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BIBLIOMETRIC MAPPING OF RESEARCH IN THE MINING FIELD AND ITS RELATIONSHIP WITH THE SUSTAINABLE DEVELOPMENT GOALS

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БІБЛІОМЕТРИЧНЕ КАРТУВАННЯ ДОСЛІДЖЕНЬ У ГІРНИЧІЙ ГАЛУЗІ ТА ЇХ ЗВ'ЯЗОК ІЗ ЦІЛЯМИ СТАЛОГО РОЗВИТКУ

Purpose. To identify the conceptual structure of research in the mining field, determine its main thematic domains and subdomains, and establish their relationship with the Sustainable Development Goals on the basis of bibliometric analysis.

Methods. Bibliometric analysis was used to investigate the publication dynamics, subject structure, geographical distribution, and thematic organization of publications in the mining field. The information base was formed using Scopus data and the TITLE-ABS-KEY query for the period 2000–2025. To reveal the field's conceptual structure, index keyword co-occurrence analysis was applied in VOSviewer, with a minimum co-occurrence threshold of 10 documents. Semantically similar terms and keywords with different spelling variants were unified. The resulting network relationships were used to identify thematic clusters, generalize them into macrodomains and subdomains, and further compare them with the Sustainable Development Goals.

Findings. The keyword co-occurrence analysis showed that the studied scientific field has a clearly defined multicomponent, interdisciplinary structure. Within it, three macrodomains were identified: the engineering core of mining, energy and digital transformation, and mineral processing and sustainable development. Within these macrodomains, ten subdomains were distinguished. The obtained results demonstrated that contemporary research in the mining field extends beyond traditional engineering issues and forms a broader scientific space that integrates technological, energy-related, environmental, digital, and managerial directions. The strongest relationship was also established between the field under study and the Sustainable Development Goals.

The originality. An integrated approach to interpreting research in the mining field is proposed, combining analysis of publication dynamics, keyword co-occurrence mapping, structuring into macrodomains and subdomains, and interpreting the results through the lens of the Sustainable Development Goals.

Practical implementations. The results obtained can be used to define scientific priorities, plan interdisciplinary research, position mining science within the context of contemporary sustainable development challenges, and substantiate development strategies for research and educational institutions.

Keywords: *mining field, bibliometric analysis, VOSviewer, Sustainable Development Goals, sustainable development, science mapping.*

Introduction. Mining remains one of the fundamental sectors supporting industrial development, energy supply, infrastructure construction, and technological progress worldwide [1–3]. Mineral resources are indispensable for metallurgy, power generation, transport systems, manufacturing, and the production of advanced materials [5, 6]. At the same time, mining is no longer viewed solely as a raw-material extraction activity. Modern mining systems are increasingly assessed in terms of environmental impact, technological modernization, energy efficiency, digital AI transformation, and sustainability-oriented governance [7–15].

Among bibliometric approaches, keyword co-occurrence analysis is particularly effective for identifying conceptual patterns and thematic clusters within large publication datasets [16]. By examining the frequency with which specific terms co-occur, this method enables the reconstruction of the semantic structure of a scientific domain, the identification of its central research directions, and the visualization of relationships between established and emerging topics [17]. Tools such as VOSviewer are widely used for this purpose because they enable network construction, clustering, and graphical interpretation of datasets [18]. In mining-related research, this approach is particularly valuable because the field is inherently multidimensional and increasingly interconnected with environmental, digital, and energy-oriented domains [16, 19].

A further important dimension of contemporary mining research is its connection with the Sustainable Development Goals (SDGs) [20–23]. Mining activities are directly or indirectly linked with industrial development, employment, infrastructure, resource efficiency, energy systems, environmental protection, water management, climate action and ESG strategy [24, 25]. However, the contribution of mining-related science to the SDGs is complex and often contradictory, since the same field may simultaneously support industrial growth and generate environmental risks [26]. For this reason, it is important not only to describe mining-related research thematically, but also to assess how its major domains correspond to broader sustainability objectives [27].

Despite the large volume of publications in the mining field, the available literature still lacks sufficiently integrated studies that combine publication dynamics, thematic clustering, and SDG-oriented interpretation within a single analytical framework [20, 28]. Existing reviews often focus on narrow topics, individual technologies, single commodities, or specific environmental issues, whereas the broader conceptual structure of mining-related research remains less clearly systematized [29–31]. In particular, there is a need to identify how traditional mining engineering topics interact with newer directions related to digitalization, artificial intelligence, energy transformation, materials science, and ecological sustainability [32, 33].

This need is especially relevant in the context of strategic academic and institutional planning. A clear understanding of the thematic architecture of mining-related research, as well as of the publication landscape and ranking position of mining and mineral processing journals, can support the modernization of educational programmes, prioritization of interdisciplinary projects, development of research strategies, and stronger alignment of mining science with contemporary societal challenges [10, 34–36]. From this perspective, bibliometric mapping is not only a descriptive tool, but also a means of revealing the structural logic of a field and its future development trajectories [37].

Therefore, this study aims to provide an integrated bibliometric interpretation of mining-related research by combining publication dynamics, subject-area analysis, keyword co-occurrence mapping, and SDG-oriented thematic assessment. The study seeks to reveal how the field has evolved conceptually, which thematic domains currently shape its structure, and how these domains can be understood within the broader framework of sustainable development.

Methods. *Data source and search strategy.* The bibliometric dataset was retrieved from Scopus, a widely used abstract and citation database for scholarly literature [38]. The search query was constructed to capture the broad field of mining-related research while excluding the unrelated use of the term “data mining”. The exact query was: TITLE-ABS-KEY ((mining OR "mineral extraction" OR "mining engineering") AND NOT "data mining") AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (EXCLUDE (AFFILCOUNTRY, "russian federation") OR EXCLUDE (AFFILCOUNTRY, "belarus")).

The study period covered 2000–2025. However, because 2025 was still incomplete at the time of data retrieval, the corresponding publication counts were treated as partial and were not directly compared with the full-year values of previous years.

Publications affiliated with the russian federation and belarus were excluded deliberately. In view of the ongoing military aggression against Ukraine, records associated with these countries were removed from the analytical corpus as part of the study design [39, 40].

Bibliometric indicators. The final dataset contained a set of documents. The first stage of analysis consisted of descriptive bibliometric assessment, including:

– annual publication output;
– distribution of documents across subject areas;
– contribution of countries and territories.

These indicators were used to characterize the scale, dynamics, disciplinary composition, and geographical distribution of mining-related research.

Keyword co-occurrence analysis. The conceptual structure of the field was analysed using keyword co-occurrence mapping in VOSviewer [41]. The analysis was based on index keywords. A minimum occurrence threshold of 10 documents was applied in order to focus on sufficiently recurrent terms and avoid excessive fragmentation of the network.

A thesaurus-based unification procedure was used to merge semantically similar keywords and terms with different spellings or closely related formulations. No separate formal keyword-cleaning protocol beyond this thematic and semantic unification was applied.

The VOSviewer settings were retained at their default configuration. Accordingly, the network construction and visualization relied on the software’s standard normalization and counting procedures. Because the exact number of keywords retained in the final network may vary depending on export and post-processing settings, the interpretation in this study focused on the conceptual organization of the map rather than on reporting a fixed terminal keyword count.

The co-occurrence map was interpreted in two stages. First, local clusters of semantically connected keywords were identified visually and analytically. Second, these clusters were grouped into broader conceptual units, referred to in this study as macrodomains. On this basis, the field of mining-related research was structured into three macrodomains and ten thematic subdomains.

SDG alignment. After the thematic structure had been identified, the macrodomains and subdomains were linked to the Sustainable Development Goals. This stage was based on expert interpretation of thematic correspondence between the content of each domain and the aims of particular SDGs. The mapping was therefore analytical and conceptual rather than automated.

Results. *Publication dynamics.* The bibliometric analysis identified 324,433 documents published during 2000–2025 (fig. 1). The annual dynamics show a strong, nearly continuous increase in mining-related research output over the study period. In the early 2000s, publication activity was relatively moderate, with approximately 2–4 thousand documents per year. However, the number of publications increased steadily over time and accelerated markedly after 2018.

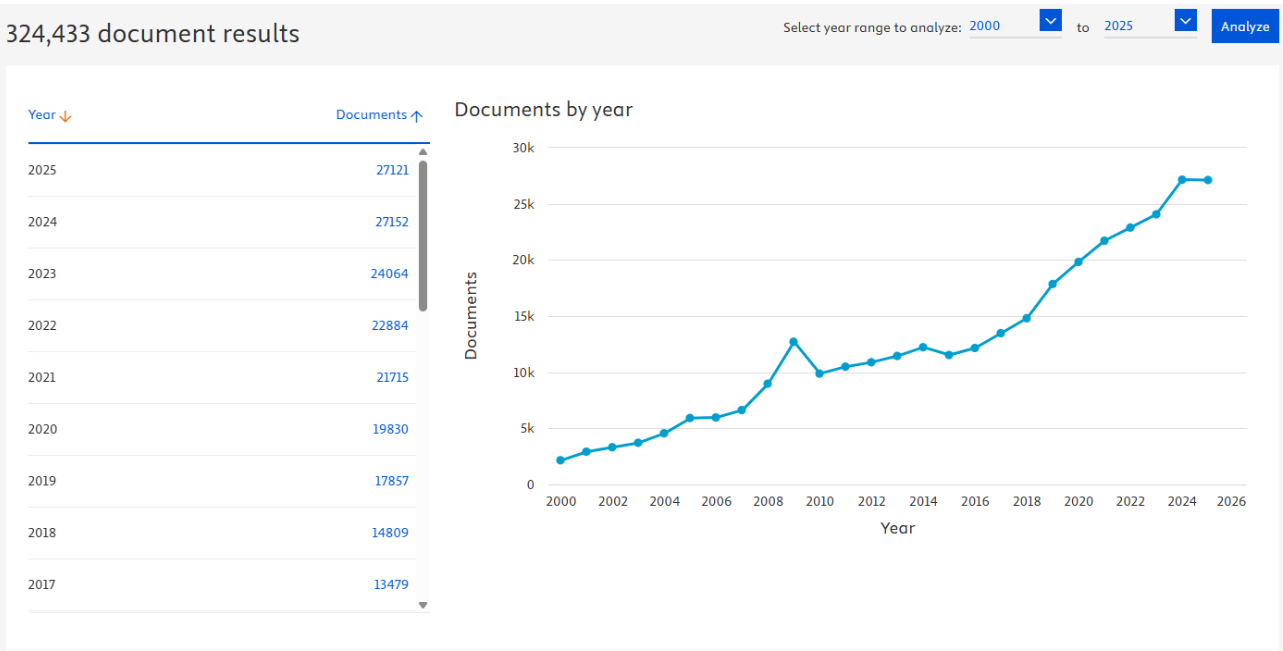

Fig 1. Publication dynamics of mining-related research in Scopus, 2000–2025

A first notable rise occurred in 2008–2009, when annual output increased from about 9 thousand to nearly 13 thousand documents, followed by a temporary decline in 2010. After a relatively stable period in the early 2010s, publication activity resumed rapid growth. From 14,809 documents in 2018, the annual output rose to 27,121 in 2025. The highest values were recorded in 2024 (27,152 documents), indicating that the field has reached a historically high level of scientific production.

Overall, the publication trajectory confirms that mining-related research has expanded substantially over the last twenty-five years. This trend reflects the sustained relevance of mining science and its increasing integration with adjacent domains such as digital technologies, environmental studies, and energy systems.

Subject-area structure. The subject-area distribution confirms the broad interdisciplinary character of mining-related research. The largest share of publications belongs to Engineering (15.5%), followed by Earth and Planetary Sciences (14.0%), Computer Science (12.3%), and Environmental Science (10.5%). Together, these four subject areas form the principal disciplinary core of the field (fig. 2).

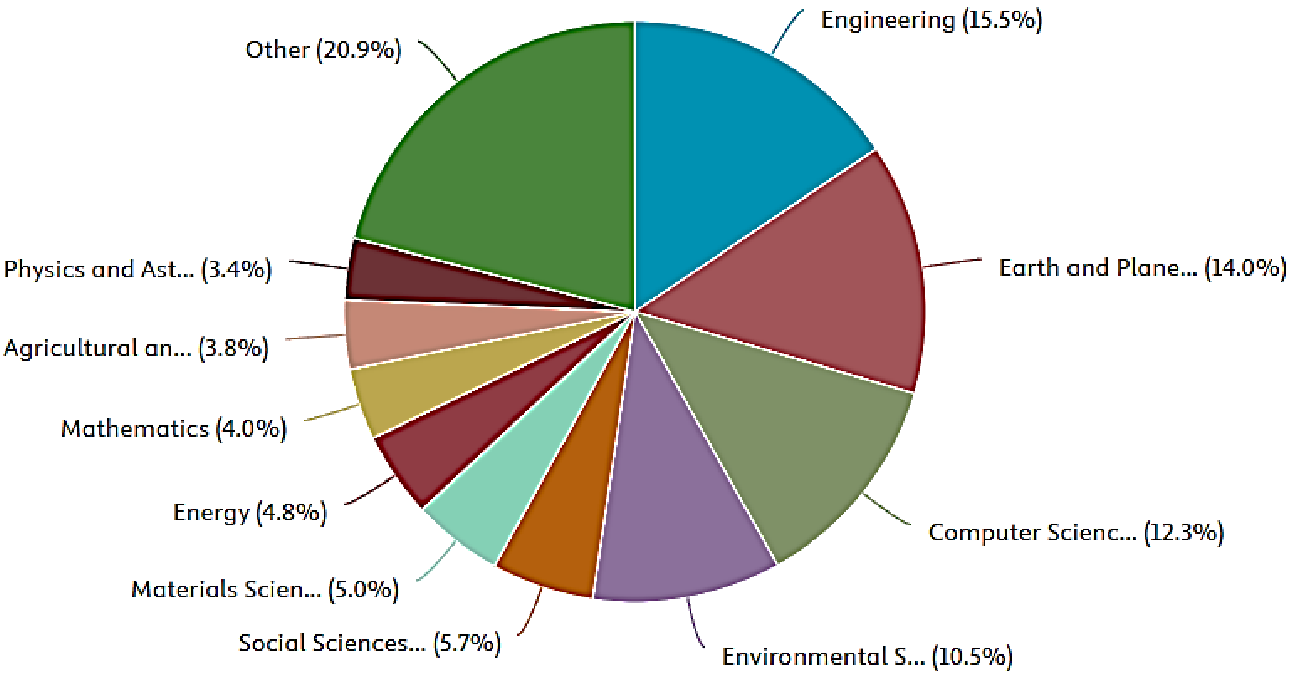

Fig. 2. Subject-area distribution of mining-related publications indexed in Scopus for the period 2000–2025

The next positions are occupied by Social Sciences (5.7%), Materials Science (5.0%), and Energy (4.8%). Smaller but still visible contributions come from Mathematics (4.0%), Agricultural and Biological Sciences (3.8%), and Physics and Astronomy (3.4%), while Other subject areas account for 20.9% of the total output.

This structure indicates that mining-related research is no longer confined to traditional extraction, geology, and mine design. A substantial proportion of publications is now linked to computational methods, environmental impact assessment, sustainability issues, and cross-disciplinary analytical approaches. In particular, the high share of Computer Science highlights the growing importance of modelling, simulation, data analysis, and artificial intelligence in the mining domain. At the same time, the significant presence of Environmental Science confirms the increasing role of ecological monitoring, resource efficiency, and sustainability-oriented research.

Country distribution. The geographical distribution of publications shows a strong concentration of mining-related research in several leading countries. China is the dominant contributor by a very large margin, followed by the United States. A second tier includes India, Australia, Canada, the United Kingdom, and Germany. Other countries with substantial output include Brazil, Poland, Spain, France, Japan, Italy, and South Africa (fig. 3).

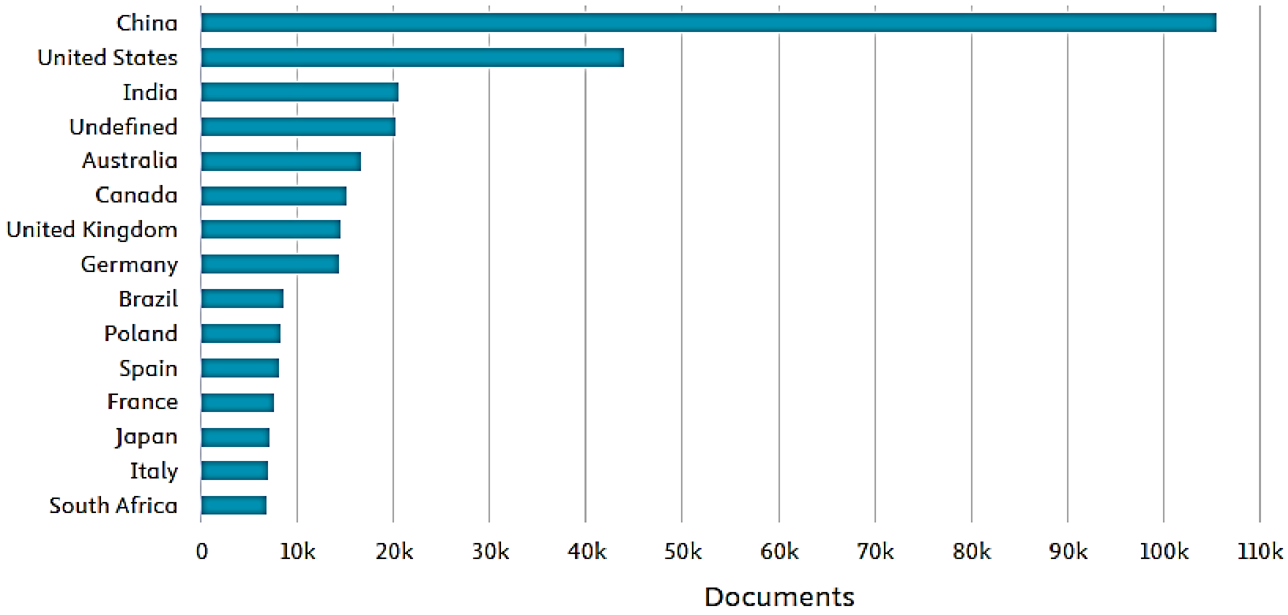

Fig 3. Geographical distribution of mining-related publications by country or territory based on Scopus data for 2000–2025

The visualization also includes a notable category labelled "Undefined", which indicates records for which country attribution was not clearly assigned in the analytical output. Even with this category present, the overall pattern remains clear: global mining-related knowledge production is concentrated primarily in large, industrial, technological, and resource-oriented research systems.

The leading role of China and the United States reflects their scale of scientific infrastructure, industrial capacity, and strategic interest in mineral resources, energy, and technological development. The strong positions of countries such as Australia, Canada, Poland, and South Africa are also consistent with their established mining sectors and long-standing research specialization in mineral extraction and related technologies. More broadly, the geographical pattern demonstrates that mining-related research is global in scope, but uneven in intensity, with output concentrated in countries where mining remains economically and strategically significant.

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Keyword co-occurrence structure (three macrodomains). The keyword co-occurrence network revealed a complex but interpretable conceptual architecture that can be grouped into three major macrodomains (fig. 4):

– Engineering Core of Mining;
– Energy and Digital Transformation;
– Mineral Processing and Sustainability.

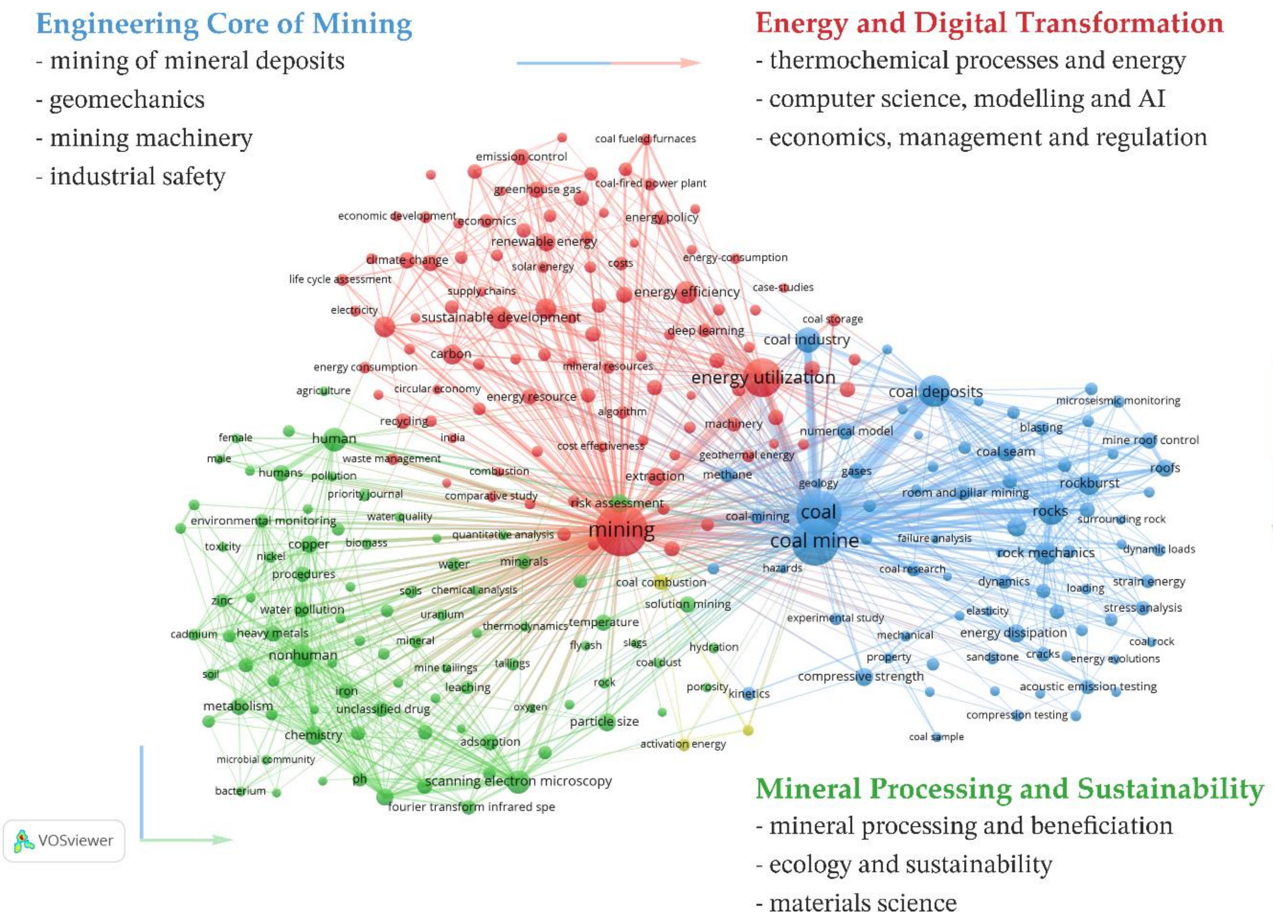

Fig 4. Keyword co-occurrence map of mining-related research showing the three major macrodomains

These macrodomains reflect both the historical foundations of mining science and its contemporary expansion into adjacent knowledge systems.

Engineering Core of Mining. The first macrodomain represents the traditional engineering nucleus of the field. It includes four subdomains: mining of mineral deposits; geomechanics; mining machinery; and industrial safety (fig. 5).

The mining-oriented cluster is centred on terms such as *mining*, *coal mine*, *coal deposits*, *coal seam*, *coal industry*, and related production-oriented concepts. This subdomain reflects the classical operational basis of mining science, including resource development, mine organization, and deposit-related studies.

The geomechanics subdomain is characterized by terms such as *rock mechanics*, *rocks*, *rockburst*, *blasting*, *roofs*, *mine roof control*, *stress analysis*, *strain energy*, *compressive strength*, and *acoustic emission*. These keywords indicate a strong focus on rock mass behaviour, failure mechanisms, deformation processes, and mine stability.

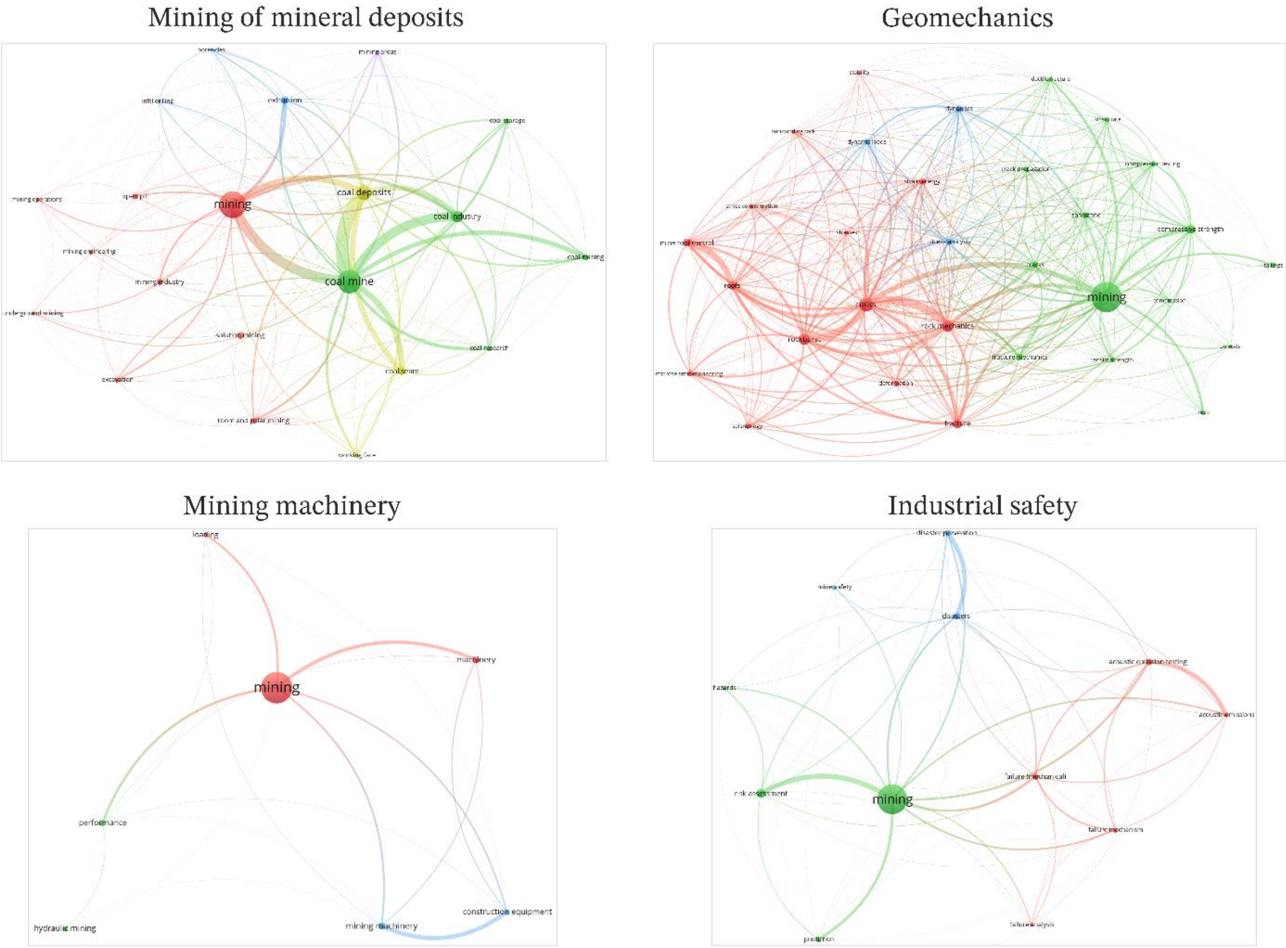

Fig 5. Keyword co-occurrence submaps of the Engineering Core of Mining

The mining machinery subdomain is smaller but conceptually distinct, with terms connected to *machinery*, *mining machinery*, *construction equipment*, *hydraulic mining*, and performance-related characteristics. This cluster reflects the technological and equipment-oriented component of mining engineering.

The industrial safety subdomain includes terms such as *disaster prevention*, *mines safety*, *hazards*, *risk assessment*, *failure analysis*, and *acoustic emission*. It highlights the persistent importance of occupational and technological safety in mining systems, including monitoring and prevention of hazardous conditions.

Taken together, this macrodomain represents the historically established engineering framework of the field and remains strongly linked to physical production environments, rock behaviour, and operational safety.

Engineering Core of Mining. The second macrodomain demonstrates the expansion of mining-related research into energy systems, computational approaches, modelling, and governance. It includes three subdomains: thermochemical processes and energy; computer science, modelling and AI; economics, management and regulation (fig. 6).

The thermochemical and energy subdomain is organized around terms such as *energy utilization*, *renewable energy*, *energy efficiency*, *carbon*, *carbon dioxide*, *methane*, *hydrogen*, *coal combustion*, *energy policy*, and *fossil fuel power plants*. These terms indicate that mining-related research increasingly addresses the energetic dimension of mineral resources, including efficiency, emissions, energy conversion, and energy transition challenges.

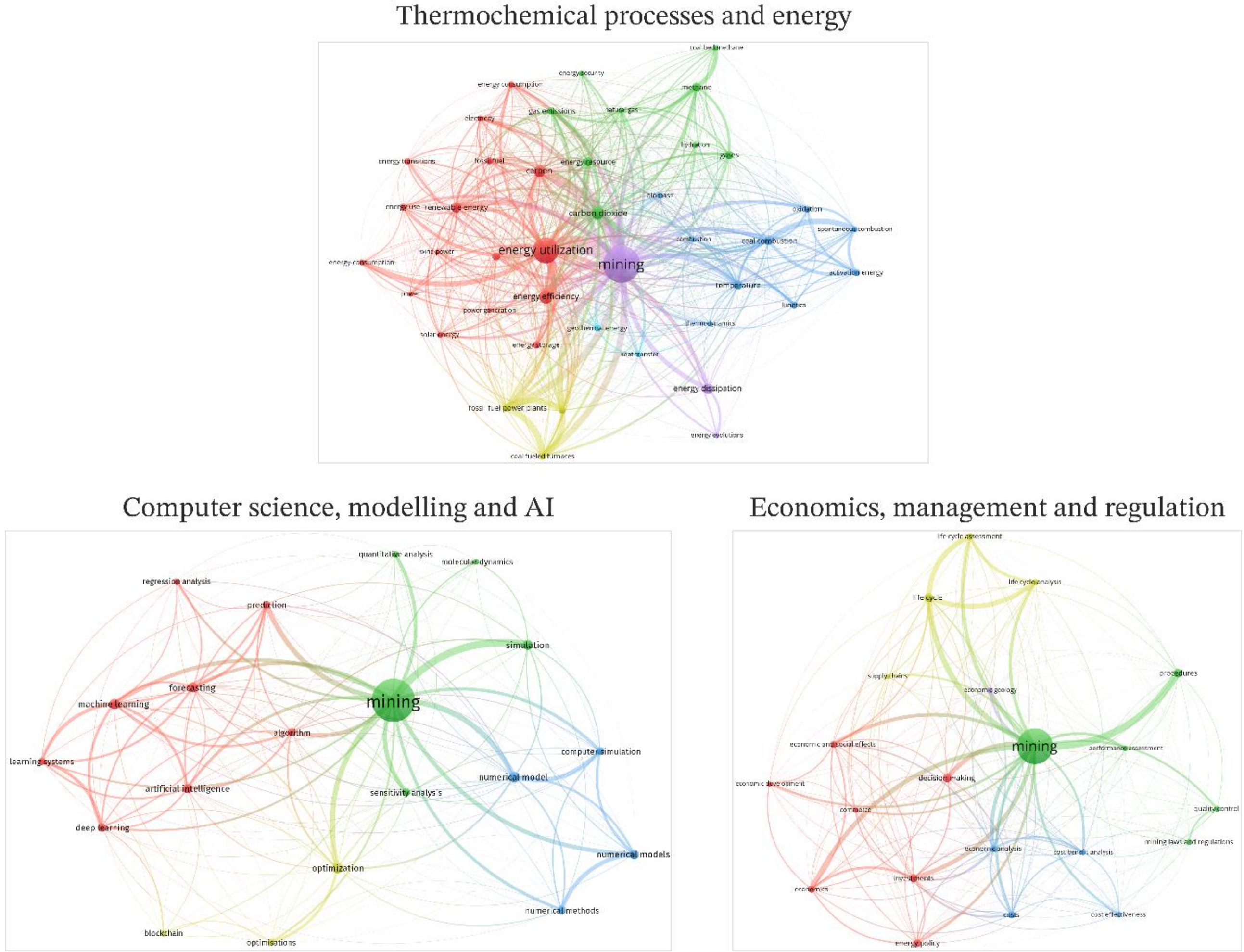

Fig 6. Keyword co-occurrence submaps of Energy and Digital Transformation

The computer science, modelling and AI subdomain includes terms such as *artificial intelligence*, *machine learning*, *deep learning*, *algorithm*, *forecasting*, *simulation*, *numerical model*, *computer simulation*, *optimization*, and *prediction*. This subdomain reflects the growing use of intelligent methods and computational tools for process modelling, risk estimation, forecasting, and decision support in mining-related contexts.

The economics, management and regulation subdomain includes keywords such as *decision-making*, *cost-benefit analysis*, *economic analysis*, *investments*, *performance assessment*, *quality control*, *life cycle analysis*, *procedures*, and *mining laws and regulations*. This cluster demonstrates that the contemporary mining knowledge system also includes managerial, institutional, and policy dimensions.

This macrodomain is particularly important because it shows that mining research is undergoing a transition from a purely production-oriented framework toward integrated energy, digital, and governance-related approaches.

Mineral Processing and Sustainability. The third macrodomain combines technological processing, environmental assessment, and materials-related studies. It consists of three subdomains: mineral processing and beneficiation; ecology and sustainability; materials science (fig. 7).

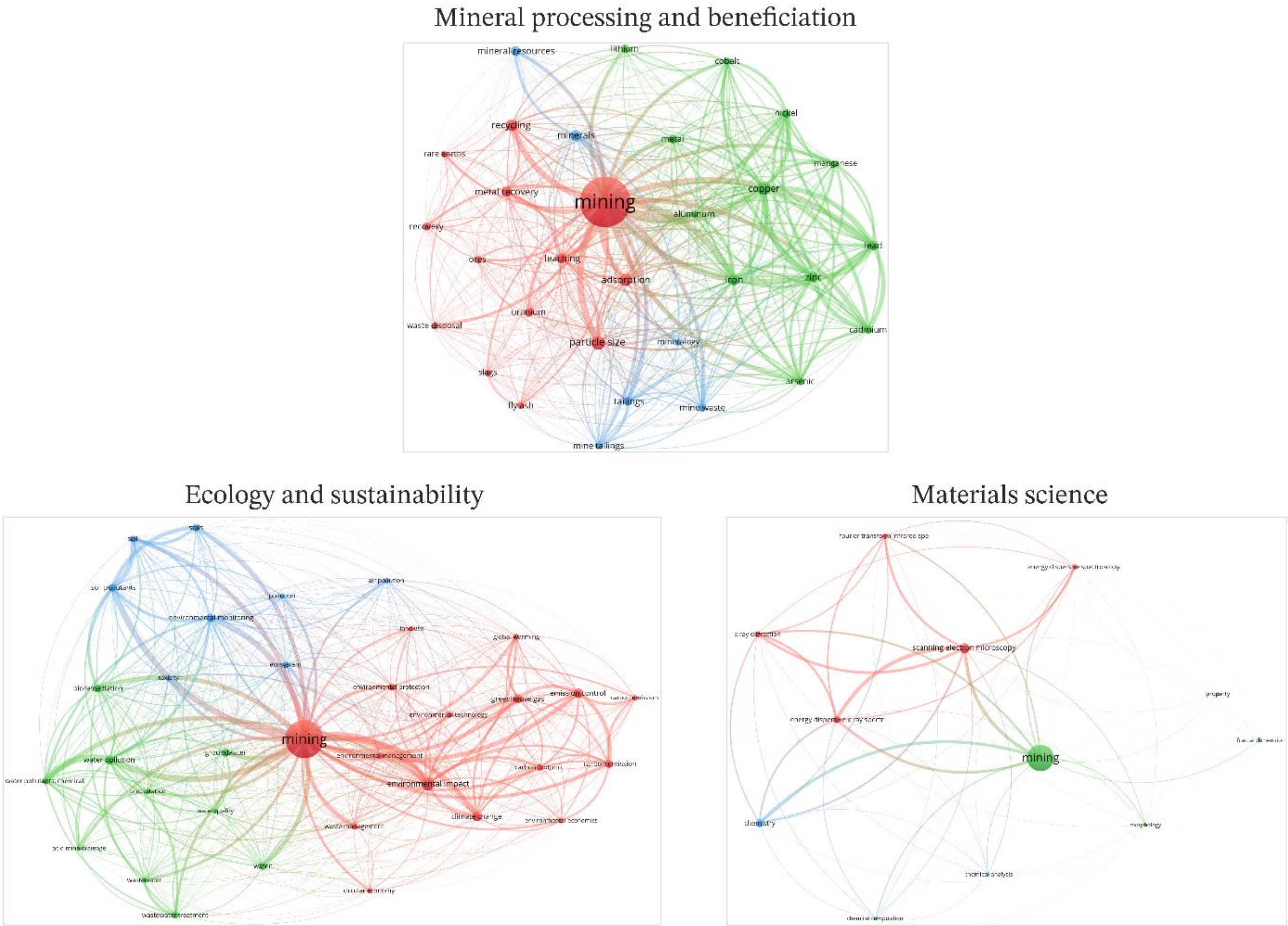

Fig 7. Keyword co-occurrence submaps of Mineral Processing and Sustainability

The mineral processing subdomain contains terms such as *adsorption*, *leaching*, *recycling*, *tailings*, *mine tailings*, *mine waste*, *recovery*, *rare earths*, *ores*, *particle size*, and *mineralogy*. This cluster shows a strong focus on processing technologies, resource recovery, secondary raw materials, and waste-related valorization.

The ecology and sustainability subdomain is characterized by *environmental impact*, *water pollution*, *wastewater treatment*, *acid mine drainage*, *air pollution*, *carbon emissions*, *climate change*, *circular economy*, and *environmental protection*.

This cluster clearly represents the sustainability turn in mining-related research and links extractive industries with broader ecological concerns.

The materials science subdomain includes terms associated with *scanning electron microscopy*, *Fourier transform infrared spectroscopy*, *chemical analysis*, *chemical composition*, and other material characterization methods. Although smaller in size, this subdomain contributes analytical depth by connecting mining-related materials with laboratory characterization and composition-based assessment.

Overall, the third macrodomain demonstrates that mining-related research increasingly addresses not only extraction and processing efficiency, but also environmental externalities, waste reuse, and material-level understanding.

SDG alignment of the identified domains. The identified macrodomains and subdomains were further interpreted in relation to the Sustainable Development Goals (fig. 8).

Engineering Core of Mining
- mining of mineral deposits (8, 9 12, 15)
- geomechanics (9, 11, 15)
- mining machinery (8, 9, 12)
- industrial safety (3, 8, 9)

Energy and Digital Transformation
- thermochemical processes and energy (7, 9, 12, 13)
- computer science, modelling and AI (4, 9, 12, 13)
- economics, management and regulation (8, 12, 16, 17)

Mineral Processing and Sustainability
- mineral processing and beneficiation (9, 12, 13)
- ecology and sustainability (6, 12, 13, 15)
- materials science (7, 9, 12)

Fig 8. Alignment of the identified mining-related macrodomains and subdomains with the Sustainable Development Goals

Within the Engineering Core of Mining, extraction of mineral resources was linked primarily to SDGs 8, 9, 12, and 15, reflecting economic productivity, industrial development, responsible resource use, and land-related implications. Geomechanics was associated with SDGs 9, 11, and 15 through its relevance to resilient infrastructure, safety of underground space, and geosphere-related impacts. Mining machinery corresponded mainly to SDGs 8, 9, and 12, while industrial safety was linked to SDGs 3, 8, and 9 due to its relation to worker well-being, productive employment, and safe industrial systems.

Within Energy and Digital Transformation, thermochemical processes and energy were aligned with SDGs 7, 9, 12, and 13. Computer science, modelling and AI were associated with SDGs 4, 9, 12, and 13, since digital competencies, innovation, efficiency, and climate-related optimization are all relevant. Economics, management and regulation were linked to SDGs 8, 12, 16, and 17, reflecting institutional effectiveness, governance, responsible production, and partnerships.

Within Mineral Processing and Sustainability, mineral processing was connected mainly with SDGs 9, 12, and 13. Ecology and sustainability corresponded to SDGs 6, 12, 13, and 15, while materials science was linked to SDGs 7, 9, and 12.

The SDG interpretation shows that mining-related research is not confined to industrial development alone. Instead, it contributes to a broader sustainability agenda spanning clean water, energy, innovation, responsible production, climate action, and terrestrial ecosystems.

Discussion. The results indicate that mining-related research has undergone substantial expansion and conceptual transformation during the period under study. The strong rise in annual publication output suggests that the field remains strategically important and continues to respond to global industrial, environmental, and technological challenges. The particularly strong growth after 2018 may be interpreted as a sign of intensifying interest in the role of mining within the energy transition, digital industry, and sustainability discourse.

The subject-area distribution confirms that mining-related research is inherently interdisciplinary. While Engineering and Earth and Planetary Sciences remain central, the strong presence of Environmental Science, Computer Science, and Energy indicates that hybrid research agendas increasingly shape the field. This is consistent with the current need to address resource extraction not only as a technical activity but also as a system that involves ecological constraints, computational control, and energy optimization.

The co-occurrence structure of the keyword provides the clearest evidence of this transformation. The identified macrodomains show that the field now operates simultaneously at three levels. First, it preserves its classical engineering core, including resource extraction, geomechanics, machinery, and safety. Second, it expands toward energy systems, modelling, AI, and governance. Third, it deepens its engagement with mineral processing, waste valorization, environmental assessment, and material characterization.

This three-part structure has strategic meaning. The Engineering Core of Mining reflects the sector's enduring traditional foundation. Without stable underground structures, safe operations, reliable equipment, and effective extraction systems, mining cannot function. However, the Energy and Digital Transformation macrodomain indicates that the field is no longer limited to mechanical and geological concerns. Instead, mining increasingly depends on numerical forecasting, intelligent control systems, techno-economic decision-making, and energy-efficiency considerations. Likewise, the Mineral Processing and Sustainability macrodomain indicates that research priorities are moving downstream and outward, incorporating waste management, environmental risk reduction, circularity, and material utilization.

An important implication of these results is that mining science should not be interpreted solely as an extractive discipline. The present mapping suggests that it is better understood as an integrated research ecosystem linking subsurface engineering, industrial technology, energy systems, digital methods, ecological management, and sustainability-oriented innovation. This broader understanding has practical value for universities, research institutions, funding bodies, and policy planners.

The SDG mapping further strengthens this interpretation. The strongest thematic links were observed for SDGs 6, 7, 8, 9, 12, 13, and 15. These goals align well with the field's actual structure: water and environmental protection, energy efficiency, industrial innovation, responsible production, climate-oriented solutions, and land-related impacts. The presence of SDGs 3, 4, 11, 16, and 17 in selected subdomains also shows that mining-related research intersects with health, education, urban resilience, governance, and partnerships. Thus, the field contributes not only to industrial capacity but also to broader societal transformation.

At the same time, several limitations should be acknowledged. First, the analysis was based on a single database, which may affect coverage. Second, the use of index keywords may shape the network differently than author keywords or full-text terms.

Third, thesaurus-based unification, while necessary, introduces an element of expert interpretation. Fourth, the SDG mapping was conceptual rather than algorithmic. Despite these limitations, the dataset is large enough and the thematic patterns are sufficiently strong to support robust conclusions about the conceptual structure of mining-related research.

Conclusions. This study mapped the thematic structure of mining-related research using bibliometric indicators and keyword co-occurrence analysis based on Scopus data for 2000–2026. The results lead to several main conclusions.

1) Mining-related research demonstrates strong long-term growth in publication activity, with the highest full-year output recorded in 2025. This confirms the field's continuing and expanding scientific relevance.

2) The disciplinary composition of the field is markedly interdisciplinary. Engineering, Earth and Planetary Sciences, and Environmental Science form the core subject areas, while Computer Science, Energy, Materials Science, and Social Sciences contribute important adjacent perspectives.

3) An obtained conceptual structure of the field can be interpreted through three macrodomains: Engineering Core of Mining, Energy and Digital Transformation, and Mineral Processing and Sustainability. Together, these macrodomains encompass ten thematic subdomains that reflect both the traditional foundations and the modern transformation of mining-related research.

4) The identified domains show that mining science is evolving from a narrowly extraction-centred field toward an integrated knowledge system that includes energy transition, digital modelling, artificial intelligence, environmental management, circular economy logic, and materials-oriented analysis.

5) The SDG-oriented interpretation demonstrates that mining-related research is especially relevant to SDGs 6, 7, 8, 9, 12, 13, and 15, while also connecting to selected governance, education, and institutional goals. This confirms the strategic importance of mining science within the broader agenda of sustainable development.

The proposed framework may be used in future studies to design research strategies, prioritize themes, modernize curricula, and position mining-related science within national and international sustainability agendas.

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АНОТАЦІЯ

Мета. Виявити концептуальну структуру досліджень у гірничій галузі, ідентифікувати основні тематичні домени та піддомени й установити їхній зв'язок із Цілями сталого розвитку на основі бібліометричного аналізу.

Методика. У роботі використано бібліометричний аналіз для дослідження динаміки, предметної структури, географічного розподілу та тематичного спрямування публікацій у гірничій галузі. Інформаційну базу сформовано за даними Scopus із використанням пошукового запиту TITLE-ABS-KEY за 2000–2025 рр. Для виявлення концептуальної структури застосовано аналіз співзустрічальності індексованих ключових слів у VOSviewer з мінімальним порогом входження 10 документів. Семантично близькі терміни та ключові слова з варіантами написання були уніфіковані. Мережеві зв'язки використано для виділення тематичних кластерів, їх узагальнення у макродомени та піддомени, а також для подальшого зіставлення з Цілями сталого розвитку.

Результати. У результаті аналізу співзустрічальності ключових слів встановлено, що досліджуване наукове поле має виражену багатокомпонентну та міждисциплінарну структуру. У його межах виокремлено три макродомени: інженерне ядро гірничої справи, енергетичну та цифрову трансформацію, а також переробку мінеральної сировини і сталий розвиток. У межах цих макродоменів ідентифіковано десять піддоменів. Отримані результати засвідчили, що сучасні дослідження у гірничій галузі виходять за межі традиційної інженерної проблематики та формують ширший науковий простір, у якому поєднуються технологічні, енергетичні, екологічні, цифрові та управлінські напрями. Також установлено найбільш тісний зв'язок досліджуваного поля з Цілями сталого розвитку.

Наукова новизна. Запропоновано інтегрований підхід до інтерпретації досліджень у гірничій галузі, який поєднує аналіз публікаційної динаміки, картування співзустрічальності ключових слів, структуризацію на макродомени й піддомени та орієнтоване на Цілі сталого розвитку трактування отриманих результатів.

Практична значимість. Одержані результати можуть бути використані для формування наукових пріоритетів, планування міждисциплінарних досліджень, позиціонування гірничої науки в контексті сучасних викликів сталого розвитку та обґрунтування стратегій розвитку наукових і освітніх установ.

Ключові слова: *гірнича галузь, бібліометричний аналіз, VOSviewer. Цілі сталого розвитку, сталий розвиток, картування науки.*

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