmental risks, but their effectiveness depends on compliance with technical standards and the exercise of rigorous institutional control.

The chapter pays particular attention to the social dimension of the exploitation of mineral resources, analyzing the effects generated on the standard of living, employment and development of local communities. Both the economic benefits associated with mining activities and the social difficulties generated by their restriction or cessation are highlighted, with a focus on the phenomena of migration, demographic aging and diminishing economic opportunities. The analysis demonstrates that the success of a mining project cannot be evaluated exclusively through economic indicators, but must also be related to the effects produced on local communities and its capacity to generate sustainable development.

In the final part, the need to integrate the economic, social and environmental dimensions in the process of substantiating decisions on the valorization of mineral resources is highlighted. Research shows that sustainable development involves finding a balance between resource exploitation, environmental protection and the interests of local communities, and the lack of an integrated approach can lead to social conflicts and administrative bottlenecks. These conclusions constitute the foundation of the applied research carried out in the following chapter, dedicated to the analysis of the Rosia Montana case study.

Chapter V. The role of civil society, non-governmental organizations and public participation in the development of mining projects. Case study – Roșia Montană

Chapter V represents the applicative component of the research and highlights how civil society, non-governmental organizations and local communities influence the decision-making process on the development of mining projects. At the same time, the chapter capitalizes on the field research carried out in the commune of Roșia Montană and offers an integrated analysis of the economic, social and legal effects generated by the inclusion of the locality in the UNESCO World Heritage List, constituting one of the main original contributions of the thesis.

The central part of the chapter is dedicated to the Roșia Montană case study and capitalizes on the results of applied research carried out directly in the community. The research was based on the application of questionnaires addressed to the inhabitants, economic agents and the local public administration authority, completed by direct observation and documentation in the field, through dialogues with community representatives, offering the possibility of comparing the results of the theoretical analysis with the existing realities in the

territory. The methodology used allowed the assessment of the community's perception of the UNESCO status, the identification of the main economic and social effects generated by the cessation of mining activities and the analysis of the relationship between the local community and the public authorities in the process of implementing the heritage protection measures.

An important place is occupied by the analysis of the disputes generated by the Rosia Montana project, considered the expression of the complexity of the relations between mining legislation, environmental legislation and norms on the protection of cultural heritage. The research reveals that the numerous legal actions and administrative procedures carried out over time have highlighted the existence of legislative and institutional vulnerabilities, as well as the difficulty of harmonizing economic interests with the objectives of heritage conservation and environmental protection. The study demonstrates that the lack of clear legislative mechanisms and effective coordination between the competent institutions has contributed to prolonging conflicts and increasing legal uncertainty regarding the implementation of the project.

The results of the research highlight the existence of a significant difference between the objectives pursued by the inclusion of the locality in the UNESCO World Heritage and the population's perception of the economic and social effects produced. Although the UNESCO status is recognized for its importance in the preservation of cultural heritage, most respondents appreciate that it has not been accompanied by economic measures capable of generating sustainable development of the community. The research shows that the anticipated economic benefits have not materialized at the level of the population's expectations, and employment opportunities and living standards have remained affected by the lack of alternative investments capable of replacing the traditional role of mining in the local economy.

A particularly valuable element of the research is the integration of the local public administration perspective. The dialogue with the mayor of Roșia Montană and the analysis of the official position of the local authority complement the results obtained by applying the questionnaires and confirm the existence of difficulties in identifying alternative sources of economic development. The local administration appreciates the preservation of cultural heritage as necessary, but considers that it must be supported by consistent public investments, development programs and economic policies adapted to local realities. In the absence of these measures, heritage protection risks being perceived by the community as a restriction, and not as an opportunity for development.

In the final part, the results of the research are summarized and the main conclusions drawn from the case study are formulated. The analysis demonstrates that the protection of cultural heritage and economic development should not be approached as antagonistic objectives, but as complementary elements of sustainable development. At the same time, recommendations are made on strengthening the dialogue between the state, investors and civil society, in order to develop more transparent and efficient decision-making mechanisms.

The conclusions of the chapter highlight that the Roșia Montană case study goes beyond the significance of a local analysis and represents a relevant model for understanding the difficulties encountered in the management of complex mining projects in Romania. The results of the research demonstrate that the lack of an integrated approach favors the emergence of imbalances between the objectives of heritage protection and the need to ensure the sustainable economic development of local communities. These findings form the basis of the analysis developed in the next chapter, in which the vulnerabilities of the legislative and institutional

framework are critically examined and the legal causes that contributed to the emergence of these dysfunctions are identified.

Chapter VI. Critical analysis of the legislative and institutional framework regarding the exploitation of gold-silver deposits. Case study – Rosia Montana

Chapter VI represents the analytical core of the research and aims to identify the vulnerabilities of the legislative and institutional framework that regulates the exploitation and valorization of gold-silver deposits in Romania. Starting from the conclusions formulated in the previous chapters and from the results of the Rosia Montana case study, the research analyzes how legislative mismatches, overlapping administrative powers and lack of effective coordination mechanisms influence the development of mining projects.

The chapter begins with a systematic analysis of the main vulnerabilities of the legislative framework applicable to the exploitation of gold-silver deposits. The research highlights the fact that the current regulatory system is characterized by the existence of insufficiently correlated provisions and by the overlapping of regulations belonging to mining law, environmental law and legislation on the protection of cultural heritage. The situations in which the lack of a unitary regulation generates difficulties in the interpretation and application of the law are identified, affecting the predictability of the authorization process and the development of mining investments.

The vulnerabilities specific to the Mining Law no. 85/2003 and its relationship with the other relevant normative acts. The chapter examines the difficulties generated by the modification of the legal regime of some mining perimeters, the suspension or cessation of exploitation activities and the overlapping of obligations resulting from environmental legislation and the legal regime of cultural heritage. Research shows that the lack of clear legislative mechanisms to address these situations can lead to administrative bottlenecks and long-standing litigation, with direct effects on the development of mining projects.

A separate section is devoted to the analysis of institutional and administrative vulnerabilities. The attributions of the authorities involved in the management of mineral resources are evaluated and the difficulties generated by the overlap of competences, the lack of unitary procedures and the insufficient interinstitutional cooperation are highlighted. The analysis shows that the efficiency of the decision-making process is affected by the existence of complex administrative mechanisms and the different interpretation of legal rules by the competent authorities. In this context, the effects that these dysfunctions produced in the case of the Roșia Montană project are also analyzed, where the succession of administrative procedures and litigations highlighted the limits of the current legislative and institutional system.

The chapter also includes a comparative analysis of how other European states regulate the exploitation of mineral resources and manage the relationship between the development of mining projects, environmental protection and the preservation of cultural heritage. Examples of good practices and legislative solutions are presented that demonstrate that a coherent regulatory system and efficient administration can strike a balance between the exploitation of mineral resources and the protection of the public interest.

The results of the research confirm that the difficulties encountered in the implementation of mining projects in Romania are determined, to a significant extent, by the vulnerabilities of the legislative and institutional framework. The analysis demonstrates that the mere existence of a regulatory framework is not sufficient for the development of a competitive mining sector, requiring the modernization of the legislation, its correlation and adaptation to the current economic, technological, social and environmental realities, the clarification of institutional competences and the development of integrated administrative mechanisms, capable of ensuring a coherent, predictable and efficient decision-making process. These conclusions constitute the foundation of the last chapter of the thesis, in which the proposals for lege *ferenda* and the recommendations regarding the modernization of the legislative and institutional framework applicable to the exploitation of gold-silver deposits in Romania are formulated.

Chapter VII. Proposals to improve the legislative framework on the exploitation of gold-silver deposits

The last chapter of the thesis capitalizes on the results of theoretical and applied research and formulates proposals for improving the current legislative and institutional framework regarding the exploitation and valorization of gold-silver deposits in Romania. The chapter transposes the conclusions of the critical analysis into concrete legislative and administrative solutions, aimed at eliminating the identified vulnerabilities and developing a modern, coherent system adapted to the current economic, technological and social realities. By its applicative character, this chapter represents the main normative contribution of the thesis.

The chapter begins with the systematization of the main dysfunctions identified during the research and highlights the need to reform the legislative framework regulating the exploitation of mineral resources. The analysis demonstrates that the difficulties encountered in the implementation of mining projects are not determined exclusively by the complexity of administrative procedures, but also by the existence of legislative gaps, mismatches between normative acts and insufficient adaptation of regulations to the economic, technological and institutional transformations produced in recent decades. In this context, the research argues the need for an integrated approach, which ensures the coherence of mining legislation with the norms on environmental protection, cultural heritage, spatial planning and sustainable development.

A typology of the main legislative gaps identified in the research is further developed, highlighting the regulatory gaps, regulatory conflicts and difficulties generated by the overlapping of administrative competences. The analysis shows that the lack of clear provisions on the correlation of authorisation procedures, the management of mining perimeters under special protection regimes and institutional coordination affects the efficiency of the decision-making process and reduces the predictability of investments. At the same time, the limits of the current administrative system in the management of complex mining projects are highlighted, in which requirements regarding the exploitation of mineral resources, environmental protection and preservation of cultural heritage intervene simultaneously.

The central part of the chapter is devoted to the formulation of the proposals for lege *ferenda*. These aim to improve the Mining Law no. 85/2003 by clarifying some legal institutions, harmonizing it with environmental legislation and with the rules on the protection of cultural heritage, simplifying and integrating administrative procedures, as well as strengthening cooperation between competent authorities. Recommendations are made on the

reorganization of institutional mechanisms for the management of mineral resources, the development of integrated authorization procedures, the strengthening of public consultation mechanisms and the digitization of administrative processes, in order to increase the transparency and efficiency of public administration.

The research also makes proposals to strengthen the dialogue between authorities, investors and local communities, considering that public participation must be a permanent component of the decision-making process and not just a formal stage of administrative procedures. At the same time, the need to develop public policies for mining communities and the importance of correlating measures for the protection of cultural heritage with economic instruments capable of generating local development and reducing the socio-economic effects produced by the cessation of mining activities are highlighted.

The results of the research demonstrate that the modernization of the legislative framework should not only aim to amend some normative provisions, but to build a coherent, flexible regulatory system adapted to the current realities of the mining sector. The responsible exploitation of mineral resources requires the existence of a predictable legal framework, efficient institutions and administrative mechanisms capable of harmonizing economic interests with environmental protection, the preservation of cultural heritage and the sustainable development of local communities. In this perspective, the proposals formulated offer a model of legislative and institutional reform that can contribute to increasing the competitiveness of the mining sector and to the responsible management of Romania's mineral resources.

The chapter synthesizes the conclusions of the entire research and transposes them into a coherent set of legislative and institutional proposals. Through the formulated solutions, the research goes beyond the level of descriptive analysis and offers concrete directions for improving mining legislation, strengthening the institutional framework and adapting it to the current requirements for sustainable development, environmental protection and responsible management of mineral resources. The ferenda law proposals and the formulated recommendations represent the main practical and normative contribution of the thesis and can constitute a starting point for future legislative initiatives and public policies in the field of mineral resources.

The analysis of the evolution of the legislative framework demonstrates that the development of the mining sector in Romania has been influenced by the economic, institutional and European transformations produced after 1990, but the successive amendments to the legislation have not fully eliminated the mismatches between mining law, environmental legislation and the rules on the protection of cultural heritage. These dysfunctions explain an important part of the difficulties encountered in the implementation of the mining projects analyzed in the present research.

Validation of research hypotheses

The analysis of the research results demonstrates that all the objectives set at the beginning of the thesis have been achieved. The research allowed not only to identify the main vulnerabilities of the legislative and institutional framework regarding the exploitation of gold-silver deposits, but also to formulate concrete solutions for its improvement. The interdisciplinary nature of the research, corroborated with the applied research carried out within the Rosia Montana case

study, contributed to the validation of the hypotheses formulated and to the substantiation of legislative and administrative proposals with practical applicability.

The specific hypotheses formulated at the beginning of the research:

- the fragmentation and complexity of mining and environmental legislation has been shown to make it difficult to interpret and apply legal rules;
- it has been confirmed that the distribution of competences among many public authorities, in the absence of effective coordination mechanisms, affects the efficiency of the administrative process;
- empirical research has shown that the development of mining projects cannot be analyzed exclusively from an economic perspective, and it is necessary to integrate social, environmental and cultural dimensions into the decision-making process;
- The critical analysis and proposals made confirmed that improving the legislative framework and strengthening institutional mechanisms can contribute to the development of a more efficient, coherent governance system better adapted to the principles of sustainable development.

Scientific contributions and elements of originality

This doctoral thesis brings original contributions in theory, methodology, application and normative, by developing an interdisciplinary approach to the exploitation and processing of gold-silver deposits in Romania. The originality of the research results from the integration of the perspectives specific to mining engineering, law, environmental protection and social sciences in a unitary model of analysis, which allows the complex evaluation of the relationship between the valorization of mineral resources, environmental protection, preservation of cultural heritage and the development of local communities.

An important contribution of the research is to carry out an integrated critical analysis of the legislative and institutional framework applicable to the exploitation of mineral resources, by correlating mining legislation with regulations on environmental protection, cultural heritage, spatial planning, administrative law and other related areas that influence the authorization and implementation process of mining projects. This approach has made it possible to identify the relationships between the different regulatory areas and to highlight the effects generated by the lack of legislative and institutional harmonisation.

The thesis also makes an original contribution by identifying and systematizing the vulnerabilities of the legislative and institutional framework, respectively the regulatory gaps, regulatory conflicts, overlapping competences and administrative dysfunctions that affect the predictability of the decision-making process and the efficiency of the management of mineral resources. The systematization of these vulnerabilities is a useful methodological tool both for the evaluation of other mining projects and for substantiating future approaches to improve the legislation.

The applicative character of the research is supported by the integration of empirical research into the legal analysis of the exploitation of mineral resources. The case study carried out in Rosia Montana, based on direct observation, sociological research and dialogue with local actors, allowed the assessment of the economic, social and administrative effects generated by the cessation of mining activities and the inclusion of the locality in the UNESCO World

Heritage List. The correlation of the results of the field research with the legal and technical analysis is an element of originality of the thesis and gives the conclusions a high degree of substantiation.

Research contributes to the development of knowledge by demonstrating that the protection of cultural heritage and economic development are not incompatible objectives, but can become complementary within coherent public policies and an adapted legislative framework. In this regard, the thesis substantiates a governance model applicable to mining communities, based on cooperation between public authorities, investors and local communities, as well as on the transformation of public participation into a permanent mechanism for substantiating decisions on the valorization of mineral resources.

The practical value of the research is complemented by the formulation of a coherent set of proposals for lege *ferenda*, aimed at harmonizing mining legislation with environmental legislation and norms on the protection of cultural heritage, simplifying administrative procedures, clarifying institutional competences and developing integrated mechanisms for authorization and administrative cooperation. Through the interdisciplinary methodological approach and the proposed solutions, the thesis provides an analysis model and a useful scientific support for the improvement of the legislative and institutional framework regarding the management of mineral resources in Romania.

Limits of research

The results of the research must also be interpreted in relation to certain limits. The empirical analysis was focused on the Rosia Montana case study, which is considered the most representative mining project in Romania. Also, the continuous evolution of European legislation and policies in the field of critical raw materials may lead to the emergence of new regulations that will require updating the conclusions and proposals made.

Future research directions

The research opens up prospects for the development of future studies on the adaptation of mining legislation to the new European policies on critical raw materials, the digitalisation of administrative processes, the assessment of the impact of innovative mining technologies and the development of integrated models for the governance of mineral resources. At the same time, the results obtained can be the basis for comparative research on the management of mineral resources in other Member States of the European Union and can contribute to the substantiation of future public policies in the field of natural resource exploitation.

Scientific Publications

1. ***"Legislative aspect at national and international level regarding the exploitation of gold – silver deposit"***., 10th edition of the International Multidisciplinary Symposium "UNIVERSITARIA SIMPRO 2022" Petroșani, MATEC Web Conf. Volume 373, 2022 https://doi.org/10.1051/matecconf/202237300062
2. ***"Roșia Montană under the Unesco umbrela between symbolic protection and real degradation"***. International Scientific Congress Research-Innovative Entrepreneurship Chișinău, 2025, ISBN 978-9975-48-282-0. CZU: 502.4/.5(498) =111 DOI: 10.46727/c.v2.07-08-06-2025.p186-193 https://dir.upsc.md/handle/123456789/8139

3. ***"A critical analisis of the Roșia Montană Unesco heritaj mining area"*** International Multidisciplinary Syposium Universitaria Simpro" Petroșani, 2024, Mines Magazine – Mining Revue ISSN-L 1220-2053 / ISSN 2247-8590 vol. 32, issue 1 / 2026, pp. 55-65 https://reference-global.com/download/article/10.2478/minrv-2026-0005.
4. ***"The current context of gold-silver mining projects in Romania – Legal continuities and dysfunctions"*** International EnviroMining Virtual Conference 2026

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