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Twenty years of regional innovation studies: From local-global to agency-structure

Bjørn T. Asheim[1] and Markus Grillitsch[2]

Abstract: The chapter discusses the theoretical reorientation in economic geography over the last twenty years from a focus on structures, represented by regional innovation systems, to addressing the role of human agency in regional economic development, and reflects on what the two approaches can contribute to achieving sustainable regional restructuring. We are doing this by focusing on two articles – published in 2002 and 2022 - representing the two approaches. The 2002 article discusses the role of place-specific, local resources and external knowledge in strengthening the competitiveness and innovativeness of firms and regions. This perspective is still relevant in analyses and designs of regional innovation policies. However, a realisation of the shortcomings of a structural approach to explaining the variations of regional development outcomes in different types of regions, has led to a more explicit focus on the importance of change agency in regional change processes, as articulated in the 2022 article.

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Introduction

The chapter sets out to do two things. First, in what will constitute the larger part of the chapter, we will analyse the development of economic geography and regional innovation studies over the last 20 years, from a structural approach based on clusters and regional innovation systems to a more actor and agency-based approach, and try to evaluate which advances, theoretically and with respect to policy implications, this development has implied. Secondly, we will reflect on what these two different approaches can contribute to achieving sustainable regional restructuring. In section three, we argue that the structural approach of clusters and regional innovation systems is still useful through a reorientation strategy to support green innovation (Isaksen et al., 2022) and that the actor and agency perspective is strategic to achieve a green transition and regional sustainable restructuring as we think that this depends more on the ability of key actors to obtain public legitimacy and support for necessary policy initiatives than on technological capacity. Moreover, we argue that the agency perspective is essential to understand when, why, and how sustainability directionalities emerge in regions.

We are doing this by focusing on two articles representing the two approaches, the article "Regional innovation systems: the integration of local 'sticky' and global 'ubiquitous' knowledge " by Asheim and Isaksen (2002) in the Journal of Technology Transfer and the article "Advancing the treatment of human agency in the analysis of regional economic development: Illustrated with three Norwegian cases" by Grillitsch et al. (2022) in Growth and Change, in which Asheim and Isaksen are co-authors. To allow for greater depth and a more theoretical informed discussion we have decided to focus on these two representative articles to illustrate a key conceptual shift in regional studies, instead of presenting a literature review.

Despite the significant differences, there are several similarities between the two articles. They both aimed at explaining regional development; they used regional innovation systems as an analytical framework, and they were based on three case studies, one, the maritime cluster in Sunnmøre, even being the same in the two articles. However, they also differ considerably. The 2002 paper focused on innovation – how firms innovate, what kind of cooperation was involved, what kind of knowledge was used, and what was the importance of regional internal versus external knowledge – as a key aspect for firms' and regions' competitiveness. The 2022 paper had a broader aim, using the interplay between change agency and structures to explain the development path of the three cases. Both articles referred to internal and external conditions, but whereas the 2002 paper focused on different types of knowledge exploited for innovation activities, the 2022 paper looked at external conditions as constraints and enablers on the potential regional path development that actors and agency can initiate. These two contributions are important as they illustrate the development of regional innovation studies from a focus on the nexus between local and global to the nexus between change agency and structure. We have chosen these two articles as they are representative examples of the two approaches.

The 2002 article aimed at examining how firms in the three clusters make use of 'place-specific, local resources as well as external, world-class knowledge to strengthen their innovativeness and competitiveness' (Asheim & Isaksen, 2002, p. 77). The article carried out this examination by analysing the innovation performance in three regional clusters, shipbuilding at Sunnmøre,

outside Ålesund, farm-machinery at Jæren, south of Stavanger, and electronics industry in Horten, south-west of Oslo. In the following section, we take a closer look at what characterised the way innovation took place in the three clusters and how this impacted the regional development. The next section will elaborate on the article from 2022, discuss the differences between the two articles and based on this, reflect upon the development the field over the two decades. We continue with a proposal of integrating the two approaches as local-global and structure-agency nexus.

Innovation in three clusters

Shipbuilding at Sunnmøre

The shipbuilding industry at Sunnmøre can be characterised as a cluster where the firms mainly depended on incremental innovations in a regional network. The firms carried out innovation in four, interlinked ways: (1) by local user-producer interaction, (2) as incremental innovations on the shop floor, (3) by local knowledge spill-over, and (4) by means of cooperation via local organisations (Asheim & Isaksen, 2002, p. 78)These are typical drivers of innovation in engineering-based industries, such as shipbuilding, drawing on experienced-based knowledge, that is local and place-specific, as a result of years of specialised industries and workforce in the cluster, what Marshall referred to as 'industrial atmosphere', and, thus, based on knowledge that is rather immobile and 'sticky' (Asheim, 2000). Such experienced-based knowledge of engineering industries would later be termed 'synthetic' in contrast to science-based knowledge, called 'analytical' (Asheim, 2007; Asheim & Coenen, 2005).

A condition for these factors driving innovation and making the firms competitive was spatial proximity or co-location in a cluster between the various actors. This was especially important for user-producer interactions and local spill-over. This shipbuilding cluster was characterised by being constituted by a complete value chain, from shipowners via yards to specialised equipment suppliers, subcontractors, designers and consultants. In this value chain system, yards played a strategic important role as integrators of specialised equipment and other input, and the tendency in later years to outsource the most labour-intensive parts of building a ship, the hull, to low-cost countries, weakens the position of shipyards in the cluster, which could have devastating effects on the innovation capacity of firms in the cluster. In addition to spatial proximity, this co-location of actors in the value chain in a local production system, also represented social, organisational and institutional proximity. If specialised equipment suppliers had to travel to Turkey or EastAsia to discuss with the shipyard how their products work, this would more or less eliminate the innovation advantages of the user-producer interactions. In addition, outsourcing hull production would also reduce the manufacturing capacity and capabilities of the yards, where learning and innovation on the shop floor take place.

In engineering-based industries, learning and incremental innovation play an important role. In such industries with batch production, it is common to make a distinction between technology development, which is applied research often done in cooperation with technical universities or research institutes, and application development, which is carried out on the shop floor when products for the end market is manufactured (Asheim & Parrilli, 2012). This application

development is based on input from users and customers, consultants, and suppliers, and is made use of in the manufacturing process by a highly qualified workforce with specialised knowledge. In manufacturing industries, this is frequently the most important mode of innovation, which often is neglected, as it does not appear in Research and Development (R&D) statistics. In the shipbuilding industry at Sunnmøre, this mode of innovation constituted a high share of the incremental innovations.

As the article also mentioned, even if the case from the shipbuilding industry at Sunnmøre was characterised by incremental innovations based on localised learning and interactions, 'innovations nevertheless increasingly involved the use of R&D based knowledge'(Asheim & Isaksen, 2002, p. 79). R&D-based knowledge was often sourced externally at national and sometimes international R&D institutes and technical universities, which is an example of innovation understood as technological development of new technology platforms for the next generation of products. This combination of local competence with nationally and globally available R&D competence was necessary for the cluster firms to strengthen their competitiveness.

Farm-machinery at Jæren

The cluster at Jæren producing mostly different types of farm machinery was characterised by close, horizontal inter-firm cooperation and interacting learning processes, resulting in the development of core technologies (Asheim & Isaksen, 2002, p. 80) In contrast to the Sunnmøre case, at Jæren it was a question of horizontal cooperation to develop new technology of common benefit, in this case robot technology, and not vertical cooperation between suppliers, subcontractors and lead firms along a value chain. What was also characteristic of the Jæren cluster, was that this horizontal cooperation was initiated and orchestrated by an organisation called TESA (Technological cooperation), which was established by local industry as early as 1957 with the aim of developing robot technology. The members of TESA were mostly small and medium-sized, export-oriented firms producing mainly farm machinery. The technological cooperation in TESA had, at the time of the writing of the 2002 article, resulted in the district being the centre of industrial robot technology in Norway (Asheim & Isaksen, 2002, p. 80). TESA represented an interesting example of what in the Third Italy is called 'centres of real services' (Asheim, 2000).

The technological cooperation in TESA between the member firms was primarily dependent on the high level of internal resources and competence in the firms, especially in the two leading large firms, ABB Flexible Automation, at that time the largest producer of painting robots for the car industry in the world, and Kverneland, one of the largest producers of farm machinery in the world, and did not basically involve R&D institutes in Stavanger or nationally (Asheim & Isaksen, 2002, p. 80).

Later on, the cooperation with national and international R&D institutes and technological universities became more important, but one interesting observation was that the firms had more and closer cooperation with technical universities abroad, especially in Sweden and Germany, both with a large manufacturing industry, than with the largest technical university in Norway, the Norwegian University of Science and Technology. The explanation of this is that Norway does not have a large manufacturing industry (i.e., automotive industry as in Germany and

Sweden). In addition to using foreign technical universities, the second most important source of R&D-based knowledge was to utilise corporate R&D capacity for those firms which were part of international corporations, such as ABB, or research in cooperation with foreign, strategic partners.

Despite the differences, what was common for the clusters at Jæren as well as at Sunnmøre, was the use of place-specific, local and 'sticky', often tacit knowledge, as well as R&D-based knowledge that often were sourced nationally and internationally. This result confirmed later research that demonstrated that a combination of different modes of innovation (STI (science, technology and innovation) and DUI (doing, using, interacting) modes of innovation) showed the best innovation performance (Jensen et al., 2007).

Electronics industry in Horten

While the industries in the clusters of Sunnmøre and Jæren were engineering-based industries, where synthetic and tacit knowledge were dominant, the electronics industry in Horten represented a combination of science-based, analytical and synthetic knowledge. This implied that the relative importance of localised learning and innovation was of less significance than non-local, external R&D-based cooperation, even if the cluster constituted a local production system with suppliers and subcontractors. Thus, the firms' innovation activity mainly took place in cooperation with national (The Norwegian University of Science and Technology) and international technical universities and R&D institutes. Large, mainly national customers also formed part of the national innovation system in the role of early and demanding customers. Other specialised firms and suppliers complemented the firms' internal competence in advancing product innovation v.

The innovative capacity of the firms was also more characterised by R&D-based knowledge than experience-based, as in the clusters of Sunnmøre and Jæren. Many of the firms in the Horten cluster had relatively large R&D departments with scientists and engineers employed (Asheim & Isaksen, 2002, p. 81). Corporate R&D resources in other locations strengthen this R&D-based innovation activity. Part of the localised learning in the production system took place between the system firms and specialised suppliers. Location close to suppliers, as was also the case in the production systems in Sunnmøre and Jæren, represented an advantage for promoting new product innovation as proximity matters in industries which depend on interacting and learning to strengthen their innovativeness and competitiveness.

Regional innovation system – types and function in the three clusters

In addition to analysing the innovation performance of firms in the three clusters, the second aim of the article was to investigate the role of regional innovation systems in underpinning innovation. The concept of the regional innovation system (RIS) was at the time of the writing of the article a relatively new concept, first launched by Phil Cooke in 1992 (Cooke, 1992), as a complement to the National Innovation System, that appeared some years earlier (Freeman, 1987).

The analysis of the three clusters in the 2002 article was used to distinguish between three main types of RIS: 1) territorially embedded regional innovation network, which Sunnmøre was an example of, 2) regional networked innovation systems, illustrated by Jæren, and 3) regionalised

national innovation system, which characterised Horten. The article uses this typology to make two points. First, it argues that the RIS concept may not be a fruitful analytical framework in peripheral areas and in declining industrial regions dominated by branch plants of multinational enterprises (MNEs). This point highlights that for a region to have a RIS the two subsystems of a knowledge exploration system of universities and research institutes and a knowledge exploitation system of industries, often located in clusters, must exist, as well as a systematic and long-term interaction between the two subsystems. In peripheral areas, neither of these subsystems may exist, or only one of them, the exploitation subsystem. However, the Sunnmøre cluster might be characterised as having a peripheral or a semi-peripheral location, and still, we were able to find, if not a fully-fledged RIS, at least what we called a territorially embedded regional innovation network. We found a well-working subsystem of exploitation with a whole value chain co-located, but not a strong exploration subsystem at the time of the writing of the article. As the 2022 article shows, this has now changed due to the merger of the regional university college with the Norwegian University of Science and Technology, the advancement of the cluster to the highest status in the Innovation Norway cluster program, Global Centre of Excellence, and with the establishment of a Centre for Research Driven Innovation in a collaboration between the maritime industry and the university, funded by the Research Council Norway.

This point of being careful with taking for granted the existence of RIS in all types of regions can be illustrated by looking at Norway. Norway is characterised by an unbalance between the location of the largest universities and most of the manufacturing industry. While the two largest universities, the University of Oslo and the Norwegian University of Science and Technology, are located in the capital and the third largest city, a majority of the export-oriented small and medium-sized enterprises (SMEs) is located along the coast, often in semi-peripheral areas as the Sunnmøre cluster. The two largest universities dominate the intake of R&D means with the University of Oslo bringing in around 60% of all R&D funding and the technical university around 60% of funding for technical research. According to a study published in 2017 (Herstad & Sandven, 2017), only one region, Agder in the south of Norway, had a regional networked innovation system, the ideal type of a RIS. In the other regions, the at best regionalised national innovation systems were identified, constituted by regional clusters supported by Innovation Norway's cluster program, collaborating mostly with the Norwegian University of Science and Technology in Trondheim. This picture has been modified in the years after with at least two more regional networked innovation systems, the one found in Møre og Romsdal, where Sunnmøre is located, due to the merger of the university college and the technical university, and in Vestland, with Bergen as the main centre, where its many clusters have started collaborating more with local universities and research institutes.

The second point that was made in the article pointed at the danger of focusing too much on the regional level and ignoring the need to integrate place-specific, experience-based and tacit knowledge with codified, R&D-based knowledge, which was found externally, either nationally or internationally. This was precisely one of the main results from the three case studies in the article (Asheim & Isaksen, 2002, p. 85). In later research on RIS, as reported in Asheim et al. (2019), the external knowledge sourcing, e.g., when clusters are part of global value chains, has become much more in focus. However, because of the transition from a

neoliberal globalisation to a post-neoliberal era with reshoring and deglobalisation, the discussion of the importance of external knowledge sources has taken a new turn (Grillitsch & Asheim, 2023).

What was not in focus in 2002 was the role of actors and agency in explaining the innovation performance in the three cases, the type of collaboration taking place and the resulting regional development. There were a lot of actors and agency implicit in the three clusters analysed, e.g., when the four ways innovation was carried out in the shipbuilding cluster was discussed, when the workings of the TESA collaboration were analysed, and in the functioning of the three types of RIS, but there was no explicit focus on how agency plays out in establishing, reproducing or changing these structures. This was what the article from 2022 aimed to do, and we now turn to lay out which advances in explaining regional development this has implied.

Agency-structure in regional development

Between the 2002 and 2022 articles, we have witnessed a fundamental change in the public and academic debate. In the 2000s, the focus of regional innovation studies (and policy) was to investigate and better understand the region (place-based) characteristics, which contribute to learning and innovation, and thereby promote economic development and the creation of income and job opportunities. The 2020s have seen a growing emphasis on studying processes of structural transformation towards sustainability. This change in focus follows in the backwaters of financial, economic, environmental, and health crises. As Donald and Gray (2019) argue, regions must deal simultaneously with the double crisis of striking regional disparities and global warming.

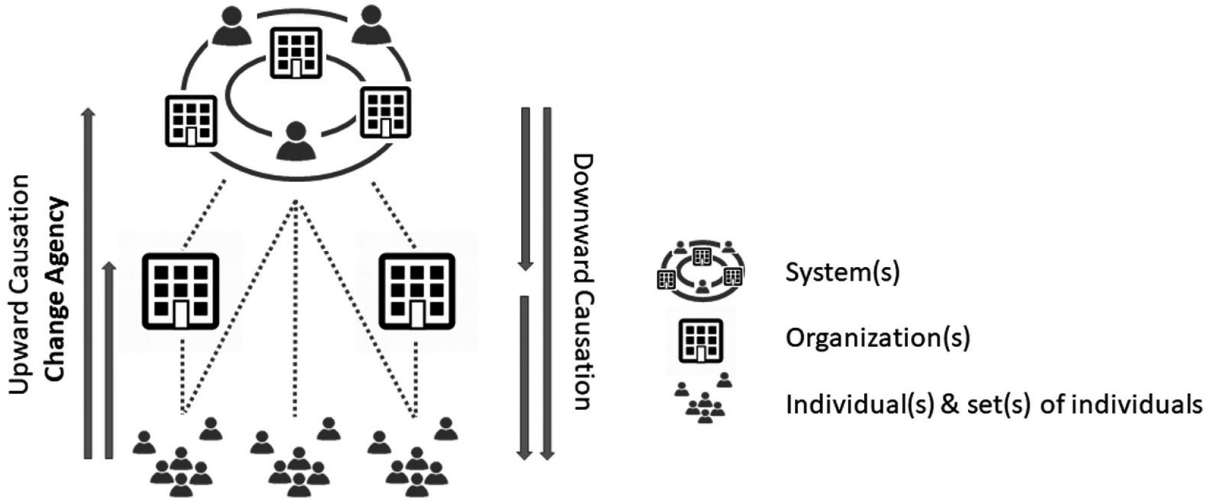
The aim of understanding structural transformation towards sustainability exposed a fundamental limitation of studying regional preconditions and structures for innovation. Firstly, it neglected whether innovation influenced the direction of regional development and, secondly, if the direction of regional development changed, the processes and causes of such change in direction remained mainly in the dark. Hence, to gain knowledge about regional change processes, it was necessary to dig into these processes and study how actors engage with their environment and respond to the many crises of recent times, as well as to better understand how regional and extra-regional conditions influence such social engagement and its outcomes. This is also the focus of the paper published in 2022.

One of the main contributions of this paper was to conceptualise the interplay between top-down causation (how regional and extra-regional structures influence agency) and bottom-up causation (how change agency affects structures) and anchor this conceptualisation in a critical realist methodological approach (Asheim et al., 2022). In essence, a stratified ontology is proposed in which individuals, organisations, and systems exercise human agency (see Figure 1). Upward causation refers to the possibility for and the engagement of sets of individuals to affect and shape organisations and systems (for instance regional innovation systems). The social engagement of actors in such transformative processes is referred to as change agency. Downward causation refers to how systems affect organisations and individuals, and how organisations affect individuals. Organisations and systems influence, for instance, through organisational routines, institutions, and embedded power relations who can engage in change

processes, and what outcomes such engagement may have (downward causation). Hence, the opportunities for change agency will differ between organisations in the same region as well as between regional innovation systems. This is the agency of organisations or systems.

Figure 1

A stratified ontology of human agency



Note. From "Advancing the treatment of human agency in the analysis of regional economic development: Illustrated with three Norwegian cases." by Grillitsch, M., Asheim, B., Isaksen, A., & Nielsen, H. (2022).Growth and Change, 53(1), 248–275. https://doi.org/10.1111/grow.12583.

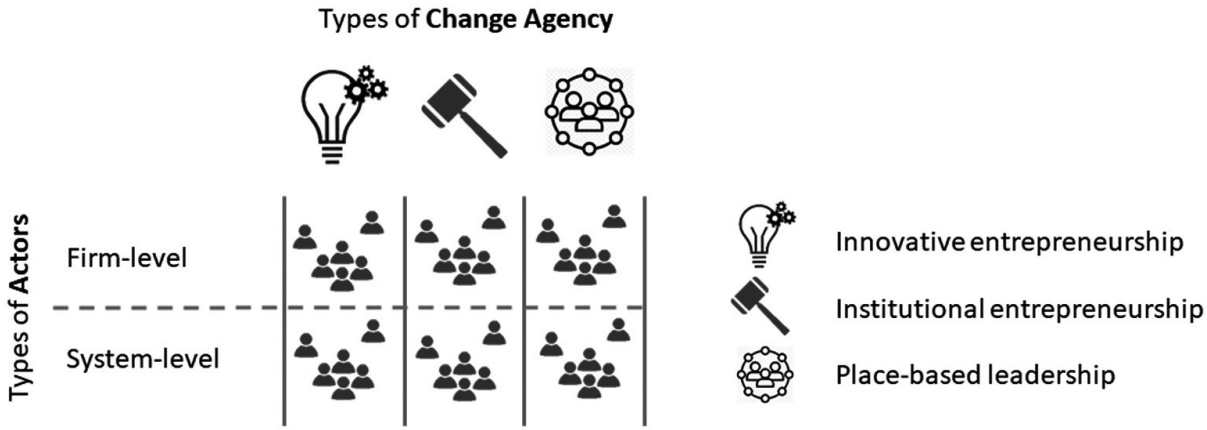
This perspective is then complemented by combining two influential conceptualisations of change agency in regional development. First, in 2019, Isaksen and colleagues (Isaksen et al., 2019) published an article in which they built on the differentiation between knowledge exploitation and knowledge exploration subsystems established in the literature on regional innovation systems. They argue that transformation in regional innovation systems requires change in both subsystems. Referring to the knowledge exploitation subsystem, the authors see a role for firm-level agency, which captures mainly innovative efforts to diversify into new markets and technologies (hence, introducing change from existing industrial pathways). Referring to the knowledge exploration subsystem, the authors argue that system-level agency is required, which makes changes to the regional support structures for innovation and entrepreneurship.

Second, Grillitsch and Sotarauta (2020) argue that in the context of regional development, local actors engage in three main forms of change processes: i) innovative entrepreneurship as a process where knowledge and recourses are combined in new ways to generate new or improved products, services, processes, or organisational forms, ii) institutional entrepreneurship, which covers the engagement of actors in changing existing or introducing new informal (e.g., values, norms) or formal (e.g., regulations, laws) institutions, and iii) place-based leadership which concerns processes of mobilisation and coordination between different actor groups in the pursuit of common goals. While being theoretically distinct, it is argued that regional transformation processes often require combinations of this 'Trinity of Change Agency', thus positing that innovation alone is not sufficient to achieve structural transformations.

These two perspectives are integrated in the 2022 paper suggesting firm-level actors and system-level actors could engage in different ways in any of the three types of change agency during a regional transformation process resulting in six change agency-actor combinations in regional innovation systems as shown in Figure 2. This relates to the findings of Jolly et al. (2020) and Bækkelund (2021) that actors change their role over time, where some actors might contribute to change in one period while promoting the maintenance or reproduction of systems in another.

Figure 2

Change agency-actor combinations in regional innovation system



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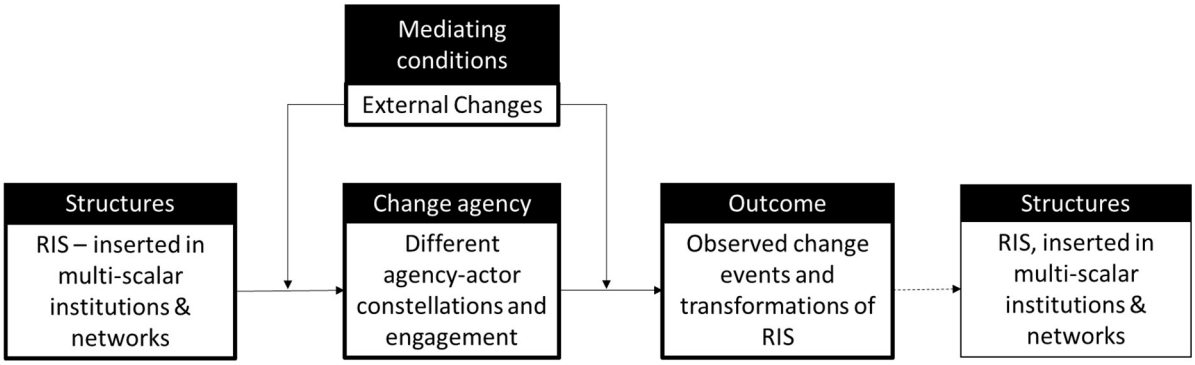
The integration in a critical realist framework shows the link between agency and structure, and mediating conditions in the context of transforming regional innovation systems (see Figure 3). Working backwards following the idea of path tracing (Sotarauta & Grillitsch, 2023), the framework is to explain observed change events and transformations of regional innovation systems. This transformation is explained by the ways in which different sets of actors engage in the change process. Yet, how, why and to what extent actors engage further needs to be understood in the context of pre-existing structures, in this case, the regional innovation system, which is inserted in a multi-scalar institutional and network architecture, as well as the external changes that may mediate actor's engagement and its outcomes. The focus of this framework is on understanding structural changes to regional innovation systems. It caters for top-down causation, referring to how the structures manifested in a regional innovation system influence change agency, as well as in how external changes mediate what local actors decide to do or refrain from doing, and how the outcomes are influenced by external changes. Bottom-up causation is captured by the intended and unintended consequences of local actors' intentional and purposive engagement in change processes (i.e., the link between change agency and observed changes).

Figure 3

Agency and structure in a critical realist framing



Note. Adapted from "Advancing the treatment of human agency in the analysis of regional economic development: Illustrated with three Norwegian cases." by Grillitsch, M., Asheim, B., Isaksen, A., & Nielsen, H. (2022).Growth and Change, 53(1), 248–275. https://doi.org/10.1111/grow.12583

The shift in scholarly attention to the nexus between structure and agency leads to different insights as compared to the previous research focus on the local-global learning dynamics. This is best illustrated by comparing the insights of the 2002 with the 2022 paper for a shared case, the shipbuilding industry in Sunnmøre. The 2002 paper explained the innovativeness of the local cluster based on the learning processes between firms located in close geographic proximity, the role of shipyards in integrating the knowledge, as well as the appropriation of some knowledge from extra-regional networks to research environments. Despite being innovative, the cluster in the early 2000s was also in a problematic situation, a time when many shipbuilding clusters in high-cost countries were declining due to a relocation of activities to lower-cost countries. The then-responsible minister for industry suggested that the region diversify into other industries as shipbuilding was projected to have no future in high-cost countries like Norway. However, collective place-based leadership of the business community, mayors, and the technical university college from the early 2000s up to 2020 has been instrumental in building a strong local support infrastructure for innovation and entrepreneurship. At the same time, local firms have individually, and in collaboration taken risks to be early movers in the maritime industry and diversify into new market niches. These agentic processes combined with a high demand from around 2004 to 2014 boosted growth and upgrading of the local industry, while a drop in demand thereafter and the green growth agenda led to a diversification of the industrial paths.

While the involved change agency-actor combinations in the case of Sunnmøre could be related to local preconditions and an entrepreneurial culture, the agentic patterns in the other two cases emerged despite unfavourable regional preconditions. Mo i Rana struggled for years from the disintegration of Norsk Jernverk exhibiting continuous decline, weak local networks, and no collaborative or entrepreneurial culture. A few private actors laid the seed for a change process, started to build local networks, gained knowledge about capabilities and interests of actors in the region, developed a direction for regional development and a collaborative culture, and mobilised resources and funding to build a regional innovation system. Over time, both the knowledge exploitation and exploration subsystems were strengthened by a combination of

entrance of external actors and engagement of actors already present in the region. This led to a turn from regional decline to renewal and diversification.

Arendal, even though having had a stronger regional innovation system with advanced capabilities of multi-national companies and the presence of higher education institutions, suffered from relatively weak local networks, a perceived passive and somewhat intolerant local culture, and declining investments. Against this backdrop, the long-term strategy of the county council to support university-industry collaboration and strengthening the research environments of the local university campus were important. This engaged the rector of the local university campus and the municipalities in institutional entrepreneurship and place-based leadership. Through a variety of activities such as the development of the 'Arendalsuka', a week bringing together top-level stakeholders from business, academy and government, the successful application to the global centre of expertise programme, or the development of test labs and centres for research-based innovation, the local engagement has led to a strengthened regional innovation system, a more positive people's climate, industrial diversification, and enhanced innovativeness.

The elaboration of the cases in comparison to the empirical study of the 2002 paper illustrates the different foci and insights. In 2002, the focus was on the regional characteristics and how the nature of local and global relations promoted learning and innovation. In the 2022 study, the focus was on how the engagement of local actors transformed the regional structures and thereby also influenced innovation outcomes. Hence, these two "generations" of regional innovation studies are complementary, where the understanding of regional structure and innovation processes provides an important foundation for the nexus between structure and agency. The connection between studies on regional innovation systems and agency is relatively natural because the innovation system literature is in its origin an institutional approach referring to socially produced structures such as formal and informal institutions and networks that underpin local learning and innovation dynamics. When studying structure and agency in the context of regional innovation systems, the concern is thus how the engagement of sets of actors transforms or reproduces regional innovation systems, and how the established structures enable or hinder certain agentic patterns and affect outcomes.

An integrated framework

The nexus of the local-global and structure-agency dynamics is summarised in Table 1. In the 2000s research has paid attention to structural characteristics. One focus was to identify how regional innovation systems differ in structure. The differentiation in territorially embedded regional innovation networks, regional networked innovation systems, and regionalised national innovation systems as described in the 2002 article is a good case in point. However, it was also noted that focussing too much on regional structural preconditions overlooks the possibilities to access markets or combine technologies available globally. This analysis was made with the perspective of firm innovation, i.e., how the regional innovation system and the embedding in global networks would promote innovation (downward causation).

Grillitsch and Sotarauta (2020) suggest the notion of opportunity spaces to link structures with agency. Opportunity spaces are anchored in the historically developed structures (e.g., RIS) but

capture the range of possibilities for innovation and transformation towards sustainability in the future. Grillitsch and Sotarauta (2020) suggest that opportunity spaces are stratified differentiating in an actor-specific, place-specific, and time-specific layer. The local structures, in this case, the type of RIS, would be the foundation of the place-specific opportunity space. The time-specific level of the opportunity space captures the possibilities for innovation and transformation towards sustainability given the macro-level institutions, technologies, and markets established beyond the region (national, global). The actor-specific level refers to the perceptions of actors and their ability to affect the development at the local and global levels and is the direct link to agency.

Agency then captures at the local level the perceptions and narratives about possible future transformations of place. The agency literature has extended the focus from innovation to system transformation, including institutional work (e.g., to change mindsets or to legitimise new paths) and place-based leadership (e.g., to pool and mobilise resources for shared goals). It covers how and why actors engage in shaping place-specific opportunity spaces. Establishing the directionality for such actor engagement is in itself an agentic process, and thus subject of studies on agency (for instance, if local actors decide to push hard towards a zero-emission society and economy). This means that agency-structure provides a theoretical and conceptual framework to understand why and how sustainability directionalities emerge in some places but not in others. Finally, the agency perspective captures the processes of identifying, grasping, and exploiting opportunities through innovative entrepreneurship.

At the global level, agency relates to the perceptions and narratives about global challenges and opportunities. For instance, the idea that global challenges are business opportunities (green growth agenda) would be one narrative, degrowth another. However, agency would also capture how actors engage in shaping framework conditions at the national and European levels mainly through institutional work. However, the process of identifying, grasping and exploiting opportunities also extends to the global domain, and diffusion of innovation can be one way of achieving system impact.

Table 1

Nexus of local-global and structure-agency dynamics

	Local	Global
Structure	- Different types of RIS shape the place-specific opportunity space for innovation and transformation towards sustainability	- Macro-level institutions, technologies and markets shape time-specific opportunity spaces for innovation and transformation towards sustainability
Agency	- Perceptions and narratives about possible future of place	- Perceptions and narratives about global challenges and opportunities

	- Engagement in shaping place-specific opportunity spaces - Identifying, grasping, exploiting opportunities	- Engagement at national and European level to shape framework conditions - Identifying, grasping, exploiting opportunities

What can the perspectives of agency and structures contribute to solving today's sustainability challenges?

Trippl and co-authors have pioneered the concept of challenge-oriented RIS (CORIS) (Isaksen et al., 2022; Tödtling et al., 2022). Here they argue that one can apply two strategies to make RIS relevant for contributing to solving grand societal challenges, a reorientation strategy as well as a transformative one respectively, and, thus, turning RIS into CORIS. The reorientation strategy implies that a RIS and a cluster can use their existent knowledge, technology and workforce to restructure from supporting CO_2-pollutingindustries to e.g. producing equipment for renewable energy production, as is the case when earlier suppliers of oil drilling platforms transform to producing platforms for offshore wind.

However, RIS and clusters belong to what Schot and Steinmueller (2018) call the second framing of innovation policy, while transformative policies constitute the third framing. Thus, instead of stretching the concept of RIS into CORIS to also take account of transformative innovation policies, we would argue that it is theoretically and analytically more productive to concentrate on the potentials of RIS and clusters to optimise the reorientation strategy, and to develop new concepts and theories to deal with transformative innovation policies, as the scale and scope of the third framing innovation policies is far broader than what the second framing innovation policy, focusing on growth and competitiveness, sought to promote. The type of problems, often called wicked problems because of their complexity and scale, demand different actor constellations, knowledge and technology to be solved than what lies within the limits of an innovation systems approach (Haus-Reve & Asheim, 2023). Stretching concepts bears the risk of emptying their theoretical and analytical content, making them less valuable and capable of analysing problems contributingto constructive solutions, and is, thus, not a recommendable path to take moving forward.

In developing new concepts and strategies, we think a focus on actors and agency has great potentials and, thus, is especially important in realising framing three transformative innovation policies. Such policies are not mainly dependent on the capacity of existing technologies and for developing new ones, even if many of them are complex and costly to implement, but on policy, on the capacity of the political systems and politicians to implement the necessary policies, including to obtain public legitimacy and support. Thus, one of our important messages is that a successful regional sustainable restructuring will not primarily be a result of technological path dependency but of political will and policy decisions. We are living in a 'world of many possible worlds' (Sabel & Zeitlin, 1985, p. 162) and policy and politics will determine which world we will be ending up living (or dying) in. Change agency allows investigating the social and political processes associated with regional transformations beyond

the realm of innovation, and study how contestations in relation to wicked problems are resolved, and resources mobilised for sustainable regional transformations.

The change agency approach holds promise to contribute to addressing today's sustainability challenges because, as illustrated by the 2022 paper, it goes beyond the realm of innovation towards a broader, social approach to regional transformation. This is illustrated by several recent studies that apply a change agency perspective to study transformations towards sustainability outcomes (e.g., Jolly et al., 2020; Sotarauta et al., 2021; Suitner et al., 2023; Trippl et al., 2020). The change agency perspective allows to build an understanding of how and why actors engage in changing mindsets, value propositions, and norms at the local level, and attempt to coordinate and mobilise a set of actors to join efforts in the pursuit of new directionalities. It also allows to understand the context-specific conditions that enable or hinder such engagement, and influence outcomes. Studies on agency and structure tend to provide context-sensitive and concrete theoretical and empirical insights about transformation processes (in contrast to decontextualised and abstract models), which have relevance to policy makers and practitioners.

Conclusion

The chapter has attempted to do two things. First, it analysed the development of economic geography and regional innovation studies in the last twenty years, from a structural approach based on clusters and regional innovation systems to a more actor and agency-based approach, and tried to evaluate which advances, theoretically as well as with respect to policy implications, this development has implied. We did this based on two articles, one published in 2002 and the second in 2022. Despite the significant differences, there are similarities between the two articles. They both aimed at explaining regional development using regional innovation systems as an analytical framework, and they were based on three case studies. However, they also differed considerably. The 2002 paper focused on innovation as a key aspect for firms' and regions' competitiveness, while the 2022 paper had a broader aim, using the interplay between agency and structures to explain the development path of the three cases. Secondly, the chapter reflected on what these two different approaches can contribute to achieving sustainable regional restructuring. We argued that the structural approach of clusters and regional innovation systems is still useful through a reorientation strategy to support green innovation, and that the actor and agency perspective is strategic to achieve a green transition and regional sustainable restructuring as we maintained that this transition depends more on the ability of key actors to obtain public legitimacy and support for necessary policy initiatives than on technological capacity.

We suggest that the nexus between local-global and agency-structure dynamics provides a comprehensive explanatory framework for regional structural change processes. Being generic in nature, we argue that this framework can be used to study why some regions embark on sustainability pathways while others do not, and why some regions succeed with these efforts while others fail. For instance, setting priorities for regional development and the mobilisation of resources for joint goals are agentic processes, and require to be studied with an agency perspective. However, the possibilities for actors to engage and succeed also depend on place-specific (local) and time-specific (global) circumstances.

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