



Structural and transformative change as central challenges for regional development

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Abstract Investigating the dynamics of regional development is central to the broader literature on the geography of innovation. While the role of innovation in economic modernisation, industrial growth, and the restructuring of regions has long dominated the scientific discourse, increasing attention has recently been directed towards major societal challenges and the need for transformative change. However, integrative perspectives on how regions cope with the dual challenge posed by structural and transformative change remain scarce. Against this background, the contributions in this special issue provide new insights into how regional development, particularly in lagging and old industrial regions, unfolds, shaped by region-specific actor constellations, agency, and institutional settings. This editorial synthesises the articles and outlines future research directions.

Keywords Regional development · Transformative change · Innovation · Structural change · Innovation and structural policies

1 Introduction

Regional development is characterised by ongoing change and the realignment of economic activities, including technological, industrial, and sectoral shifts (MacKinnon et al. 2019; Martin et al. 2019). Among the factors shaping these structural

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changes, innovation stands out as a critical catalyst (Feldman and Kogler 2010), embedded within broader social, organisational, and institutional structures (Granovetter 1985; Maskell and Malmberg 1999). This insight is central to the systemic understanding of regional innovation activities, highlighting that relevant potentials and capabilities are shaped by the quality of actor networks, institutional arrangements, and localised learning processes (Asheim et al. 2011).

From an evolutionary perspective, which has served as a central pillar of geographical innovation research for the past two decades (Boschma and Frenken 2011; Essletzbichler and Rigby 2007), these region-specific preconditions largely determine future development paths. It is well documented that innovation activities typically build on existing and related (technological) capabilities, leading to path-dependent regional development. However, one-sided specialisation can result in institutional, functional, or political lock-ins (Grabher 1993). The inertia accompanying such lock-ins often manifests in the decline of regions that were once highly successful. On the other hand, region-specific assets may provide a basis for economic renewal, contingent upon absorptive capacities, recombinant effects, and agency (Grillitsch and Sotarauta 2020; MacKinnon et al. 2019; Steen 2016).

Given the emergence of grand societal challenges such as climate change, scholarly debates increasingly emphasise the need for regions to chart new pathways and implement transformative change (Grillitsch et al. 2025; Hansmeier and Kroll 2024). Transformative change is a radical new paradigm of development that extends beyond structural change in the economy (Baumgartinger-Seiringer et al. 2021). The premise is that systemic transformations in production and consumption, rather than incremental adaptations, are imperative to address these challenges. Accordingly, there is growing interest in green and transformative regional development (Chlebna et al. 2022; Grillitsch and Hansen 2019; Hansmeier and Losacker 2024; Tödting et al. 2020), the challenge orientation of regional innovation systems (Isaksen et al. 2022; Tripl et al. 2024), and the evolving role of (regional) innovation policy (Bours et al. 2022; Grillitsch et al. 2025; Santos et al. 2023).

Alongside efforts to address systemic failures, policy approaches also increasingly seek to foster transformative change (Schot and Steinmueller 2018). Political concerns now extend beyond merely steering change to also addressing spatial disparities, as reflected in concepts such as left-behind, lagging, or trapped regions (Benner et al. 2024; Jolly et al. 2023; MacKinnon et al. 2022; Rodríguez-Pose and Bartalucci 2023). Despite the multi-scalar nature of transformative change, there is consensus that regional development is a context-specific and interdependent process, resulting from changing conditions and potentials (Chlebna et al. 2022; Tripl et al. 2020).

While the implications of sustainability requirements and related efforts for regional development have attracted increased interest, e.g., the recent special issue by Benner et al. (2024), integrative perspectives linking structural and transformative change remain rare in the geographical innovation literature. Specifically, little attention has been paid to the extent to which structurally lagging regions, characterised by demographic, institutional, and socio-economic weaknesses, cope with the additional challenges posed by transformative change.

This special issue brings together various contributions on regional structural and transformative change. The studies help advance our understanding of overlapping dynamics of economic restructuring and sustainable development in (lagging) regions (Hansmeier et al. 2025; Chlebna and Suitner 2025); the role of agents of change, with a particular focus on established cluster actors (König and Brenner 2025; Gangaliuc et al. 2025); and power relations and collaboration among actors in local sustainable development (Hernández et al. 2025). Emphasising stability and change, specifically path dependencies versus new path creation, these studies further offer broader recommendations for regional innovation policies aimed at addressing diverse challenges and reducing regional disparities.

2 Summary of contributions

Chlebna and Suitner (2025), in their article “The transition-development nexus: Disentangling growth and transformation agendas in regional sustainability transitions,” develop a starting point from a holistic perspective for a research agenda that enables the analysis of regional strategies at the interface of transition and regional development. Their aim is to contribute to a better understanding of the motivations, structures, and processes underlying regional development and sustainability transitions, and to integrate debates on transition and development.

The article’s theoretical focus includes reflections on regional development (e.g., the growth and competition paradigm, changes in regional sectoral structures, cluster development, and regional policy) and on transition studies (including the socio-technical systems perspective, actors, networks, and institutions). The authors show that in both theoretical fields, the political dimension and important social-ecological principles are increasingly recognised and incorporated. Empirically, the paper draws on two case studies of energy-transition processes: one from Magdeburg, Germany (wind industry), and one from Murau, Austria (wood biomass for energy production).

The transition-development nexus consists of four conceptual stages, each with an associated research objective and guiding questions: (1) Regional agenda-setting: in-depth empirical investigation of a region’s development agenda in relation to its transition agenda; (2) Nexus formation: the integration of development and transition agendas in regional practice; (3) Transition-development outcomes: the paper distinguishes between an unjust and unsustainable regional growth trajectory, an optimised or green regional growth trajectory, and transformative regional development; (4) Beyond outcomes: consideration of how transitions diffuse to different places and sectors.

Hansmeier et al. (2025), in “Lagging regions between economic restructuring and addressing societal challenges,” examine the dual challenge facing lagging regions: the need to restructure their economic and innovation systems while simultaneously addressing major societal challenges such as climate change. The paper empirically assesses opportunities and obstacles for innovation-induced change in economically weak regions.

Drawing on the literature of regional innovation systems and evolutionary economic geography, the article outlines key concepts such as structural laggardness,

peripheral and left-behind regions, innovation as a driver of change, and re-orientation versus transformation. Using qualitative case studies of ten German regions, each receiving federal funding under the “WIR!—Change through Innovation in the Region” programme, the research investigates how these regions pursue both incremental structural re-orientation and broader transformative renewal. The empirical investigation comprises thirty-seven semi-structured interviews across the ten lagging regions.

The study’s findings highlight several key patterns regarding innovation initiatives in lagging regions. Although technological innovation remains prominent, many regions place strong emphasis on non-technological innovations such as new organisational structures, business models, and social innovations. These are crucial in contexts where traditional R&D capacities are limited, and local actor collaboration is scarce. While a range of stakeholders participate, effective innovation often depends on just a few actors. Weak and loosely connected networks lead to reliance on external expertise to compensate for inherent regional limitations. Rather than producing comprehensive or disruptive shifts in economic structures, activities tend to foster incremental improvements. Regional re-orientation is observed as path upgrading rather than system-wide transformation. Despite generating local employment, increased income, and improved visibility, these efforts appear insufficient to drive an overall transformation of the region’s economic base. This is largely due to pre-existing fragmentation, lack of a critical mass of innovative activity, and constraints from the political funding framework that limit broader applicability.

Two further articles address clusters and cluster organisations in the context of transformative regional development. The article “Decline or renewal? Factors influencing the evolution of mature industrial clusters” by König and Brenner (2025) sheds light not only on factors influencing cluster transformation but also on the triggers and self-reinforcing processes that drive cluster evolution.

According to the authors, literature shows that clusters are prone to negative developments and that economic advantages are not permanent. However, these developments are not inevitable, and a cluster can transform or renew itself. Transformation refers to shifting toward a new field of activity, while renewal marks the beginning of a new phase of growth through innovation and diversification. Clusters share determinants of resilience, such as industrial structure, human capital, policy and support structures, and geographic location. The authors argue that clusters with higher resilience are more likely to renew themselves. The study is based on a descriptive meta-analysis of sixty-nine empirical case studies reported in eighty-six publications, identified through keyword searches in Web of Science and citation tracking in Google Scholar. Thirty-eight potential factors for cluster decline, renewal, or renewal of a declining cluster were identified and differentiated among pre-conditions, triggering events, and self-reinforcing processes.

The findings show that most industrial clusters declined after reaching maturity ($n = 33$ of 69), 15 clusters renewed themselves, and 21 experienced both decline and subsequent renewal. In renewal processes, universities and research institutes emerged as the most relevant actors for revitalisation. Triggering events included industry restructuring, historical events, and external market changes. Self-reinforcing processes arose from interactions with policy stakeholders, firm formation, network

interactions, innovation activities, internal knowledge transfer, engagement with educational institutions, and cooperative activities. With regard to cluster decline, unfavourable conditions were identified at the sectoral or market level.

The article “Revisiting Cluster Organizations as Drivers of Public-Private Cooperation in Central and Eastern Europe” by Gangaliuc et al. (2025) investigates the role of cluster organisations (COs) in fostering cooperation between industry and research organisations (ROs) in Central and Eastern Europe (CEE). The main objective is to understand the conditions that facilitate or hinder public-private collaboration in innovation and R&D, and to evaluate COs as intermediaries bridging industry-driven innovation demand and research knowledge supply.

The paper draws on three theoretical strands: regional innovation systems, public-private cooperation, and cluster organisations as intermediaries. Influencing conditions are grouped into structural factors (e.g., funding, human resources, proximity, R&D capacity), socio-behavioral factors (e.g., trust, communication, reputation, personnel exchange), and power dynamics (e.g., organisational differences, collaboration costs, misaligned goals). Empirically, the study uses fuzzy-set Qualitative Comparative Analysis (fsQCA). Thirty-seven COs from Poland, Hungary, the Czech Republic, and Slovakia were surveyed between 2022–2023; only clusters with at least five years of operation and RO membership were included. CO managers were interviewed face-to-face, assessing fifteen hindering or facilitating factors on a Likert scale. Two scenarios were tested: Scenario A (industry initiates $\geq 50\%$ of cooperation) and Scenario B (industry initiates $\geq 67\%$). For Scenario A, facilitating structural factors included finance, human resources, and location; socio-behavioural factors included trust, communication, reputation, and exchange; hindering factors related to organisational differences, administrative structures, and collaboration costs. Mixed effects comprised R&D constraints and cross-sector differences, varying by industry. Scenario B revealed that socio-behavioural factors such as trust, communication, and exchange are important in early stages of collaboration but become less prominent as institutionalisation occurs. Additionally, structural factors such as finance, facilities, and location remained significant motivators.

The fifth paper in this special issue relates to the multiple-helix approach. In “Exploring a Multiple-Helix Approach to Local Development,” Hernández et al. (2025) develop and explore a “multiple-helix” analytical approach for local sustainable development. Moving beyond traditional fixed frameworks such as the triple, quadruple, or quintuple helix models, the study argues that a flexible, variable, and locally adaptable approach is better suited to capture the dynamic interactions among diverse stakeholders in rural and coastal areas. The objective is to propose a model that integrates both the spatial and cultural uniqueness of local contexts with the collaborative potential of various sectors—including public authorities, private enterprises, academia, civil society, environmental advocacy groups, and informal social agents—thus fostering innovation and transformative change.

The article synthesises literature from economic geography, knowledge creation, and organizational learning to illustrate that local development depends on more than a fixed triad of actors. It highlights that spatial proximity, trust, and culturally embedded networks are vital for effective knowledge exchange and innovation. By integrating additional spheres, such as civil society, environmental organisations,

and social entrepreneurs, the proposed model emphasises co-creation, continuous learning, and place-based leadership, addressing limitations of earlier helix models in capturing power dynamics and the variable nature of stakeholder interactions.

Empirically, the study relies on the EU Interreg North Sea project SIRR (Sustainability, Innovation and Resilience in Rural Areas). The research design is primarily qualitative with supporting quantitative elements. Data were collected through a survey administered to hub management teams and semi-structured interviews with nine hub leaders. These hubs, located in diverse regions across France, Germany, Denmark, and Sweden, act as intermediary platforms linking various sectors.

The findings reveal that while all hubs aim to promote more resilient and sustainable local development, there is considerable variation in stakeholder composition and operational maturity. In established hubs, traditional actors such as local government and small- to medium-sized enterprises prevail, with well-developed networks often including academic and research institutions. In contrast, newer hubs often rely more on civic groups and environmental advocates, though they frequently lack deeper integration of knowledge institutions. The survey and interview data indicate that a flexible multiple-helix arrangement allows stakeholders to adopt varied roles, acting as facilitators, innovators, or policy-shapers, and emphasises the mutual benefits of knowledge co-creation. However, persistent barriers include resource constraints, ambiguous power dynamics, and challenges in consistently engaging traditional actors such as academia.

3 Implications for further research

The articles in this special issue cover a broad spectrum of topics related to regional development and transformation processes, the contribution of clusters to transformative processes, and strategic approaches to local sustainable development.

A key overarching research question arising from the five articles is what implications follow from the tension between regional development and transformation for individual regions, organisations, and policy. Fundamentally, regional structural policy has a balancing function; it aims to ensure comparable living and economic conditions within a country or even in broader contexts (e.g., EU cohesion policy) (Maucorps et al. 2022). If transformation is understood not only as a new development path (Baumgartinger-Seiringer et al. 2021), but as a radical new development paradigm, then new spatial and economic configurations are conceivable that could fundamentally challenge existing structures. This is possible both at the technological level and with regard to changed social and economic objectives (e.g., sustainable economic practices, changes in the structure of driving forces, or innovation and product preferences). This does not necessarily entail regional balance; it is also conceivable that regional disparities could increase. Such transformations may result from shifts in global priorities and competitive conditions, requiring different uses and distributions of resources (financial, human capital, infrastructure, research, etc.).

This raises a set of fundamental research questions, which offer a range of promising avenues for future investigation:

RQ 1 What development opportunities do structurally weak regions currently have within national and global processes of transformation?

According to Hansmeier et al. (2025), further research should focus on the heterogeneity of lagging regions and their stakeholder structures, as well as on analysing the links between laggardness, institutional framework conditions, and opportunities for path renewal. In this context, it is necessary to understand the roles of actors, stakeholders, and multi-interest collaborations in order to better assess the potential for transformative pathways of change in regional development. Hernández et al. (2025) also highlight significant research needs in this area.

RQ 2 Do such regions have realistic prospects of participating in broader economic development, or can national competitiveness only be secured and enhanced by concentrating resources on leading regional growth poles?

The contributions by König and Brenner (2025) and Gangaliuc et al. (2025) show that clusters can strengthen economic development. Clusters serve as network nodes connecting regional economies to national and international cooperation and value creation networks. The role clusters play depends on specific preconditions, triggering events, and self-reinforcing processes. This applies to both economically strong and lagging regions. For lagging regions, there is still considerable research needed into the impact of these influencing factors. There is also a need to better understand the dynamics by which cluster organisations act as agents of change and can initiate transformative and structural changes.

RQ 3 How can public policy contribute to improving these opportunities?

The articles in this special issue call for a better balance between innovation and structural policies. The paradigms of regional balance and innovation-based regional growth generally lead to structurally weak regions being disadvantaged (Hansmeier et al. 2025). It is therefore necessary to compensate for systemic failures through political intervention. Further studies could assess how this balance between structural and innovation policies can be achieved. With regard to transformative developments, Chlebna and Suitner (2025) identify a need for research to better understand the similarities and differences between traditional development and transition agendas.

RQ 4 Is it possible to formulate region-specific transformation pathways that safeguard existing living standards without requiring national industrial, innovation, and competition policies to focus primarily on these lagging regions?

One approach is to strengthen regional endogenous capacities, although exogenous influences cannot be ruled out. Chlebna and Suitner (2025) show how regional growth and transformation agendas can be analytically disentangled and what opportunities exist for structurally weak regions to formulate region-specific pathways. However, further case studies are required to explore the transition-development nexus to better understand both sectoral and regional specificities.

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