The combination of supply and demand-side eco-innovation policies for regional sustainability transitions



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The need for eco-innovation policies

Although it is undisputed that innovations contribute significantly to the competitiveness, economic development and growth of regions and countries, it is

becoming equally clear that the economic implications of their widespread application are leading – at least indirectly – to environmental burdens such as pollution, environmental degradation or climate change. However, since the emergence of the innovation concept in the first half of the 20th century, the (positive) economic effects associated with innovation have been the focus of scientific, economic and political attention (Fagerberg et al., 2012). It is only recently that the negative effects of technological change and innovation have been increasingly discussed (Biggi & Giuliani, 2021). This paradigm shift is also reflected in the emergence of transformative and mission-oriented innovation policies aimed at better linking innovation with social and environmental challenges (Schot & Steinmueller, 2018).

Transformations of unsustainable systems of production and consumption (i.e. sustainability transitions), which are necessary to tackle global societal challenges, involve fundamental changes of actor constellations and institutional set-ups beyond the technological dimension. Along with changes in user practices, lifestyles, infrastructures and organizational structures, technological innovations are central and necessary conditions for socio-technical transitions (Markard et al., 2012). Innovations "*that contribute to a reduction of environmental burdens or to ecologically specified sustainability targets*" (Rennings, 2000: 322) are referred to as environmental or eco-innovations. These include climate change mitigation technologies, improvements in energy efficiency, and environmentally friendly alternatives to harmful products. From a theoretical perspective, environmental innovations deserve special attention when compared to regular innovations, as they are characterized by an additional externality. The so-called double externality problem refers to the phenomenon that environmental innovations often not only need support in the phase of innovation development (IPR, R&D funding), but also suffer from an additional externality in the diffusion phase, namely costs borne by adopters of environmental innovations whose benefits are shared with other actors as well as with society in general (Rennings, 2000).

In the scholarly discussion on spatial dimensions of environmental innovation and (regional) eco-innovation policy, we observe two distinct strands of literature examining these two different phases of innovation: the supply side, which deals with the emergence and production of environmental innovations, and the demand side, which deals with diffusion and transitions of socio-technical

systems.

Supply and demand-side views on eco-innovation policies

Green industries are considered a growth engine to stimulate regional development through creating new jobs and boosting innovation capabilities. The literature on green regional path development emphasizes that regions, or different types of regions, have varying possibilities and abilities to benefit from local green industries (Trippl et al., 2020). This place-based approach is very much echoed in current innovation policies, promoting the development of green industries on the regional level (e.g. through smart specialization strategies (S3)) and justifying interventions with market failures on the supply side such as under-investments in R&D. The S3 policy rationale explicitly targets the supply side and addresses chronic issues related to investments in knowledge creation, entrepreneurial activities and networking between actors, within and between clusters, regional innovation systems etc. (Schot & Steinmueller, 2018).

On the demand side, the literature on geography of sustainability transitions deals, among other things, with the question of how environmental innovations diffuse within and across regions, helping to consolidate sustainable socio-technical regimes. In this regard, place-specificities such as local market formations or local informal institutions are particularly important (Hansen & Coenen, 2015). But despite the prominence of the spatiality of transition processes, policies meant to stimulate demand and diffusion of environmental innovations are mainly designed at the national level (e.g. feed-in tariffs, regulations).

We argue that the double externality problem associated with environmental innovations leads to a spatial imbalance of supply and demand-side innovation support. It implies that supply-side innovation policy does not necessarily lead to locally developed environmental innovations being adopted in the region of their origin. At the same time, (regional) demand-side innovation policy, which aims to support the diffusion of environmental innovations, may fail to stimulate local invention and development of these technologies. It appears that the normative turn in innovation policy (mission-orientation, sustainability) has not yet succeeded in combining supply and demand sides on the regional level, thus widely ignoring market failures along the innovation phases. This is surprising, since the mainstreaming and up-scaling of these locally/regionally developed

solutions to the national and international level is central to system-wide sustainability transitions (Späth & Rohracher, 2012).

The combination of supply and demand-side eco-innovation policies

In a recent article, Tödtling et al. (2020) provide a set of three scenarios for how the supply (production) and demand (application) of environmental innovations may differ across regions. We present a modified version of these scenarios in Figure 1, following the simplified classification that production and/or application either occur in the region or outside the region. Accordingly, regions produce environmental innovations for the global market (region B, quadrant II), apply them from outside the region (region C, quadrant III), or conduct both production and application of environmentally friendly solutions within the region (region A, quadrant I). While scenarios II and III lead to either economic or ecological advantages for the region, the creation of green regional supply and demand structures could be economically and ecologically advantageous (scenario I). In addition, regional sustainability transitions might benefit from regional legitimacy that stems from co-located demand and supply (Rohe & Chlebna, 2021).

The framework provided by Tödtling et al. (2020) is intentionally simplistic. However, we argue that a dynamic perspective, at the very least, is needed to conceptualize further pathways for green regional development. One possible path is illustrated for region D. At an early stage of the industry life cycle, region D produces green technologies that are also demanded locally. As such, region D can build an early competitive advantage that, down the road, leads to region D' producing for the global market and driving inter-regional and international diffusion. This scenario requires the alignment of regional supply-side and demand-side eco-innovation policies that leverage technological potentials while creating local markets. As a consequence, three mutually reinforcing factors on which regional lead markets for environmental innovation rely can take effect: regional technological advantages, demand advantages, and advantages stemming from regional regulations and policies (Losacker & Liefner, 2020).

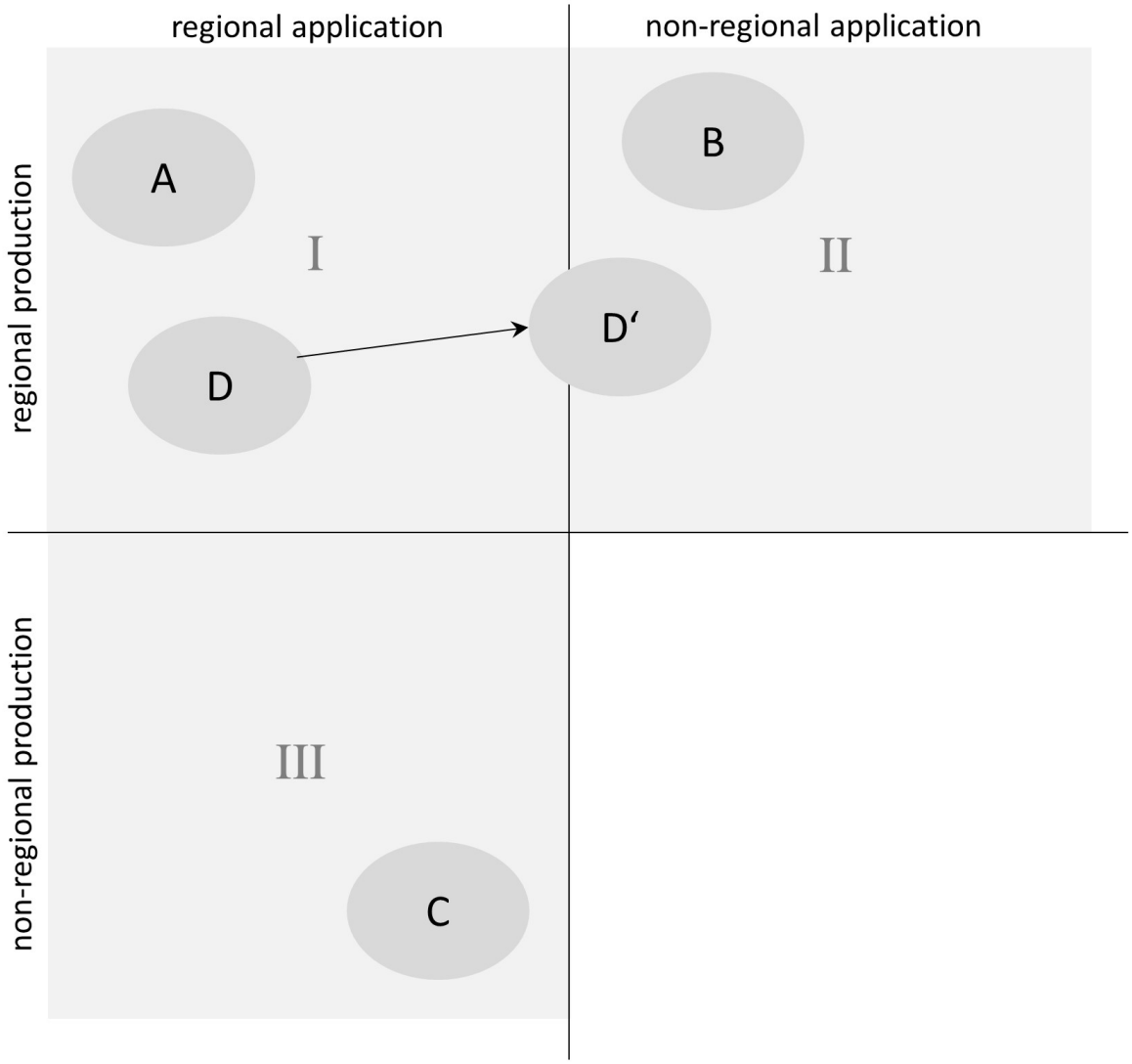


Figure 1: A simplistic spatial perspective on supply and demand of green technologies, adapted from Tödtling et al. (2020)

One example of a demand-side regional innovation policy, a de facto environmental policy, is a regulation to mandate photovoltaic (PV) installations for new (non-residential) buildings from 2022, stipulated in the climate protection act of the state of Baden-Württemberg, Germany. Although this regulation has great potential to create value, the region (and Germany) has already faced great reductions in PV manufacturing capacities, with China being the lead market (Quitzow, 2015). Therefore, while the regional transition towards sustainability in Baden-Württemberg will be accelerated, only a part of the value creation (e.g.

through installations) will remain in the region. It is now up to policymakers to drive forward the combination of supply and demand-side eco-innovation policies in such a way that regional lead markets emerge and both ecological and economic goals are met. In this respect, regional demand-side policies are lacking in sectors that Baden-Württemberg already promotes in its supply-side innovation policy, such as sustainable mobility, bioeconomy or circular economy.



Figure 2: Construction workers installing PV systems (Source: MEV Verlag GmbH)

In conclusion, we support most of what Tödtling et al. (2020) propose and argue that the combination of place-based supply-side and demand-side innovation policies is particularly important for environmental innovations. Beyond that, we call attention to the double externality problem of environmental innovations, which requires (region-specific) policy support in the diffusion phase (Rennings, 2000). Finally, we posit that the successful combination of region-specific supply and demand-side eco-innovation policies can create regional lead markets and help to leverage sustainability transitions.

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