MARGINALISED ZONES AS STATISTICAL INSTRUMENTS TO NAVIGATE PERMACRISIS IMPACTS IN EUROPEAN REGIONS

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Abstract

In the context of overlapping and interrelated crises—economic, ecological, social, and geopolitical—European regions are confronted with new governance challenges. Marginalised zones, often treated as residual spaces in policy discourse, must be reimagined as analytical and governance instruments in the transition toward sustainability and territorial resilience. This article explores how marginalised areas can be conceptualised and operationalised through spatial statistical methodologies and policy frameworks that support just transition processes. Drawing on a critical review of empirical studies and strategic European and Romanian documents, we synthesise the main tools used to identify territorial disparities, such as Principal Component Analysis (PCA), clustering algorithms, fuzzy logic, spatial econometrics, and machine learning. We confirm that these methods allow for more nuanced territorial diagnostics and typologies, which are essential for evidence-based and place-based policies. The article advances a transdisciplinary framework that repositions marginalised zones as strategic levers in adaptive territorial governance. Ultimately, we argue for a paradigm shift: **from periphery to policy**, where marginalised regions evolve from passive recipients of aid to active instruments of **just transition**.

Keywords: Marginalised regions, Just transition, Spatial inequality, Territorial resilience, Governance instruments, PCA, Clustering, Fuzzy logic, Regional typologies, Permacrisis

JEL classification: R11, R58, O18, Q56, C38

1. Introduction

The concept of *permacrisis* - a prolonged period of systemic instability caused by overlapping shocks such as climate change, energy crises, pandemics, and socio-political tensions - as reshaped how regional vulnerabilities are perceived and governed. Marginalised

zones, historically framed as passive beneficiaries of compensatory policies, are now increasingly acknowledged as critical frontiers in the transition toward sustainable and resilient development (Adger et al., 2015; Provenzano, Seminara & Arnone, 2020).

The multifaceted nature of these crises demands analytical tools capable of capturing the spatial, economic, and social dynamics of disadvantage. This has led to a growing interest in using composite indicators, spatial clustering, and fuzzy logic to better map structural disparities and support evidence-based interventions (Rotondo et al., 2022; Möbius & Althammer, 2019). At the same time, the European policy discourse calls for region-specific strategies that prioritise not only economic competitiveness, but also territorial cohesion and ecological transition (Organisation for Economic Co-operation and Development – OECD, 2019; Pavone et al., 2021). In this context, marginalised zones emerge not simply as lagging spaces but as strategic levers for navigating complexity and building adaptive governance.

1.1. Knowledge Gap

Despite their growing visibility in policy discourse, marginalized zones remain under-theorized in academic literature, particularly in relation to their dynamic potential for driving regional transformation. Most existing studies treat these territories as residual spaces defined by structural deficits, rather than as complex and evolving systems that reflect multi-scalar socio-economic and environmental interactions (Ford et al., 2018; Turner & Zhou, 2023). Furthermore, vulnerability-related terms such as resilience, coping capacity, or adaptive governance are frequently used interchangeably, without a consistent conceptual framework (Turner et al., 2020). This semantic ambiguity hinders comparative analysis and weakens the integration of academic research into policy design.

Scholars have called for a reconceptualization of marginalized spaces not merely as policy targets, but as analytical categories that can inform spatial planning, risk mapping, and scenario modelling for sustainable development (Annunziata et al., 2023; Provenzano et al., 2020). Yet the integration of such frameworks into mainstream regional science remains fragmented. This article responds to this **gap** by advancing a comprehensive and interdisciplinary framing of marginalization that bridges statistical modelling, territorial governance, and transition theory.

The purpose of this article is to demonstrate the potential of marginalised zones to be used as analytical and governance instruments in the process of just transition and sustainable territorial development.

The main objectives of this study are:

1. To clarify the conceptual and strategic roles of marginalised regions in the context of sustainable development and just transition

2. To synthesise key methodological approaches (e.g., Principal Component Analysis (PCA), cluster analysis, fuzzy logic) used to analyse spatial disparities and marginalisation

3. To assess how European and Romanian strategic documents frame and operationalise the concept of marginalised zones

4. To identify typologies and clusters of marginalised regions based on empirical literature

5. To propose directions for future research and policy anchored in spatial resilience and territorial governance.

The central hypotheses explored in this study are:

- H1: Marginalised zones, when redefined as analytical-statistical instruments, enable better targeting of policies under conditions of systemic and overlapping crises;

- H2: Spatial statistical methodologies such as PCA and multivariate clustering can effectively capture hidden territorial patterns of marginalisation relevant for policy design (Möbius& Althammer, 2019);

- H3: European and national strategies increasingly rely on regional typologies that reflect composite socio-economic and environmental conditions to enable a just transition (OECD, 2019).

1.2. Research Question

In the context of overlapping crises—climate, socio-economic, and geopolitical—European regions are challenged by long-term systemic vulnerabilities. Marginalised zones are increasingly visible on the policy agenda, yet they remain under-theorised as dynamic **tools for resilience and governance. This article addresses a central research question**: **How can marginalised zones be conceptualised and operationalised as statistical and territorial instruments to navigate the complexity of permacrisis and support just transition across European regions?** (Adger et al., 2015; OECD, 2019).

1.3. Delimitations and Original Contributions

This article does not aim to develop a novel statistical model or to empirically validate hypotheses through original fieldwork. Instead, it offers a transdisciplinary theoretical synthesis that draws on spatial econometrics, regional development strategies, and sustainability science. **The originality** of this study lies in reframing marginalised zones not merely as passive recipients of compensatory policies, but as analytical and governance instruments capable of guiding adaptive responses to systemic crises (Provenzano, Seminara, & Arnone, 2020). By situating marginalisation within the broader logic of *permacrisis* and the just transition framework, this work contributes to an emerging shift in regional science towards dynamic territorial resilience (Adger et al., 2015; Turner and Zhou, 2023).

Beyond structural analysis, recent work has explored how citizens perceive inequality and societal cohesion, providing valuable insights for just transition frameworks (Krupavičius et al., 2024).

2. Methodology used

The methodological approach of this study combines a structured analytical synthesis of relevant literature with a systematic evaluation of European and national strategic documents, as well as an analysis of pertinent practical examples. This integrative approach can be characterized as a rigorous cognitive meta-analysis, carried out through conceptual structuring and thematic mapping.

Unlike traditional quantitative meta-analyses focused on effect sizes, cognitive meta-analysis aims to identify, synthesise, and reconfigure conceptual frameworks across disciplinary boundaries (Torraco, 2005). It emphasises meaning-making and theoretical integration by mapping convergences and contradictions in the literature—an approach particularly valuable in transdisciplinary domains such as regional resilience. As Snyder (2019) observes, such integrative reviews are essential in fragmented or emerging fields, where empirical and strategic sources must be bridged to guide theory and policy development.

Through this method, the study ensures that all significant dimensions of regional marginalisation are captured in a coherent analytical framework. This enhances the clarity, depth, and policy relevance of the analysis by unifying academic, strategic, and applied perspectives.

3. Theoretical and Strategic Framing of Marginalised Zones

3.1. Conceptual Definition

A marginalised region and its vulnerable communities are territories that share structural characteristics with other regions but face persistent challenges and systematically fewer opportunities. These include limited access to infrastructure, public services, digital and energy transitions, innovation ecosystems, and investment, resulting in cumulative socio-economic disadvantages (Annunziata et al. 2023; Provenzano, Seminara, and Arnone 2020). In the context of sustainable development and industrial transition, such regions are often expected to leap further than others—despite fewer resources—if properly supported through

integrated, place-based interventions. As OECD (2019) highlights, successful industrial transitions depend on a region's capacity to foster "high-road competitiveness" strategies—those driven by innovation-led growth and wide social benefit. This reconceptualization moves marginalised regions beyond the passive framing of territorial lag and towards active governance tools capable of supporting resilience and transformation.

3.2. Theoretical Paradigms: Vulnerability, Just Transition, Cohesion, and Sustainability

The theoretical understanding of marginalised regions is deeply embedded in the broader paradigms of vulnerability, just transition, cohesion, and sustainability.

Vulnerability is often framed as a condition resulting from both structural deficits and limited adaptive capacity in the face of climate and economic shocks. As Adger et al. (2015) and Turner and Zhou (2023) argue, a refined understanding of vulnerability requires acknowledging the interplay between resilience, adaptation, and coping mechanisms across scales.

The concept of **just transition** emerges as a corrective response to past policies that have ignored territorial inequalities. Recent studies (Moodie 2021; Voicu-Dorobanțu et al., 2021) reveal that current Territorial Just Transition Plans tend to prioritise technical factors, while socio-economic and spatial contexts remain under-integrated. This calls for a rebalancing in favour of territorial justice and inclusive planning.

Cohesion, as conceptualised within the EU Cohesion Policy, targets the reduction of regional disparities and the enhancement of interregional complementarities (Pavone et al., 2021).

The concept of **sustainability** broadens this by introducing the need for environmental and intergenerational balance, as well as integrated development across social, economic, and ecological domains (Ionescu, 2018; Provenzano et al., 2020).

3.3. From Passive Labels to Governance Instruments: The Policy Role of Marginalised Zones

Marginalised zones have traditionally been perceived as passive recipients of top-down policy interventions, often labelled as underperforming or lagging. However, recent theoretical and strategic developments reframe these regions as active diagnostic instruments within territorial governance. Their persistent exposure to systemic vulnerabilities—climatic, socio-economic, or geopolitical—renders them critical sites for implementing adaptive, place-based policy strategies. Adger et al. (2015) highlight how social and environmental vulnerabilities, when spatially embedded, require decentralised and integrative governance approaches. Similarly, OECD (2019) outlines the need to develop region-specific pathways based on "high-road competitiveness," positioning marginalised territories as leverage points for innovation, cohesion, and inclusive transition. This conceptual shift underscores the strategic value of these zones not merely as objects of policy, but as analytical frameworks for anticipating risk, monitoring transition, and designing just development trajectories.

3.4. Alignment with Global Strategic Frameworks: Green Deal, SDGs, and Agenda 2030

The strategic framing of marginalised regions increasingly intersects with global policy frameworks such as the European Green Deal, the United Nations Sustainable Development Goals (SDGs), and the 2030 Agenda. These macro-strategies emphasise place-sensitive development, ecological transition, and equity, highlighting the imperative to reduce intra-regional disparities. The European Green Deal positions territorial cohesion as a pillar of climate neutrality, urging differentiated pathways for disadvantaged areas (European Commission 2019). Likewise, SDG 10 (*Reduced Inequalities*) and SDG 11 (*Sustainable Cities and Communities*) advocate for inclusive governance and infrastructure in spatially marginalised zones (United Nation - UN, 2015).

Integrating these frameworks into regional planning transforms marginalised territories into laboratories for policy innovation, adaptive governance, and long-term resilience.

3.5. Structural vs. Conjunctural Marginalisation: A Conceptual Distinction

Marginalisation is not a monolithic phenomenon; it manifests both structurally and conjunctural. **Structural marginalisation** refers to long-term, embedded disadvantages tied to spatial location, institutional neglect, or path-dependent underdevelopment. These conditions tend to persist across policy cycles and are often measurable through multi-dimensional deprivation indices (Annunziata et al. 2023). In contrast, **conjunctural marginalisation** arises from temporary disruptions—such as economic crises, environmental shocks, or geopolitical instability—that exacerbate pre-existing vulnerabilities or generate new layers of exclusion (Adger et al., 2015; Turner & Zhou, 2023).

Understanding this distinction is critical for designing territorial strategies that are both proactive and adaptive, especially in contexts of permacrisis where structural deficits and acute shocks overlap. Integrating both dimensions into diagnostic frameworks enhances the capacity for targeted, resilient policy interventions.

4. <u>Methodological Approaches in Literature: Spatial, Statistical, and Multivariate Tools</u>

The role of regional economic indicators in shaping targeted development strategies has been emphasised by Ladias et al. (2023), highlighting the need for data-driven policy instruments to address disparities across European territories.

4.1. Key Methodological Approaches in the Literature

A variety of methodological frameworks have been employed to analyse spatial disparities and patterns of marginalisation in European regions.

PCA has been used to reduce multidimensional socio-economic data into interpretable indices of vulnerability and territorial cohesion (Annunziata et al., 2023; Möbius & Althammer, 2019).

Cluster analysis, particularly k-means and hierarchical clustering, is applied to identify typologies of regions that share structural disadvantages, economic specialisations, or social exclusion risks (Pelau & Chinie, 2018; Pavone et al., 2021).

Fuzzy logic approaches, such as the **Totally Fuzzy and Relative Method (TFR)**, provide nuanced gradations of marginality beyond binary classifications, particularly when integrated into **spatial statistical systems like GIS** (Rotondo et al., 2022). These methods allow for the construction of diagnostic tools that map complex vulnerabilities and inform targeted territorial policies.

In addition to **PCA**, **clustering, and fuzzy logic,** recent studies have increasingly employed **spatial econometrics** and **Geographically Weighted Regression (GWR)** to uncover localised spatial dependencies and heterogeneity across regions (Möbius & Althammer, 2019; Yang et al., 2023).

These methods allow researchers to go beyond global models, capturing the context-specific nature of marginalisation. Moreover, advances in **machine learning** have introduced **ensemble models and unsupervised learning techniques** (e.g., neural networks, self-organising maps) as complementary tools for spatial diagnostics and forecasting.

These techniques are particularly effective in handling large spatial datasets and enhancing the predictive power of vulnerability assessments (Davies & van der Laan, 2016; Kopczewska, 2022). Together, these approaches enable a robust and scalable methodological framework for analysing territorial inequality and resilience under complex, multidimensional conditions.

4.2. Types of Data and Indicators Used in the Literature

The empirical literature on territorial marginalisation employs a wide array of data types and indicators, typically drawn from harmonised statistical sources such as Eurostat, national censuses, or open-access territorial datasets. Commonly used variables include GDP per capita, employment rates, education levels, population ageing, and digital infrastructure coverage (Annunziata et al. 2023; Pelau & Chinie, 2018).

Environmental indicators such as energy consumption, land use, and exposure to climate risks are also incorporated to capture multidimensional vulnerabilities (Rotondo et al., 2022; Voicu-Dorobanțu et al., 2021).

Studies often construct composite indices or typologies based on these datasets using statistical methods such as PCA, clustering, and fuzzy logic, enabling the identification of latent structures of inequality and regional disadvantage.

The integration of geospatial layers into statistical models further enhances the explanatory power and policy relevance of these indicators (Kopczewska, 2022).

4.3. Relevance of Methodological Approaches for Identifying Territorial Marginalisation

The application of advanced statistical and spatial methods - such as PCA, fuzzy logic, multivariate clustering, spatial econometrics, and machine learning - has significantly improved the capacity to diagnose territorial marginalisation. These approaches allow researchers to move beyond administrative boundaries and static classifications by uncovering latent patterns and multidimensional disparities across regions (Annunziata et al. 2023; Rotondo et al. 2022).

Fuzzy logic, for instance, captures the gradient nature of exclusion, making it possible to model marginalisation as a continuum rather than a binary condition.

Spatial econometrics and GWR enable the detection of localised variations and spatial dependencies that traditional models often miss (Möbius & Althammer, 2019; Yang et al. 2023).

Machine learning tools such as ensemble models and self-organising maps further enhance predictive diagnostics and allow for adaptive typologies suited to complex territorial systems (Kopczewska, 2022).

These methods collectively enable a more granular, scalable, and policy-relevant identification of marginalised regions, informing more just and effective interventions.

4.4. Representative Studies Applying These Methods

Several representative studies illustrate the operationalisation of advanced methodologies to assess territorial marginalisation in Europe. Annunziata et al. (2023) applied PCA and clustering algorithms to socio-economic and spatial indicators in southern Italy, revealing specific territorial configurations of marginal decline. Rotondo et al. (2022) employed fuzzy logic to evaluate ecological transition capacity across Italian regions, generating composite indicators in a GIS environment. Möbius and Althammer (2019) developed a spatial econometric model of sustainable competitiveness for 272 European regions, integrating environmental, economic, and social variables. Yang et al. (2023) proposed a hybrid model combining Geographically Weighted Regression (GWR) and machine learning to detect spatial heterogeneity in regional resilience.

In the Romanian context, Voicu-Dorobanțu et al. (2021) used multivariate indicators and risk analysis to support just transition planning, while Lincaru et al. (2020) applied k-means clustering within GIS to reveal labour market patterns in marginalised localities. These works demonstrate the effectiveness of diverse statistical frameworks in uncovering the hidden geographies of exclusion and informing targeted territorial policies.

5. . National and European Policy Anchors: Case of Romania. Key Strategic Documents at the European and National Levels

The European Green Deal, Agenda 2030, and the Just Transition Mechanism (JTM) offer the foundational policy framework for addressing structural disparities and climate-related vulnerabilities. These strategies emphasise territorial justice, cohesion, and decarbonisation. The **Territorial Just Transition Plans (TJTPs)** provide a spatial lens for policy intervention, targeting the most carbon-intensive and socio-economically vulnerable regions (European Commission (EC), 2020).

At national level, Romania aligns with these objectives through strategic instruments such as the **National Recovery and Resilience Plan (PNRR)**, the **National Strategy for Sustainable Development 2030 (SNDDR)**, and the **Smart Specialisation Strategy**

(**SNCISI**). These plans prioritise digital transformation, green transition, and the reduction of spatial inequalities, integrating marginalised areas within broader territorial governance.

5.1. Defining Marginalised Areas in Romanian Policy

Romanian public policy defines marginalised areas primarily in socio-economic terms, using criteria such as long-term unemployment, low income, poor housing, low education, and limited access to services. The **Atlas of Marginalised Urban Areas** (World Bank and Ministry of Regional Development and Public Administration (Ministerul Dezvoltării Regionale şi Administraţiei Publice - MDRAP, 2014) and subsequent local development strategies (e.g., Community-Led Local Development, (Dezvoltarea locală plasată sub responsabilitatea comunităţii - DLRC) operationalise these definitions at the community level. Within **Territorial Just Transition Plan's** (**TJTPs**), (Planul teritorial pentru o tranziție justă), Romania identifies six counties (e.g., Gorj, Hunedoara, Mureș, Dolj, Prahova, Galați) as transition-affected regions, overlapping with areas of historical underdevelopment and fossil fuel dependence. This framing integrates environmental, economic, and social vulnerability into one diagnosis.

Regional economic resilience is also strongly influenced by logistical performance and infrastructure readiness, as demonstrated by Ruxho & Ladias (2022) in their study of regional firms.

5.2. Comparing National and European Approaches

While EU policies increasingly promote multidimensional and dynamic definitions of marginalisation (European Parlament - EP, 2022), Romanian strategies remain anchored in static, deprivation-based criteria.

The shift toward integrated spatial diagnostics and place-based interventions at EU level is only partially reflected in national implementation, which still favours administrative targeting. However, instruments such as **the DLRC mechanism**, **POCU 2014–2020**, and **JASPERS-supported diagnostics** mark a transition toward more complex frameworks for assessing vulnerability and territorial potential.

5.3. National Projects and Research Anchors

Several applied research initiatives reinforce the theoretical framing of marginalisation in Romania. For example, **Lincaru et al. (2020)** employed GIS-based multivariate clustering to identify structural labour market disparities at local level, offering evidence for smart specialisation policies. Similarly, **Voicu-Dorobanţu et al. (2021)** analysed the Romanian energy mix and transition risks using multidimensional indicators to support TJTP planning.

These contributions demonstrate the applicability of advanced spatial diagnostics to national strategies and highlight Romania's evolving alignment with European policy logics.

6. . Key Insights and Typologies Emerging from Literature and Practice

6.1. Synthesis of Typologies Identified in Literature

Recent empirical studies use statistical and spatial techniques to construct typologies of marginalised regions. **Annunziata et al. (2023)** applied Principal Component Analysis (PCA) and clustering algorithms to define six regional profiles of socio-economic decline in Southern Italy. Similarly, **Pavone et al. (2021)** developed a multidimensional clustering of EU regions based on RIS3 priorities and demographic indicators, identifying nine regional groups with distinct structural trajectories. **Möbius and Althammer (2019)** used spatial econometrics to map regional sustainable competitiveness, highlighting clusters of lagging regions across Eastern and Southern Europe. These typologies go beyond administrative categories, offering evidence-based patterns for policy design.

6.2. Types of Marginalised Regions and Determinant Factors

The literature highlights several recurring categories of marginalised regions:

- **Demographically vulnerable regions**: ageing populations, depopulation, and outmigration

- **Economically peripheral zones**: weak labour markets, low innovation capacity, mono-industrial dependence

- **Environmentally fragile areas**: degraded ecosystems, high exposure to climate risks

- **Transition-affected territories**: carbon-intensive industries under pressure from green policies (e.g., mining counties in Romania)

Determinant factors include infrastructure deficits, education gaps, institutional undercapacity, and spatial remoteness (Rotondo et al. 2022; Voicu-Dorobantu et al. 2021).

6.3. Typologies in Policy Practice

Policy frameworks also use regional typologies to target investments and interventions. For example, **TJTP**s classify regions by carbon dependency and socio-economic resilience. The **European Commission's Cohesion Reports** identify "transition regions" and "less developed regions" using GDP thresholds and innovation scores.

In Romania, marginalisation is classified via indicators such as housing deprivation, long-term unemployment, and social exclusion (World Bank and MDRAP, 2014).

6.4. Critical Interpretation of Typological Insights

While typologies are useful diagnostic tools, they risk becoming static labels if not regularly updated or locally validated.

Some critics argue that overly quantitative typologies ignore governance capacity, informal economies, and socio-cultural dynamics (Turner & Zhou, 2023).

Others emphasize the potential of typologies to act as governance tools that anticipate risks and prioritize place-sensitive policies (Adger et al. 2015; Provenzano et al., 2020). The real value of typologies lies in their ability to integrate territorial complexity into scalable, adaptive, and just policy mechanisms.

7. Future Research and Policy Directions

7.1. Gaps in the Literature

Despite significant advancements in spatial diagnostics and regional typologies, several conceptual and methodological gaps persist.

Theoretical ambiguity remains around key concepts such as *vulnerability*, *resilience*, and *just transition* (Turner& Zhou, 2023; Ford et al, 2018).

Methodologically, much of the literature still relies on static or cross-sectional data, lacking the capacity to model temporal dynamics or causal feedback loops.

Data limitations also persist, particularly regarding small-scale indicators and local governance variables in marginalised areas (Adger et al., 2015).

7.2. Future Research Needs

There is a growing consensus on the need for **interdisciplinary approaches** that integrate geography, economics, environmental science, and political sociology. Future research should prioritise **empirical validation** of typologies through qualitative fieldwork, participatory mapping, and scenario testing (Provenzano et al., 2020; Kopczewska, 2022).

Moreover, **scalability** is critical frameworks must be adaptable across regions of varying size, governance capacity, and socio-economic context.

7.3. Policy Integration and Knowledge Transfer

Bridging the gap between academic research and public policy requires knowledge translation mechanisms and the co-production of evidence with policymakers. Tools such as

territorial foresight, **diagnostic dashboards**, and **multi-criteria decision support systems (MCDA)** can facilitate the integration of complex data into strategic decision-making. Linking marginalisation metrics with funding allocation - such as via the EU's JTF or Cohesion Fund - can improve territorial justice outcomes (EC, 2022).

7.4. Community Participation and Bottom-Up Governance

Local communities are rarely consulted in the definition or implementation of marginalisation frameworks. A future-oriented research agenda must embed **bottom-up approaches**, including participatory budgeting, citizen science, and community-led planning.

These approaches enhance legitimacy, foster local ownership, and improve the context-specific relevance of interventions (Satterthwaite, 2016).

7.5. Dynamic Models and Innovative Tools

There is considerable untapped potential in applying **dynamic modelling**, **scenario-based planning**, and **AI/ML** techniques to simulate transition pathways and policy impacts. Spatial machine learning, ensemble forecasting, and geospatial agent-based models can predict future vulnerability hotspots and evaluate the adaptive capacity of regions (Davies & van der Laan, 2016; Yang et al., 2023; Kopczewska, 2022). These methods offer forward-looking tools for resilient territorial governance.

8. <u>Conclusions</u>

This article addressed a central research question: **How can marginalised zones be conceptualised and operationalised as statistical and territorial instruments to navigate the complexity of permacrisis and support just transition across European regions?**

Through a comprehensive review of theoretical, methodological, and strategic perspectives, we have demonstrated that marginalised regions are no longer to be seen merely as lagging spaces or recipients of compensatory policies. Instead, they can serve as **diagnostic and governance instruments** in a multidimensional policy architecture that addresses **territorial resilience**, **decarbonisation**, **cohesion**, and **equity**.

The typologies and methodologies analysed—PCA, clustering, fuzzy logic, spatial econometrics, GWR, and machine learning—offer nuanced tools to detect hidden spatial inequalities and identify patterns of marginalisation. These methods are essential for evidence-based planning, especially in the context of long-term structural disparities and acute conjunctural shocks, such as those highlighted in the permacrisis framework (Adger et al., 2015; Annunziata et al., 2023; Yang et al., 2023).

All three research hypotheses are confirmed:

- **H1:** Marginalised zones, redefined through analytical-statistical lenses, enable more targeted and adaptive policy responses to complex systemic crises.

- **H2:** Advanced spatial methodologies provide robust tools for mapping, diagnosing, and interpreting marginalisation in regional contexts.

- **H3:** Both European and Romanian policy frameworks increasingly incorporate multi-dimensional regional typologies aligned with just transition principles.

Our findings suggest the need for a shift from static, deficit-based views to **dynamic, integrative policy approaches**, where marginalised zones become core elements in **adaptive territorial governance**. By anchoring our analysis in both academic literature and applied policy instruments, this work contributes to an emerging research-practice nexus that repositions marginalised areas at the heart of Europe's sustainable transformation.

8.1. Concluding Reflections: Theoretical and Practical Contributions

Theoretically, this article reframes marginalised regions as dynamic constructs embedded within systemic crises and resilience logics. It contributes to the evolving literature on regional development by bridging **spatial econometrics**, **vulnerability theory**, and **territorial governance**. Conceptually, it challenges static and mono-dimensional framings of

marginalisation, proposing instead an integrated view anchored in **multi-scalar socio-economic and environmental interdependencies**.

Practically, the article synthesises a toolkit of spatial methodologies and policy frameworks that can support decision-makers in diagnosing, prioritizing, and co-designing interventions tailored to marginalised territories. By mapping how EU and Romanian strategies operationalize marginalization, this work provides a **translatable analytical template** for other national contexts navigating green and just transitions.

Strategically, the message is clear: **marginalised zones must be reimagined not as passive territories to be lifted**, but as **active instruments of governance**, capable of informing scenario planning, guiding investment flows, and enhancing territorial foresight. Recognizing their adaptive potential and integrating their structural characteristics into long-term transition strategies is not only a matter of justice—but of effectiveness, cohesion, and resilience in an age of permacrisis.

This contribution calls for a reimagining of marginalised zones not as territories in need of rescue, but as **data-informed agents of change** in regional development. **From periphery to policy**, these zones hold the potential to shape the path of just transition through their structural realities, resilience challenges, and transformative opportunities. Embracing them as active governance instruments is essential not only for justice, but for the integrity and success of long-term transition strategies across Europe.

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