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JUST ENERGY TRANSITION IN COAL-DEPENDENT REGIONS – A CASE STUDY OF THE SILESIA REGION, POLAND

Abstract: The Upper Silesia region, historically shaped by hard coal mining and related heavy industry, is currently in a critical phase of just energy transition driven by the European Union's goal of achieving climate neutrality by 2050. This article aims to assess the feasibility of this process in the coal-dependent subregions of the Silesian Voivodeship, with particular attention to institutional, legal, and spatial planning conditions. The study uses an interdisciplinary desk-based research approach based on the analysis of normative acts, strategic and operational documents, statistical data, official regional sources, and selected comparative literature on post-mining transformation and energy justice. The findings indicate that the principal challenge no longer lies in the absence of strategies or financing instruments but in a weak integration of sectoral restructuring, post-mining land governance, spatial planning, and labor market policy. The 2025 amendment to the Act on the Functioning of Hard Coal Mining improved the operational framework for mine closure and enabled asset transfers to local governments, yet it did not eliminate inequalities in access to social protection or remove the procedural bottlenecks affecting the redevelopment of post-mining land. Although the regional governance architecture has been strengthened by the Territorial Just Transition Plan (TJTP), the Regional Council for Just Transition (RCJT), and the Regional Observatory of the Transformation Process 2.0 (ROPT 2.0), the implementation gap remains substantial. The article concludes with legislative recommendations aimed at improving the implementation of a just transition in coal-dependent regions.

Keywords: Just Energy Transition (JET), post-mining areas, Upper Silesia, spatial planning, Just Transition Fund (JTF)

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Introduction

The energy transition in Upper Silesia represents one of the most complex structural challenges facing contemporary Poland. For more than a century, this region functioned as an industrial hub based on a coal monoculture, in which mining, metallurgy, and conventional energy shaped not only the economic structure but also the social fabric, local labor markets, and the cultural identity of its residents. Currently, this historical legacy collides with the need for deep decarbonization, driven by the objectives of the European Green Deal (EGD, 2019) and the EU's goal of achieving climate neutrality by 2050 (European Climate Law, 2021). This process requires the gradual phasing out of coal from the energy mix, as mandated by the „Fit for 55" legislative package (2021). In this context, the transformation of Upper Silesia extends beyond a simple technological shift; it is a multidimensional restructuring process that affects public finances, spatial planning, and the future development trajectories of communities traditionally dependent on the mining sector (Drobniak, 2022). The study area is located in southern Poland, with the Silesian Voivodeship, as shown in Figure 1.

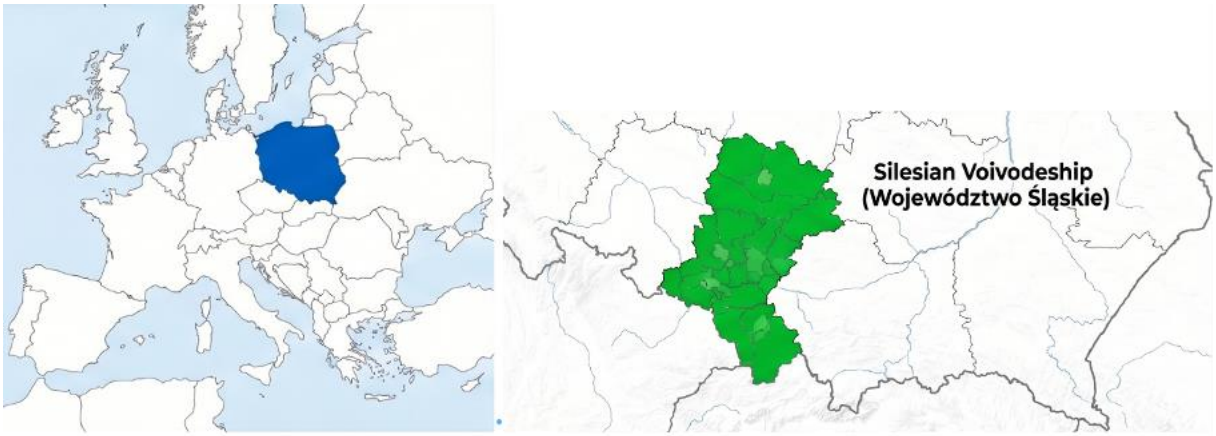

Figure 1. Location of Upper Silesia within Poland and Europe
Source: authors elaboration based on public-domain Geoportal.gov.pl

From a theoretical perspective, a just energy transition requires a precise definition. According to Drobniak (2022), "Just Transition" is a concept addressed specifically to coal-dependent regions and should be distinguished from the broader nationwide „Energy Transition". Whereas the latter focuses on the technological shift toward low-carbon sources, the former concentrates on mitigating social costs and reorienting the development paths of areas dependent on fossil fuels. The key postulate advanced by this author is the pursuit of a „socially positive balance of change", implemented in accordance with the „1:1+" principle. This principle assumes that the loss of value in traditional industries must be offset by the creation of at least equivalent capital in new sectors of the economy (Drobniak, 2022). Heffron and McCauley (2018), in turn, define this paradigm as a fair and just transition to a post-carbon society that integrates three dimensions: energy, climate, and environment. Within this framework, the transition is

participatory, based on dialogue, prioritizes inclusion, and addresses the vulnerabilities of groups affected by industrial restructuring.

This concept emerged from debates on the protection of workers and local communities exposed to the decline of carbon-intensive industries. Over the course of academic debate, however, it evolved into a broad normative category. It now encompasses not only compensation for losses but also the fair distribution of benefits, transparency in decision-making procedures, and the prevention of new forms of inequality (IRENA, 2026). In this sense, the fairness of the process is not an automatic result of decarbonization, but depends on the quality of institutions, the design of public instruments, and the extent to which state policy recognizes territorial asymmetries.

This perspective is particularly relevant to Upper Silesia. The region continues to have the largest workforce in Poland directly and indirectly linked to the coal sector while also containing extensive post-mining and post-industrial areas, the reuse of which is a prerequisite for long-term economic diversification. The effects of restructuring are not limited to the mines themselves and their employees. They also extend to cooperating firms, subcontractors, municipal budgets in mining comunnities, local service markets, technical infrastructure, and planning regimes. Frankowski et al. (2023) point out that employment indirectly linked to hard coal mining in Upper Silesia remains substantial and spatially concentrated, which means that the socioeconomic costs of the transition cannot be assessed solely through the lens of direct employment.

The regional response to these challenges is formally comprehensive. The TJTP for the Silesian Voivodeship 2030 serves as the strategic basis using funds from the JTF and other EU instruments that support coal regions. According to information published on the official regional portal, the TJTP covers seven subregions of the Silesian Voivodeship and identifies key transformation challenges in the social, economic, spatial, and environmental dimensions, including the need for structural change, worker retraining, and the reclamation of degraded areas (Marshal's Office of the Silesian Voivodeship, 2026a). The same source indicates that preparation of the plan since 2019 has been accompanied by an extensive process of public dialogue, including 33 workshops in seven subregions with the participation of nearly 1,850 people representing local government, public administration, business, trade unions, expert communities, and civil society organizations (Marshal's Office of the Silesian Voivodeship, 2026a). The regional governance architecture was further strengthened by the establishment of the RCJT and the implementation of the ROPT 2.0 project.

However, the mere existence of governance structures and funding sources does not guarantee effective implementation. The literature on regional energy transitions increasingly shows that the success of just transition policies depends on their ability to link sectoral restructuring with the broader logic of territorial development, rather than treating these two orders as separate domains (Loewen, 2022; Frantál et al., 2022). In the Silesian Voivodeship, this challenge is particularly evident at the intersection of regulations governing mine closure, the transfer of post-mining assets, local planning systems, labor market adjustments, and the creation of alternative economic functions in post-mining areas.

The aim of this article is therefore to assess the feasibility of a just energy transition in the coal-dependent subregions of the Silesian Voivodeship, with particular emphasis on institutional, legal, and spatial-planning conditions. The article argues that the most significant barrier to an effective transition stems not from a lack of strategic documents, but from the growing disconnect between ambitious policy design and its piecemeal implementation. This gap is particularly evident in four interrelated areas: unequal access to social protection, the slow and procedurally cumbersome transfer of post-mining assets, the weak link between mine closure and spatial planning, and the limited administrative capacity of municipalities to manage complex processes of redeveloping degraded areas.

JET's Regional Strategic and Institutional Framework

The situation in Upper Silesia is shaped by an extensive, multilevel, yet still evolving system of strategic documents and implementation instruments. At the regional level, the main reference point is a package of documents in which the TJTP for the Silesian Voivodeship 2030 plays a central role. It is embedded in a broader strategic context that includes, among others, the Silesian Voivodeship Development Strategy "Silesia 2030" – Green Silesia, the 2019 Regional Transformation Action Plan, the Low-Carbon Economy Policy, the Regional Innovation Strategy 2030, the Silesian Voivodeship Social Policy Strategy for 2020–2030, and the Regional Urban and Revitalization Policy.

The key operational document is the TJTP, adopted by Resolution No. 2326/383/VI/2022 of the Silesian Voivodeship Executive Board. It serves as the basis for spending funds from the Just Transition Fund (JTF) and for using other EU sources that support mining regions. It is strategic in nature and sets out the main trajectory of the region's socioeconomic transition through 2030. Its principal objective is the just and effective transformation of seven mining subregions toward a green and digital economy. Within the TJTP, the following subregions are identified as particularly vulnerable to the negative effects of the transition: Katowice, Bytom, Sosnowiec, Gliwice, Tychy, Rybnik, and Bielsko-Biała (Białas & Pypłacz, 2024). Appendix 1 to the TJTP defines the list of municipalities comprising the Strategic Intervention Areas (OSI), grouping them according to the degree of loss of socioeconomic functions and the scale of spatial problems. Table 1 summarizes the TJTP subregions and the OSI municipalities included in the analysis.

At the current stage of implementation, the TJTP should be treated not only as a planning document but also as part of a broader governance architecture. According to official data, since 2019 the provincial government has conducted an extensive public dialogue on the transition; 33 workshops were organized in seven subregions, attended by nearly 1,850 people, and the former Regional Transformation Team was transformed in 2023 into the RCJT. The Council currently has 70 members representing government and local government administration, business, trade unions, the academic community, and civil society organizations. This means that the regional transformation model is

based not only on expenditure planning but also on consultation, advisory, and monitoring mechanisms.

Table 1. Division into subregions and OSI municipalities in TPST 2030

No.	Subregion	Municipality
1.	Bielsko	Wilamowice, Hażlach, Strumień, Zebrzydowice, Bestwina, Czechowice-Dziedzice
2.	Bytom	Radzionków, Zbrosławice, Bytom, Piekary Śląskie
3.	Gliwice	Knurów, Gierałtowice, Pilchowice, Sośnicowice, Gliwice, Zabrze
4.	Katowice	Chorzów, Katowice, Mysłowice, Ruda Śląska, Siemianowice Śląskie, Świętochłowice
5.	Rybnik	Kornowac, Czerwionka-Leszczyny, Gaszowice, Jejkowice, Lyski, Świerklany, Pszów, Radlin, Rydułtowy, Wodzisław Śląski, Godów, Gorzyce, Lubomia, Marklowice, Mszana, Jastrzębie-Zdrój, Rybnik, Żory
6.	Sosnowiec	Będzin, Czeladź, Wojkowice, Bobrowniki, Psary, Dąbrowa Górnicza, Jaworzno, Sosnowiec
7.	Tychy	Łaziska Górne, Mikołów, Orzesze, Ornontowice, Wyry, Goczałkowice-Zdrój, Miedźna, Pawłowice, Pszczyna, Suszec, Bieruń, Imielin, Lędziny, Bojszowy, Chełm Śląski, Tychy

Source: Territorial Plan for a Just Transition of the Silesian Voivodeship 2030

From a financial perspective, the TJTP remains closely linked to the European Funds for Silesia 2021–2027 (EFSL). In the current version of the program, approved by the European Commission on May 28, 2025, and adopted by the Provincial Executive Board on June 11, 2025, the Silesian Province has the largest allocation among Polish regional programs—nearly 5.14 billion euros. At the same time, the regional discussions emphasize that approximately 2.2–2.22 billion euros of this amount comes from the JTF, which confirms the key role of the Silesian Voivodeship in EU and Polish transition policy (Lubicz-Posochowska & Benduch, 2024).

The TJTP outlines 10 specific operational objectives, including the development of an innovative and diversified economy, the expansion of distributed energy systems, and the effective use of brownfield sites. It is worth noting that under the regional program "European Funds for Silesia 2021–2027" (FEŚL), the province is set to receive a total of 5.1 billion euros, which represents the largest funding allocation for a single region across the entire European Union (Białas & Pypłacz, 2024). The scale of this funding underscores the significance of the Silesian Voivodeship in national and European transition policy.

Other regional documents serve to reinforce the TJTP, but their significance is primarily strategic and coordinative rather than directly executive. The "Silesia 2030" strategy, adopted in 2020, highlights long-term development challenges, including population aging and demographic pressure. The 2019 Regional Transformation Action

Plan defines three priorities: the Green Transformation Region (spatial dimension), the Sustainable Transformation Region (Industry 4.0), and the Inclusive Transformation Region (social and identity dimensions). By contrast, the Regional Innovation Strategy 2030 reinforces the logic of "Smart Silesia" by emphasizing the competitiveness of the regional innovation ecosystem. The problem, however, is that a substantial part of this architecture is strategic rather than prescriptive, which limits its effectiveness in implementation and hinders the enforcement of coherence among mining-sector restructuring, the development of post-mining areas, and local development policy.

National regulations concerning the restructuring of the mining industry remain an additional source of tension. The amendment to the Act on the Functioning of Hard Coal Mining of December 4, 2025, introduced mechanisms for the independent liquidation of mining facilities by companies and expanded protective measures for employees. At the same time, draft bill UD377, which was under consideration in 2026, explicitly states that further legislative changes are needed to ensure equal access to protective benefits for mining-plant employees, regardless of whether they are employed by public or private entities. This issue became visible in the tensions surrounding the "Silesia" mine, where employee protests became a symptom of unequal access to protective mechanisms.

Furthermore, the registered unemployment rate in the province rose to 4.8% at the end of February 2026. This does not alter the overall diagnosis: the deterioration of the labor-market conditions, together with population aging and the outflow of part of the labor force, reinforces the structural tension inherent in the transformation of coal regions. This can be interpreted in terms of a "double bind", that is, the simultaneous contraction of traditional jobs and the weakening of the region's demographic potential. (GUS, 2026; Martin, 2025).

Materials and methods

The study was based on an interdisciplinary desk-research approach, that combined the analysis of legal acts, strategic documents, official statistical data, institutional materials, and selected scholarly literature. The point of departure was the assumption that the just transition of a coal region should be analyzed not only through the lens of changes in the energy and employment sectors, but also within a broader institutional and territorial framework in which legal regulations, public administration, spatial planning, and socioeconomic restructuring processes intersect.

The primary source materials were regional and national programmatic and regulatory documents, including the Territorial Plan for the Just Transition of the Silesian Voivodeship 2030, the European Funds for Silesia Program 2021–2027, the Detailed Description of FEŚL Priorities, as well as the amendment to the Act on the Functioning of Hard Coal Mining of December 4, 2025, and legislative materials related to draft UD377. The analysis was supplemented with data from the Local Data Bank of the Central Statistical Office (GUS), regional analytical materials on the labor market and the redevelopment of post-mining areas, information published on the official portal on the transformation of the Silesian Voivodeship, and selected comparative and conceptual

literature on just transition, regional energy transitions, and the redevelopment of post-mining areas.

The analytical procedure was organized around four interrelated dimensions: legal-institutional, planning-spatial, socioeconomic, and governance. This made it possible to assess the consistency of regulations on mine closure and asset transfers, the degree of integration of post-mining areas into local planning, the vulnerability of the labor market and demographic structures, and the quality of coordination and monitoring of the transformation process. A limitation of the study is that it relies on secondary data and document analysis, without field research, as well as the fact that some instruments and reforms are still in the implementation phase. Nevertheless, the adopted approach makes it possible to identify accurately the systemic barriers and institutional conditions that shape the feasibility of a just transition in Upper Silesia. The analytical workflow is summarized in Figure 2.

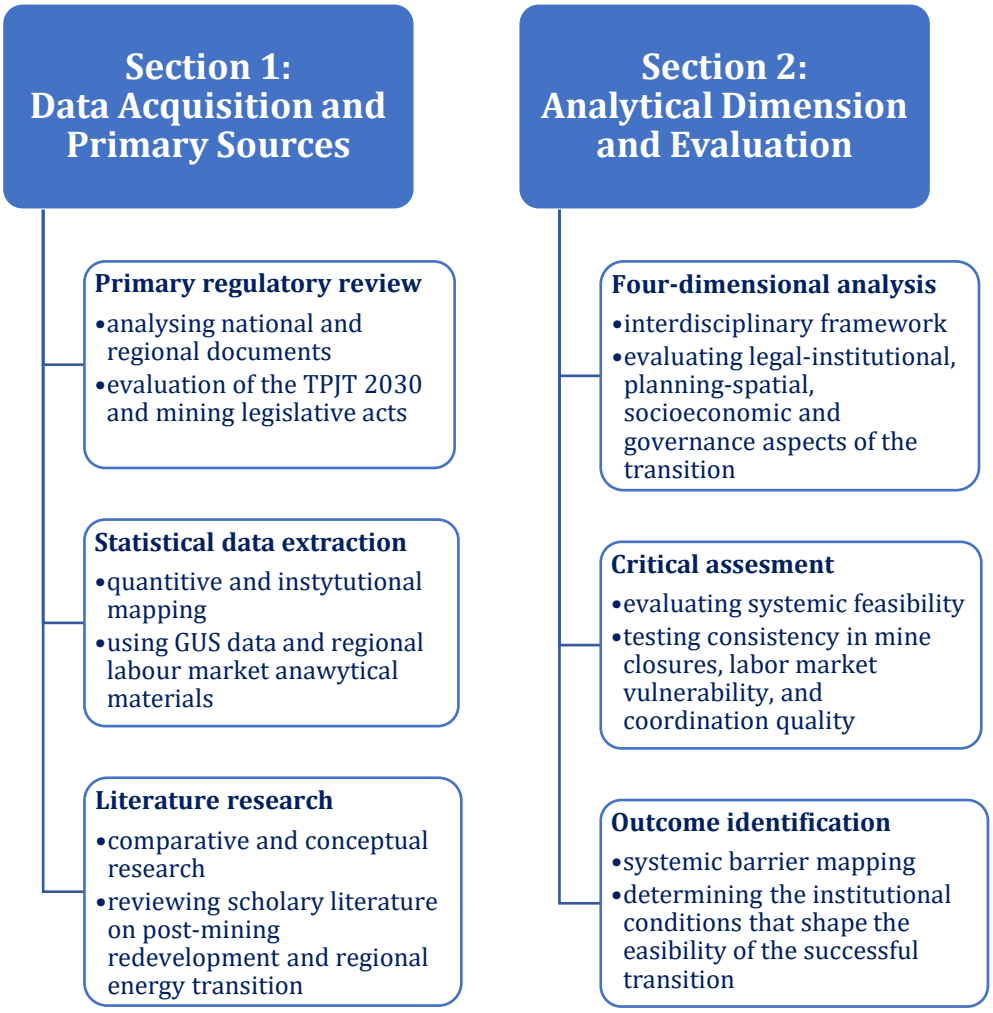

Figure 2. Research methodology workflow
Source: authors elaboration

Results and discussion

The analysis indicates that the Silesian Voivodeship has created an extensive institutional architecture for the transition, but the fundamental problem lies in the weak integration of its individual elements at the implementation level. The TJTP serves as the strategic framework for using JTF funds and other European sources dedicated to coal regions, covering seven subregions and linking the transition to structural restructuring, worker retraining, and the reclamation of degraded areas (Marshal's Office of the Silesian Voivodeship, 2026a). In addition, the regional governance system has been strengthened by the establishment of the Regional Council for Just Transition, whose role is to support the Silesian Voivodeship Executive Board and the FEŚL Monitoring Committee in implementing activities financed by the JTF (Marshal's Office of the Silesian Voivodeship, 2026c). The Council's 70-member composition, which includes representatives of the central government, local government, business, academia, trade unions, and non-governmental organizations, suggests a relatively inclusive governance model.

This strengthening should be regarded as a significant asset of regional policy. The same applies to the ROPT 2.0 project, implemented from April 1, 2024, to December 31, 2026, with a value of PLN 11,420,126.06, fully funded by the JTF. The project's objective is to improve the management of the just transition in the Silesian Voivodeship, with particular emphasis on the labor market, economic diversification, and the potential of postindustrial, including post-mining, areas. Importantly, the project is not limited to simple monitoring. Its design combines analytical-research, participatory-educational, pilot, and strategic-implementation components, which represents an attempt to link diagnosis, stakeholder participation, the dissemination of good practices, and systematic institutional learning. This approach is consistent with the argument that a just transition requires a coordinated combination of instruments rather than isolated sectoral actions (IRENA, 2026).

At the same time, the mere existence of governance structures does not remove legal constraints. A key milestone in this respect was the amendment to the Act on the Functioning of Hard Coal Mining of December 4, 2025. It enabled mining companies to carry out mine-closure activities independently and introduced a mechanism for transferring post-mining assets to local government units. The protective package for employees affected by the phaseout process was also expanded. Formally, this reform addressed some of the long-standing concerns about the rigidity of the previous liquidation model and the limited ability of local governments to acquire post-mining land for development purposes.

However, the analysis also showed that this reform is inherently incomplete. Materials related to draft UD377 indicate that, as early as the first quarter of 2026, serious concerns emerged regarding unequal access to protective measures for employees of private mining entities, such as the "Silesia" mine. This means that the amendment improved the operational conditions for phasing out mining but did not fully address the social-justice dimension of the transition. In practice, the law strengthened the technical and organizational aspects of sectoral restructuring while leaving one of the key redistributive issues unresolved: who gains access to social protection and under what

conditions. From the perspective of a just transition, this type of asymmetry is not merely incidental. IRENA (2026) clearly indicates that the fairness of the transformation process requires not only general support for workers but, above all, careful assessment of how costs and benefits are distributed among different sectors, places, and social groups.

Legal asymmetry compounds the problem of poor integration between mine closure and territorial restructuring. The GIG-PIB report from October 2025 documents the slow pace of property transfers by SRK S.A.—the planned transfer of approximately 200 ha by the end of 2025 represents a mere 7% of the company's holdings. (GIG-PIB, 2025). The main barriers are incomplete information on underground infrastructure and the high remediation costs, which often exceed the market value of the land.

These conclusions correspond to findings on the model for the reuse of post-mining areas, which remains poorly integrated with spatial planning and leads to fragmented and opportunistic development (Wyrzykowska & Janiszek, 2025). The significance of this problem is also evident in multilayered spatial systems - so-called "three-dimensional brownfields" - where geological and hydrological risks complicate land transfers (Cherevatskyi et al., 2023). This perspective is particularly relevant for Upper Silesia because it helps explain why seemingly simple land transfers are often delayed or complicated: the issue concerns not only title to the surface plot but also whether the site can safely accommodate new functions, at what remediation cost, and with what scope of long-term liability. A current example is the former KWK Wieczorek site in Katowice, where preserved mining buildings are being redeveloped into the Katowice Gaming and Technology Hub. This case illustrates how post-industrial land can be redirected toward technology-intensive and knowledge-based functions while retaining industrial heritage, as presented in Figure 3. It shows the adaptive reuse of the former KWK Wieczorek site in Katowice as the Katowice Gaming and Technology Hub.

Figure 3. Adaptive reuse of the former KWK Wieczorek site in Katowice
as the Katowice Gaming and Technology Hub
Source: Interia Gry

A similar disconnect exists in the realm of spatial planning. The 2023 reform of Poland's planning system introduced the General Municipal Plan and Integrated Investment Plans (ZPI), which have the potential to reduce planning chaos (Act of July 7, 2023, amending the Act on Spatial Planning and Development and certain other acts, Journal of Laws 2023, item 1688). In theory, these tools can support a more strategic and multifunctional approach to post-mining areas by linking their future use to local objectives related to housing, services, industry, transport, or green infrastructure. However, the 2026 amendment to the reform suspended penalties for delays in issuing zoning decisions until the end of 2026, which suggests that local government administrative structures remain overburdened.

Labor-market analysis reinforces the conclusion that the transformation challenge is territorial rather than merely sectoral. At the same time, the region is experiencing population aging and an outflow of working-age residents. The "double bind" phenomenon means that the labor pool is shrinking, which undermines the assumption that new sectors will automatically absorb workers leaving mining. This is particularly evident in mining-related companies, where 41% of jobs are at risk of being eliminated. Regional emphasis on monitoring under ROPT 2.0, covering, among other things, the situation of women and the preservation of mining identity, is therefore crucial, especially since women are disproportionately vulnerable to energy poverty (Frankowski et al., 2023).

Comparative studies of Czech mining and post-mining regions confirm this assessment. Frantál et al. (2022) argue that coal regions should not be treated as homogeneous territorial categories. In their analysis, negative phenomena typically associated with coal dependence—such as population decline, a weakened labor market, and deficits in social capital —are shaped not only by the decline of mining itself but also by peripheral location, the level of urbanization, educational attainment, and entrepreneurial activity. These findings are also relevant to the Silesian Voivodeship. They imply that a uniform regional policy may prove insufficient given the varying vulnerabilities of individual cities and subregions. Some municipalities may be constrained primarily by the condition of post-mining areas and planning barriers, others by a weak labor market, and still others by insufficient entrepreneurship or deepening demographic decline.

Conclusions

The analysis indicates that the just energy transition in the Silesian Voivodeship has entered a phase in which its success depends less on the availability of strategies and financial resources than on the quality of their institutional integration. The main barriers are now legal, procedural, and organizational. They primarily concern the incomplete alignment of national regulations with the social costs of restructuring, the slow transfer of post-mining assets, the poor synchronization of spatial policy with transition goals, and the limited administrative capacity of municipalities to manage complex processes of redeveloping degraded areas. Consequently, the main problem today is not a lack of

instruments but the persistent gap between transformation planning and implementation at the local and regional levels.

In light of these findings, the success of Upper Silesia's transformation requires further clarification of the protective framework for employees of all types of mining entities, acceleration and simplification of procedures for transferring post-mining land to municipalities, stronger links between spatial-planning instruments and the objectives of the TJTP, and the strengthening of the monitoring and coordination functions performed by ROPT 2.0. At the same time, regional policy should better account for the diversity of local labor markets, the situation of mining-related enterprises, and the needs of groups particularly vulnerable to marginalization. Ultimately, the region's future depends on shifting from a management approach focused on the decline of the mining sector to one that actively shapes a new economic and spatial structure in which post-mining areas become a resource for development rather than a permanent burden on local governments.

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Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

This study is based on desk research and analysis of publicly available legal acts, strategic documents, official statistical data, institutional materials, and scholarly literature. No new empirical dataset was generated. The public sources used in the analysis are identified in the References section.

Use of Generative AI and AI-Assisted Technologies

Generative AI was used solely for language editing and formal editorial corrections during the preparation of the manuscript. The tool used was ChatGPT, based on the GPT-5.5 Thinking model. The authors reviewed and approved all changes and take full responsibility for the content of the manuscript.

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