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# Building regional (transformative) resilience by regional innovation policy?

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## Abstract

In regional studies and economic geography, interest in regional economic resilience and regional innovation policy has steadily increased in recent decades. Although these two perspectives appear to be closely related, relatively little research has elaborated on the interrelationships between them. In this chapter, we take stock of the current two key conceptual extensions of the work on regional economic resilience, i.e., 1) the simultaneous consideration of regional and value chain resilience and 2) the discussion on transformative resilience and the normative turn on regional innovation policy in economic geography and beyond. Overall, we find that the shift toward more sustainable and inclusive development is increasingly being advocated by scholars working on regional resilience or regional innovation policy, leading to increased interest in new concepts such as "transformative resilience" and "challenge-oriented/transformative regional innovation policy" in the respective research fields. However, there is relatively little evidence on how regional resilience that is transformative in nature (e.g., transformative resilience) can be fostered by the new generation of regional innovation policy and how the increasing frequency of shocks of all kinds requires new thinking in regional innovation policy. We therefore suggest four promising avenues for future research that link the hitherto largely isolated perspectives of regional resilience and regional innovation policy to explain regional economic change in the post-crisis period.

JEL-codes: O30; O38; R10

Keywords: regional innovation policy; regional resilience; transformative resilience; economic geography

### 1. Introduction

In times of crisis, the notion of resilience is often used to analyse the recovery processes of systems from the shock. Resilience refers to the notion to describe that systems recover from shocks or can build up capabilities to deal with future shocks (Wilson 2018). It is a notion used in several academic disciplines, such as psychology, ecology and planning. Regional resilience is part of a broader literature on resilience in human geography, which includes urban resilience (Fastenrath et al. 2019), social resilience and community resilience and so on (Wilson 2018). More recently, economic geographers, have become interested in regional economic resilience in tackling the question of why some regional economies manage to renew themselves or to lock themselves out, whereas others are more locked in existing structures (Martin 2018; Hassink and Gong 2020; Bristow and Healy 2020; Martin and Sunley 2020; Sutton and Arku 2022).

The rising interest in resilience from a regional, urban and metropolitan perspective can be explained by two factors. First, the increase or perceived increase in the number of shocks and disruptions, such as natural hazards, terrorist attacks, financial crises, etc., has led to a strengthened feeling of uncertainty and insecurity. This perception is strengthened by the awareness that increasingly the modern global economy is only possible due to increasing interconnecting and interdependent global networks that are necessary but that also lead to vulnerabilities (OECD 2011a). The perception is also partly caused by the influence of commercial broadcasting, internet technology and instant communication software through which people are increasingly informed about events happening in different parts of the world, which was unimaginable previously. Moreover, the financial and economic crisis in 2008 has generated a boom in studies on how regional economies recovered from that crisis (see for instance Sensier et al. 2016), as well as the current COVID-19 crisis (Gong et al. 2020; Coulson et al. 2021; Bailey et al. 2021). Secondly, successful studies on socio-ecological resilience have raised the interest in resilience. These studies were boosted by a US national research network, Building Resilient Regions, sponsored by the MacArthur Foundation between 2006 and 2013, as well as the highly citied special issue of the Cambridge Journal of Regions, Economy and Society published in 2010 (Christopherson et al. 2010). After the publication of that special issue and the critique (Hassink 2010; MacKinnon and Derickson 2013; Gong and Hassink 2017), a burgeoning conceptual and empirical literature emerged on regional resilience (for a bibliometric analysis, see Fröhlich and Hassink 2018). Several factors affect the resilience of regional economies. In the empirical literature, the emphasis has been on the effect of regional economic structures (such as a diversified vs. a specialized economic structure) on resilience. However, the role of institutions, agency and policies, such as regional innovation policy on regional resilience has only recently started to be explored (see for instance Bristow and Healy 2020; Magro et al. 2022; Asheim and Herstad 2021).

In parallel to such an interest on regional economic resilience triggered by the intensified occurrence of crises and shocks in the last decades, the issue of how regional policies can support the innovation activities of firms and non-firm actors in different types of regions

has also attracted huge interest in the literature. Regional innovation policy has gone through at least three paradigm shifts (or framings) as observed in the broader science, technology and innovation policies, including R&D framing, Systems of Innovation framing and transformative change framing (Asheim et al. 2020; Schot and Steinmueller 2018). In each period, the rational for regional policy intervention differs and the correspondent policy approaches taken vary (for details, see section 3).

It can be said that the development of work on regional resilience and regional innovation policy has been extremely fruitful in recent decades. While the work on these two aspects seems to be highly inter-connected, as both can influence each other in non-trivial ways especially in times of crisis, these two approaches have remained largely isolated from each other until recently. In the context of different crises and shocks, as each crisis or shock has its own specific characteristics, but also differs concerning scale and duration (Martin 2018), ex-post regional innovation policy needs to be crisis-specific, but at the same time placebased, in order to resume socio-economic recovery after the crisis. On the other hand, the incorporation of an extra layer of sensitivity and preparedness ex-ante to crises and shocks in regional innovation policy seems inevitable in these fast changing times as the occurrence of such shocking events could fundamentally change the kinds of innovation that is of relevant to the local actors. To engage with these two perspectives in a more meaningful way, this chapter aims at analysing the interrelationship between regional (transformative) resilience, on the one hand, and regional innovation policy, on the other hand. In the following, we will first shortly introduce the regional resilience concept and the more recent conceptual extensions in Section 2. In Section 3, we will then review the studies on regional innovation policy as well as the normative turn that this literature is currently experiencing. Section 4 provides an overview of the recent work that tries to bring together these two perspectives in explaining regional development in and after a crisis, whereas the final section will suggest promising avenues for future research that combines these two perspectives.

#### 2. Regional economic resilience and regional economic transformation

Resilience can be considered at several scales, such as the individual, household, local, regional and national scale, and categories, such as industries, knowledge production, entrepreneurship and labour markets (Martin 2018). In addition, the disturbances take places at different scales. They range from *macro-level shocks* (such as wars and financial crises) having varying effects on different places, to *multi-local shocks*, for instance when a national industry collapses, to *local disruption*, for instance if a major plant closes (Martin 2018). Regional economic resilience is a popular concept in economic geography and regional studies (Martin 2018; Martin and Sunley 2020; Bristow and Healy 2014; Gong and Hassink 2017, 2020; Gong et al. 2020; Evenhuis 2017; Sutton et al. 2023). Regional economic resilience as a conceptual framework is useful in helping us to think about regions in a dynamic, holistic and systematic way as it highlights "the ability of regional economies to resist and adapt to or transform in the face of shocks and subsequently recover to maintain

or improve their pre-shock economic performance" (Sutton et al. 2023, 8). However, the concept has also been criticized for its fuzziness. As Martin (2018, 854) mentions, "the lack of such a commonly agreed understanding means that policy programmes and strategies aimed at 'building' local economic resilience may rush ahead of a thorough appreciation of what, precisely, it is that they are supposed to build, and how this aim can best be achieved."

While enormous insights have been gained in the regional economic resilience literature (for a comprehensive overview, see Sutton et al. 2023), the current conceptual extension on regional economic resilience focuses primarily on two key aspects, i.e. the simultaneous consideration of regional and value chain resilience (Sutton et al. 2023; Yeung 2024) and the discussion on transformative resilience (Martin and Sunley 2020; Sutton et al. 2023; Trippl et al. 2024).

The simultaneous consideration of regional and network/value chain resilience has been prompted by the temporary blockage of global logistics during the COVID-19 pandemic, as well as the current increasingly strained geopolitical relationships among the world's major economies and increased risks of all kinds (Gong et al. 2022a; Yeung 2024). While economic geographers have focused primarily on the regional dimensions of economic resilience, the disruption of global supply chains has brought into discussion the importance of looking locally and globally at the resilience of the economic or industrial structures in which a region is embedded. As Sutton et al. (2023) mention, the resilience of regional economies is also influenced by broader macroeconomic processes (e.g., currency values, interest rates, and foreign direct investment) as well as global value chains and global production networks. Thus, multi-scalar thinking would be needed to capture the key factors affecting the resilience of regions and value chains. In the same vein, Yeung (2024) argues that in the post-pandemic period, massive global change will generate new regional development opportunities and challenges in different regions through the reconfiguration of strategic (de/re)coupling with global production networks. In such a broader context of shifting back from the global to the regional, how to simultaneously address regional and value chain resilience and design effective regional and national policies for better value creation and capture is a key challenge for many governments today. While the simultaneous consideration of the two types of resilience is highly tempting, so far, empirical work on this topic has been sparse. However, it is expected to become an important topic in the coming years as regionalization and deglobalization trends intensify.

As far as regional transformative resilience is concerned, recent studies highlight that regional economic resilience needs to be considered in terms of the relationships between the intensity and duration of the shocks and the different kind of economic transformation outcomes that can be expected. Martin and Sunley (2020), for instance, point out that shocks can be of low intensity and short duration, which would lead to *bounce-back resilience*, or of high intensity and long duration, which could potentially lead to *transformative resilience* (Martin and Sunley 2020, 20; Sutton and Arku 2022). Trippl et al. (2024) extend Martin and Sunley's (2020) work by differentiating between three types of resilience, including "bouncing back", "bouncing forward" and "transformative resilience" (or "bouncing beyond" according to Grillitsch and Asheim 2023). Bouncing back differs from

the latter two types of resilience, as it does not lead to fundamental structural changes. While both highlight structural change, the difference between bouncing forward and transformative resilience/ bouncing beyond, however, lies in whether the direction of change is desirable and whether it leads to more sustainable and inclusive development outcomes. Such a distinction is important, as it considers shocks as a window of opportunity for transforming to a radically different and more sustainable and inclusive trajectory that benefits the society and the environment (not just the economy). Transformative resilience may take many different forms. It may entail the regionalization of global supply chains (relates to both regional and value chain resilience!), shifts towards more environmentallyfriendly forms of production and consumption, more sustainable-oriented sociotechnical systems such as energy, mobility, food or housing, post-growth initiatives, new institutional and behavioral practices, etc. (Trippl et al. 2024). In the same vein, the recent work on green and inclusive recovery in the post-Covid era (Phillips and Heilmann 2021; Lahcen et al. 2020; Malpass 2021) also emphasizes such directionality of transformative changes.

While the introduction of the concept of transformative resilience is certainly interesting and promising, there is still confusion in the current literature about how to operationalize the concept empirically. This raises questions such as (1) What kinds of shocks (e.g., financial crisis, energy crisis, pandemics, etc.) lead to the opening of a window of opportunity for sustainable and inclusive regional transformation? (2) How can the normative dimensions of transformative resilience be balanced and whether such resilience should address shock situations or also long-term structural change and "slow burn" (Martin 2018; Martin and Sunley 2020)? (3) Methods and indicators for measuring transformative resilience (Martin and Sunley 2020); (4) What primary factors (internal or external) influence regional transformative resilience (Bristow and Healy 2020).

Overall, while the role of innovation in regional economic development is widely acknowledged, the interrelationship between innovation and regional resilience has received less attention. As Viana et al. (2022) point out, innovation is often narrowly defined in the regional resilience literature, either as an innovation-related variable in quantitative research or as knowledge accumulation and learning capacity in qualitative studies after a crisis. Consequently, limited research has examined regional resilience from an innovation policy perspective. As we will demonstrate in the next section, this trend is also evident in the regional innovation policy literature, which has largely overlooked issues of regional resilience until very recently.

## 3. Regional innovation policy and the role of the state

Following a critical overview of the state of work on regional resilience above, this section reviews advances in the literature on regional innovation policy. Regional policies, which are supposed to successfully tackle regional economic inequalities, have increasingly moved towards regional innovation policies, particularly in Europe (OECD 2011b). The increasing importance of regions for innovation policy can be considered as the outcome of a

convergence of regional and technology policy since the early 1980s. These two policy fields converged into regional innovation policies because some of their objectives increasingly overlapped, namely to promote the innovative capacity and thus the competitiveness of SMEs and regional economy. In addition, there have been decentralization and regionalization trends in innovation policy in major economies in Europe, North America and East Asia since the 1990s (Cooke and Morgan 1998). These trends align with what Asheim et al. (2003) observed as a shift from a firm-oriented, static allocation of resources for innovation to a trans-sectoral, dynamic and system-oriented, learning-to-innovate policy based on pro-active, multi-actor partnership. Although we can speak of a general phenomenon, there are of course significant differences between individual regions and countries concerning the extent to which these trends take place. Generally, contributing factors to regional innovation policies are a federal political system, decentralization, strong regional institutions and governance, a marked industrial specialization in the region, socio-cultural homogeneity and thus relationships of trust, large economic restructuring problems, and a robust commitment of regional political leaders.

In the last decades, three approaches on regional innovation policy can be derived. The first approach is based on neo-liberal rationale; the second approach is based on a conventional systemic perspective. The third and more recent approach, in contrast, takes a more comprehensive perspective pointing at the directionality of innovation (Tödtling et al. 2022; Magro and Wilson 2024; see also Schot and Steinmueller 2018)

At the regional level, the first framing of R&D (neoliberal rationale) was partly manifested in the 'Growth Centre' strategy in Europe. Growth Poles in concrete geographic spaces were constituted by firms belonging to the same or closely supporting sectors. This perspective on industrial and innovation policies was later revitalised by Porter's cluster concept in the 1990s. They include several regional innovation support measures, such as science parks, technopoles, technological financial aid schemes, innovation support agencies, community colleges and initiatives to support clustering of industries. Over the years, the first generation of regional innovation policies focusing purely on market failures has been the target of criticism for a variety of reasons. Tödtling and Trippl (2005) criticized one-size-fits-all approaches, on the basis that different regions suffer from different shortcomings, and that innovation policy, the use of benchmarking, the creation of partnerships and the search for best practices have led to the standardization of regional innovation policies in Europe (Tödtling and Trippl 2005).

The second framing of (regional) innovation system started in the mid-1980s, when the focus has been placed on tackling system failures. In the context of the European Union's regional policy agenda, the RIS perspective firstly became manifested in policy initiatives promoting technology transfer between university and industry in programmes and initiatives such as the European Commission's Regional Technology Plan (RTP) (Asheim et al. 2020). In more recent years, the most important regional innovation policy at the EU level is the smart specialisation strategy (S3) (Foray 2015; Hassink and Gong 2019). The aim is to plan for economic diversification in the short- and medium-term, in addition to establishing a long-term perspective for promoting more fundamental structural changes in the economy

through transformative activities. S3 represents an explicit, place-based approach, emphasising prioritisation through non-neutral, vertical policies as well as, for the first time in the EU's history, providing a policy framework for promoting and implementing a broadbased innovation policy.

While useful in guiding regions in setting priorities for their economic activities, the secondgeneration regional innovation policies, especially the S3, suffer from the innovation paradox, as defined by Oughton et al. (2002). This refers to the observed fact that lagging regions are often the ones with less absorptive capacity to make effective use of the policy instruments created to increase innovation potential. Therefore, innovation policies are likely to reinforce current regional inequalities, by allowing those firms in core regions to develop even further their potential (Pinheiro et al. 2022). This is especially true for the S3 policy, as deficiencies such as lack of institutional capabilities, poor initial regional industrial conditions (Hassink and Gong 2019; Marques and Morgan 2018; Rodríguez-Pose et al. 2014) have been constantly reported in lagging regions when implementing the S3 strategy.

As far as the third framing is concerned, the ongoing shift toward transformative change means a reorientation of the strategic focus from a place-based to a challenge-driven policy, transcending sectoral, geographical and organizational domains (Asheim et al. 2020). This, however, poses several challenges to the conventional RIS-based innovation policy. In this regard, several scholars (e.g., Asheim et al. 2020; Tödtling et al. 2022) have given detailed insights on how the conventional RIS approach can be broadened to take into account factors that have been previously ignored (Isaksen et al. 2022). They include the directionality of change, multi-scalar policy coordination, RIS reconfiguration and/ or transformation, and the actors of relevance to regional innovation policy.

For a long time, regional innovation policies were embedded in a relatively narrow understanding of market-based, technology-driven innovation, without much questioning of the need and function of innovation (Coenen and Morgan 2020). The current generation of innovation (e.g., artificial intelligence, radical innovations in green and/or manufacturing technologies, digitalization) is much more complex than innovation of the previous generations as it is characterized by high uncertainty and high risk (Coenen and Morgan 2020). Moreover, high hopes are put on innovation, or innovation-based activities, for solving many of the grand societal challenges, such as climate change, demographic changes, the widening of digital gaps, environmental deterioration and the loss of biodiversity (Schot and Steinmueller 2018). In this context, states and thereby (regional) innovation policies, have increasingly been expected to play a more important role in facilitating the new generation of innovation, as the complexity of innovation requires various resources and actors that are beyond the reach of individual firms.

As a result, a growing number of studies on new concepts such as responsible innovations (Owen et al. 2013; Sjøtun and Solheim 2023), mission-oriented (Mazzucato 2018), challengeoriented (Hassink et al. 2022), and transformative innovation policies (Schot and Steinmueller 2018) have become increasingly popular among policy-makers at several spatial levels, both in coordinated and liberal market economies (Mazzucato 2018; Tödtling et al. 2022). This new generation of innovation policy argues for a broader understanding of innovation that includes social and institutional innovations besides those in technological and business fields. Moreover, they suggest that rather than solely aiming at economic growth, the focus of innovation policy needs to shift towards tackling grand societal challenges and transformative change. Similar in emphasizing the directionality of innovation and change, increasingly, scholars from regional innovation policy studies have plead to move beyond GDP-oriented growth objectives by leveraging policy approaches for achieving more sustainable and inclusive forms of development (Tödtling and Trippl 2018). Such a normative turn (Uyarra et al. 2019) in regional innovation policy research, however, does not mean that the previous generations of innovation policies are obsolete. Rather, the new generation of innovation policy is often an extension of, rather than a replacement for, conventional regional innovation policy (Hassink et al. 2022).

Another recent development in the regional innovation policy domain is the acknowledgement of wicked problems related to sustainability transitions and regional transformations being ill-defined, contextual and often contested at local levels (Wanzenböck and Frenken 2020). Due to such wickedness, multi-scalar / inter-scalar policy coordination seems to be essential for the new generation regional innovation policy to be effective (Hassink et al. 2022). Here, the principle of subsidiarity in innovation policy is the key (Wanzenböck and Frenken 2020). According to Wanzenböck and Frenken (2020), given the contested nature of problem identification and the contextual nature of problemsolving, innovation policies aimed to tackle societal challenges are best pursued at subnational levels. Regional innovation policy should formulate concrete societal goals tailored to the local context, while the transnational context (e.g., the EU) promotes interregional learning and provides the complementary policies in the realms of basic research, regulation and taxation. In addition, the supranational level can set overall goals that are made more concrete and operational at the subnational level. This subsidiarity principle has been proved especially important in the EU context as the EU's multi-scalar governance structure requires decision-making to be effectively distributed across various levels (Grillitsch et al. 2019; Hassink et al. 2022; Wanzenböck and Frenken 2020).

# 4. Building regional (transformative) resilience by regional innovation policy?

As written above, regional innovation policies are an important part of state interventions that affect regional economic resilience. However, apart from Bristow and Healy (2014), who emphasized modes and structures of governance, types of policy interventions and horizons or timings for intervention in more general terms, it is only recently that more literature explicitly deals with the relationship between regional innovation policy and regional economic resilience, albeit to different extents.

For instance, the recent work by Kurikka and Grillitsch (2021) on resilience in two peripheral regions in Finland emphasizes active change agency, including place leadership, institutional entrepreneurship and innovative entrepreneurship, as key to guarantee long-term adaptability (see also Magro et al. 2022). They also relate change agency and crisis to

opportunity space, which can be seen as "the time or set of circumstances that make a change possible" (Grillitsch and Sotarauta 2020, 713). They emphasize that "it may also be useful for regional innovation policy to think about interventions in terms of affecting opportunity spaces" (Kurikka and Grillitsch 2021, 156). Connecting global value chain and regional development perspectives, Gong et al. (2022b) describe how regional economies that have been strongly embedded in global value chains and production networks can be affected by crises such as trade wars and COVID-19. With the help of a comparative case study of two clusters in Zhejiang Province in China, they show that a local institutional innovation, namely the Industrial Chain Chief Model (ICCM) proposed by Zhejiang Province, helped to strengthen, integrate and replenish local industrial chains in order to secure key products supply and achieve self-sufficiency. The ICCM is an institutional innovation in times of crisis that helps regional economies that are heavily embedded in GPN/GVC to reshape their strategies and thus their position in global production networks. Although not strongly related to existing regional innovation policy, such institutional innovations can help to increase the resilience of clusters by proactively reconfiguring and reshaping production networks in times of uncertainty.

While interesting, these works have not emphasized the transformative nature of regional resilience after crisis as well as the role of policies therein. In order to tease out to what extent regional transformative resilience can be fostered by regional innovation policy, in the rest of this section, we will examine the very recent work that deals with the interrelationship between these two aspects. Emphasis will be placed on issues such as directionality and experimentation of regional innovation policies, the multi-scalar coordination of different policies, the sequencing of crisis and policies and the consideration of short- and long-term interests in transformative resilience policy making.

As rightly pointed out by Asheim and Herstad (2021), when regional innovation policies are discussed in demanding times featured, for example, by current problems, the strategic question remains whether the best strategy is to seek to bounce back to the old normal. Alternatively, the strategy would be to use this critical time as a conjuncture to transform to a new normal that is more innovative, sustainable, and inclusive (i.e. transformative resilience according to Martin and Sunley (2020), Trippl et al. (2024)). According to the authors, policy advice derived from evolutionary approaches (e.g., smart specialization) to focus on supporting diversification into related activities is not very helpful to increase the resilience of the local economy, as it merely reinforces evolutionary processes already at play. Little room is thus left for entirely new products or technologies, and thus for radical innovation based on new combinations of unrelated knowledge. To increase regional transformative resilience in the long run, regional innovation policies should focus on directionality and experimentation<sup>1</sup>. Policy-makers thus need to focus on the creation of shared visions regarding the direction of change, coordination across different levels of governance and multiple policy fields, and importantly, the establishment of spaces for policy experimentation where failure is legitimate and learnt (Gong 2024). Moreover, different policy domains (e.g., industrial, innovation, science and technology, and social policies) also need to complement each other in order to achieve long-term transformative

<sup>&</sup>lt;sup>1</sup> Of course, experimentation is not without risk. For a detailed discussion, see Sengers et al. (2019).

resilience. These complementarities include considerations between supply-side and demand-side interventions, firm-level versus system-level types of policies, and support for industrial structure and research institutions.

Moreover, on a more practical level, Asheim and Herstad (2021) note, that long-term transformative resilience should neither be promoted by 'picking the winner' strategies of supporting national champions, nor by general policies in the form of tax reliefs and subsidies for R&D investments. What is needed, however, is multi-scalar, multisectoral policy coordination including top-down policies that strengthen the macro level innovation supporting infrastructure, e.g., global innovation linkages, and national and regional innovation systems, as well as bottom-up experimentation by the regional triple helix stakeholders to decide on which specific economic activities to develop (Koundouri et al. 2022). This top-down and bottom-up approach should be supplemented by a combination of sectoral-neutral, horizontal and non-neutral, vertical innovation policies. In the EU context, Koundouri et al. (2022)'s analysis of the EU Next Generation policy package (NGEU) which was launched in 2020 to cope with the COVID-19 crisis, and its cornerstone policy The Recovery and Resilience Facility (RRF), demonstrates the necessity of combining different policies. In the authors' view, to achieve resilience and sustainability at the same time after crises such as the COVID-19, frameworks such as the UN Agenda 2030 with its 17 SDGs, the European Green Deal, as well as the NGEU are essential as they share the objective of leveraging innovation policies to support transformations required to address current global challenges. These, however, have to be complemented by concrete national and regional strategies and policy initiatives from below. This also implies greater coordination and cooperation between innovation and other policy domains.

Another key question related to regional innovation policy promoting transformative resilience is the sequencing of crisis and policy responses, i.e. whether regional innovation policy should be in place ex-ante to ensure regional resilience or whether regional innovation policy should be deployed ex-post after the shock to accelerate adaptation processes. In this respect, Magro et al. (2022) provide an excellent discussion on the relationship between agency, policies and institutions and regional resilience, using the Basque region as an example. They distinguish between adaptation after short-term shocks, such as COVID-19 and the financial crisis, and adaptability for long-term changes, such as deindustrialization or climate change (see also Pike et al. 2010). For adaptation after shortterm shocks *reactive* policies need to be created, which often are not strongly related to regional innovation policy, whereas for adaptability, *proactive* policies are needed that are more strongly embedded in regional innovation policy (Magro et al. 2022). The distinction between adaptation and adaptability "... is important in order to understand regional resilience as each process relates to very different types of policy rationales and attitudes of the actors involved, namely reactivity and proactivity ..." (Magro et al. 2022, 278). Examples of reactive policy measures, which are *ex-post* and deal with the urgent and unexpected, include particularly macro-economic policies, often at the national level, such as labor market policies having short-term effects to cope with a shock (Magro et al. 2022, 281). Proactive policy measures and instruments, in contrast, are often ex-ante (i.e. prior to crisis), meaning that they are dealing with the necessary and expected. Useful proactive measures

such as cluster policies, smart specialization policies, challenge-oriented innovation policies, aiming to foster long-term restructuring and transformation, are clearly closer to regional innovation policies (Magro et al. 2022), and they are helpful for regions to achieve transformative resilience when crisis occurs.

While such a discussion on the sequencing of crisis and policy action is helpful, it is important to note that proactive, adaptive measures can also be implemented ex-post after a crisis to promote transformative resilience, as people's long-established perceptions of innovation, quality of life, prosperity and well-being can fundamentally change due to such a crisis. A good example of this is the current dual crisis of COVID-19 and climate change (Markard and Rosenbloom 2020). While in much of the world GDP-led growth has been the dominant rationale for regional innovation policy, COVID-19 and increasingly frequent climate disasters have provided many regions with the opportunity to rethink their innovation policy rationale (Kanda and Kivimaa 2020; Steffen et al. 2020). Against this backdrop, more and more regions are now using this window of opportunity to promote alternative futures by emphasizing the importance of a sustainable, inclusive growth model that takes serious account not only of human welfare, but also of the environmental impacts of economic activities (Markard and Rosenbloom 2020). The Green Recovery policy in Europe is an example of this, as the purpose of such a proactive ex-post innovation policy is not to 'bouncing back' to the previous unsustainable and unequal paths, but rather to 'bouncing beyond' the old paths by clearly pointing to and promoting more sustainable and inclusive growth trajectories. In terms of the time horizons of such post-crisis policies, Steffen et al. (2020) propose that three different policy horizons (i.e., months, years and decades) need to be developed and policy priorities of the three-time horizons should be coordinated according to the challenges of the different periods after a crisis.

The balance of short- and long-term interests is another crucial factor to consider for transformative resilience policies. Moghadam-Saman et al. (2024), for instance, focus on the coordination of policy goals and instruments in order to achieve the best outcomes after a crisis. They state that potential tension within a policy mix because of conflicting rationales, goals and approaches to implementation can lead to tensions between short-term adaptation and long-term transformative resilience. They also develop a framework for assessing policy mixes in addressing regional resilience. They illustrate this with the help of an empirical case about petroleum-dependent Western Norway during COVID-19, showing the tension between national industry policy to save jobs in the oil industry and the regional long-term goal of economic transformation. The debate about balancing short-term and long-term interests in the aftermath of a crisis has also taken place in the broader social science (Markard and Rosenbloom 2020; Steffen et al. 2020). Markard and Rosenbloom (2020), for instance, point out that response to the COVID-19 crisis can potentially provide an opportunity to advance the climate agenda if policies are carefully designed. With scarce resources available to most governments today, it is critical to focus efforts to address the twin challenges of the pandemic and climate change. The authors therefore propose two approaches to address the dual challenge: On the one hand, governments must harness the disruptive forces of the COVID-19 pandemic to accelerate the phase-out of carbon-intensive industries, technologies and practices instead of bailing out carbon-intensive activities; on

the other hand, they can also use the response to promote low-carbon, clean innovation. While many governments have tried to save carbon-intensive sectors during and shortly after a crisis out of concern for short-term job losses, the authors argue that from a longterm perspective, it would be more important to channel resources into cleaner and more sustainable technologies while accelerating the exit from dirty and unsustainable economic activities. The capability to leverage policy responses to promote innovation that meets SDGs can thus be seen as a key capability for countries and regions to achieve transformative resilience.

Overall, recently some studies have been carried out in exploring the relation between regional transformative resilience and regional innovation policy, in a broad sense, with emphasizing different aspects of the relations. Most take short-term adaptation and long-term adaptability (and thus transformative resilience) as a starting point of the discussion, which are not necessarily opposed with different degrees of tension, but can also complement each other (Magro et al. 2022).

# 5. Conclusions and avenues for future research

This chapter provides an overview of the work on regional resilience and regional innovation policy, respectively. The recent efforts in bringing these two perspectives have also been critically examined as well. We argue that although the concept of regional resilience has been around in economic geography and regional studies for some years, it has increasingly been discussed more recently because of an increasing number of crises, such as climate change, energy crisis, and COVID-19 (Martin 2021). Moreover, the directionality of change in the post-crisis era has become increasingly important as well. Whereas previous research has largely overlooked the issue of how regions can leverage on crises as windows of opportunity to realize greener, more inclusive and sustainable recovery, it has become a central concern in the current discussion on how to build back better in the COVID-19 crisis. New concepts, such as 'transformative resilience' or 'bouncing beyond' the status quo, have been suggested recently even though empirical evidence is still largely missing.

On the other hand, regional innovation policy studies have experienced a similar normative turn in the last decade or so. In responding to increasingly intensified occurrence of crises, scholars and policy-makers started to question the growth-driven rationale for innovation policies (Tödtling et al. 2022). Similar to the work on resilience, sustainability and inclusivity have become increasingly important in recent work on regional innovation policy.

As far as the interrelationship between regional resilience and regional innovation policy is concerned, the existing literature points to the essentiality to differentiate intensity and duration of the shock or crisis as well as different mixes of (innovation) policy instruments that can be applied to tackle them. While regional innovation policy and related change agencies at the regional level are particularly prone to support long-term adaptability of regional economies, they are less well able to react to short-term shocks, so that in many cases national policies are needed to deal with short-term adaptation. So arguably, in times

of more crises, as well as grand societal challenges, regional innovation policies need to be more multi-scalar in character and coordination between regional, national supra-national levels becomes more important, which leads to coordination challenges. Moreover, in current times, regional innovation policies need to become more flexible and show a better early awareness, as shocks and crises come often unexpectedly. In order to be better able to use crises also to change structures and to support transformative resilience, active change agencies will be increasingly important in regional innovation policies, particularly also given the tension between short-term and long-term goals, and between adaptation and adaptability.

Moreover, an important distinction between place-based and spatially blind regional innovation policies also need to be made against the background of the resilience discussion. In our view, the former is better able to support regional resilience, as not only is each crisis unique, also each regional economy has unique conditions and a unique context that needs be taken into account when dealing with a shock or crisis. Moreover, in order for innovation policy to be effective in contributing to achieving long-term resilience, it is important to take a systemic perspective. This requires consideration of a range of issues, including R&D, networks and interactive learning of those involved in the innovation process, competence building, demand-side requirements from the perspective of product use, and finance for both commercialization and adoption (Cook and Vorley 2021).

Based on our elaborations we see potential for future research along four promising avenues. The first avenue concerns the different types of resilience and the different types of regional innovation policy required. As mentioned earlier, different types of regional resilience can be distinguished, including 'bouncing back', 'bouncing forward' and 'bouncing beyond' (Grillitsch and Asheim 2023). These differences mean that the policy mix and tools needed to promote resilience also differ fundamentally. In this context, future research could analyse the alignments and misalignments between the different types of resilience and regional innovation policy, the reasons behind them and potential solutions for better alignments of the two. Policy makers need to think carefully about what the key challenges are that they want their innovation policies to address. Often, concerns about the urgency of a short-term rescue (e.g., bailing out unsustainable industries, businesses, etc.) outweigh long-term regional transformation for policy makers, in part due to short-term constituencies of election systems. While innovation policies that enable short-term recovery are sometimes inevitable, future research needs to elaborate on how to leverage policies during the crisis time for medium- or long-term regional transformations, ideally in a more sustainable and inclusive direction (Steffen et al. 2020). How to balance such conflicts of interest is, of course, an extremely difficult and tricky issue, but at least some degree of policy continuity and consistency should be ensured in order to realize regional long-term transitions. In this respect, the simultaneous consideration of ex-ante and ex-post innovation policies in times of crisis is an important step towards achieving policy coherence. Moreover, the balance between investments in old versus new economic activities also needs to be carefully analysed, as each crisis or shock can also be seen as an opportunity to re-direct and / or diversify a region's economic structure.

Secondly, since a normative turn can be observed in both the regional resilience and regional innovation policy studies, we believe that the discussion on how to direct innovation activities (with innovation policy tools) to realize regional transformative resilience, or changes that are more desirable, is currently highly relevant. In this regard, interesting research questions include: how can regional innovation policy be used to attract more investments in green technologies and infrastructure, more responsible and people-oriented innovations after a crisis? How can they facilitate regional green and inclusive recovery and thus realize transformative resilience? And how can regional innovation policy facilitate the multi-scalar resource mobilization needed for transformative resilience?

Thirdly, in order to facilitate regional resilience through innovation policies, policy coordination and learning across scales are inevitable. Here, interesting research questions include: how to coordinate multi-scalar, multi-sectoral and multi-temporal policy-making and implementation in order to achieve transformative resilience? What are the best scales to deal with specific challenges that are related to short-term shocks but also long-term slow burns?

Finally, while both regional resilience and regional innovation policies have been calling for greater involvement of state in innovation, such call for more state continues to promote a 'weak' vision of the relationship between innovation and the state, and prevents a more substantive understanding of statehood in socio-political terms in the context of innovation policy for transformative resilience (Juhl et al. 2024). In other words, the state has long been treated as a hands-off facilitator as part of a technology-to-market framing, which conceptually external to the innovation process itself. In order to arrive at truly transformative vision for innovation policy, we need to develop a "strong" conception of statehood in innovation that allows for inclusive political deliberations not just about technological possibilities and economics, but also about the power and political responsibility of the innovation policy should focus on innovation politics in order to give a substantive role to the state in harnessing innovation for the public good (Juhl et al. 2024).

All in all, we believe that the exploration of the interrelationship between regional (transformative) resilience and regional innovation policy is a highly promising field for future research in economic geography and regional science.

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