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The transition development nexus. disentangling growth and transformation agendas in regional sustainability transitions

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Abstract The sustainable transformation of socio-technical infrastructure systems such as energy or mobility has become a dominant theme in regional development policy. Regional sustainability transitions enable the integration of local development goals associated with structural change with ubiquitous 'global challenges' such as combating climate change. Energy transition, for example, is particularly known for conveniently promoting both sustainable development and (green) growth at the same time. This entanglement blurs economic and social-ecological objectives, begging the question, how transformative alleged regional sustainability transitions really are in practice. In this paper, we conceptualize the 'transition development nexus' as a differentiated research perspective to disentangle the often taken-for-granted combination of regional transition agendas and regional growth agendas. We glimpse at exemplary energy transition efforts in rural regions of Austria and Germany, where this combination noticeably appears, and infer a set of questions that we consider key for a differentiated research agenda on transformative regional development.

Keywords Transition-development nexus · Regional sustainability transition · Regional development · Transformative change

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Zusammenfassung Die nachhaltige Transformation soziotechnischer Infrastruktursysteme wie Energie oder Mobilität ist zu einem beherrschenden Thema der regionalen Entwicklungspolitik geworden. Regionale Nachhaltigkeitstransformationen ermöglichen die Integration von lokalen Entwicklungszielen, die mit dem Strukturwandel verbunden sind, mit allgegenwärtigen „globalen Herausforderungen“ wie der Bekämpfung des Klimawandels. Beispielsweise die Energiewende scheint praktischerweise gleichzeitig nachhaltige Entwicklung und (grünes) Wachstum zu befördern. Diese Verflechtung vermengt wirtschaftliche und sozial-ökologische Ziele und wirft die Frage auf, wie transformativ vermeintliche regionale Nachhaltigkeitstransformationen in der Praxis wirklich sind. In diesem Beitrag konzeptualisieren wir den „Transitions-Entwicklungs Nexus“ als eine differenzierte Perspektive, um die oft selbstverständliche Kombination von regionalen Transformationsagenden und regionalen Wachstumsagenden zu entflechten. Wir werfen einen Blick auf beispielhafte Energiewendebemühungen in ländlichen Regionen Österreichs und Deutschlands, in denen diese Kombination deutlich zu Tage tritt, und leiten daraus eine Reihe von Fragen ab, die wir für eine differenzierte Forschungsperspektive auf eine transformative Regionalentwicklung für entscheidend halten.

Highlights

- We establish the concept of the transition development nexus.
- We distinguish a techno-economic regional development perspective from a wider regional transition perspective.
- We suggest key research avenues based on this nexus.

1 Introduction: transition and development—entangled, but not the same

Regional development agendas have increasingly taken up a focus on sustainability transition in response to ‘grand societal challenges’ (Coenen et al. 2015), especially with reference to climate change. This seems only logical. Such challenges pose specific regional problems and responses in dealing with them must be developed from within path-dependent contexts. Yet, this pairing often goes hand in hand with a ‘green growth’ agenda that naturally links ecological sustainability with economic opportunity (Capasso et al. 2019), and policy on the national and the international level has encouraged this (UNEP 2011).

This liaison becomes particularly apparent in the context of regional transition efforts and for peripheral and structurally weak areas this is perfectly understandable. Opportunities to renew the regional industrial base are not plenty and engaging with apparent ‘clean’ or ‘green’ sectors either by hosting the respective industries or by encouraging their build-out can offer important development impulses to a region (Tödtling and Trippl 2018; Grillitsch and Hansen 2019). On the face of it, this is of course positive and certainly contributes to setting up the region for future economic gains. There is need for build-out in most ‘green’ sectors and the associated industries will likely be of importance well into the future. A regional ‘sustainability’ transition may be reasonably expected to go well beyond the mere renewal

of regional industries and address systemic root causes of unsustainable development, beyond technological change also spanning across the actors and institutions involved (Markard et al. 2012). We do, however, observe a worrying tendency to take up 'sustainability' as another buzzword that allows to change little and continue business much as usual in regional development research and practice[1]. Yet, given the severity of the impacts of climate change, both practices and the respective research agendas need to change more fundamentally to mitigate further negative trends and to adapt to the outcomes we may reasonably expect in our communities and regions in the near future (Ripple et al. 2023).

The above does not only apply to practitioners such as planners in regions. A similar tendency is also discernible amongst our own community of scholars. There exist plenty of records of so-called green development that offer up little discussion of what exactly is meant by 'green' and which amount to a reiteration of known and established theory to a case of (more) environmentally friendly technology[2]. Of course such case studies are useful exercises and constitute a relevant part of the canon of expertise on "transitioning to (more) sustainable provisioning systems" (Chlebna et al. 2024a) but whole-system perspectives, that recognise long-term effects beyond individual regions are essential in this context (Liu et al. 2019; Chlebna et al. 2023). Neither of us are immune to this and so we can each point to recent work of our own, where this concern can be raised. For example, Chlebna and Mattes (2020) explore wind energy development in Oldenburg in Lower Saxony in Germany. The core argument concerns the fragility of regional energy transition at each stage. We do point to the role of actors and institutions beyond technological path development but arguably the quiet entanglement between regional economic development and the wider transition process occurs. Suitner and Ecker (2020), in a similar vein, scrutinise how energy transition pathways are being created in peripheral regions of Austria—despite detrimental conditions for endogenous development and comprehensive infrastructure makeovers. In our study, we engage with the political dimension of regional path development in peripheral contexts, explaining how the skilful combination of agentic and discursive resources enables institutional and structural change in regional energy systems. While we do point out that energy transition is discursively framed as an opportunity for economic development and growth in all our case study regions, we do not critically reflect on and question this aspect.

In retrospect, these empirical findings indicate to us that 'transition'—often self-evidently—is interpreted as a leitmotif of regional development strategies with growth aspirations, which are at best inscribed with weak sustainability (cf. 'almost BAU' in Bina 2013). This also reflects similar findings on 'sustainability' for the building sector in the United Kingdom by Gibbs and O'Neill (2015) as well as for the regional take-up of EU policy for the bioeconomy by Albrecht et al. (2021). Neither transition nor regional development have unique definitions and can

[1] The phenomenon is also observable at the national and international levels. We here focus on the regional level as it particularly manifests itself there in regional development policy, strategies and practice.

[2] Rather than enumerating references here, we leave it to the readers' reflection whether this may apply to their own work.

be widely interpreted to meet many objectives. This paper offers a starting point for a research agenda around what we refer to as the 'transition development nexus'[3], a holistic perspective that allows to analyse regional strategies at the interface of 'transition' and 'development'. It is aimed at scholars who identify with the lively subfield of a 'geography of sustainability transitions' and are interested in regions as level of observation. This subfield has recently emerged and is populated by contributions stemming from Local and Regional Development, Sustainability Transitions, Economic Geography, Spatial Planning, and other related fields. Our contribution may serve as a starting point for those who seek to disentangle 'transition' and 'development' in their work to discern motifs and interests of transition engagement, to critically reflect on growth agendas and 'transition washing', and to engage with paths towards transformative regional development.

We begin our paper with a brief discussion of both transition and regional development, ending with a critical note on the common interpretation of regional development as regional growth (Chap. 2). Chap. 3 explains where our insights stem from and the methods used to investigate the respective case studies. We then present two short empirical vignettes of regional transition processes in peripheral regions of Austria and Germany (Chap. 4). Based on these theoretical and empirical considerations, we sketch out an illustrative framework that outlines the relation between the sustainability transition and the regional development agendas and suggest key research avenues around their entanglement (Chap. 5). Finally, we discuss the limitations of our contribution and resulting scope for further research and conclude in Chap. 6.

2 Literature review

Both 'regional development' and 'transition' are not uniquely defined in the literature. This serves their rather broad use for different contexts and agendas. We hence briefly discuss each term in the following sections.

2.1 Regional development

We interpret 'region' as a spatial unit that can be distinguished from other regions by their internal functional coherence, specific structural characteristics, and their respective change over time (Cresswell 2013; Henning 2021). The latter is commonly referred to as regional development, although the term 'development' has undergone various interpretations over the years in the disciplines of geography[4] and planning (Pike et al. 2016). Most commonly, a relatively narrow interpretation that focuses on the firms and industries within regions is applied under the 'regional development' headline. A well-known example may be debates in the German context

[3] In line with the Cambridge Dictionary (2024), the term nexus here signifies 'an important connection of a group of things' or, as in Merriam-Webster.com Dictionary (2024), a 'causal link between entities'.

[4] We won't to enter this debate in depth in this paper but for a historic overview of the use of the term 'development' in geography, please refer to Willis (2014).

of '*Strukturwandel*' (Koschatzky and Kroll 2019), which refer to socio-economic change in regions that are considered structurally weak and peripheral and describe the changes that come along with declining (heavy) industries and the varied effects this has on respective places, regions and people (Hassink 2010; Görmar 2023). Such regional restructuring may be interpreted strictly analytically when it comes to observing and describing regional economic change processes and analysing respective drivers and hinderers. This will be mainly in the hands of public sector observatories or institutes, and often dominated by descriptive, quantitative methods (e.g. BMWK 2024). A change in the sectoral structure of a region, and associated population changes may be examples (e.g. Dispan et al. 2023). On the other hand, it may be interpreted in more strategic and fundamentally normative terms when it comes to discussing potential interventions to encourage the growth of regional industries, or indeed, to encourage sustainable development of a region. Here, development conveys the idea that regional changes can be deliberately initiated and moved in desired directions through targeted intervention ('regional strategy'—e.g. Faller 2014).

Most regional development concepts remain characterised by the prevalence of a growth and competition paradigm. Prominent examples include ideas surrounding the development of 'clusters', which are directed at the growth of local firm agglomerations and not only point towards but also laud competition between places to attract workers, in particular the so-called 'creative class' due to their impact on innovation dynamics, as a productive force (Porter 1998, 2000; Malecki 2004). The literature on path creation, although stemming from a more evolutionary background, also implicitly carries with it a trust in apparently self-evident benefits of regional industrial growth (MacKinnon et al. 2019). Smart specialisation strategies have become very popular with policy makers, in essence suggesting to build on already existing regional industrial strengths to stimulate or sustain economic growth (Foray et al. 2009, Rakhmatullin and Brennan 2015). In the context of sustainable regional development, the popular notion of 'ecological modernisation' (sustainable development achieved through primarily technological innovation and economic growth) allows for these dominant concepts not to be fundamentally challenged as illustrated by Gibbs (2000).

Regional policy has therefore often become synonymous of a techno-economic claim of initiating those changes that would spur private investment, job creation, firm allocation, or innovation activity and 'trickle down' to less competitive sectors, citizens, and society. The shortcomings of this approach have been discussed widely, e.g. that added value doesn't trickle down sufficiently, that only few regions benefit from a competitiveness paradigm because they can use existing advantages to secure their supremacy and structurally disadvantaged regions are thus left even further behind, and that the political focus is placed on techno-economic productivity and efficiency as an evaluation criterion for successful development policy, but not on the equally important social and ecological sustainability of development and change (Pike et al. 2007; Schulz and Bailey 2014; Donald and Gray 2019; Bärnthaler 2024). Recent contributions empirically investigate claims of 'green growth' and associated material decoupling and assert that progress in high-income countries is insufficient

to affect carbon emissions and that more fundamental measures that tackle systemic properties are needed (Hickel and Kallis 2020; Vogel and Hickel 2023).

2.2 Regional sustainability transition

The research field of Transition Studies deals with the complex societal change processes that come along with transitions from one socio-technical configuration to another. The term transition is defined as "a change or shift from one state, subject, place, etc. to another" or "a period or phase in which such a change or shift is happening" (Merriam-Webster.com Dictionary 2024). 'Transformation' is commonly used synonymously, despite differences of meaning (Child and Breyer 2017; Hölscher et al. 2018). In the context of Transition Studies, scholars have propagated the use of 'socio-technical systems perspectives' whereby they consider a wide range of actors, networks, and institutions as associated with processes of technological innovation and therefore also with processes of transition (Geels 2004). Systems are focused on the fulfilment of different human needs such as food, energy or mobility and undergo long-running change processes (i.e. 'transitions'). Becker et al. (2016) emphasise the role and relevance of the local level and of cities and communities as the place where the success or failure of such wide-reaching processes is decided. These are the places where nation- and countywide decisions are put into practice and where negotiations over collective needs and future visions, and the conflicts they bring along, emerge (cf. Chlebna and Mattes 2024). Recently, perspectives of transformative innovation (Loorbach et al. 2020; Haddad et al. 2022) and transformative local and regional development (Chlebna et al. 2023; Suitner et al. 2024) have taken hold, which encourage views that go beyond technological innovation and address more systemic, root causes of unsustainable development as well as recognizing transregional effects.

In Transition Studies, too, a more analytical examination of the process of (regional) transformation towards sustainable infrastructure and explanations based on specific influencing factors can be distinguished from a more normative perspective on (regional) transitions (Wittmayer and Hölscher 2017). The former attempts to gain a deeper understanding of system components and their spatially and temporally varying composition. Analysing and explaining processes is in the foreground. The most commonly applied frameworks are the multi-level perspective (MLP) (Kemp et al. 1998; Rip and Kemp 1998; Geels 2002) and technological innovation systems (TIS) (Carlsson and Stankiewicz 1991; Hekkert et al. 2007; Bergek et al. 2008). Both frameworks are rooted in innovation studies, again putting the process of the emergence and development of industries centre stage. Despite undoubtedly being part of the canon of research on 'sustainability transitions', both are relatively agnostic about the (environmental) 'sustainability' of eventual outcomes (Andersson et al. 2024).

From this common root, more normative perspectives around strategic niche management (SNM) (Kemp et al. 1998; Caniëls and Romijn 2008) and transition management (TM) (Rotmans et al. 2001; Loorbach 2010) have emerged, which foreground opportunities for intervention and take a clearer stand as to the 'direction' of innovation, building on prescriptive theories of sustainable development

and responsible innovation. This normative stance becomes most articulate in recent debates on mission oriented innovation and directionality (Mazzucato 2018; Hekkert et al. 2020; Pfotenhauer et al. 2023). Another stream within this more normative transitions perspective emphasizes the political character of transitions, critically questioning, among other things, the dominant framings of 'sustainability' (Haarstad 2017; Andersson et al. 2024) and the influence of power and (in)justice on transitions (Avelino 2017, 2021; Arora and Stirling 2023). It takes a stand, for example by calling for 'just transitions' (Swilling 2020) or by taking an interventionist or even activist approach and becoming an agent of change itself (WBGU 2011; Wittmayer and Hölscher 2017).

To sum up, transition and development are two key debates in current regional discourse, each of which allows for an analytical and a normative reading. We are particularly interested in the practical interpretation of both debates and how they are being integrated. In the rest of this paper, we briefly share observations on this practical integration in two recent examples and then build an illustrative framework based on key aspects.

3 Methodology and case rationale

As the above already indicated, we draw on two recent examples from our own work to show the practical integration of regional development and regional transition agendas. We have been engaged in two sizable projects around regional transitions in Germany and Austria that, while aiming at different research objectives and following slightly different procedures, encountered similar phenomena and storylines that pointed to the transition development nexus. Although regional energy transitions were the subject of much scholarly attention including the two projects here, the conclusions drawn will often apply to regional sustainability transitions in general.

We do not intend to present comprehensive, systematic case studies and elaborate in detail on the events entailing change in the respective regional energy systems. Rather, we offer two empirical vignettes from Magdeburg, Germany, and Murau, Austria, to illustrate our notion of the deep entanglement of regional transition and development agendas. The REENEA project (2018–2024) on regional energy transition in Germany, examined wind energy development in six German regions with an emphasis on exploring the involved social dynamics around wind energy deployment (Chlebna et al. 2024b). PLAISIR (2017–2019) analysed energy transition in three peripheral Austrian regions, focusing especially on the role that social innovation played for sparking regional sustainability transitions under challenging conditions (Suitner et al. 2022). Both projects were designed as multi-case studies of energy transition processes in different regions of Germany and Austria respectively. They built on overviews of the respective regions' structural conditions to contextualize the study of energy system change in each region's characteristics, and involved thorough analyses of the material, institutional, and agentic constituents of the respective regional energy system. Conducting semi-structured interviews with stakeholders that had been involved in these regional transition processes, both projects

aimed to reconstruct what spurred the sustainable transformation of energy infrastructures under different region-specific conditions (Suitner and Ecker 2020; Rohe and Chlebna 2021; Löhr et al. 2022; Suitner et al. 2022).

The Magdeburg case was analysed in the context of a wider study on the development of the wind energy industry in six different regions in Germany. Magdeburg was considered an interesting case as it had become a manufacturing site for a wind energy company early-on in the development of the wind energy industry in Germany. The site in the former German Democratic Republic was kept at arms' length, whilst higher added value activities remained in the company headquarters in Eastern Frisia in North West Germany (see Rohe and Mattes 2021). The area did also experience significant build-out of wind energy, mostly because agricultural land was available and due to pragmatic attitudes of landowners. Semi-structured interviews were carried out with a broad range of stakeholders in and around the wind energy industry in the region. This included public as well as private sector experts (local and regional authorities, companies including the sub-structures of suppliers around the main wind energy company, civil society actors including trade union reps). Questions focused on regional factors that helped or hindered both the industry development as well as the wind build out in the region, with a particular interest for non-technological factors. Interviews lasted around one hour and were carried out at a site chosen by the interviewee. They were recorded with permission and later transcribed by research assistants. Coding was done by the researchers of the project, in the first instance with a common code frame for the project and later with additional layers for specific interests (see Chlebna and Mattes 2024 for further detail of this process).

The Murau region in Austria was analysed as one of three case studies within a research project on social innovation dynamics in energy transition in peripheral regions of Austria. Murau was considered a suitable case due to its peripheral location at an inner Alpine valley in Styria and its well-documented history of transformation from old industrial region to endogenously developed wood industry that had been at the verge of substantiating a bioeconomy around the use of wooden biomass for regional energy transition (Späth and Rohracher 2010; Suitner and Ecker 2020). The research project followed a mixed methods approach. It first analysed each case study region in terms of quantifiable structural characteristics (mainly regional socio-economic development indicators and data on respective regional energy system components) that would help understand its current trajectory, conducted thorough analyses of both the regional development and regional energy transition policy field by looking into instruments and strategic discourse, and combined these layers of analysis with an innovation biography approach to grasp the social innovation dynamics in energy in the respective regions (Suitner and Ecker 2020; Suitner et al. 2022). In Murau, in-depth interviews with regional managers and representatives of regional energy providers were conducted on site to retrieve detailed information on the chronology of events that sparked relevant social innovation dynamics in the regional energy field and how this related to a regional development trajectory and a wider energy system landscape. Interviews were recorded with permission of the interviewees and transcribed and inductively coded by the research team.

Admittedly, the two case study methodologies differ, however, our ambition here is not to deliver a systematic comparative case study but to illustrate how regional transitions in different political-institutional contexts reveal similar patterns of entanglement of transition and development. We will expand on this in the following chapter.

4 Sustainable energy as growth-oriented regional development strategy. Empirical vignettes from Magdeburg and Murau

Magdeburg is situated in Saxony-Anhalt in the East of Germany, part of the former German Democratic republic. The region had suffered badly from a loss of heavy industries after German reunification but also had unique infrastructural features such as large factory halls with good freight (train and river) connections. Furthermore, a skilled workforce became available. This was identified by a leading wind energy firm who decided to locate its manufacturing in the region, starting production in 1997. This was initially received positively and supported by the regional authority who expected an impulse to the region's economic development, both through jobs creation and attraction of further firms and activities.

> "Of course, this entry to renewable energy was seen as a development opportunity." (MD12_regional politician).

In addition, the economic conditions in Eastern Germany after reunification meant that potential additional income from wind energy build-out was very welcome for the municipality.

> "Municipalities don't have much money. So, the expectation has also been to re-fill those public purses through income from wind energy." (MD18_regional planner).

At its heyday in the mid-2010s the company has been the region's largest private employer (Rohe and Mattes 2021) with around 5000 to 6000 employees in the production facility in Magdeburg as well as various exclusive sub-contracting firms in the region under the umbrella of the company (thereby reducing opportunities for unionisation, a practice since abandoned) (dpa 2019). Following a reduction of nationwide political support for wind energy due to a combination of manifold socio-political reasons (for more detail see Löhr and Mattes 2022), and a resulting reduction in build-out rates, as well as a strategic focus primarily on the German onshore market and very high-end products, the company came under considerable pressure and was forced to make significant job cuts. Around 1500 jobs were cut in 2019 in Magdeburg alone (dpa 2019). The site is primarily managed as a production facility and therefore is heavily dependent upon decisions made in the company headquarters in Lower Saxony (Rohe and Mattes 2021). Furthermore, the wind energy industry lacks the political support that other industries have, as it is traditionally less unionised (not least due to efforts to prevent this by the founder of the firm in focus here, a phenomenon which is not uncommon in renewable energy—cf. Stevis 2018 for the US context). Recently, there are reports of re-investment into the

facilities in Magdeburg as a new surge of wind energy build-out is foreseen (MDR 2023).

The case of the wind energy industry in Magdeburg and the two quotes above make the (understandable) entanglement between development interests and a broader transition agenda apparent. The deeper reasons and the motivations underlying the engagement with the wind energy industry would warrant further investigation. It is, however, very likely that the need to restructure the local industries played a significant role, greater than any interest in sustainability transition in the region.

Murau in Styria, Austria, is a rural region that has long struggled with the negative consequences of industrial decline in the 1980s' but is now recognized for its innovative wood industry—the result of a deliberate process of regional restructuring. Murau's energy transition can be read as a story of multiple efforts towards infrastructure sovereignty and regionalised energy provisioning. Peaking oil prices for regional heating during the financial crisis in 2008/09 were the ultimate push for the sustainable transformation of its energy infrastructure (Späth and Rohracher 2010). When talking to different stakeholders in the region about the intentions to engage in regional sustainable energy transition efforts, it became clear that the infrastructure makeover was not considered worth pursuing for its social-ecological impact, but as a means to another end. As one of the interviewees put it,

> "Our region has turned to renewable energy at a very early stage—not so much because of climate change, but primarily for generating added value." (M1.1, regional development manager)

The relevance of an existing regional wood industry that had long been catering to both the economic base and identity of Murau played a large part in establishing the techno-economic framing of energy transition. The reinterpretation of wood as biomass opened new sales opportunities for the regional wood industry and offered a further pillar for diversification, innovation and growth. This prospect, coupled with a growth-oriented regional development imaginary among key stakeholders, served as a foundation to root for energy transition. Key strategic documents revealed the same framing (LAG 2014). One interviewee left no doubt as to the ultimate purpose of the commitment to regional energy transition:

> "It's not just about [renewable] energy or wood. It's about regional development." (M1.3, regional development manager)

These two brief descriptions confirm empirically our theoretically derived suspicion. In both regions—despite being embedded in different national contexts of energy policy, energy infrastructure and regional policy—there is a striking similarity regarding the entanglement of transition and development, where the vision of sustainable infrastructure transformation primarily serves to legitimize the continuation of a growth-oriented regional development path. This is what we call the transition-development nexus, which we conceptualise in the following section.

5 Conceptualising the transition-development nexus

The starting point of this contribution is not the question whether entanglement of transition and development in regional agendas as such is good or bad, but rather, that we think it is important to analytically untangle the two and want to offer some inroads how this can be done. What we thereby hope to achieve is to enable more concrete and critical studies of why transitions succeed or fail, which aspirations, interests and power dynamics are involved in the deliberate integration of the two, and how different kinds of transition processes are interrelated both within and across regions. Below, we lay out where we see key similarities and differences between 'transition' and 'development'.

Within the literature around both 'regional transition' and 'regional development', a more distanced analytical stream can be distinguished from a more normatively loaded, strategic stream. Further, both bodies of literature are characterized by a process perspective. In the context of regional studies, the evolution of industries in regions (their emergence, their growth, but also their stagnation and/or decline) and the factors which drive and hinder it are commonly in focus. In the context of regional transitions, the process of change from one socio-technical system state to another is at the core of interest. Due to their respective conceptual foundations, the territorial focus is more pronounced in 'regional development', whereas 'regional transition' tends to adopt a wider systemic perspective which is rarely focused on one region alone and inherently takes an interest in interlinkages with development elsewhere.

Actors, networks, institutions, technologies, and innovation are paramount building blocks in both debates. However, in response to a relative dominance of instrumental techno-economic interpretations of change in both, the political dimension (e.g., through agency, power, and interests), and important social-ecological principles (e.g., planetary boundaries and justice) are now increasingly being recognized and incorporated into the respective debates. In practice, though, the normative association of regional development with economic growth and regional transition to this very end is often salient. Especially in already structurally weak regional contexts, as we have shown in the preceding section, it makes perfect sense to focus on sustainability as a driver of growth oriented regional development. A better understanding of what distinguishes a mere regional development agenda from a broader regional transition agenda may help promote wider-reaching regional development outcomes.

Table 1 summarizes these aspects (of course in reality the two are rarely as separate as we show them here but for the purpose of exposition, we use this bipolar illustration).

Based on the above, we thus think it is worthwhile to explore the transition development nexus further and are convinced that a holistic research agenda can be defined. In our conceptualisation, we distinguish four stages, each alluding to a phase or group of events with relevance for the process of transition development entanglement. These stages should not necessarily be understood along a timeline but are rather conceptual. For each stage, we define a specific research objective

Table 1 Key similarities and differences of 'regional development' and 'regional transition' (authors' elaboration)

	Underlying objective	Key values	Direction or focus	Key conceptual parameters
Regional development	Territorial development (tendency for narrow, economic interpretation)	Prosperity, autonomy and independence, competitiveness	Evolution and growth of industries (techno-economic innovation)	Multi-scalar, path-dependent actors, networks, institutions, technologies, and innovations
Regional transition	Sustainable development (tendency for a broad interpretation including environmental and social dimensions)	Sustainability, restoration, equity, restitution, sufficiency	Wholesale transformation of means of production & consumption (infrastructure optimization, sustainable practices)	

and related research questions that are aimed at helping us explore and unravel the entanglement at the nexus (cf. Fig. 1).

In the following, we go through each stage and discuss some of the key considerations from our point of view. We start by assuming a region where both a path-dependent development agenda and a transition agenda are promoted. The distinction in development agenda on the one hand, and transition agenda on the other, allows us a differentiated perspective on respective regional issues regarding each aspect, and envisioning scenarios where one might be seen as more important and may eventually dominate at the cost of the other, which in turn influences outcomes and potential regional transformation pathways.

5.1 Stage 1: regional agenda setting

Stage 1 is concerned with tracing the emergence and (co-)evolution of both agendas. This requires an in-depth empirical examination of a region's (implicit and explicit) development agenda vis-à-vis its transition agenda—the respective policies, strategies, concepts, and visions, discourses, frames, narratives, and imaginaries—and their respective evolution and interdependencies over time, their respective content, and objectives and how they contrast, intersect, or build on one another. Further research may dig deeper into key dimensions in which transition and development agendas intersect or differ, and support or contradict each other. In the context of regional case studies such as the ones referred to above, researchers may explore the political debate that becomes apparent from respective policy documents and speak with relevant stakeholders about their reasons for promoting a particular agenda. For example, discussing underlying motivations of regional decision makers, such as supporting the location of a company, may produce interesting results. Discourse analysis, framing analysis, and narrative analysis might also be fruitful ways to go in that regard (cf. van Hulst et al. 2024 for an excellent overview). Of course, individual motivations are difficult to trace but organizational rationales are still useful to explore. In the analysis the spatial scope as well as the geographic specificity of

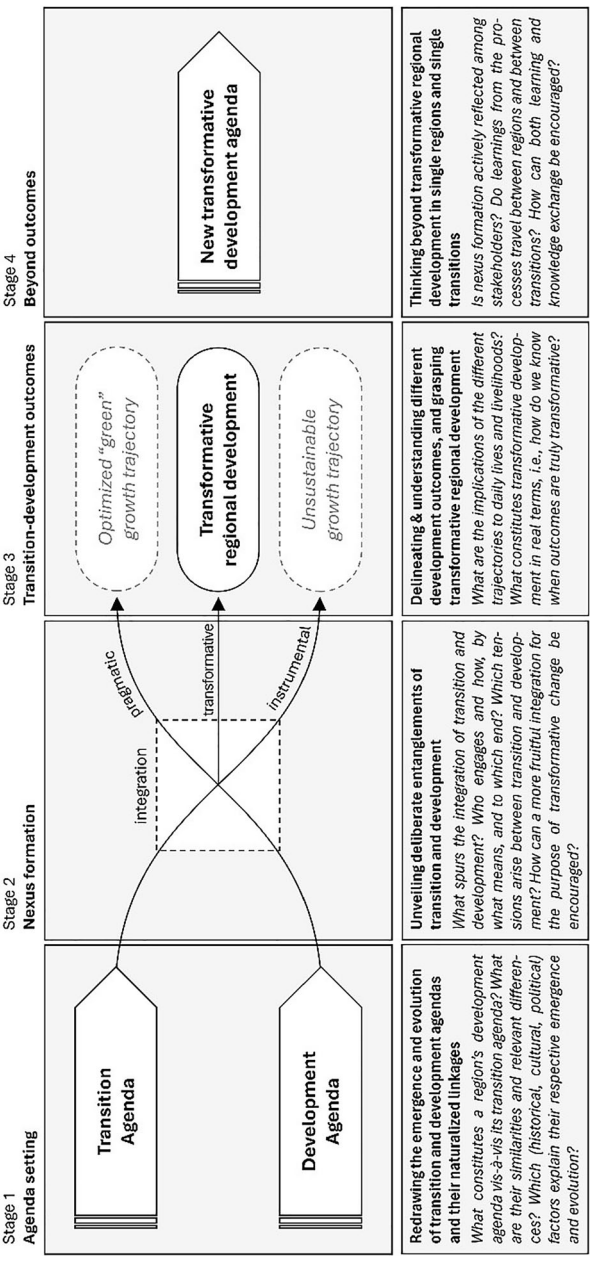

Fig. 1 Four conceptual stages in the transition development nexus and associated research questions

objectives and their rationales could be of interest as well (i.e. do considerations go beyond the own region or locality, are they contingent on regional circumstances).

Research objective Redrawing the emergence and evolution of transition and development agendas and their interdependencies.

Guiding question(s) What constitutes a region's development agenda vis-à-vis its transition agenda? What are their similarities and relevant differences? Which (historical, cultural, political, geographical) factors explain their respective emergence and evolution?

5.2 Stage 2: nexus formation

This stage focuses on the actual integration of development and transition agendas in regional practice. It refers to the core questions that we have so far tackled in this contribution: Why and on which terms are transition and development combined to form a common agenda for regional change, how is their integration being legitimized, and which (and whose) aspirations and interests go into these considerations or are, vice versa, excluded? Work on this stage is thus primarily focused on actors and agency, the active engagement with the nexus and how it shapes ensuing regional paths and their respective transformative potential. We propose three stylized scenarios of transition development integration: (1) an instrumental integration that misuses transition to legitimize growth-oriented development, herewith depleting sustainability transition objectives and reproducing unjust, unsustainable "business as usual" growth paths, (2) a pragmatic integration that considers sustainable infrastructure transformation a window of opportunity for efficiency or productivity gains, autonomy or "green" growth, and (3) a transformative integration that aligns transition and development agendas to shape transformative change for the good of people and planet. Here, empirical investigations would concern the more detailed considerations when choosing strategic targets and measures of implementation. What is of interest is the extent to which longer-term effects and impacts beyond the immediate stakeholders are considered and how this may be encouraged among stakeholders. Innovation biographies as, for example, used in the Murau vignette above may be a suitable approach to grasp the motifs, networks and resources that went into the considerations for deliberate entanglements of transition and development (cf. among others Butzin and Widmaier 2016). Furthermore, the geographical reach of the extent of integration may be of interest as a scenario where a region achieves transformative integration despite working in a spatial context (neighboring regions or national level) that takes a different direction (e.g. more pragmatic approaches).

Research objective Unveiling deliberate entanglements of transition and development.

Guiding question(s) What spurs the integration of transition and development? Who engages and how, by what means and to which end? Which tensions arise

between transition and development? How can a more fruitful integration for the purpose of transformative change be encouraged?

5.3 Stage 3: transition development outcomes

Stage 3 is particularly focused on the actual implementation of transformative regional development and the shape of it 'on the ground': the activities, dynamics, opportunities, and challenges that arise. Here, the main research interest is a better understanding of what outcomes may or may not be expected. Following on from dynamics in stage 2 we distinguish between (1) an unjust and unsustainable (regional) growth trajectory, where the transition agenda only served as a marketing label but did not materialize to a considerable degree, (2) an optimized or 'green' (regional) growth trajectory, where the transition agenda was actually implemented to spur regional industrial growth through the development and deployment of more efficient and sustainable technology, and (3) transformative regional development that integrates both agendas to foster wholesale transformation of production, consumption and practices. Research in this area should hence focus on the implications of these development trajectories in daily lives and livelihoods. Empirical investigations therefore must approach regions at a later point in time than for Stage 1 and 2 or indeed observe and work with regions over time in longitudinal studies. In our two examples above this did not happen because of the respective project context with differing objectives. Ideally this may include action-oriented, transformative research endeavours (cf. Wittmayer and Hölscher 2017). This makes it possible to explore the daily implications of plans and measures and/or co-create their implementation together with regional decision makers. Such outcomes should be assessed for the extent of their transformative impact (cf. transformative outcomes—Ghosh et al. 2021).

Research objective Delineating and understanding different development outcomes and grasping transformative regional development.

Guiding question(s) What are the implications of the different trajectories to daily lives and livelihoods? What constitutes transformative development in real terms, in other words, how do we know when outcomes are truly transformative?

5.4 Stage 4: beyond outcomes

This is the final stage of conceptualizing the transition development nexus. Here, we emphasize the geographical aspect by looking beyond a particular region, set of regions, or sectors, and encourage an interest in how transitions diffuse to different places and sectors. In all stages, but here in particular, knowledge plays a key role. It is therefore of great interest how such knowledge may be fostered, how it may spread, whether it can travel between places and between sectors. This diffusion is expected to happen both between different 'kinds' of transitions (take e.g. the process of digitalization and sustainability transition) and between different regions. It would be of interest what arenas of exchange already exist, and which ones are

most effective in 'translating' between transitions and regions. This alludes, for one, to the field of policy mobilities (cf. for instance Temenos and McCann 2013) and the methodologies applied there (Ramirez et al. 2024). Empirically, interviews with stakeholders can directly ask for mechanisms of exchange and references to other regions or similar processes in other sectors. There may also be regular events with a cross-sectoral character which serve such a knowledge exchange, or intermediary actors and platforms established for the very same reason of exchange, networking and mutual learning. Their study might hence be useful for grasping transregional learning and travelling concepts that emerged from engagement at the nexus.

Research objective Thinking beyond transformative regional development in single regions and single transitions.

Guiding question(s) Is nexus formation actively reflected among stakeholders? How do attempts of transition-development integration, specific rationalities of nexus formation, and learnings from the process travel between regions and between transitions? How can both learning and knowledge exchange be encouraged?

6 Limitations, further research, and concluding remarks

Building on our own empirical experiences we have presented a foundational conceptualisation of the transition development nexus in this paper. It is not meant to be a complete, in-depth analysis, but rather an impulse for a more differentiated debate around the common entanglement of regional development and regional transition within the geography of transitions debate. Being aware of and understanding the transition development nexus is relevant not just to researchers but also to policymakers and practitioners. This awareness may prevent a naïve adoption of a seemingly popular 'green' discourse or indeed enable to perceive it and direct focus towards the interests and motivations that underlie it.

We have provided some essential groundwork in clarifying core differences between the transition and development agendas. Both conceptually and empirically, this is a highly promising research avenue. We consider the discussion of transformative regional development as the result of a progressive, well-aligned integration of transition and development to be particularly valuable. Such transformative regional development may involve (1) a general reinterpretation of infrastructures as provisioning systems, (2) the assertion of a regional well-being economy over conceptions of growth-oriented economies, or (3) the embedding of regional agendas and socio-material infrastructures in conceptions of strong sustainability.

A current limitation is our rather marginal treatment of the knowledge dimension, which can and should be put much more in focus in future research. Different types of knowledge seem to become relevant in transformative regional development as compared to 'normal' regional development (cf. for instance ProClim 1997; Abson et al. 2014; Urmetzer et al. 2020; Levin-Keitel and Behrend 2023). In this context the role of learning at the nexus could also be explored further. Generating a better

understanding of these processes will be of great policy relevance when it comes to encouraging transformative development in and beyond regions.

Another limitation is our focus on the conceptual introduction of the transition development nexus, thus only offering short empirical vignettes, drawn from projects and case studies that were initially designed with another purpose and around a particular sector (i.e. energy). Further research should design case studies that specifically explore the transition development nexus and its likely dimensions such as the knowledge dimension from the outset to gain a deeper understanding. Sector-specificity (consider, for example, transition dynamics in food or mobility) might also play a role. Another aspect may be the question of what motivates actors to engage in development activities in the first place and how this affects the nature of regional development processes. Existing studies already address this question (e.g. Zoll et al. 2024), albeit not against the transition development nexus perspective.

In conclusion, our starting point for this contribution has been the observation that both in academic and practice contexts, regional development and regional transition agendas are commonly entangled. Motivations may be manifold and in and of themselves make for interesting objects of study. It is hence important to treat transition and development independently and critically assess their entanglement. A more nuanced understanding of the similarities and differences between 'traditional' regional development agendas and transition agendas is likely to yield more genuine engagement with the whole-sale transformation of our systems of production and consumption that is necessary to address the challenges that lie ahead for our regions.

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References

Abson DJ, von Wehrden H, Baumgärtner S, Fischer J, Hanspach J, Härdtle W, Heinrichs H, Klein AM, Lang DJ, Martens P, Walmsley D (2014) Ecosystem services as a boundary object for sustainability. Ecol Econ 103:29–37. https://doi.org/10.1016/j.ecolecon.2014.04.012

Albrecht M, Grundel I, Morales D (2021) Regional bioeconomies: public finance and sustainable policy narratives. Geogr Ann Ser B Hum Geogr 103:116–132. https://doi.org/10.1080/04353684.2021.1921603

Andersson J, Lennerfors TT, Fornstedt H (2024) Towards a socio-techno-ecological approach to sustainability transitions. Environ Innov Soc Transit 51:100846. https://doi.org/10.1016/j.eist.2024.100846

Arora S, Stirling A (2023) Colonial modernity and sustainability transitions: a conceptualisation in six dimensions. Environ Innov Soc Transit 48:100733. https://doi.org/10.1016/j.eist.2023.100733

Avelino F (2017) Power in sustainability transitions: analysing power and (dis)empowerment in transformative change towards sustainability. Env Pol Gov 27:505–520. https://doi.org/10.1002/eet.1777

Avelino F (2021) Theories of power and social change. Power contestations and their implications for research on social change and innovation. J Polit Power 14:425–448. https://doi.org/10.1080/2158379X.2021.1875307

Bärnthaler R (2024) When enough is enough: Introducing sufficiency corridors to put techno-economism in its place. AMBIO. https://doi.org/10.1007/s13280-024-02027-2

Becker S, Bues A, Naumann M (2016) Zur Analyse lokaler energiepolitischer Konflikte. Skizze eines Analysewerkzeugs. Raumforsch Raumordn. https://doi.org/10.1007/s13147-016-0380-0

Bergek A, Jacobsson S, Carlsson B, Lindmark S, Rickne A (2008) Analyzing the functional dynamics of technological innovation systems: a scheme of analysis. Res Policy 37:407–429. https://doi.org/10.1016/j.respol.2007.12.003

Bina O (2013) The green economy and sustainable development: an uneasy balance? Environ Plann C Gov Policy 31:1023–1047. https://doi.org/10.1068/c1310j

BMWK (2024) Jahreswirtschaftsbericht: Wettbewerbsfähigkeit nachhaltig stärken. https://www.bmwk.de/Redaktion/DE/Publikationen/Wirtschaft/jahreswirtschaftsbericht-2024.pdf?__blob=publicationFile&v=6. Accessed 24 Apr 2024

Butzin A, Widmaier B (2016) Exploring territorial knowledge dynamics through innovation biographies. Reg Stud 50:220–232. https://doi.org/10.1080/00343404.2014.1001353

Cambride University Press & Assessments (2024) Nexus. https://dictionary.cambridge.org/dictionary/english/nexus. Accessed 13 Dec 2024

Caniëls MC, Romijn HA (2008) Strategic niche management: towards a policy tool for sustainable development. Technol Anal Strateg Manag 20:245–266. https://doi.org/10.1080/09537320701711264

Capasso M, Hansen T, Heiberg J, Klitkou A, Steen M (2019) Green growth—A synthesis of scientific findings. Technol Forecast Soc Change 146:390–402. https://doi.org/10.1016/j.techfore.2019.06.013

Carlsson B, Stankiewicz R (1991) On the nature, function and composition of technological systems. J Evol Econ 1:93–118. https://doi.org/10.1007/BF01224915

Child M, Breyer C (2017) Transition and transformation: a review of the concept of change in the progress towards future sustainable energy systems. Energy Policy 107:11–26. https://doi.org/10.1016/j.enpol.2017.04.022

Chlebna C, Mattes J (2020) The fragility of regional energy transitions. Environ Innov Soc Transit 37:66–78. https://doi.org/10.1016/j.eist.2020.07.009

Chlebna C, Mattes J (2024) Regional Transition Fields—Exploring institutional dynamics of contestation and entrenchment in an energy transition case in Germany. Energy Res Soc Sci 116:103684. https://doi.org/10.1016/j.erss.2024.103684

Chlebna C, Martin H, Mattes J (2023) Grasping transformative regional development—Exploring intersections between industrial paths and sustainability transitions. Environ Plan A 55:222–234. https://doi.org/10.1177/0308518X221137346

Chlebna C, Evenhuis E, Morales D (2024a) Economic geography and planetary boundaries: embracing the planet's uncompromising call to action. Prog Econ Geogr 2:100021. https://doi.org/10.1016/j.peg.2024.100021

Chlebna C, Löhr M, Mattes J, Rohe S (2024b) Regionale Treiber und Hemmnisse der Windenergieentwicklung in Deutschland. Geogr Rundsch: 22–26

Coenen L, Hansen T, Rekers JV (2015) Innovation policy for grand challenges. An economic geography perspective. Geogr Compass 9:483–496. https://doi.org/10.1111/gec3.12231

Cresswell T (2013) Geographic thought: a critical introduction. Critical introductions to geography. Wiley-Blackwell, Chichester
Dispan J, Koch A, König T, Seibold B (2023) Resilienz der regionalen Wirtschaft vor dem Hintergrund von Krisen und Transformation. Stuttgart (Strukturbericht Region Stuttgart). https://www.region-stuttgart.org/fileadmin/Verband_Region_Stuttgart/Wirtschaft/Dokumente/Strukturbericht_2023_Langfassung.pdf. Accessed 24 Apr 2024
Donald B, Gray M (2019) The double crisis: in what sense a regional problem? Reg Stud 53:297–308. https://doi.org/10.1080/00343404.2018.1490014
dpa (2019) Enercon-Mitarbeiter sollen aufgefangen werden, Standort Magdeburg bleibt. Über eine Transfergesellschaft sollen nach dem Stellenabbau Enercon-Mitarbeiter aufgefangen werden. Die Zukunft von Enercon in Deutschland ist ungewiss. heise online 2019
Faller F (2014) Regional strategies for renewable energies: development processes in greater manchester. Eur Plan Stud 22:889–908. https://doi.org/10.1080/09654313.2012.741572
Foray D, David PA, Hall B (2009) Smart specialisation—the concept. Knowl Econ Policy Br 9:100
Geels FW (2002) Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Res Policy 31:1257–1274
Geels FW (2004) From sectoral systems of innovation to socio-technical systems. Res Policy 33:897–920. https://doi.org/10.1016/j.respol.2004.01.015
Ghosh B, Kivimaa P, Ramirez M, Schot J, Torrens J (2021) Transformative outcomes: assessing and reorienting experimentation with transformative innovation policy. Sci Pub Pol 48:739–756. https://doi.org/10.1093/scipol/scab045
Gibbs D (2000) Ecological modernisation, regional economic development and regional development agencies. Geoforum 31:9–19
Gibbs D, O'Neill K (2015) Building a green economy? Sustainability transitions in the UK building sector. Geoforum 59:133–141
Görmar F (2023) Loss and change: culture narratives in old industrial regions in east Germany. Reg Sci Policy Pract 15:1577–1595. https://doi.org/10.1111/rsp3.12689
Grillitsch M, Hansen T (2019) Green industry development in different types of regions. Eur Plan Stud 14:1–21. https://doi.org/10.1080/09654313.2019.1648385
Haarstad H (2017) Constructing the sustainable city: examining the role of sustainability in the 'smart city'discourse. J Environ Policy Plan 19:423–437
Haddad CR, Nakić V, Bergek A, Hellsmark H (2022) Transformative innovation policy: a systematic review. Environ Innov Soc Transit 43:14–40. https://doi.org/10.1016/j.eist.2022.03.002
Hassink R (2010) Locked in decline? On the role of regional lock-ins in old industrial areas. In: The handbook of evolutionary economic geography. Edward Elgar, p 12864 https://doi.org/10.4337/9781849806497.00031
Hekkert MP, Suurs R, Negro SO, Kuhlmann S, Smits R (2007) Functions of innovation systems: a new approach for analysing technological change. Technol Forecast Soc Change 74:413–432. https://doi.org/10.1016/j.techfore.2006.03.002
Hekkert MP, Janssen MJ, Wesseling JH, Negro SO (2020) Mission-oriented innovation systems. Environ Innov Soc Transit 34:76–79. https://doi.org/10.1016/j.eist.2019.11.011
Henning M (2021) Evolving regional economies. Agenda, Newcastle upon Tyne
Hickel J, Kallis G (2020) Is green growth possible? New Polit Econ 25:469–486. https://doi.org/10.1080/13563467.2019.1598964
Hölscher K, Wittmayer JM, Loorbach D (2018) Transition versus transformation: what's the difference? Environ Innov Soc Transit 27:1–3
Kemp R, Schot J, Hoogma R (1998) Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management. Technol Anal Strateg Manag 10:175–198. https://doi.org/10.1080/09537329808524310
Koschatzky K, Kroll H (2019) Innovationsbasierter regionaler Strukturwandel: Strukturschwache Regionen in Deutschland. Arbeitspapiere Unternehmen und Region. Karlsruhe (R1/2019). https://hdl.handle.net/10419/193966
LAG Holzwelt Murau LEADER Entwicklungsstrategie 2014–2022. https://www.holzweltmurau.at/wp-content/uploads/2021/11/20210727_LES-ueberarbeitet.pdf. Accessed 25 Sept 2024
Levin-Keitel M, Behrend L (2023) The topology of planning theories: a systematization of planning knowledge. The urban book series. Springer Nature, Cham
Liu J, Herzberger A, Kapsar K, Carlson AK, Connor T (2019) What is telecoupling? In: Telecoupling: exploring land-use change in a globalised world, pp 19–48

Löhr M, Mattes J (2022) Facing transition phase two: analysing actor strategies in a stagnating acceleration phase. Technol Forecast Soc Change 174:121–221. https://doi.org/10.1016/j.techfore.2021.121221
Löhr M, Chlebna C, Mattes J (2022) From institutional work to transition work: actors creating, maintaining and disrupting transition processes. Environ Innov Soc Transit 42:251–267. https://doi.org/10.1016/j.eist.2021.12.005
Loorbach D (2010) Transition management for sustainable development: a prescriptive, complexity-based governance framework. Int J Policy Adm Institutions 23:161–183
Loorbach D, Wittmayer J, Avelino F, von Wirth T, Frantzeskaki N (2020) Transformative innovation and translocal diffusion. Environ Innov Soc Transit 35:251–260. https://doi.org/10.1016/j.eist.2020.01.009
MacKinnon D, Dawley S, Steen M, Menzel M-P, Karlsen A, Sommer P, Hansen GH, Normann HE (2019) Path creation, global production networks and regional development: a comparative international analysis of the offshore wind sector. Prog Plann 130:1–32. https://doi.org/10.1016/j.progress.2018.01.001
Malecki E (2004) Jockeying for position: what it means and why it matters to regional development policy when places compete. Reg Stud 38:1101–1120. https://doi.org/10.1080/0034340042000292665
Markard J, Raven R, Truffer B (2012) Sustainability transitions: an emerging field of research and its prospects. Res Policy 41:955–967. https://doi.org/10.1016/j.respol.2012.02.013
Mazzucato M (2018) Mission-oriented innovation policies: challenges and opportunities. Ind Corp Change 27:803–815. https://doi.org/10.1093/icc/dty034
MDR (2023) Trotz Kurzarbeit – Enercon will mehrere Millionen Euro am Standort in Magdeburg investieren
Merriam-Webster.com Dictionary (2024) transition. https://www.merriam-webster.com/dictionary/transition. Accessed 26 Apr 2024
Pfotenhauer SM, Wentland A, Ruge L (2023) Understanding regional innovation cultures: Narratives, directionality, and conservative innovation in Bavaria. Res Policy. https://doi.org/10.1016/j.respol.2022.104704
Pike A, Rodríguez-Pose A, Tomaney J (2007) What kind of local and regional development and for whom? Reg Stud 41:1253–1269. https://doi.org/10.1080/00343400701543355
Pike A, Rodríguez-Pose A, Tomaney J (2016) Local and regional development. Routledge
Porter ME (1998) Clusters and the new economics of competition vol 6. Harvard Business Review, Boston
Porter ME (2000) Location, competition, and economic development: local clusters in a global economy. Econ Dev Q 14:15–34. https://doi.org/10.1177/089124240001400105
ProClim—Forum for Climate and Global Change (1997) Research on sustainability and global change—visions in science policy by Swiss researchers. Swiss Academy of Science, Bern
Rakhmatullin R, Brennan L (2015) Global value chains and smart specialisation strategy. Edited by Joint Research Centre, Institute for Prospective Technological Studies. Brussels, Belgium. https://data.europa.eu/doi/10.2791/44840. Accessed 24 Apr 2024
Ramirez M, Boni A, Wade I, Byrne R (2024) How does transformative innovation policy travel across physical and cognitive spaces? Exploring the role of mutable fluid space in experimental policy engagements. Environ Innov Soc Transit 52:100881. https://doi.org/10.1016/j.eist.2024.100881
Rip A, Kemp R (1998) Technological change. In: Rayner S, Malone E (eds) Human choice and climate change 2. Battelle Press, Washington, pp 327–399
Ripple WJ, Wolf C, Gregg JW, Rockström J, Newsome TM, Law BE, Marques L, Lenton TM, Xu C, Huq S, Simons L, King DA (2023) The 2023 state of the climate report: entering uncharted territory. BioScience. https://doi.org/10.1093/biosci/biad080
Rohe S, Chlebna C (2021) A spatial perspective on the legitimacy of a technological innovation system: regional differences in onshore wind energy. Energy Policy. https://doi.org/10.1016/j.enpol.2021.112193
Rohe S, Mattes J (2021) What about the regional level? Regional configurations of technological innovation systems. Geoforum 129:60–73. https://doi.org/10.1016/j.geoforum.2022.01.007
Rotmans J, Kemp R, van Asselt M (2001) More evolution than revolution: transition management in public policy. Foresight 3:15–31. https://doi.org/10.1108/14636680110803003
Schulz C, Bailey I (2014) The green economy and post-growth regimes: opportunities and challenges for economic geography. Geogr Ann Ser B Hum Geogr 96:277–291
Späth P, Rohracher H (2010) 'energy regions': the transformative power of regional discourses on socio-technical futures: special section on innovation and Sustainability transitions. Res Policy 39:449–458
Stevis D (2018) US labour unions and green transitions: depth, breadth, and worker agency. Globalizations 15:454–469. https://doi.org/10.1080/14747731.2018.1454681

Suitner J, Ecker M (2020) “Making energy transition work”: Bricolage in Austrian regions’ path-creation. Environ Innov Soc Transit 36:209–220. https://doi.org/10.1016/j.eist.2020.07.005
Suitner J, Haider W, Philipp S (2022) Social innovation for regional energy transition? An agency perspective on transformative change in non-core regions. Reg Stud 25:1–13. https://doi.org/10.1080/00343404.2022.2053096
Suitner J, Haider W, Krisch A (2024) Socially innovative experiments for transformative local development: putting more-than-growth-oriented local interventions in spatial context. Reg Sci Policy Pract. https://doi.org/10.1016/j.rspp.2024.100035
Swilling M (2020) Age of sustainability: Just transitions in a complex world. Routledge studies in sustainable development. Routledge, London
Temenos C, McCann E (2013) Geographies of policy mobilities. Geogr Compass 7:344–357. https://doi.org/10.1111/gec3.12063
Tödtling F, Trippl M (2018) Regional innovation policies for new path development—beyond neo-liberal and traditional systemic views. Eur Plan Stud 26:1779–1795. https://doi.org/10.1080/09654313.2018.1457140
UNEP (2011) Towards a green economy: Pathways to sustainable development and poverty eradication—a synthesis for policy makers. Available online at www.unep.org/greeneconomy. Accessed 19 Feb 2024
Urmetzer S, Lask J, Vargas-Carpintero R, Pyka A (2020) Learning to change: transformative knowledge for building a sustainable bioeconomy. Ecol Econ 167:106435. https://doi.org/10.1016/j.ecolecon.2019.106435
van Hulst M, Metze T, Dewulf A, de Vries J, van Bommel S, van Ostaijen M (2024) Discourse framing and narrative: three ways of doing critical interpretive policy analysis. Crit Policy Stud. https://doi.org/10.1080/19460171.2024.2326936
Vogel J, Hickel J (2023) Is green growth happening? An empirical analysis of achieved versus Paris-compliant CO2-GDP decoupling in high-income countries. Lancet Planet Health 7:e759–e769. https://doi.org/10.1016/S2542-5196(23)00174-2
Willis K (2014) Development: geographical perspectives on a contested concept. Geography 99:60–66. https://doi.org/10.1080/00167487.2014.12094395
Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (WBGU) (2011) Welt im Wandel. Gesellschaftsvertrag für eine Große Transformation. WBGU, Berlin
Wittmayer J, Hölscher K (2017) Transformationsforschung: Definitionen, Ansätze, Methoden. Umweltbundesamt
Zoll F, Harder L, Manatsa L, Friedrich J (2024) Motivations, changes and challenges of participating in food-related social innovations and their transformative potential: three cases from Berlin (Germany). Agric Hum Values. https://doi.org/10.1007/s10460-024-1056