Capabilities for regions to support net-zero-carbon transitions and implications for Cohesion Policy

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Final report
February 2023

Contract No. 2022CE16BAT100

Group of high-level specialists on the future of Cohesion Policy

The European Commission, the Directorate-General Regional and Urban Policy (lead) and the Directorate-General Employment, Social Affairs and Inclusion (associated) have set up a Reflection Group on the future of Cohesion Policy. The group includes high-level members from academia and practice and in 2023 will meet nine times to reflect on current and future needs and the functioning of Cohesion Policy.

The group will offer conclusions and recommendations that will feed the reflection process on Cohesion Policy post-2027 including through the 9th Cohesion Report in 2024 and the mid-term review of Cohesion Policy programmes in 2025.

About the author

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Disclaimer

Key words

Capabilities, transition, intermediaries, stewarding capacity, anticipatory capacity, transformative innovation

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Acronyms

ERDF	European Regional Development Fund
ESF+	European Social Fund Plus
EU	European Union
PRI	Partnership for Regional Innovation
R&D	Research and development
RRF	Recovery and Resilience Fund
RTD	Research and Technological Development
TIP	Transformative Innovation Policy
TIPC	Transformative Innovation Policy Consortium
UN SDG	UN Sustainable Development Goals (SDGs)

Introduction

During the 2020s, the World and Europe have faced increasingly turbulent times, with major influences from the Covid-19 pandemic and the war started by Russia in Ukraine. The latter created an energy crisis and rapid inflation in Europe. Alongside these developments, climate change continues to advance, and we see increasingly its impacts unfolding via a growing number and scale of forest fires, floods, heat waves, and other extreme weather events. Therefore, along with the current health, energy, and security crises, the transition to climate neutrality is more important and urgent than ever.

It seems quite likely that different kinds of intertwined risks related to the environment, trade and security concerns will increase in the coming decades. For instance, globally, we have witnessed a growing number and magnitude of direct and indirect impacts from climate change (Carter et al. 2021), increasing global demand for energy (Kivimaa & Sivonen 2021), growth in hybrid influence, for instance, by China and Russia (Wigell 2021), and expanding security concerns as well as hydrocarbon and minerals exploitation in the Arctic resulting from polar ice retreat (Morgunova 2021). Recent attention has focused on the (limited) availability and supply chains for critical minerals and metals used in new energy technologies and digital devises (European Commission 2020; IEA 2021; Wilson 2018). These production facilities and supply chains are largely dominated by China, creating vulnerability over risks connected to international relations as well as, for instance, adverse weather events which might disrupt the trade routes of these materials.

These global trends are combined with local developments that can differ quite substantially from region to region. One of the key factors for regional resilience is the energy system. All other sectors of the society are dependent on the energy system on an hourly basis and, hence, any risks related to energy system operation will cascade into other sectors, such as food and water supply, health care, logistics, and fire and rescue services (Kivimaa et al. 2022). Renewable and smart energy systems provide new local opportunities and improve energy access in more rural and remote regions (Alstone et al. 2015). In addition, increasing wind power production can improve the economic situation in regions that can attract wind power developers (e.g., by bringing in more land tax revenue), and make these regions more attractive to new industries. But these conditions are unevenly distributed between regions. Some regions are facing the negative consequences of phasing out fossil fuels (e.g. Abraham 2017). The recent international developments also increase focus on those EU regions that have potential for mining critical minerals and metals (Kalantzakos 2020), with various interests at play, some of which affecting the indigenous communities of the Sami people (Raitio et al. 2020).

All these developments imply a move towards increased sector-interconnectedness and horizontality. Horizontality means that both climate change and the recent security concerns have such broad implications across different policy domains (e.g., economic policy, industrial policy, environmental policy, social policy, health policy, defence policy) that the resulting issues cannot be solved by and within a single policy domain. Therefore, increasingly horizontal governance of pursuits towards carbon neutrality is required, which considers other policy objectives and sectors, without compromising the carbon neutrality goals.

The pursuit of climate neutrality, i.e., net-zero-carbon transitions and its governance can benefit from insights developed in the sustainability transitions field during the past two decades (Köhler et al. 2019; Truffer et al. 2022). This field has already proven its applicability

and relevance for policy communities and the development of governance (e.g. Geels et al. 2019). Therefore, in this paper, I will, first explore, the capabilities that regions need to cope with the transition to climate neutrality drawing from sustainability transitions research. In particular, I will explore some of the social and institutional aspects that have been recognised in this transitions literature to support socio-technological change. Second, I will briefly discuss how Cohesion Policy specifically can support regions on this path and enhance their resilience and responsiveness to the challenge of climate neutrality transitions.

1 Capabilities for regions to support transitions

The sustainability transitions literature explores socio-technical change in systems associated with societal functions, such as energy, mobility, water and food, as well as industrial transitions (Köhler et al. 2019; Markard et al. 2012; Truffer et al. 2022). Over the two decades of empirical research, this research field has provided many insights into what kind of social changes are needed alongside technological change to achieve transitions, and what kind of actors and processes can advance transitions. For example, it has demonstrated how socio-technical systems around energy and mobility change in an interplay between emerging and expanding niche innovations and the relatively stable but sometimes destabilising socio-technical regime (i.e. the institutional deep structure), especially when faced with disruptive landscape (i.e. external context) influences (e.g. Geels 2005; 2010) However, the research field has paid little attention to the topical issues of the present, such as national and societal security and adaptation to climate change. I will here outline some of the central actors and processes that this literature has identified and connect this to regional capabilities and the governance changes needed, considering also resilience towards future risks.

1.1 Shared visioning and institutional change

Articulation of expectations and visions for the future has been well established to be a core part of transition processes (van der Laak et al. 2007; Schot & Geels 2008). These processes are, however, complicated by differing interests and perspectives (including difficulties to align them) which become more visible as transitions accelerate and societies are faced with geopolitical, health and climate security related risks. It is important to note that even when using the same terminology, people may have differing understandings of what 'low-carbon' or 'sustainability' in practice means (referred to as 'appraisal diversity') (Pel et al. 2020) and different ideas about how an ambitious approach should policies take (Lindberg et al. 2019). Nevertheless, shared visions or even missions are necessary to advance transitions and they need to be enforced with accompanying institutional changes.

Visions express a wanted end-state for a specific socio-technical regime, such as energy, mobility or food system; are supported by a network of actors, and; are meant to direct and encourage processes of technological, institutional and behavioural change (Berkhout 2006). A vision could, for example, be a 'fossil-free and digitalised mobility system' or a 'low-carbon and resilient food system' and it can and should be specified with quantitative targets. The importance of visions is that they function as shared narratives for a range of actors (e.g., policy makers, businesses, citizens, the civil society); create credibility for the sustainability direction pursued, and; describe 'what technologies and resources will be used, what kind of services will be offered to people, what institutions and policies will be needed, and how people could live their day-to-day lives' (Geels et al. 2019 p. 106). It is important that specific responsibilities are assigned to named actors and organisations for implementing measures to achieve these visions, and that these visions are regularly assessed and revised based on changing circumstances and improving knowledge about the future.

Regions should add to their capabilities by organising processes for shared vision and expectation building. Yet, regional administrations need to note that they are not the only actors attempting to conduct such processes and are tied to the existing regime and established structures. For instance, civil servants and politicians may not have the latest knowledge of what is technologically possible or environmentally safe. Hence, regional administrations need to open up orchestration and systemic intermediation opportunities to other, potentially more neutral, actors (see Section 2.2).

The key factors in vision building processes are the inclusion of a diversity of actors (going beyond the typical participants) and engaging in processes of learning and unlearning (Ghosh et al. 2021). The 'inclusivity' of various policy engagement activities pertaining to transitions is increasingly important both to acknowledge questions of social justice in transitions (Jenkins et al. 2018; Kaljonen et al. 2021) and benefit from a broad variety of knowledge linked to the interconnectedness of sectors in transitions. Transition arenas are one of the tools for this, proposed by the sustainability transitions literature (Kemp et al. 2007; Loorbach & Rotmans 2010), with many relatively recent examples from practice pertaining to national and city level processes (Hölscher, Wittmayer, et al. 2019; Hyysalo et al. 2019; Lähteenoja et al. 2022). Transition arenas could be further developed to be used also in advancing transition and resilience together.

Given the urgency of achieving climate neutrality, regions cannot merely advance transitions with collaborative vision building but need to implement supportive institutional changes. Institutional change happens when several actors shift from one logic of action to another (Streeck & Thelen 2005). In practice, this implies substantial changes in overarching legislative frameworks that destabilise high-carbon systems and remove barriers for the commercialisation of zero- or low-carbon technologies and services, and organisational restructuring in public administrations (Kivimaa & Kern 2016; Kivimaa & Rogge 2022) as well as changing the informal localised institutions (European Commission et al., 2021). To know what kind of institutional change is needed, collaboration across sectors and policy experimentation is needed (Bernstein & Hoffmann 2018; Kivimaa & Rogge 2022). A case of the development of mobility-as-a-service in Finland showed that long-term change process in restructuring the administration and the implementation of a new legislative framework, the Transport Service Act enforced in 2017, were instrumental in commercialising these business model innovations that aimed to reduce private car ownership and use, while collaborative vision building preceded the legislative change (Kivimaa & Rogge 2022).

In many real-life processes, high-level political support has been instrumental to create ambitious enough visions and create the matching institutional changes and resource base (Kivimaa et al. 2020; Kivimaa & Rogge 2022). The short-term political cycles make achieving long-term political commitment difficult unless combined with long-term policies enshrined in law, such as the UK carbon budgets. Moreover, visions need to be matched with resource allocation so that actions and pathways towards these visions are implemented and realised. The 'resource effect' is a part of a transformative policy mix, where resource allocation supports certain technologies and solutions directly via funding and indirectly via human resource development in certain fields (Edmondson et al. 2019). In practice, due to limited public resources, the resource effect of the policy mix often entails choosing certain technological pathways or sub-parts of those pathways over others. This can be problematic as decision makers will not have all the knowledge and information pertaining different pathways. The 'socio-technical multiplicity' which refers to competing socio-technical configurations for decarbonisation means that policy decisions are influenced by different

actor-coalitions behind each pathway (Pel et al. 2020; Smith et al. 2005), and more technology neutral policies enable a more widespread public support for different alternatives when knowledge about the future is scarce.

In sum, supporting climate neutrality transitions via shared visioning and institutional change necessitates:

- Explicit and inclusive processes for vision building: There are many examples of city-level or regional vision building processes, but regional visions are also constrained by the national level policy plans and programmes. Therefore, national and EU-level visions as well as cross-regional networks can advance regional vision building processes. For instance, it has been proposed that regions should re-engage in vision building focusing on sustainability challenges and localising the UN Sustainable Development Goals (European Commission et al. 2021). One could even consider national and regional carbon neutrality visions as an enabling condition for future Cohesion Policy.
- Substantial and ambitious legislative and organisational changes: EU member states differ in terms of regional and municipal autonomy, and there is also sector-specific variation. Most often, e.g., energy markets, construction and industrial emissions are tied to national legislation while, e.g., regions may have control over transport and land-use planning which also have substantial negative or positive impacts on transitions. Regions can also influence the organisational structure and horizontal coordination across policy domains. They need best practice -examples from other regions to advance institutional changes. Such changes could also be set as enabling conditions for future Cohesion Policy.
- Political ambition and long-term political commitment: Regions can aim to have political commitment to pursue carbon neutrality in their regions by facilitating research, innovation, and technology/service diffusion as well as structural change activities supporting this aim. However, for many regions, the EU and national ambitions can lead the way. The long-term political commitment could be tied into legislative reforms that set conditions spanning electoral cycles (akin to UK carbon budgets).
- Matching public and private sector resources for multiple socio-technical pathways: Especially economically more deprived regions lack in financial or human resources needed for new socio-technical path creation and, hence, make them often less attractive for new company investment. This places the need for national government and the EU Cohesion Policy to direct resources to regions supporting alternative socio-technical pathway building that address environmental and social sustainability goals (e.g., those identified in the UN SDGs).

1.2 Intermediating and orchestrating

The capacity to orchestrate and intermediate has been brought forward as another key elements in supporting sustainability transitions. Orchestrating means coordinating multi-actor processes towards transformation via strategic alignment/direction and (inter)mediating across scales and sectors (Hölscher, Frantzeskaki, et al. 2019). This process overlaps with intermediating, but intermediating can be seen as a broader process too.

There is a wealth of literature and knowledge on the role of intermediation in sustainability transitions (Kanda et al. 2020; Kivimaa, Boon, et al. 2019; Nordt et al. 2023). It indicates that one important way in which regions can support transitions is by making sure there are intermediary actors and platforms in place – or set them up anew. Transition processes have

also been characterised by multiple intermediaries, called as 'ecologies of intermediation' (Kivimaa & Martiskainen 2018a; Soberón et al. 2022) where they have their own roles in different parts of the transition process (Kivimaa, Boon, et al. 2019). It is likely that multiple intermediaries are needed operating on different scales (e.g., on the food transition and across different sectors).

Transition intermediaries have been defined as "actors and platforms that positively influence sustainability transition processes by linking actors and activities, and their related skills and resources, or by connecting transition visions and demands of networks of actors with existing regimes in order to create momentum for socio-technical system change, to create new collaborations within and across niche technologies, ideas and markets, and to disrupt dominant unsustainable socio-technical configurations" (Kivimaa, Boon, et al. 2019). Such intermediaries are even more important now when different sectors are increasingly interconnected, and the societal conditions have experienced rapid changes. Each region is unique and, hence, some require public sector established intermediaries to take care of the same or similar intermediation tasks that are handled by non-profit private organisations in others (Kivimaa & Martiskainen 2018b). The key issue is that certain transition functions which are relevant for transitions are occurring in regions and are linked to the climate neutrality visions and pathways the regions want to pursue.

The key intermediation functions identified in the literature are: (a) articulating transition-oriented expectations, demands and visions – which often requires coordination from systemic intermediaries; (b) creating and brokering transition-oriented networks; (c) support for knowledge exchange and learning processes; (d) innovation process management (e.g., process intermediation, resources procurement); (e) translation between different actors, interests and contexts, noting the diversity of interests and even understandings of sustainability that exist; (f) capacity building; (g) institutional support (e.g. advocacy and lobbying support for policy change); and (i) configuration of local technological assemblages (Kilelu et al. 2011; Kivimaa, Hyysalo, et al. 2019; Klerkx & Leeuwis 2009; van Lente et al. 2003; Stewart & Hyysalo 2008). Different types of intermediation activities are suitable for different functions. "For example, creating networks involves the identification of suitable participants and motivating them to join the network …Support for learning processes entails collecting information or knowledge of pilots, aggregating and modifying that knowledge, and communicating and translating that to different stakeholders." (Kivimaa, Hyysalo, et al. 2019). Based on the conditions of the present decade, 'resilience enhancement' could be added to the list of transition intermediary activities.

The range of micro-, meso- and macro-level activities involved in transitions means that different types of intermediaries are needed, and they should be a key part of governance activities. Kivimaa et al. (2019) have created a typology of intermediaries consisting of systemic intermediaries, regime-based transition intermediaries, niche intermediaries, process intermediaries and user-oriented intermediaries (Table 1) which may be useful in assessing the status of intermediation and setting up new intermediation activities.

Table 1.1: Typology of intermediaries

Systemic intermediary	Operates on all levels (niche, regime, landscape), promoting an explicit transition agenda and taking the lead in aiming for change on the whole system level. Systemic intermediaries are typically politically and financially independent actors, thus, at least partly detached from public administrations.

Regime-based transition intermediary	Is tied through, for example, institutional arrangements or interests to the prevailing socio-technical regime but has a specific mandate or goal to promote transition and, thus, interacts (often) with a range of niches or the whole system. Regime-based intermediaries are quite often public sector task forces or organisations.
Niche intermediary	Typically works to experiment and advance activities of a particular niche (e.g., green hydrogen, building energy efficiency), and is trying to influence the prevailing socio-technical system for that niche's benefit. Niche intermediaries can be, for instance, non-profit organisations oriented to a particular niche or consultant companies.
Process intermediary	Facilitates a change process or a niche project rather than broader niche level; often without explicit individual agency or agenda, but in support of context-specific (project-based or spatially located) and/or external (niche, regime) priorities set by other actors. Process intermediaries range from individual project workers and task forces to, for example, consultancies facilitating selected processes.
User intermediary	Translates new niche technologies to users and user preferences to developers and regime actors, qualifying the value of technology offers available. User intermediaries range from internet platforms and, for instance, energy advisors to specific organisations set up to advance user interests.

Source: Kivimaa et al. (2019)

In essence, intermediation can address the overall transition process or some of its parts, ranging from technological and service innovation processes to policy change. It is important to be aware that transition intermediaries are faced with counterforces, i.e. intermediaries and other actors aiming to block transitions (Kivimaa et al. 2020; Nordt et al. 2023). Public administrations can establish regime-based transition intermediaries by giving certain units or organisations specific mandates in transitions; they can hire process intermediaries to support in the practical side of transition processes, and; set up, for instance, different platforms or advisors to function as user intermediaries pertaining to energy and food system transitions. Systemic intermediaries typically need a degree of detachment from the public administration but could be independent bodies supported with public funding.

In sum, the following need to be noted when advancing intermediation for climate neutrality transitions:

- **Assessing the level of intermediation**: Regional assessments are needed to determine whether sufficient politically and financially neutral intermediation exists to support transitions. Such intermediation should span from an overall systemic level to the micro-level of facilitating, for instance, green building, green hydrogen, or circular economy innovation processes. Regions may not have the capabilities for this, and external guidance, e.g., from the European Commission (Cohesion Policy, RTD policy) or national governments is needed.
- **Setting up new intermediaries**: Intermediary organisations, roles within organisations, and platforms should be established to advance climate neutrality transitions in multiple sectors, different levels (from micro-level activities to macro-level vision building) and between sectors. This is based on the assessment above and potential good practices from other regions. Also, inter-regional intermediaries, such as the Carbon Neutral Municipalities Network in Finland, may be useful.
- **Intermediary functions for response and resilience**: Transition intermediary functions should also cover creating capacity to respond to sudden shocks and building resilience. Here, again external guidance and best practice examples from the European Commission (Cohesion Policy, RTD policy) and national governments would be useful.

1.3 Unlocking unsustainable and high-fossil regimes

Calls for destabilisation (Kuokkanen et al. 2018; Turnheim & Geels 2012), phase out (Rogge & Johnstone 2017) and exnovation (David 2017) of unsustainable socio-technical regimes all address the same need to initiate, manage and coordinate processes where high-carbon emitting regimes will decline in magnitude. This will not only require physical dismantling of high-carbon technologies and infrastructures but broader processes of deinstitutionalisation (Novalia et al. 2022), novel policy mixes (Kivimaa & Kern 2016) and changing practices (Laakso et al. 2020). These are important, because the social, institutional and cultural structures have over time formed around certain technologies creating very stable and path dependent systems.

A related capability has been named as unlocking capacity: to recognise unsustainable path dependencies; to phase out drivers of path dependence; to weaken established interests and incentive structures tied to high-carbon practices, and; to dilute open resistance to change (Hölscher, Frantzeskaki, et al. 2019). Opening up and unlocking socio-technical regimes for new types of configurations has been described to constitute of (Ghosh et al. 2021): (1) dealigning and destabilising (e.g. new industrial policies and phase out plans); (2) unlearning and deep learning (e.g. accepting risks, uncertainty and costs of reorganisations); (3) strengthening regime-niche interactions (e.g. via broader networks and intermediation that covers both the existing structures and new alternatives), and; (4) changing perceptions of landscape pressures (e.g. overcoming traditions and inertia in how external pressures are interpreted). Many of the above activities link to how regions could respond to future disruptions and security risks. For instance, phase out plans and new industrial policies need to be consistent, but build in reflexivity for contingencies and alternatives to implementation. Deep learning in the form of accepting risks and uncertainty is important to be able to quickly respond to future crises. Changing perceptions of external events are important to be able to respond rapidly and consistently and to be able to recognise the interconnections between different systems and scales (local-global) which are impacted by undesired events and developments.

One of the concrete ways to unlock or destabilise unsustainable systems and structures is to develop new policies, frameworks and governance arrangements that aim to do this (Ghosh et al. 2021). An example can be drawn from the development of mobility-as-a-service in Finland which benefitted from both (1) an administrative reform that took a systemic approach and combined transport and communications under same agencies and ministry units (albeit lacking a specific sustainability priority) and (2) a structural legislative reform, in the form of the new Transport Service Act, which removed barriers from the diffusion of a new kind of service innovation aiming to replace private car ownership (Kivimaa & Rogge 2022). These processes are increasingly connected to the need for unlearning. Unlearning has been described as "discarding certain routines, practices and mental models to embrace and learn a new one" (van Oers et al. 2023). For example, using electric vehicles requires unlearning the old way of filling a petrol tank when it is empty to learn to charge your car at home. Whereas unlearning mobility more broadly is about questioning whether each trip by car or by plane is necessary, and how could it be replaced instead with a virtual connection or a local holiday.

It is clear that unlocking activities also need to consider achieving the transitions in a just manner and, hence, link to just transition policies at the EU, national and local levels. Besides concerns and assessments about distributive and restorative justice (Jenkins et al. 2016; Sovacool et al. 2019; Williams & Doyon 2019), it is vital to take into account the temporal

aspect, i.e., intergenerational justice, and different scales. Carbon neutrality transitions are essentially about safeguarding a liveable planet for future generations (Kivimaa et al. 2021) and, therefore, the negative economic and social consequences of phasing out high-carbon activities are acceptable but need to be addressed and to a degree compensated. The question of scale poses a somewhat tricky issue also for just transitions, as some activities might look different in terms of local or global justice, e.g., the question of mining critical minerals and metals needed in the energy transition. Recognitive justice is important in the context of more vulnerable regions and regions with indigenous communities.

In sum, the following need to be noted when advancing unlocking for climate neutrality transitions:

- **Phase out and exnovation**: Identification of structures that support high-carbon technologies and infrastructures needs to be followed by phased out removal of such structures (e.g., legislation, subsidies, permit structures). Regions may need help from the European Commission and national governments in how to identify problematic structures and legislation as well as formulating a phase out approach. Such activities could also be set as enabling conditions for future Cohesion Policy.
- **Governance culture oriented to deep learning**: The governance culture needs to change by taking a more open approach to deep learning and unlearning, uncertainty, and risks. This, for example, means allowing civil servants to spend time on experimenting. Governance cultures are not easy to change and may need certain kinds of leadership and new intermediary actors within the public administrations (see Section 2.2).
- **New regional industrial and innovation policies** are needed that place emphasis on the emergence of new socio-technical systems that replace the old ones, providing new employment and opportunities. There are of course strong ties to national industrial and innovation policies, as well as, for example the European Commission Smart Specialisation Strategies and the Partnership for Regional Innovation (PRI) which can provide concrete tools on how to begin carbon neutrality and transition-oriented innovation policies in regions.
- **Just transition mechanisms** are needed that address intergenerational issues, justice from a global perspective, and provide compensation for those that are disproportionately harmed by the transition. The EU Just Transition Mechanisms and Fund are important here and require proper implementation in those regions that are able to use these. However, going beyond this instrument, regions can work together and with the national government to be able to better recognise the links of resource and trade flows to questions of global justice, and find compromises. For instance, to what degree to allow mining which has local environmental consequences to alleviate the pressure on mining using child labour or leading to local conflicts outside Europe.

1.4 Managing change and resilience to respond to disruptions

Transitions will inevitably be disruptive to some actors, despite attempts for managed transitions and just transition initiatives. This kind of disruption is in many cases necessary to unlock existing high carbon systems but can be a complicated process. Disruptions can involve technological systems, infrastructure, markets, institutions, ownership structures as well as professional and everyday practices (Johnstone et al. 2020; Kivimaa et al. 2021). A related capacity has been described as **stewarding capacity** in responding to disturbances which is argued to require the following conditions: generating knowledge about system dynamics, strengthening self-organisation, and monitoring and continuous learning (Hölscher, Frantzeskaki, et al. 2019). For instance, while the City of Rotterdam in the

Netherlands has had some stewarding capacity in relation to water safety, it has paid insufficient attention to climate change effects and has not fully integrated climate change adaptation to different operations (Hölscher, Frantzeskaki, et al. 2019).

Given the turbulent conditions we live in, also the creation of knowledge about the diversity of future expectations and potential disturbances is paramount. In essence some kind of **anticipatory capacity** pertaining to transitions is needed. In practice such capacity also means political honesty about the nature of the immediate or expected disruptions, so that actors have time to respond and take the need for actions seriously enough. A case in point is the reluctance of many EU countries to acknowledge the geopolitical risk around reliance on Russian energy imports, which resulted in 2022 a much more disruptive effect than perhaps otherwise would have been (Kivimaa 2022). Yet, thanks to the already advancing energy transition, the effect was manageable in many places.

Managing change and enhancing resilience means considering the globally challenging environment in the regions (see Section 1) but also approaching it from the perspective of regional specificities. Resilience in the context of transformation has been described "as the capacity to adhere and strengthen a specific transformation pathway rather than return to a previous state" (European Commission et al. 2021: p.29). Some regions can vastly benefit from the expansion of wind power, while others are constrained by, for instance, little available land areas due to construction, tourism, conservation, or defence concerns. Furthermore, these difficulties can be coupled with lowering population numbers, aging population, and lack of attraction to new R&D investments. Land use related tensions and conflicts are one of the major issues in the future, and also transitions themselves create both negative security risks and positive security possibilities related to land use and other factors (Kivimaa et al. 2022).

Besides land use, managing change and advancing resilience implies increasing knowledge about and preparedness of changes in global trade and supply chains. Following this decade's events local production has new value besides sustainability (e.g., near-farming and avoidance of emissions from logistics) which relates to self-sufficiency, security of supply, as well as carbon handprint. Yet, it does not make sense to be self-sufficient in everything and a resilient future world should emphasise both local aspects and networked collaborations across countries. This means that security of supply should be reconceptualised in terms of how infrastructure, supply chains, institutions and business models are organised together. For instance, tightening public-private collaborations, increasing EU-wide interaction, preparing for disturbances, and smart business models utilising, for instance, demand response can benefit new kind of security of supply. In addition, more focus on 'positive security' would be beneficial. Positive security has been defined as 'freedom from insecurity' and emancipation, which can be advanced by empowering citizens and communities (Booth 2007; Hoogensen Gjørv 2012). Therefore, regional developments can play a big role for positive security.

In sum, the following need to be noted when managing change and resilience:

- **Need for stewarding capacity** to respond to disturbances, knowledge about system dynamics, strengthening self-organisation, and monitoring and continuous learning. The development of this capacity may for some regions require support from European Commission and national governments. Many resources already exist, such as the PRI Playbook (European Commission, 2022).

- **Need for anticipatory capacity** by creating foresight about potential future developments and risks, and response plans. Knowledge about global, international, and European future developments could be provided by EU-wide platforms so that the regions have the same resources in their use. Good examples are, for instance, the EU assessment on critical materials resilience (European Commission, 2020) and the State of the Environment Report (European Environment Agency, 2020).
- **Empowerment for regional resilience building**: Connecting regional opportunities with global developments, and empowering citizens and communities to be more resilient to improve security of supply and create positive security is vital. The former is connected to anticipatory capacity but also intertwined with increasing experimentation in the region that involves its residents.

1.5 Transformative innovation policy

A transforming innovation policy approach has been emphasised during the last decade with a focus that it takes on environmental and social challenges – e.g., via the UN Sustainable Development Goals (SDGs) – at its heart. The two main strands of this approach the transformative innovation policy consortium (TIPC) (Schot et al. 2019; Schot & Steinmueller 2018) and mission-oriented innovation policy (Robinson & Mazzucato 2019; Wanzenböck et al. 2020). They both share somewhat same orientation with slightly different approaches. These include directionality and new ways of organising the governance of innovation. TIPC has placed more emphasis on socio-technical systems change, inclusivity and policy-related experimentation (Ghosh et al. 2021; Schot et al. 2019).

Directionality in terms of aiming to achieve the UN Sustainable Development Goals (UN SDGs) is at the heart of transforming innovation policy (Diercks et al. 2019). Therefore, it suggests a changing logic for innovation policy from pursuing innovation for economic growth and export to achieving broader societal change. This direction is coupled with the idea of more inclusive innovation processes and innovation policy making (Ghosh et al. 2021), which broaden the networks from the typical innovation policy actors to the civil society and addressing the concerns of more marginal groups. This emphasises also service-oriented innovation besides technological innovation. Transformative innovation policy also suggests new types of collaborations between public and private actors which encourage experimentation: from policy instrument experiments (e.g. new kind of funding programmes) to setting up experimental spaces (e.g. transition arenas) (Schot et al. 2019).

In sum,

- Transformative innovation policy approaches could complement the other transition effort in regions by spurring innovations with social and environmental benefits. This links to EU policies, such as EU Missions and smart specialisation (PRI).
- They can support just transitions and inclusive vision building by taking on board civil society and other atypical innovation process/policy stakeholders.
- Transformative innovation policy also emphasises different types of experimentation in the public policy context and between public and private actors.

2 Implications for Cohesion Policy

The problem that advancing sustainability transitions faces is that it is often those regions which have the least capabilities to advance transitions that need it the most. They are perhaps the least attractive locations for new green industrial production, may have aging and/or low skilled population, and have less resources for updating and shifting their

governance towards sustainability transitions. Hence, EU Cohesion Policy is in an important role to support these regions in a way that pays genuine attention into advancing climate neutrality transitions. The importance of Cohesion Policy in sustainability transitions has been highlighted due to the substantial amount of funding allocated via this policy area (Kelemen 2020).

Table 2 connects the above identified capabilities to potential opportunities for Cohesion Policy to help. It is obvious that, for most capabilities, different types of guidelines and illustrations of best practices may be most useful. In particular, creating shared terminology and signposts for the carbon neutrality vision on a regional level would be useful. This vision recognises the need to phase out high-carbon industries and structures and rebuild regions with new low-carbon industries and services. The question of human and financial resources is one of the most fundamental ones, especially for more deprived regions. Therefore, a key role for Cohesion Policy is to rethink resource allocation so that it incentivises broader carbon neutrality transitions in the regions. Given the need to match transition visions and resource allocations with institutional changes, the EU Recovery and Resilience Fund (RRF) model may also be useful for Cohesion Policy – the requirement of reforms connected with the allocated funding. This means also support for regions to recognise, plan and implement such institutional reforms. Here, particular advisory or intermediary bodies might be helpful.

Table 2.1 Capabilities for carbon neutrality transitions and potential support from Cohesion Policy

Capability	Specific actions	Opportunities for Cohesion Policy
Shared visioning and institutional change	· Explicit and inclusive processes for vision building for environmental and social sustainability, including the assignment of responsibilities, a broad range of stakeholders, and utilising methods such as transition arenas · Substantial and ambitious legislative and organisational changes · Political ambition and long-term political commitment · Matching public and private sector resources	Guidance for transition processes, e.g., by developing shared terminology and visions tied to other EU policy processes such as smart specialisation for sustainability (PRI) (reducing appraisal diversity and finding consensus about the degree of ambition); utilising the Partnership Principle to improve inclusivity of vision building processes. Transition as a dual goal for Cohesion Policy instruments; carbon neutrality vision as an enabling condition. Funding tied to 'reforms' similarly as in the RRF; set as enabling conditions. Regular reviews of the progress of regions.

Intermediating and orchestrating	· Assessing level of climate neutrality transition intermediation for different sectors and across sectors · Setting up new climate neutrality transition intermediaries · Intermediary functions for response and resilience	Conducting cross-region assessments about transition intermediation in regions and delivering best practices. Guidelines for how to advance transition intermediation in a regional context. Setting up an intermediary body / function to give support across regions. This may need to be tied with, e.g., EU RTD policy or Interreg, if possible, or creating enabling conditions for member states to set up cross-region climate neutrality intermediary.
Unlocking and destabilising high-fossil regimes	· Phase out and exnovation: Identification and phased out removal of structures that support high-carbon technologies and infrastructures · Changing governance culture towards deep learning and unlearning · New regional industrial and innovation policies, placing focus on the emergence of new socio-technical systems, providing new employment and opportunities · Just transition mechanisms that address intergenerational issues, justice from a global perspective, and provide compensation	Guidelines and enabling conditions on unlocking high-carbon structures: Examples already in place include the Just Transition Fund and national Plans for Just Transition. Increasing the climate targets of Cohesion Policy programmes from the present (ERDF (30%) and the Cohesion Fund (37%)). Funding tied to 'reforms' similarly as in the RRF; se as enabling conditions Linking regional industrial and innovations development to the EU Green Deal and the Partnership for Regional Innovation. Further developing the EU Just Transitions Mechanism and ESF+.
Managing change and resilience to respond to disruptions	· Need for stewarding capacity to respond to disturbances, knowledge about system dynamics, strengthening self-organisation, and monitoring and continuous learning. · Need for anticipatory capacity by creating foresight about potential future developments and risks, and response plans. · Connecting regional opportunities with global developments, and empowering citizens and communities to be more resilient.	Developing specific tools for regions to increase their stewarding and anticipatory capacity for future crises and disturbances. Guidelines for how to empower citizens and communities.
Transformative innovation policy	· TIP as a complementary approach to vision building and unlocking high-carbon regimes. · Creating inclusive innovation policy processes for achieving SDGs · Experimental policy instruments and spaces for public-private collaborations	Improved coordination and coherence between Cohesion Policy, smart specialisation for sustainability (PRI) and EU missions. Linking just transition processes to more inclusive innovation policy processes.

Advancement of some of these capabilities could be set as enabling conditions in future Cohesion Policy. For instance, the drafting of up-to-date carbon neutrality visions for regions and/or member states, institutional changes i.e. 'reforms', or the establishment of cross-

region carbon neutrality intermediation could become the new enabling conditions. The Partnership Principle could be used in improving inclusivity of vision building processes and empowering communities.

Horizontal and vertical policy coherence is also needed to make the most out of Cohesion Policy's influence on carbon neutrality transitions. Horizontally, this means improved search for synergies between Cohesion Policy and the policies of the Directorate Generals on climate change, energy and research and innovation among others. Particularly relevant policies are the Green Deal and the Fit-for-55 package, the RRF, and the Partnership for Regional Innovation (PRI) that have all tried to integrate a carbon neutrality transition logic into them. It is vital to keep this transition focus across EU policies and not sacrifice it for short term reactions to current crises. More focus is needed on coordination with EU climate adaptation policy, as the impacts of climate change will increasingly - both directly and indirectly via trade, finance and security - concern all EU regions.

In the regions, the advancement of transitions and improvement of resilience also require improvement in policy coherence between different policy domains due to the interconnectedness of socio-technical and industrial sectors as well as the cascading effects of climate change. The PRI Playbook provides some useful tools for regions to accelerate and expand their transition activities. The more concrete ways in which policy coherence can be advanced, include: (1) shared visions and frameworks (Furness & Gänzle 2017; May et al. 2006) that take create a long-term approach to transitions but also consider the risk of disruptions and regional development; (2) executive agencies (Tosun & Lang 2017) or perhaps intermediaries established to coordinate policy coherence in the context of transitions; (3) coordination mechanisms between administrations (Runhaar et al. 2018); (4) formal requirements, for example, specific plans, staff and financing for transitions that is coherent across policy sectors; (5) independent working groups, and; (6) reporting on coherence and external reviews (Mickwitz et al. 2009).

3 Conclusions

This paper suggested some key areas for capability building for EU regions and places where post-2027 Cohesion Policy could advance carbon neutrality transitions in these regions. The essential capabilities relate to (1) ambitious vision building for carbon neutral socio-technical change coupled with required institutional changes (both legislative and organisational); (2) intermediating and orchestrating transition processes on different levels from local to EU as well as in different sectors and across sectors; (3) rapidly unlocking and destabilising high-carbon industries and practices with due attention to just transitions; (4) managing change and resilience that is able to respond to disruptions caused by the transitions as well as external factors arising from a turbulent world; and (5) transformative innovation policy. The advancement of these capabilities set requirements for regions, member states and the European Commission Cohesion Policy.

For future, post-2027 Cohesion Policy, the important opportunities are:

- To increase the climate target of Cohesion Policy programmes, which creates a basis of member state and regional vision building and institutional changes.
- To utilise the model of the EU Recovery and Resilience Facility (RRF), where funding is tied to specific reforms and their implementation.
- To create other enabling conditions, such as the process and delivery of new carbon neutrality visions (with concrete pathways and actions) and the identification or

creation of cross-regional carbon neutrality transition intermediaries which aid regional progress.
- To connect with and further improve horizontal coherence between other EU initiatives, such as EU RTD policy and smart specialisation (PRI), the Green Deal and EU missions.
- To improve vertical coherence between EU, national and regional policies via the above measures as well as providing guidelines on transition vision building, intermediation, phase out and just transitions.

For EU member states and regions, advancing sustainability transitions coupled with improved resilience will:

- Help identify place-based processes and future opportunities that advance net-zero-carbon transitions but also build resilience against future external developments and crises.
- Encourage institutional change and the creation of new innovations and industries, drawing also from advancements in transformative innovation policy.
- Bring potential for attracting new resources into regions via the changes taking place.

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