Regional Innovation Systems and Transformative Innovation Policy: An Embedded Approach

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1 ABSTRACT

Transformative Innovation Policy (TIP) is a strategic framework that addresses major societal challenges by promoting (distruptive) innovation, participatory processes and cross-sector collaboration. Due to its multi-scalar perspective, TIP is gradually being adopted in regional policy contexts, where place-based needs and local capacities play a pivotal role. However, effective regional approaches require integration into strategies at a higher governance level, which address infrastructure, legislation, and regulation and provide shared learning environments. Building on a recently completed project initiated by the Austrian Conference on Spatial Planning (ÖROK), this paper proposes a practitioner-oriented approach in which regions and their innovation ecosystems are embedded within a multi-level governance framework (TrIP – Transformative regionally embedded Innovation Policy). The model links: (i) shared visions and cross-sectoral strategies; (ii) innovation spaces and co-creative processes; (iii) learning, scaling up and diffusion across regions; and (iv) the adaptation of regulations, norms and institutions, including exnovation. This approach is illustrated through two case studies: an energy transition initiative in a rural area and a logistics innovation in an urban area.

Keywords: Regional Innovation System, Transformative Innovation Policy, Multi-Level-Governance, Spatial Planning, Participatory Processes

2 RATIONALE

In the past, innovation and innovation-oriented regional policy focused primarily on an economic agenda, with economic growth and competitiveness as overarching goals. Today, there is a broad consensus that, while this type of innovation policy has had a positive effect on growth, it has failed to address societal challenges. The scientific community is therefore promoting "transformative policy" as a new political paradigm, which has been adopted by many countries and is increasingly being advocated by the OECD and the European Commission. This is referred to as "transformative innovation policy" (Schot & Steinmüller, 2018) or "mission-oriented innovation policy" (Mazzucato, 2013), and "challenge-driven innovation policy" (Coenen, Hansen & Rekers, 2015). Despite differences in detail, these variations follow the same rational of transforming socio-technical systems. According to Trippl et al. (2023), new approaches are needed to support the transition to ecologically sustainable and socially inclusive economic practices. Traditional policy approaches such as cluster promotion or smart specialisation are therefore insufficient to initiate innovation-based territorial transformations.

2.1 Building blocks and intervention points for a transformative policy

A transformative innovation policy comprises the following elements:

- A strategic policy framework that aligns existing strategies with societal challenges ("directionality").
- Participatory and open processes that enable joint learning involving different stakeholder groups.
- A cross-sector portfolio of measures that integrates public and private investment.
- A comprehensive understanding of innovation that encompasses changes in regulations, norms and institutions, as well as technological advances.
- A central challenge for transformative innovation policy is overcoming the lock-ins and path dependencies of unsustainable systems, such as fossil-based energy production and consumption. Such system innovations cannot be developed and tested in isolation. It is therefore important to

create spaces where new ideas can be developed and tested (innovation spaces), for example through living labs, enabling new approaches to be tested in systemic contexts and real-world situations.

- In addition, exnovation is also required. This can include reducing support for unsustainable technologies (e.g. fossil energy) and implementing regulatory changes to cushion the negative social effects of the transition ("just transition").

The following graphic summarises this approach and its points of intervention.

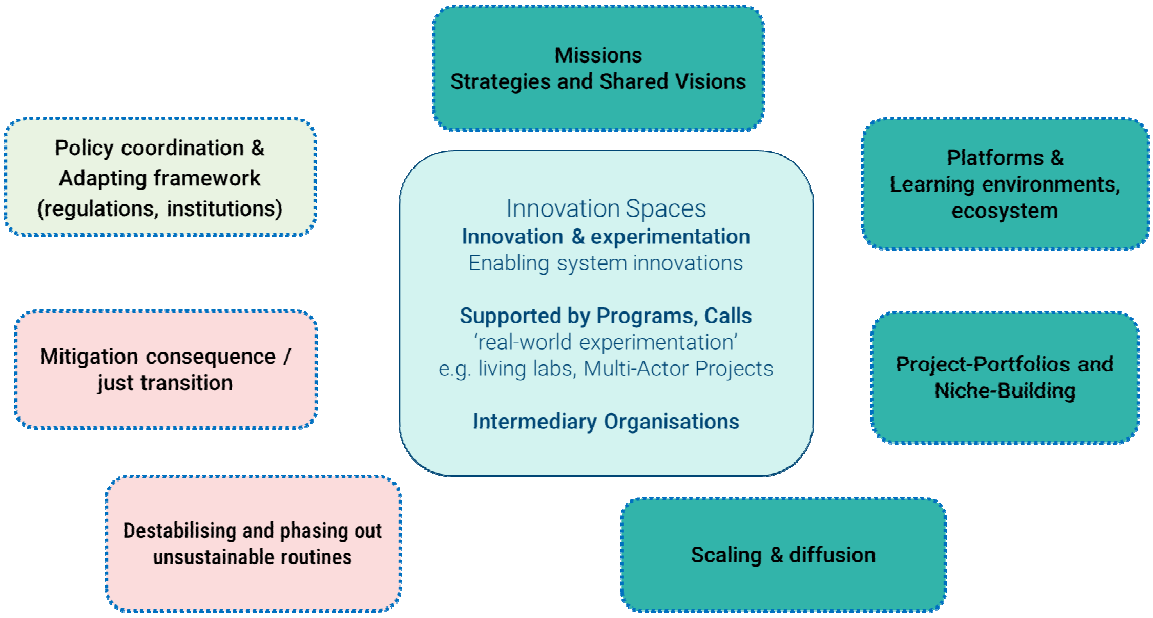

Fig. 1: Intervention Points of a Transformative Innovation Policy Source: own illustration.

3 EMBEDDED PLACE-BASED – REGIONAL INNOVATION SYSTEMS IN TRANSFORMATION PROCESSES

3.1 The Spatial Dimension and the Role of Regions

Despite its growing prominence, the initial contributions to transformative innovation policy have been criticised for paying insufficient attention to space and place, in particular overlooking the impact of geographical contexts, regional capabilities and spatial inequalities on transformation processes (Coenen et al., 2015). Traditional regional innovation policies, including Smart Specialisation Strategies, have largely focused on science- and technology-driven innovation, often failing to incorporate broader forms of social innovation and the voice of society. In response to these criticisms, an increasing amount of literature is calling for new governance models that facilitate transformation through multi-actor and multi-scalar approaches (Pontikakis et al., 2022; Serger et al., 2023). Accordingly, local and regional levels offer advantages as they represent complex systems within geographical areas and have appropriate planning instruments at the municipal level (Wanzenböck & Frenken, 2020).

However, the regional level must be embedded within higher policy levels, such as national or supranational. These levels can support transformation by defining overarching goals, supporting interregional learning (e.g. via intermediaries and platforms) and implementing complementary measures in areas such as regulation, tax policy, infrastructure and basic research. A central task of the higher levels is therefore to provide coordination structures that facilitate exchange and joint learning between regions. Thus, support from higher levels is needed to ensure the diffusion of local innovations and to coordinate the interests of different regions and sectors.

From this "embedded place-based" perspective, regional initiatives are not autonomous "containers"; they interact with and are shaped by higher-level strategies, funding architectures and regulatory environments. As RIS are open systems, they can draw on external knowledge and programmes while providing a context in which system change becomes tangible and negotiable.

3.1.1 The evolution of Regional Innovation Systems

A Regional Innovation System (RIS) denotes the set of organisations and people that cooperate in a network-like way within a geographically identifiable area to generate innovation – invention, experimentation and establishment of new practices – plus the communicative processes that keep this collective endeavour aligned. RIS as a concept ist not new and developed from the classical triple helix of education/research/business to improve conditions for firm innovation and regional competitiveness via an interactive ecosystem view that explicitly integrates demand and users, recognising that technology-push alone does not ensure adoption. Transformation-oriented RIS or challenge-oriented RIS (Trippl et al. 2023) in contrast are primarily focusing on the solution of societal–economic challenges and persue visions of sustainable regional development. So as main differences to the former concepts broader partnerships of actors and affected groups co-create solutions, multi-level interaction beyond regional borders is treated as essential, and innovation includes not only new products and business models but also social innovation and cultural change. RIS therefore function as place-based interfaces between technological development, political strategies and the "everyday world", enabling transdisciplinary collaboration, learning and mobilisation close to citizens and local practice.

3.1.2 Four types of transformation oriented RIS

Building on this transformative understanding of regional innovation systems (RIS) four models can be drawn (in reality usually found as hybrids). (1) Bottom-up grassroots: a small group of committed individuals/organisations tackles a societal problem, develops a novel solution, and diffuses it through spatial proximity, shared problem situations and personal networks; like-minded groups in other regions adopt and adapt the solution, triggering wider spread. (2) Transforming existing RIS: established, economically oriented clusters/networks (often policy-funded) expand their scope due to external triggers (e.g., regulation, market opportunities) and add sustainability/transition goals; they broaden the cluster by integrating users and complementary service actors, enabling more radical innovations and improving societal acceptance and diffusion. (3) Strategy-oriented regional coalition: within a clearly delimited inter-municipal territory, a transformative strategy is co-developed; key impulses come from core actors and regional management/intermediaries (e.g., LEADER), often acting as "social entrepreneurs" (LEADER-forum 2020) who organise initiatives around region-specific resources or challenges; networking across regions generates spill-overs and replication. (4) Bottom-linked/ Top-linked: impulse and steering originate outside the region (state/federal/EU), providing cross-sector policy framing and programme funding for regional experimentation, coordinating thematic focus, and harvesting lessons for subsequent strategic decisions.

Still these advantages of the regional level are a potential, meaning, that they not necessarily are accessible or fully developed. Additionally regional transformation pointed out with the four models provide restricted impact since levers of change are often held on other decision-making levels and systems. So, a wider perspective beyond the mere regional is needed.

3.1.3 Towards transformative regionaly embedded innovation policy (TrIP)

RIS unveil their strenghts in a set of distinct processes, often startet with diagnosing a thematic challenge by reflecting on existing practices of need provision and by identifying systemic lock-ins and interdependencies. The bounded regional context supports making system relations visible. A cross-context („multi-actor") coalition then forms (e.g., administration, business, education, technology and civil society), explicitly involving end-users to improve usability and uptake, and engaging actors defending the status quo to anticipate resistance and to develop sloutions to make them "co-winners of change". A shared image of an alternative future functions as the "glue" for collaboration. The coalition mobilises resources by combining endogenous capacities (commitment, local knowledge, networks) with inputs from outside the region (knowledge stocks, funding, programme access). This enables experimentation with sustainable (system) solutions – products, processes, services and social innovations – which are tested and applied in a regional setting. As noted, these processes alone are not sufficient for broader societal change. They need to be embedded in favourable conditions that we refer to as "transformative regionally embedded innovation policy" (TrIP).

TrIP is defined as the ensemble of actions that make RIS processes more likely, orchestrate and strengthen them, align them to shared trajectories, and enable scaling and roll-out. Key functions include articulating

cross-sectoral goals and visions ("red threads") that help to orient decentralised developments and – if also coated with political legitimacy – provides important "backing" for regional actors to foster the the importance of change. Since attempts for transformative change goes hand in hand with uncertainty and experimenting with alternative practices, TrIP is also to provides "enabling spaces" for experimentation, e.g. with suitable legal framework in funding schemes. and providing time and capacity for adjustment. Without targeted measures to unlock path dependencies and support unlearning, new solutions may merely coexist with the old or fade out. Finally, learning is linked to adaptive framework-making, including second-order learning loops that translate experiences into supportive structures and revised rules.

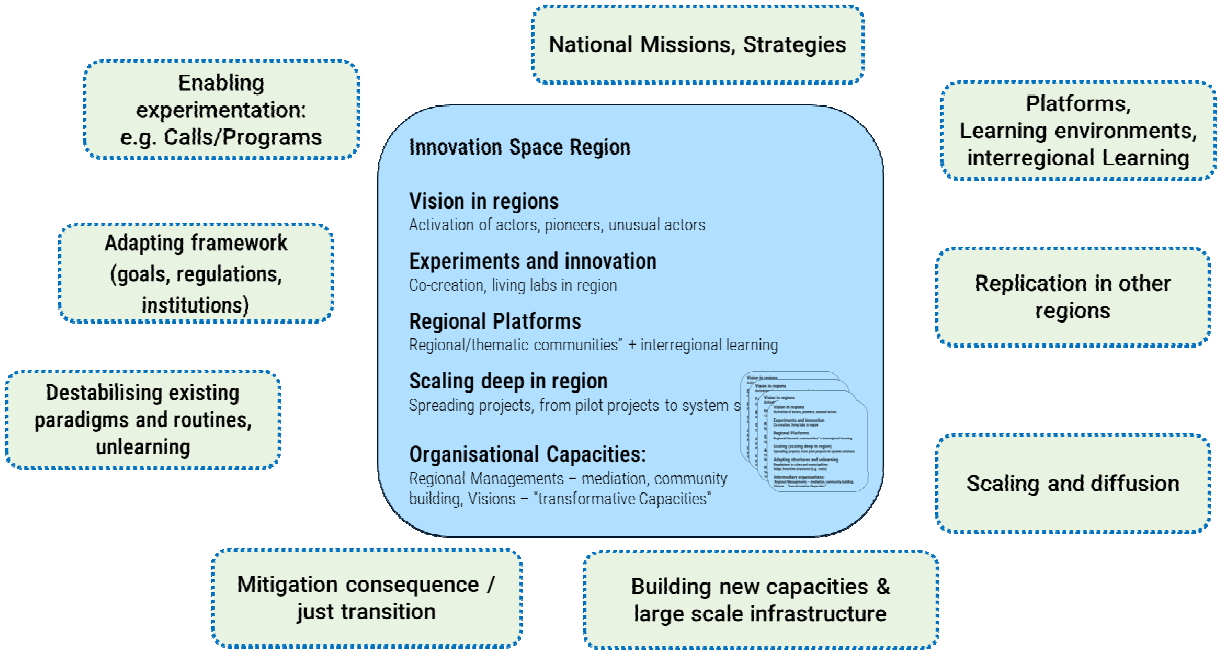

Fig. 2: Regions and Transformation embedded. Source: own illustration

3.1.4 Holzwelt Murau – RIS fostering energy transition

The Holzwelt Murau case demonstrates how an "embedded place-based" regional innovation system (RIS) can contribute to transformative change. The region's development cannot be considered a geographically and systemically isolated success story, but as an evolving constellation of actors, intermediaries, strategies and experiments that remains coupled to supra-regional goals, support schemes and knowledge relations.

A long-term trajectory emerged in the 1990s when regional actors recognised that wood could be leveraged for economic renewal and sustainability. Early projects focused on sustainable forest use, timber construction and biomass. In 2002, a broad participatory strategy process ("Energievision Murau") formulated a shared future image with a then visionary target: regional energy autonomy by 2030. This strategic framing created directionality, enabled coordinated project portfolios and helped stabilise commitment across sectors.

Capacity building can be considered as the decisive mechanism. From 2012, Holzwelt Murau established a Climate and Energy Model Region (KEM) and later a Climate Adaptation Model Region (KLAR!), strengthening professional coordination and interfaces to national instruments. The case underlines the role of intermediaries, dense networks and clear regional governance. Co-creation formats connected pioneers, firms, multipliers and municipalities, while broad communication, energy counselling and participation formats (e.g., energy camps) made benefits visible and addressed resistance.

A pivotal step towards system integration was the establishment of a regional "Reallabor". It enables experimentation with energy load-distribution models, produces demonstrators and supports cross-sector integration. Partnerships – including with Energie Steiermark – are providing an enabling environment for start-ups. Participating at the Horizon Europe project REFORMERS (Replication Valley) further institutionalised experimentation, learning and transfer. Reported outcomes indicate substantial material change: Murau produces roughly three times more electricity than it consumes; around three out of four buildings are heated CO_2-neutrally; and about 45 biomass plants are complemented by CHP-based heating plants, small power plants and wind installations. A regional energy cooperative ("Murauer GreenPower")

provides an ownership channel for citizens. Surplus electricity is intended to support e-mobility expansion and the positioning of Murau as a testbed.

Multi-level embedding is explicit through reference points such as the National Energy and Climate Plan, Styrian regional development legislation, EU instruments (LEADER, Horizon), and federal resources via the Climate and Energy Fund and the FFG. The case also points to exnovation dynamics – e.g., local installers deciding early not to install oil fuelled heating system – and to remaining governance gaps, notably the need for stronger regulatory feedback loops and intensified coordination with Land, federal and municipal levels.

3.1.5 Sustainable Logistics 2030+ Lower Austria-Vienna

The City of Vienna, the Province of Lower Austria, and the Chambers of Commerce of Vienna and Lower Austria has initiated the joint cooperation initiative "Sustainable Logistics 2030+ Lower Austria–Vienna". This initiative is part of a broader policy of mobility transition (Mobilitätswende) at national level, and aligns logistics policy with climate, transport and urban development objectives.

The action plan was developed through a comprehensive process in which more the one hundred actions were grouped into 35 measures and eight thematic clusters, supplemented by pilot projects. The focus is on social innovations and adapting framework conditions within the public sector rather than technological innovations.

Learning and experimentation are strongly emphasised through the pilot projects, for which mainly the federal government's support programmes are being utilised. This initiative incorporates systematic feedback loops to ensure that insights and lessons learned from pilot projects are continuously fed back into planning departments and other relevant public authorities, supporting institutional learning and adaptive policymaking.

An interim evaluation (Gruber/Mollay 2024) revealed positive effects on creating an ecosystem and testing and implementing pilot projects and the interaction with public administration. However, it also revealed the limitations of transformative activities based mainly on voluntary activities of the logistic companies.

3.1.6 Lessons learned for the policy approach

In summary, the critical factors and lessons learned from the cases are as follows:

- Activating people: The focus was on co-creation, citizen participation, and joint learning.
- Setting visions: Clear goals, such as achieving energy self-sufficiency, provided orientation and motivation.
- Networked working: Technology, society and the economy were systematically linked.
- Accepting resistance: Critics were actively involved, for example through consultations and concrete opportunities for participation.
- Open dialogue: Exchanging ideas with other regions and programmes strengthened capacity for innovation.
- Long-term approach: Success is based on continuous capacity building over decades.
- Multi-stakeholder and multi-level approach: Transformation can only succeed through the interaction of a wide variety of stakeholders at all levels.
- Transformation intermediaries act as a "facilitating structure". They connect local needs with supra-regional resources, thereby enabling spaces for experimentation, knowledge-building, and system change.

The case of the sustainable logistic initiative also reveals that achieving widespread impact requires either regulatory changes (e.g. a ban on trucks with combustion engines in the city) and/or economic benefits for the partners involved.

4 CONCLUSION

This paper has demonstrated that transformative innovation policy (TIP) requires stronger and more explicit regional integration to realise its potential. Regions are not merely arenas for implementing national or supranational strategies; they are also key sites for experimentation and learning. Therefore, strengthening

regional capacities for transformative innovation – including intermediary competencies, participatory governance, and reflexive policymaking – is a central policy challenge.

However, regional experimentation alone is insufficient. Scaling up must be an integral part of transformative policy schemes, connecting local pilot projects with strategic coordination, regulatory adaptation and learning across governance levels.

Transformative change gains momentum when regulatory frameworks and market conditions create joint incentives for stakeholders to invest, innovate, and adapt. Without such embedding, experimental initiatives risk remaining isolated or merely symbolic, rather than contributing to systemic change.

The agility and innovative power of the public sector is decisive. Politics and public administration should evolve from setting frameworks to taking on a proactive role ("entrepreneurial state", Mazzucato (2013)), acting as regulators, moderators, and coordinators.

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