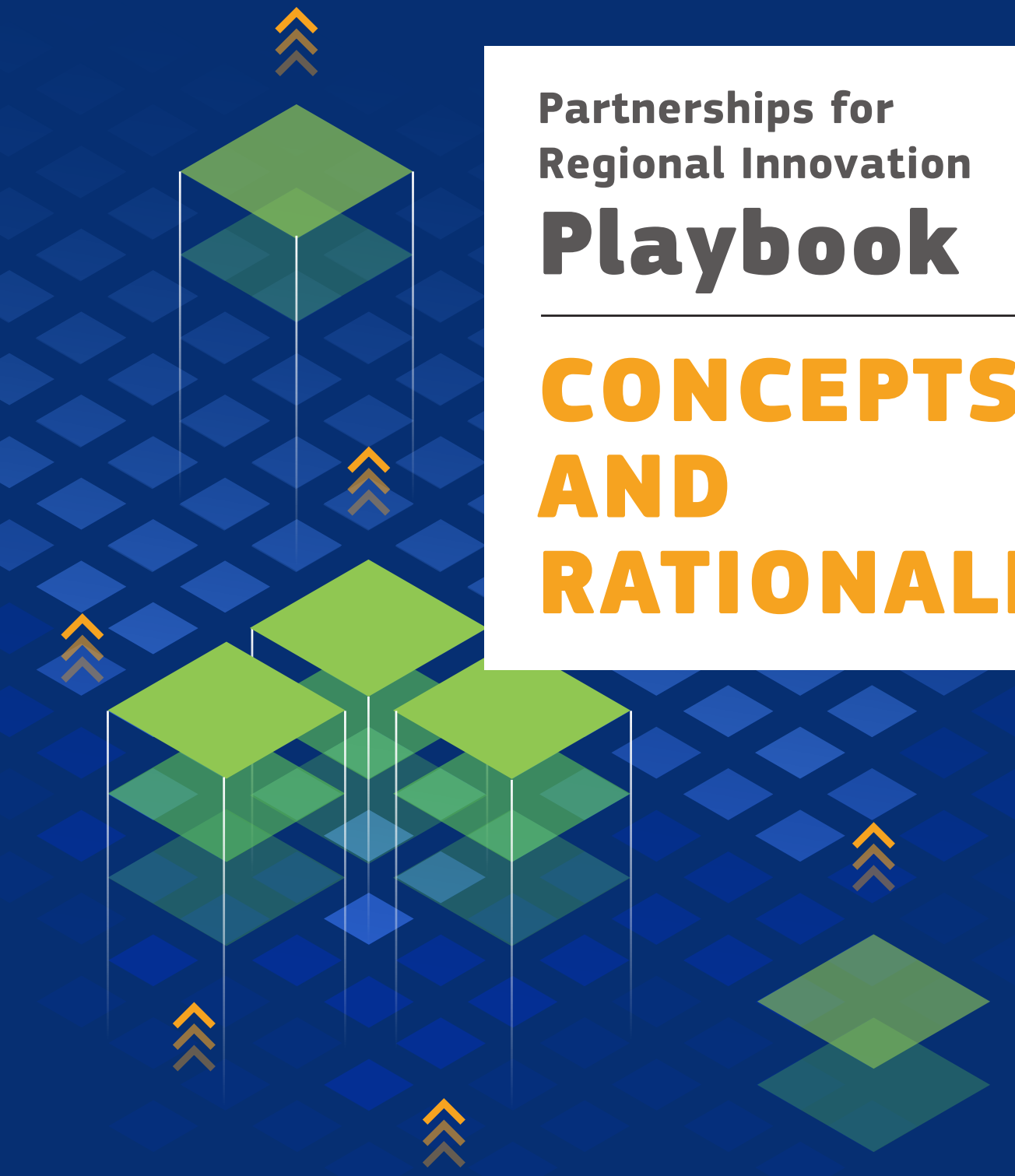
European Commission

Partnerships for Regional Innovation

# Playbook

# CONCEPTS AND RATIONALES



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Contents

# Abstract

This report accompanies the Partnerships for Regional Innovation (PRI) Playbook and aims to provide fuller explanations of the concepts and rationales underpinning the PRI approach, with references to relevant literature. It draws on the JRC's experience with smart specialisation strategies (S3) over the last decade and synthesises the new scientific paradigm of innovation governance drawing on literatures on transformative innovation policy, sustainability transitions and new industrial policies. It concludes with some key considerations for the long-term development of PRI, drawing on actionable insights from literature. The considerations apply as much to the continuous development of existing policies and instruments, as to the initiating of new ones under PRI. The key considerations emerging from this literature that can underpin PRI development are as follows: consider the needs of the territory through the lens of transition; adopt a broader framing of innovation; unlearn loaded framings; work backwards from goals with broad coalitions of stakeholders; complement, strengthen and reform governance; diagnose development bottlenecks and deploy a tailored policy mix that goes well beyond project-funding.

# Executive summary

Partnerships for Regional Innovation (PRI) aspire to become a strategic framework for innovation-driven territorial transformation, linking EU priorities with national plans and place-based opportunities and challenges. The partnerships aim to draw linkages across multiple policy domains and funding instruments, exploits synergies and address possible tensions to generate co-benefits for the economy, society and environment.

The approach is presented in the Partnerships for Regional Innovation Playbook, developed by the European Commission's Joint Research Centre with the support of a scientific committee of renowned experts. On the basis of the first edition of the Playbook, the initial approach for the development of these partnerships will be co-developed and tested during a pilot phase engaging Member States, regions and groups of regions.

This report underpins the Partnerships for Regional Innovation Playbook by synthesising the main concepts and rationales in support of PRI. It draws on the JRC's experience with smart specialisation strategies (S3) over the last decade, state-of-the-art literature on innovation governance and initial deliberations with practitioners.

The experience with S3 over the last decade is an important basis for the development of PRI. The experience with S3 varies considerably across Europe. To a significant extent, S3 appears to have contributed to more methodical planning, more effective coordination and more inclusive regional innovation policy governance. However much remains to be done to improve governance settings and policy capacity. Furthermore, in practice S3 was dominated by a narrow understanding of innovation emphasising R&D and knowledge-intensive firms, and the effectiveness of within-government coordination under S3 has been weak, both horizontal (across policy portfolios) and vertical (across levels of governance), with a persistent silo approach in government that is difficult to overcome.

In this new context requiring transformative innovation, there is now scope to refocus efforts. The PRI approach builds on the positive experience with S3 in terms of stakeholder involvement, while significantly expanding the approach for the development of a strategic framework that strives for co-benefits and long-term societal well-being, in line with the European Green Deal.

The report succinctly outlines the new scientific paradigm of innovation governance and translates its insights into key considerations in getting closer to the long-term goalposts of PRI development, namely to:

- Deliver effective solutions to pressing societal challenges within defined timeframes;
- Use resources in ways that generate co-benefits for the economy, society and environment;
- Draw linkages across multiple stakeholders and policy domains, exploit synergies and address tensions;
- Revise and reform policy and regulatory instruments to improve coordination and amplify impact.

The key considerations emerging from this literature that can underpin PRI development are as follows:

- Consider the needs of the territory through the lens of transition: it is useful to perceive the planning period as one of transition, in view of the deep and inevitable change affecting large parts of our production and consumption systems.
- Adopt a broader framing of innovation: re-orienting innovation policy towards societal goals requires broadening up our view of the system that needs to change in each territory. Innovation scholarship nowadays emphasise a broader framing of innovation that places producers (not just of knowledge, but of goods and services of all kinds) and consumers (or users) at the centre of innovation policy. In addition to supporting companies and knowledge producing organisations, this new framing of innovation draws our attention to the need for systemic change. The objective of policy is to re-configure the system so it meets the new societal purposes.
- Unlearn loaded framings: adopting broader and variable framings of innovation according to the goal sometimes requires unlearning loaded framings of innovation currently in widespread use. Framings can be 'loaded' in the sense that they can carry within them the seed of a particular goal, while diverting our attention away from other worthwhile goals.
- Work backwards from goals with broad coalitions of stakeholders: creating spaces for open deliberation and co-creation that can allow stakeholders to come closer to shared understandings of the root causes of territorial problems or identify opportunities. Once the outlines of visionary goals are in place, the task of policy becomes to work backwards from identified goals with relevant stakeholders, to open pathways so that the goals may be realised.
- Complement, strengthen and reform governance: this calls for a reconsideration of the role of public administrations in governance models that extend well beyond the boundaries of the public sector. Goals-oriented policy requires more intense collaboration between government departments and levels. This may ultimately lead to governance adjustments and administrative reform.
- Diagnose development bottlenecks and deploy a tailored policy mix: rigorous diagnostics can be important to improve the impact of efforts, and PRI requires considerable extension of policy intelligence capacities. But it also important to use evidence and stakeholder inputs to deliberate alternative future scenarios and transition pathways, which can help make plans more resilient to disruptions. An appropriate policy mix should be based on suitably informed diagnostics, should leverage stakeholder knowledge and be responsive to their proposal, and include broad-ranging but selective toolbox tailored to the goals, including regulatory and other demand-side instruments.

# 1. Introduction

*"The ultimate, hidden truth of the world is that it is something that we make, and could just as easily make differently."*

David Graeber, 1961-2020

The impacts of climate change are no longer visible just on the instruments of scientists documenting inexorable temperature and sea level rises. They are also visible on the ledgers of insurance companies and affect the livelihoods of thousands of households[1]. Other big landscape developments, ranging from global geopolitical shifts, to social polarisation, to digitalisation and the pandemic call for a deep rethink and transformation of our production and consumption systems. Intensified innovation will be a central part of the myriads of solutions, small and big, that humanity will need in order to address the challenges of our time.

Innovation policy should not just keep its sights on providing solutions to the immediate challenges themselves, but also to the wider opportunities they create: Innovation is easier to conceive, rollout, break through and propagate widely when things are changing. It is no coincidence that periods of profound socio-economic change – such as the post-war period in Europe – experienced an upswell of innovation and productivity improvements that have not been equalled since. Converging estimates from multiple sources anticipate explosive growth in global markets[2] linked to the green transition and sizeable net employment gains. Global finance has taken notice: an alliance of banks and asset managers[3] with collective investments of $130 trillion (equivalent to over seven times the EU's GDP or 40% of global financial assets) has pledged to meet the goals set out in the Paris climate agreement[4]. Yet, there is no guarantee that the opportunities will be realised in Europe or that the transition will have a long-lasting positive impact. This can only be achieved through an upgraded role for innovation policy. If, and only if, we can grasp the opportunities, this could be remembered as the time when Europe secured its position in the economy of the future, built a fairer society, and became a global champion of humanity's collective interest.

[1] Between 1980 and 2020, total economic losses from weather- and climate-related events amounted to EUR 450-520 billion (in 2020 euros) in the 32 EEA member countries (European Environment Agency, 2022)

[2] For example projections of battery demand by the World Economic Forum (WEF, 2019, p. 11) predict a 14-fold increase over 2018-2030. See also IEA (2020) IRENA (2020) estimates of the prospective size of emerging markets in renewable energy.

[3] Glasgow Financial Alliance for Net Zero, https://www.gfanzero.com/

[4] "I believe the decarbonizing of the global economy is going to create the greatest investment opportunity of our lifetime. It will also leave behind the companies that don't adapt, regardless of what industry they are in. And just as some companies risk being left behind, so do cities and countries that don't plan for the future. They risk losing jobs, even as other places gain them. The decarbonization of the economy will be accompanied by enormous job creation for those that engage in the necessary long-term planning. The next 1,000 unicorns won't be search engines or social media companies, they'll be sustainable, scalable innovators – startups that help the world decarbonize and make the energy transition affordable for all consumers." Larry Fink, CEO of Blackrock, the world's largest financial institution. (Fink, 2022).

Such a lofty outcome now seems within reach. The world is changing. There are deep global transformations of basic human support systems, including food, housing, energy, transport and the all-pervasive digitalisation. European households, businesses and governments, are now making the investments that will determine our way of life for the decades to come. We need to make the best possible use of what may well be a once-in-a-century opportunity to bring about lasting change. Doing so in ways that create multiple value for the economy, society and environment requires innovation. But not *only* as conventionally understood.

Over the past two decades innovation scholars and practitioners have co-developed a new framing of innovation policy, which is now taking centre stage (e.g. European Environment Agency, 2019a;; OECD and Eurostat, 2018; Schot and Steinmueller, 2018; Mazzucato et al.. 2020)[5]. A foundational premise for this new framing is that policy should be concerned with the outcomes of innovation, which can be good for the economy but not necessarily for the environment or society. To do so, they argue we need to take a broader view of what needs to change beyond the narrow group of knowledge producing organisations that have traditionally monopolised attention. Rather than focusing only on how to give scientists and engineers more time and money to do research, policy should also seek to transform the economy and society to make them more receptive to and demanding of beneficial innovation, and in doing so, increase the chance of both economic and societal impact. Such a 'system-level' innovation is increasingly seen as a legitimate and achievable policy goal. Small but growing numbers of policy practitioners are now working to operationalise a new framework of strategic thinking and acting in the face of transformative change.

System-level innovation is not about drafting a grand plan in advance. It requires spelling out and then constructing collectively the positive futures we want, one bit at a time. The transition affects us all and needs to involve every part of society. Discovering and making progress along the desired pathways implies working with growing stakeholder coalitions. These discussions need to involve technology users (who may be patients, students, commuters or households), financiers, regulators, professional associations, trade unions, educators, consumers or workers, and especially vulnerable groups whose voices are often unheard. Smart specialisation has introduced forms of participatory governance that are an excellent basis to build and expand on.

Nevertheless, challenging powerful incumbents is a task that innovation policy makers are not prepared for; it requires the mind-set and skills commonly found in government regulators (such as competition authorities) who will have to be enlisted too. There is a dense web of regulatory and institutional obstacles to transformation, the lifting of which can prompt openings for multiple value-creating innovation, if we are prepared to exploit them. As in previous societal emergencies, governments will have to find ways of working across departmental and jurisdictional silos, and in partnership with businesses and civil society to open up positive pathways for those who choose to take them. System-level innovation assigns new roles to governments, who in addition to channelling public resources for innovation, must also act as orchestrators, regulators, watchdogs, warners, mitigators, lead users as well as promoters of transformative change (Borras and Edler, 2020).

Europe's regions and countries face sizeable challenges in their green and digital transitions, which often demand investments greater than any one region, member state or EU fund can shoulder. Unlike previous generations of innovation strategies whose visions were usually open-ended, we now *have to* achieve impact for the economy, society and environment within defined timeframes. To do so, we

[5] At the time of writing, Schot and Steinmueller (2018) is the most cited paper in the top innovation journal (Research Policy), with some of the foundational papers by Geels (2002; 2004) following closely behind. The new OECD/Eurostat Oslo Manual of Innovation (OECD and Eurostat, 2018) now recognises households and other users as meaningful statistical units. Policy-oriented reports by the European Commission (2020a) and the OECD (2015; 2021), also reflect the growing recognition that the dominant framing of innovation is not up to the challenges of our time.

should be using both new and old solutions, investing not just in R&D and business innovation but also in education and skills and critical physical infrastructures. We should be drawing linkages with policy domains generating demand for innovation – such as energy, health, transport, waste, security - that are now largely unexploited. Building the links is costly: tensions will emerge and we need ways to make them manageable. We should also be re-tooling government, including with revised and fit-for-purpose policy instruments, such as new forms of public private partnerships, public procurement for transformation and regulatory experimentation and reform.

Taken together these require a step change in the effectiveness of coordination. They stand to accelerate and amplify impact. This is what PRI is trying to achieve.

## 2. Lessons from the experience of Smart Specialisation Strategies

Striving for innovation in innovation policy, PRI builds on and substantially extends upon the experience with S3. S3 were developed in the context of the EU Cohesion policy and were introduced in the 2014-2020 programming period of the European Regional Development Funds (ERDF)[6].

S3 are strategies for knowledge-based regional development emphasising prioritisation of regional research and innovation funding according to territorial strengths and opportunities, stakeholder participation and strengthened governance, including effective mechanisms for monitoring and evaluation. The introduction of S3 in the context of EU Cohesion policy coincided with a more than trebling of ESIF funds potentially available for research and innovation (from about €23bn in 2007-2013 to about €84bn in 2014-2020), which if fully mobilised, would have been equivalent to about 13% of government funded R&D in the EU. The most comprehensive evaluation of the European experience with S3 to date finds that 185 strategies were produced and approximately €20bn was actually funded in S3 priority areas (European Commission, 2021).

S3 represented an important turning point in regional innovation policy development in Europe. A key novelty of S3 was the introduction of stakeholder participation to identify unique strengths and opportunities in the territory and channel research innovation funding in their direction. This happened in the context of the Entrepreneurial Discovery Process (EDP), whereby authorities in charge of S3 orchestrated stakeholder engagement and consultations (usually in the form of workshops) with representatives from businesses, academia, government and civil society. The benefit of local stakeholder knowledge made S3 policies more adaptable to the specific conditions and potential of every European territory (Georghiou et al., forthcoming). A recent study concludes that, thanks to the EDP, S3 have helped address coordination problems and thicken relations between actors, making the governance of innovation policy in the regions more inclusive (Guzzo and Giannelle, 2021).

Engaging in such wide-ranging reform of innovation policies has been challenging. The introduction of S3 required substantial changes in the governance of innovation in the regions, including the introduction of new capacities in the administrations, to design innovation strategies, introduce and carry out the EDP, as well as set up monitoring and evaluation systems. Beyond the public administrations in charge of the strategy, the introduction of S3 required capacities that extend beyond the state to the whole ecosystem, in the sense of capacity of multiple stakeholders to work in concert to co-create the desired S3 outcomes through the EDP (Morgan and Radosevic, forthcoming).

The experience with S3 therefore varied considerably across Europe, depending on each territory's starting point. Surveys reveal that a majority of practitioners believe that S3 contributed to more methodical planning, has improved the quality and effectiveness of coordination mechanisms, strengthened the involvement of stakeholders and the level of trust between private and public actors (Guzzo et al., 2018; Guzzo and Perianez 2019; Marinelli and Perianez Forte, 2017)[7]. Nevertheless, much remains to be done to improve governance settings and policy capacity, especially in less developed countries and regions (Guzzo, et al. 2018). Indeed, there is risk of greater territorial

[6] The Regulation governing ESIF during the 2014-2020 Programming period included the so-called 'Research and Innovation ex-ante conditionality' which required from Member States and regions the fulfilment of the following criterion, in order to receive ESIF funds under Thematic Objective 1: 'the existence of a national or regional smart specialisation strategy in line with the National Reform Programme, to leverage private research and innovation expenditure, which complies with the features of well-performing national and regional R&I systems' (https://ec.europa.eu/regional_policy/en/information/legislation/regulations/2014-2020)

[7] In terms of its impact on the economy, no comprehensive assessment was available at the time of writing. Partial evidence demonstrates positive impacts on labour productivity and *ex ante* simulations anticipate positive impacts on growth, some of which however are conditional on the presence of an effective innovation system in the region (Marques-Santos et al., 2021; Barbero et al., 2021; Varga et al., 2020).

polarisation, unless the problem of territories with low institutional capacity to effectively mobilise funds is addressed (Incaltarau et al., 2020). Governance is highly context-specific, and appropriate approaches will need to take into account existing institutions, culture and historical trajectories of innovation policy. In the future, strategy implementation will require much more attention on the identification of bottlenecks for capability development and the development of tailored policy mixes.

The effectiveness of within-government coordination under S3 has been weak, both horizontal (across policy portfolios) and vertical (across levels of governance), with a persistent silo approach in government that is difficult to overcome (Guzzo and Giannelle, 2021). As has been argued by Radosevic (2017), S3 remains a case of an incomplete new industrial policy, requiring much more extensive mobilisation to fulfil its promise. This experience is in sharp contrast with the initial ambition for S3 strategies to act as comprehensive agendas for regional development. In practice, S3 has been used to coordinate only the R&I portion of the ERDF, with rare examples of complementary interventions in other areas, policy domains or levels of governance. As a result, a narrow understanding of innovation emphasising R&D and knowledge-intensive firms dominated in S3 practice (Hassink and Gong, 2019). The emphasis on a region's endogenous strengths has sometimes had the effect of protecting and subsidising existing industries regardless of their potential and dynamism (Fedeli et al., 2019). Moreover, S3 overlooked the importance of interregional networks and connectivity (Iacobucci & Guzzini, 2016). Taken together, this meant that S3 has been more effective in supporting niche innovations, but did not introduce mechanisms so these could be scaled up and have transformational impact (Miedzinski et al., 2021).

There is now an opportunity to refocus S3 efforts in accordance with new framings of innovation policy that emphasise directionalities focused on societal outcomes (see Schot and Steinmueller, 2018) and adapt S3 practice to the implementation of the European Green Deal (Pontikakis et al, 2020, Marinelli et al, 2021; Miedzinski et al., 2021; Nakicenovic et al., 2021). Past experience with S3 is a good basis for the development of directions that strive for co-benefits in line with the green and digital transition. Key challenges for S3 in this new direction would be more extensive coordination with other policy portfolios with central roles in societal purpose-driven transformations (environment, employment, education, industry) as well as line ministries whose budgets play a key role in solutions deployment and demand articulation such as energy, health, waste, infrastructure etc. To address these challenges, S3 (or federated strategic frameworks for innovation, industrial policy or sustainable development, including at other levels of governance) would have to adapt and extend its actions as explained in Box 1 and Box 2.

### Box 1. Important considerations in adapting S3 for transformative innovation.

A recent JRC working group on "Understanding and Managing Industrial Transitions"[8] (2019-2021) including external experts and representatives from regional and national authorities and supported by an advisory board of leading experts examined extensions and adaptations of S3 to the needs of industrial transitions. The Working Group developed an analytical methodology and reviewed policies in Andalusia, Bulgaria, Greece and Romania, seeking to advise policy makers whilst extracting useful lessons for S3. According to this body of work, and complementary work performed by the regional government of Catalonia, key considerations to take into account in strategic development of innovation policy for transformation include:

Need to promote responsible research and innovation: Many of the societal problems we now need urgent solutions to, have only emerged due to economically useful innovations which turned out to generate negative externalities. It is important to ensure that innovation does no harm to

[8] https://s3platform.jrc.ec.europa.eu/industrial-transition

society or the environment and promote directions for innovation that create co-benefits simultaneously (rather than just compensate for damage with additional innovation).

Need for time-critical solutions: The strategy must be impact-based and provide solutions to territorial problems within specific time-frames. The need for time critical solutions also implies that a large part (perhaps the bulk) of investments required for industrial transition are of a different nature than those traditionally foreseen in most innovation strategies, focusing more on application and deployment than on research.

High cost of industrial transitions: Many, if not most, of the economic and societal challenges linked to the twin transition cannot be tackled by isolated stakeholders, regions or member states, highlighting a pressing need to work together, including at the European level. To grasp the opportunities it will also be important to bring about system-level change.

**Need to move beyond the territory's existing comparative advantage and tailor** industrial policy to rigorous development diagnostics: In the new context, it is no longer enough to diversify from areas of economic strength. For example, existing strengths in some sectors (e.g. fossil fuel related industries) no longer a serve a societal purpose. Industry support should either strengthen, transform, or create new comparative advantages according to sustainable development needs. Creating new comparative advantages is especially important for lagging regions (Asheim, 2019).

Not just about research and innovation policies and funding: The range of policy actions must be expanded to include – depending on the territorial challenge– support for education and skills, investment, social protection, energy, environment, infrastructure, land use and urban planning, waste management, agriculture, health, defence among others. Many of these policy domains display strong complementarities with innovation policy in times of deep productive transformations and may have more experience in dealing with negative externalities.

*Sources*: Marinelli et al. (2021); Pontikakis et al. (2020).

### Box 2. Important considerations in adapting S3 for the SDGs

The JRC has been working on embedding the sustainability dimension in S3 strategies based on cooperation with global partners, extensive theoretical research on sustainability transitions, analysis of case studies, pilots and co-creation with practitioners. One of the outcomes of this work is a theoretical and conceptual framework for Smart Specialisation aligned with ambitious sustainability goals, notably the Sustainable Development Goals (SDGs). The main conclusion is that while the current approach to Smart Specialisation has a lot to offer to foster transitions (e.g. participatory governance and discovery process, central role of innovation, place-based approach), it needs to revisited and extended if it is to facilitate reflexive, responsible innovation and systemic change in line with the transformative ambition of the 2030 Agenda. Desirable characteristics of Smart Specialisation which can give it a stronger sense of direction and increase its potential to contribute to transformative change are:

- Shared direction towards the SDGs: Smart Specialisation could be guided by the SDGs as an overarching direction of transformative change. SDGs can become a reference for localising the territorial vision and a reference for identifying and selecting key priorities at different territorial levels. The S3 process could localise the SDGs and mobilise science, technology and broadly understood innovation to address these challenges in specific territorial contexts.
- Whole-system transformation towards sustainability: Smart Specialisation design calls for creating synergies and coherence with other policies, both horizontally and vertically, in order to drive structural and systemic change. To address sustainability challenges, this focus

needs to be extended to reflect and foster wider social-technical system transitions needed to tackle sustainability challenges. The S3 process helps to clearly identify specific areas and niches where the community of stakeholders can meaningfully act and achieve change while contributing to wider systemic transformations.

- Responsibility and reflexivity: Smart Specialisation could explicitly integrate moral and ethical considerations and discussions needed to navigate difficult transition choices, which balance creating and capturing value for the region with contributing to tackling wider environmental and social challenges. Policy learning capacity is needed to identify and foster synergies and to openly discuss trade-offs and limitations. This is key for harnessing the potential of S3 to work towards 'just transitions' that leave no one behind and create shared value for future generations.

These characteristics have important implications for the original design of Smart Specialisation. In most cases, they can be usefully aligned e.g., the process of entrepreneurial discovery and experimentations can be highly valuable for co-designing innovation activities fostering niches where transformative innovations are co-created and tested. But they may have more significant implications for the notion of competitive advantage that should not be based on the economic factors only. The quality of life, environmental factors and wellbeing are increasingly seen as elements of territorial attractiveness and require a rethinking of policy goals and objectives. SDGs as a framework imply a deeper reflection on the motivations and rules guiding territorial competitiveness and comparative advantage.

It is crucial that the reflection and design of Smart Specialisation explicitly considers the challenges of the growing innovation divide in Europe, within countries and regions. The divide may grow larger because of the lack of capabilities to address sustainability challenges in territories with lower institutional capacity.

The revised approach - adaptable to different contexts and open to different types of innovation to drive change - can be an important policy instrument to tackle this challenge and help leave no place behind.

*Sources*: Miedzinski et al (2021), Miedzinski et al (*forthcoming*)

In this new context requiring transformative innovation, there is now scope to refocus S3 efforts. A transformative S3 should be capable of harnessing the ideas of stakeholders and channelling their energy into addressing the territorial manifestations of global challenges (Marinelli et al., 2021). This could in turn enable territories to grasp opportunities within and beyond Cohesion policy, preparing stakeholders to seek synergies with other funds and positioning them to benefit from global trends and value chains. Such an approach, however, requires a significant change of perspective and the integration of tools into the policy mix that go beyond S3 as originally conceived.

Although the above challenges are not negligible, there are several examples of regions that have capitalised on the knowledge, experiences and specific elements of S3 to design and implement strategies with a sustainability focus (Box 3).

Box 3. From S3 to sustainability – examples from several EU regions

- **The Baltic Sea Region's interregional cooperation on circular bio**-economy exemplifies how a well-organised EDP could help overcome challenges in terms of communication with stakeholders and coordination of the discussions to motivate them. It helped create added value and avoid "domination by a few stakeholders".[9] Such challenges are often present in Triple Helix interactions and moving towards a Quadruple Helix will only complicate the process, as long as incentives and the perceived benefits of civil society engagement in the EDP are not present or are not communicated clearly enough.
- Municipality in Oulu Region (Finland) is a benchmark in many aspects. One of them is the EDP itself which is based on a Quadruple Helix setting and explicitly targets intense citizen participation. The region has successfully demonstrated "the benefits of combining new technologies with social innovation to drive forward energy transition, capturing above all a strong and lasting citizens' engagement in the shift towards a greener society. Ii proves that there can indeed be local solutions to global challenges. The Municipality believes that it can be a frontrunner in encouraging much larger change, as a role model to inspire replication in other EU regions."[10] They also used tools like green public procurement with tender specifications and selection criteria reflecting zero waste, elimination of overconsumption, zero emission, and sustainable employment. The 50/50 model for energy/resource saving provides financial incentives for children and young engagement and serves educational purposes simultaneously.
- Hauts-de-France is another example of fostering citizen participation and local ownership for the green energy transition in a non-prosperous region based on the recognition that both supply- and demand-side changes are needed to achieve transformation. Key ingredients of the success are the extended Quadruple Helix, incentives for local ownership (including financial one) of green energy investments, the establishment of saving accounts for green and local investment projects, and an energy company. The region operates as a cooperative with a partnership structure that, beyond the municipality, includes two local energy companies, a bank and the citizens who this way are involved in managing the project. Another tool is the participation of citizens in municipality investment projects, influencing this way the priorities. A so-called Rev3 Savings Account was developed by a national bank, based on the Regional Council's request, to collect private savings for investing in sustainable transition projects. In terms of Quadruple Helix interactions, local and regional municipalities worked well together in a complementary way where the former ensured decentralized, bottom-up transformation with a long political commitment and the latter served as facilitator and disseminator of good practices.[11]
- Algarve Region's S3 is a living lab for the sustainable energy transition and also represents a successful Quadruple Helix approach for partnership. *"The value of the Culatra 2030 initiative lies in its all-encompassing strategy covering multiple aspects of green transition, including social issues such as energy poverty. Rather than the development of new technology per se, the key perspective is the holistic model and demonstration character of the initiative."*[12] An initial Community Participatory Diagnosis[13] and a continuous EDP process ensured broad public participation[14].

[9] https://s3platform.jrc.ec.europa.eu/w/baltic-sea-region-interregional-cooperation-on-circular-bio-economy (03.03.2022)

[10] https://s3platform.jrc.ec.europa.eu/w/green-transition-becomes-reality-in-ii-municipality-oulu-region-finland (03.03.2022)

[11] https://s3platform.jrc.ec.europa.eu/w/hauts-de-france-direct-citizen-participation-in-green-energy-transition (03.03.2022)

[12] https://s3platform.jrc.ec.europa.eu/w/a-living-lab-for-the-sustainable-energy-transition-ambition-of-the-algarve-region-s-s3 (03.03.2022)

- **Slovenia's Str**ategic Research and Innovation Partnership (SRIP) on Circular Economy is a cluster organization established in 2016 as a result of the EDP process. It brings together actors in a Quadruple Helix setting with open membership to support identifying new activities in six green transition related focus areas instead of targeting only one sector. The SRIP has a strong focus on skill, competence, and knowledge building, and it is also an advocate of green public procurement.[15]
- **Romania's** support to technology transfer through Smart Specialization through a series of training workshops in technology transfer and innovation management targeted several projects developed in the framework of regional S3 strategies. The workshops, organised by the Joint Research Centre in collaboration with Romanian experts, addressed key issues, such as technological maturity, embedding technology development objectives in the project design, methodology of the project evaluation and formation of evaluators, etc. This example is highly relevant to sustainability transitions due to its focus on building the necessary skills and competences to understand and address the technological change embedded by the transitions. It is also relevant for increasing awareness on the fact that this type of competences should not remain confined to technology transfer professionals, but should expand to a much broader range of people, including government, academics, cluster representatives and business partners. This is also an excellent example of how less prosperous regions with less experience and lower capabilities in strategy settings can be supported to have a steeper learning curve.

*Source*: Erdos and Foray (forthcoming)

Participatory governance (see Fiche 27), as practiced in the context of the EDP under S3, can be a good starting point for the careful balancing act between the need to plan jointly with many others against the need for individual choice. A strengthened discovery process, enriched from experience with the EDP under S3 and leading practice with participatory governance approaches in other contexts could offer a promising path forward. Nevertheless, scholarly work on S3 shows that civil society has thus far not been well represented in these processes (Aranguren et al., 2019; Grundel and Dahlström, 2016; Marinelli and Perianez Forte, 2017; Trippl et al. 2020) due to a number of challenges and barriers that need to be overcome (Box 4). Greater participation by civil society will be central to PRI development. Civil society stakeholders can have a unique ability to galvanise actions and engagement in addressing local challenges that the formal government bodies and businesses find it difficult or impossible to address (McCann, forthcoming).

### Box 4. Challenges and barriers to civil society involvement: lessons from S3

S3 has featured a rather elitist approach to innovation (Roman and Fellnhofer, 2022) and a clear emphasis on competitiveness (Thapa et al., 2019), while environmental and/or social concerns and goals have been side-lined. Clarity in in setting up clear rules of engagement of civil society in participatory S3 processes has been shown to be very important – high variation across European regions has been reported in this respect, with some regions having established clearly codified rules of engagement, while others relied on rather informal processes (Perianez Forte and Wilson,

[13] It was carried out in three phases; *„Phase1 - Views: understanding the actors and the territory as a social product; Phase 2 - Horizons: dialogue and proposals for action; Phase 3 - Negotiation and Action: seeking consensus for the development of the territory."* [https://s3platform.jrc.ec.europa.eu/w/a-living-lab-for-the-sustainable-energy-transition-ambition-of-the-algarve-region-s-s3] (03.03.2022)

[14] It has to be mentioned that the population of the island is 1,000 permanent inhabitants.

[15] https://s3platform.jrc.ec.europa.eu/w/strategic-research-and-innovation-partnership-on-circular-economy (03.03.2022)

2021). The lack of information on the purpose and scope of S3 has often led to a lack of motivation, if the incentives for citizens or civil society organisations to participate in S3 have not always been very clear.

Broad inclusion of stakeholders and prioritising the involvement of civil society actors could lead to / might precondition a re-arrangement and modification of the tasks of public authorities, calling for the provision of additional guidance and training in relation to participatory approaches (Roman and Fellnhofer, 2022). Studies of S3 have shown that participants often do not have the skills that are needed to take part in policy decision-making processes (Perianez Forte and Wilson, 2021). In many cases, there has been an insufficient understanding of the fact that there are many different forms to involve civil society in S3, including information exchange, feedback and co-creation of strategies, as well as an insufficient understanding of the heterogeneity of civil society organisation, of their different interests and motives and their different approach of the nature and spatial reach of their activities.

Taking on board these lessons from S3 seems to be vital to further capacity-building among stakeholders and for removing challenges and barriers to the involvement of civil society in transformative innovation. In particular, the following aspects appear to be of high importance:

- *Stakeholders' complementarity in social value creation vs. economic value creation and asymmetrical power configurations, conflicting values, coordination and directionality of regional innovation policy.* Civil society stakeholders are usually focused on social value creation (Blok, 2014), thus complementing those stakeholders that are more oriented towards economic value creation. Their involvement could help finding a balance between competing demands on economic competitiveness and social and environmental matters, resulting in smart, inclusive and sustainable regional innovation and development strategies (Thapa et al. 2019). However, bringing together actors with diverging value orientations, competing demands and conflicting interests to co-shape transformative innovation could well result in coordination challenges, conflicts and battles over the directionality of innovation policy. Formulating a common vision and sharing common goals, crafting a coherent innovation strategy and selecting priorities could easily turn into daunting tasks. In the worst case, it could lead to a situation of 'no decision at all' (Kulve and Rip, 2011) or the marginalisation of the aspirations and goals of involved stakeholders. As regards the latter, close attention needs to be paid to the power distribution among participants in decision-making. Asymmetrical distribution of power could be an issue, resulting into continuity and maintenance of the status quo (Thapa et al. 2019) and hindering the entire transformative process.
- *Identifying and addressing inclusion barriers that reside both within civil society (lack of information, lack of motivation) and within regional authorities (lack of resources, guidance and ambition for intensive stakeholder engagement)* by setting transparent, strategic and rule-based forms, as opposed to non-transparent, ad hoc and informal ways.
- *Identifying and properly considering specific place-based problems and needs*, *characteristics of the political-administrative system, historically inherited political cultures, institutional legacies, and the past trajectory of innovation policy.* This would allow to better assess which actors from civil society to include (i.e., the region's problem endowment) and how to foster their inclusion and engagement (Perianez Forte and Wilson, 2021; Roman and Fellnhofer, 2022).
- *An updated vision of the innovation framework and collaborative setups in which the stakeholders operate*, such as the transition from the Triple Helix model and adoption of the Quadruple Helix model of innovation or other conceptual frameworks that accommodate the inclusion of civil society

*Source*: McCann and Trippl (forthcoming)

The broad framing of innovation raises obvious practical challenges of information, coordination and planning. How to operationalise the broad framing of the socio-technical system for smart specialisation? Are all possible policies part of the strategy? The answer is no. The relevant framing – and the implicated stakeholders and policies - will in fact vary according to the challenges faced by each territory. New innovation partnerships would have to additionally introduce mechanisms for local problem identification and work backwards with implicated stakeholders to address them. The mounting body of experience with challenge-driven (or mission-oriented) innovation policy (see Fiche 7, "*Challenge-oriented innovation policy*" and experiences documented in OECD, 2021[16]), is showing much promise for engaging with underrepresented stakeholders and can be a good basis to develop PRI.

[16] See also experiences documented in the Mission-oriented Innovation Policy Observatory: https://www.uu.nl/en/research/copernicus-institute-ofsustainable-development/mission-oriented-innovation-policy-observatory

# 3. The new scientific paradigm of innovation governance

## 3.1 System-level innovation[17]

Innovation models that emerged in the post-WWII period, from the linear models of the 1960s to the networked models of the 1990s, typically focused on innovation processes at firm level (the innovation system approach, with its national, regional, technological or sectoral innovation systems frameworks) and also recognised the contributions of other knowledge producing organisations such as universities and public research organisations. This framing of innovation set economic growth and competitiveness as the ultimate innovation goals, paid the bulk of attention to activities that directly contribute to shifting the global knowledge frontier, and saw insufficient linkages between knowledge producing organisations as a key policy challenge. Whereas the relevance of innovation to the entirety of the economy was always acknowledged in earlier works on innovation systems, in practice innovation policy focused its attention to knowledge actors and intermediaries.

Recent years have seen the emergence of a new framing of innovation (Geels, 2002; OECD, 2015;; Schot and Geels, 2008; Schot and Steinmueller, 2018; Weber and Rohracher, 2012; OECD, 2021), known as "system innovation", "systemic innovation", "system-level innovation" or the "third framing of innovation policy". It emphasises the pervasive nature of innovation within and across systems, as an aggregate outcome of both niche innovations and global impulses for change that collectively trigger changes in the structure or "architecture" of the system (Figure 1). Architectural innovation disrupts existing technical competencies and linkages between producers and users. Architectural innovation also often entails new business models, new regulations, new infrastructures, and new cultural meanings (OECD, 2015).

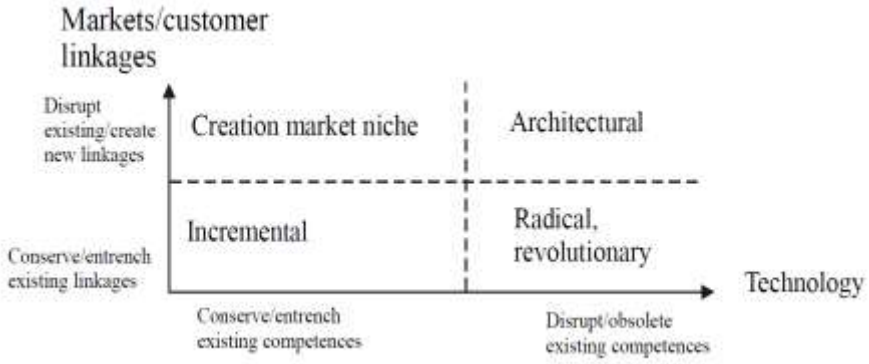



Figure 1. Typologies of innovation. Source: Abernathy and Clark (1985: p. 8).

A few indicative examples of system innovations are outlined in Table 1 on next page.

[17] The sections on system innovation and the multi-level perspective draw heavily on Pontikakis et al. (2020).

*Table 1. Examples of system innovation*

| System innovation | Functional purpose | Constituent and/or complementary innovations | Enabling regulation and infrastructure | Contributing social groups (locus of agency) |
|---|---|---|---|---|
| Electricity grid | Electrification of industry and households | Dynamo, power plant, transmission lines, electrical motors, lighting and refrigeration | Grid infrastructure, safety regulation, standards and certification | Large-scale utilities; government regulators; (formerly) state-owned firms |
| Controlled-access highway (e.g. the Autobahn) | Untethered long-range high-speed land travel; Integration of national economy | Assembly line, mechanisation of construction, off site fabrication, affordable automobiles | Legislation to restrict right of way, Spatial/urban planning regulations, Vienna Convention, Transport infrastructure, Petrochemical logistics. | Government (public infrastructure), industrial nexus of mining, manufacturing and construction, households, maintenance and repair specialists |
| Global value chains | Productivity improvements, integration of global economy | Interchangeable parts, shipping container, tank ship, just-in-time manufacturing | International trade agreements and enforcement frameworks (e.g. World Trade Organisation) | Businesses working across multiple legal jurisdictions; governments; international organisations |
| Internet | Global information exchange network | Personal computers, internet protocol, multimedia, broadband networking, mobile phones | Domain name registrars; standards development; digital communication and privacy legislation | Computer users, software and content developers, businesses developing hardware and offering telecommunication services |
| Distributed energy production from renewables | Create markets for environmentally sustainable energy; energy system resilience | Feed-in tariffs, Photovoltaic panels, wind turbines, stationary batteries, microgrids, distributed ledgers, electric vehicles | Legislation to guarantee grid access, long-term contracts, step-by-step reductions in tariffs | Energy hardware manufacturers, households, utilities, government regulators, software developers. |
| Two-sided platforms (e.g. Yellow Pages, eBay, AirBnB) | Information infrastructure to facilitate transactions | Internet, on-line payments, logistics | Business-driven standard setting and adoption. | Platform owners and developers, sellers, buyers |
| Electric vehicles and renewable energy nexus | Sustainable energy and transport and via new modalities, enhanced access to transport services | Electric power trains, high energy density batteries, autonomous driving, feed-in tariffs | Emission regulation, urban combustion vehicle bans, fiscal incentives, charging infrastructure | Drivers, passengers, manufacturers, utilities (power, grid, telecommunication), urban planners, households |
| Distributed manufacturing (3d additive and subtractive manufacturing) | Place-based manufacturing for goods where high unit costs can be tolerated (e.g. iterative prototyping, instruments) | Computer-aided design, computer numerical control (CNC), two-sided design platforms, material extrusion, milling, material innovations | Intellectual property right attribution and enforcement, environment and health and safety regulations | Model designers, platform owners, software developers, users, manufacturers of CNC mills, 3 printers and materials, machinists, repairers |

*Source:* Adapted from Pontikakis et al. (2020)

Table 2 below provides additional examples of technological, social, business model and infrastructural innovations that can bring about system-level innovation for sustainability and will often be unique to each territory.

Table 2. Examples of sustainability innovations in the mobility, food and energy domains.

| | Mobility | Food | Energy |
|---|---|---|---|
| Incremental technical innovation | Fuel-efficient petrol or diesel cars | Precision farming, food waste valorisation, integrated pest management | Insulation, energy-efficient appliances, efficient gas or coal-fired power plants |
| Radical technical innovation | Battery electric vehicles, electric bikes, alternative fuels, autonomus vehicles | Permaculture, no-tillage farming, plant-based meat and dairy products, genetic modification | Renewable electricity, heat pumps, passive houses, whole-house retrofitting, smart meters |
| Social or behavioural innovation | Car sharing, modal shift, teleconferencing, teleworking, internet retail | Alternative food networks, organic food, dietary change, urban farming, food councils | Decentralised energy production ('prosumers'), community energy, energy cafes |
| Business model innovation | Mobility services, car sharing, remanufacturing vehicles, bike sharing | Alternative food networks, organic foods | Energy service companies, back-up capacity, vehicle-to-grid electricity provision |
| Infrastructural innovation | Intermodal transport systems, compact cities, integrated transport and land use planning | Reform to distribution systems, storage provision and better fod waste management | District heating systems, smart grids, bio methane in reconfigured gas grid |

*Source:* European Environment Agency (2019b)

These examples and their myriads of contextual adaptations demonstrate that system-level innovations can be both global and place-based, and can apply to both developed and developing countries and regions. As argued by Miedzinski et al. (2021) system innovation and sustainability transitions are not concepts for advanced regions only. System innovation is a positive concept, not a normative one. Some system innovations can be partly influenced or supported by public policy but never truly directed (Grin, 2008; Mazzucato, 2016). Public policy can shape system innovation, with varying degrees of intensity, at the local community, city, regional, national or supranational levels. Resulting system innovations usually hold much potential for scaling up or filtering down to other levels. Distributed agency, loosely connected by fleetingly aligned interests, is a key feature of system innovations (Pontikakis et al., 2020).

While recognising the importance of firms and other knowledge-producing organisations, this new framing is much broader. It encompasses the entirety of the production and consumption system, with its complex functional relationships (see Figure 2). In this new framing *firms* and *knowledge producers* share the centre stage with *households* and *users*. This framing is aligned with the latest edition of the Oslo Manual (OECD/Eurostat 2018) that further expands the definition of innovation beyond the firm to other organisations and individuals, including households[18]. Moreover, this new framing recognises

[18] The latest edition of the Oslo Manual (OECD/Eurostat 2018) further expands innovation beyond the firm to other organisations and individuals, takes better account of globalisation and digitalisation trends, and aims to

that truly transformative social change is rarely just about the underlying science and technology: it invariably involves new socio-economic configurations meant to serve new socio-economic functions.

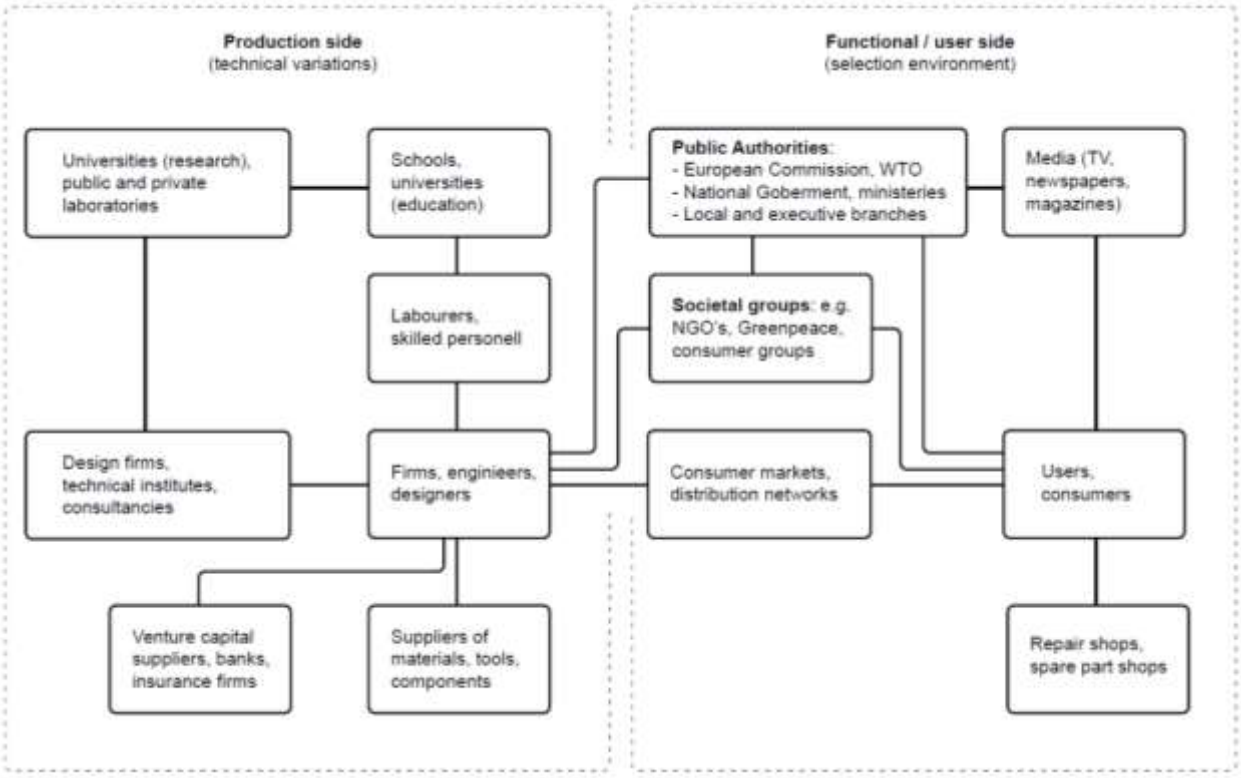



Figure 2. Social groups in a stylised production and consumption system. Source*: Adapted from Geels (2004: p.901)*

A system-level innovation approach will be essential to realise the ambitious structural and strategic transition goals of Agenda 2030 and the European Green Deal. There is a need for a policy framework with a holistic and integrated vision for socially, economically, and environmentally sustainable development, reassessing and redefining current policy objectives, strategies, and practices. The transition from a traditional project-based approach to a more systemic approach faces many obstacles. These could range from the lack of a broad and coherent policy context to an insufficient understanding of how research and innovation could contribute to sustainability or a slow pace of adopting structural and organisational changes (Koundouri et al., forthcoming). System-level innovation requires all levels of government to work in partnership towards transformative goals.

## 3.2 The multi-level perspective

System innovation needs to be understood not only as a broader, but in fact a *multi-level* and dynamic process (Schot and Geels, 2008). A dynamic multi-level perspective that usefully summarises the complex processes that also characterise industrial transitions is presented in Figure 3. System innovations are typically multi-level phenomena (Geels, 2002). The multi-level perspective considers exogenous "landscape" developments, socio-technical regimes, as well as individual, organisational or territorial niches. In addition to knowledge producing organisations, the multi-level perspective of system innovation, incorporates a broad range of additional actors relevant to societal goals (OECD, 2015).

be relevant for all economic sectors, open innovation, global value chains and innovative networks in both developed and developing countries.

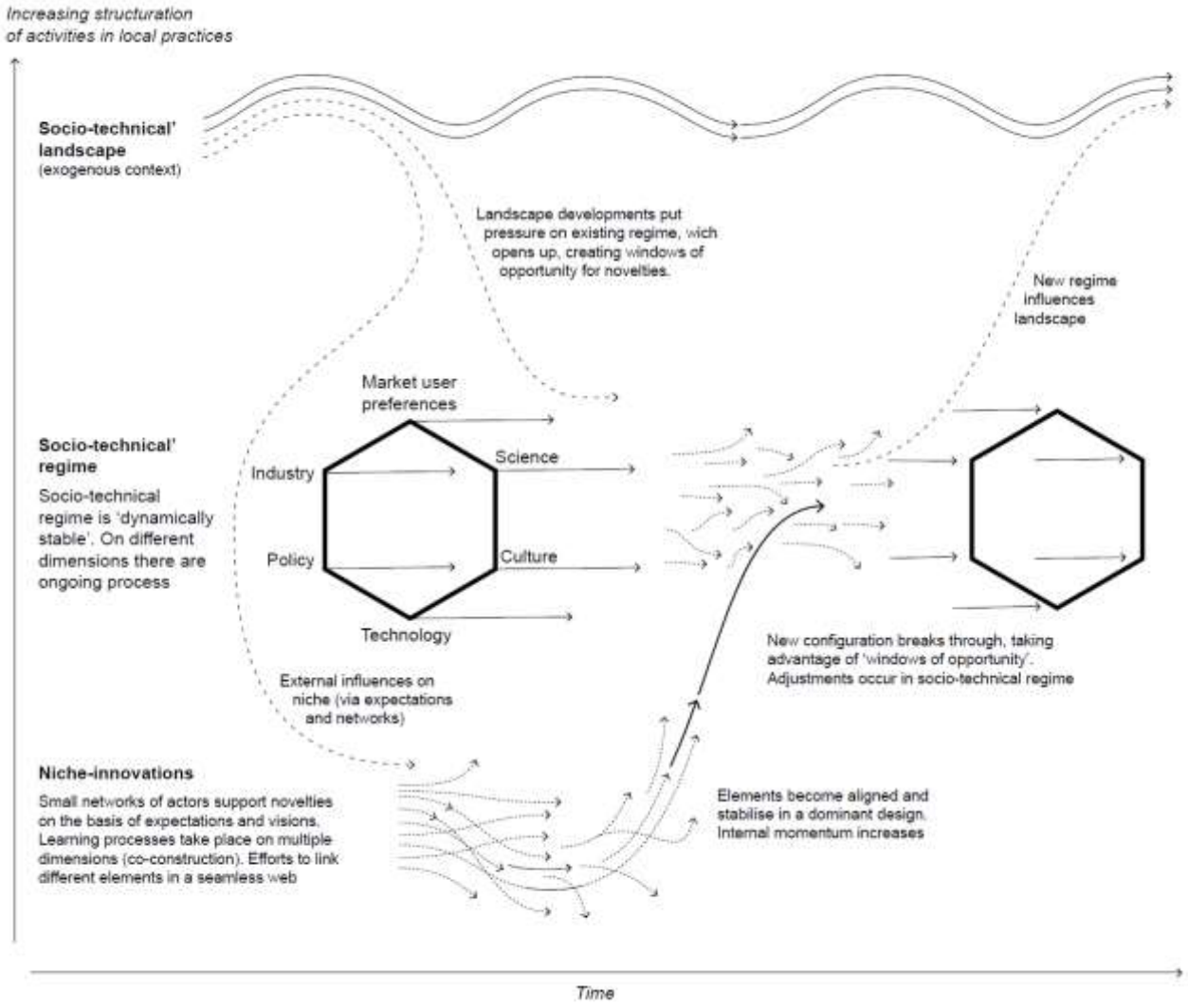



Figure 3. Multi-level perspective on transitions. *Source*: Adapted from Schot and Geels (2008: p. 546)

The framing of system innovation means that the lessons R&I policy makers have built over their long experience with innovation governance are now relevant for a broader set of policy makers than those traditionally tasked with R&I policy (Fagerberg, 2018). Moreover, the stronger societal directionalities in R&I policy – stemming from the recognition that innovation can be both "good" and "bad" for the economy, society, and the environment – means that innovation governance must be enriched from the experience of other policy domains with long traditions of regulating negative externalities[19], so that government can additionally act as a "warner", "mitigator", "gatekeeper" or "watchdog" (Borrás and Edler, 2020, see Box 5).

### Box 5. Roles of the state in system innovation

Observer: the state monitors the course of events, following up the developments and trends in the socio-technical system.

Warner: the state identifies potential risks to users, citizens and institutions; develops and communicates a warning narrative around those risks.

[19] Examples include competition/antitrust policy, environmental policy and regulation and consumer protection.

Mitigator: the state tries actively to reduce the negative effects that arises as a consequence of socio-technical change.

Opportunist: the state takes up the opportunity arising from socio-technical change, becoming itself an active beneficiary of the new social technical system for specific purposes.

Facilitator: the state actively seeks to make a process easier by supporting specific dynamics of other agents' change initiatives.

Lead-user: the state initiates market creation by acting as lead user and co-designer in order to find specific solutions to public needs.

Enabler of societal engagement: the state encourages actively the involvement of stakeholders in participatory processes to define direction of change.

Gatekeeper: the state actively controls access for change agents, opening up or closing down spaces for experimentation and transformation.

Promoter: the state acts as a champion, proponent and exponent of change in the sociotechnical system.

Moderator: the state acts as an arbitrator or negotiator between different social and political positions among agents regarding the direction of transformation of a sociotechnical system.

Initiator: the state identifies early on some opportunities, and pro-actively uses its own knowledge and resources to work in concrete ways for the transformation of the sociotechnical system.

Guarantor: the state actively and directly secures operations against financial and/or security and safety risks.

Watchdog: the state actively ensures that individual agents in a sociotechnical system comply with particular collectively defined norms.

*Source*: Borrás and Edler (2020)

Reflections on the implications of the multi-level perspective to the regional development has examined multi-scalar, place-based and spatial factors and processes that influence transition dynamics (Binz et al., 2020; Tödtling & Trippl, 2018). Considering explicitly the role of territories in a multi-level perspective allows for the mapping and analysis of how local innovation niches connect with national and global networks to obtain knowledge and resources as well as how actors active in local niches engage in international networks and vice versa (see Wieczorek et al., 2015). [20]

## 3.3 Whole-of-government (WoG) approach

There are various definitions of the Whole-of-government (WoG) approach in literature. They generally revolve around the central idea of coordinated efforts among multiple parts and levels of government, as well as other organisations outside the government to address complex and/or urgent challenges. Literature reports document the concept's relevance particularly in times of crises (threats, natural disasters, pandemics) that call for a tight government response to ensure information sharing between different government levels, timely responses and to avoid contradictory outcomes (Colgan et al., 2014; Deloitte, 2019).

[20] The reflections on the role of geographical space in socio-technical system and transitions are based on Miedzinski et al (2021).

The approach is seen as particularly useful when it is necessary to assemble exceptionally large resources and/or exceptionally diverse expertise for complex challenges with interrelated social, economic and political causes, to increase capacity and improve integration and coordination (Christensen and Lægreid, 2007). The broader framing and increased focus on coordination of WoG make it particularly relevant for system-level innovation aiming to tackle time-critical and often complex challenges.

The WoG approach emerged in response to some of the negative effects of modern public sector reforms under the New Public Management (NPM) framework, such as: increased fragmentation, self-centred authorities, lack of cooperation, structural devolution, disaggregation, single-purpose organizations, "pillarization" of the public sector, excessive focus on performance management, all at the expense of horizontal integration.

The WoG concept can cover several governance levels in scope: from policy making to implementation, from horizontal to vertical linkages, several targets (a group, a locality, a policy sector), spanning any or all levels of government and groups outside government. Better horizontal and vertical coordination are acknowledged as effective means to eliminate policy conflicts and make better use of scarce resources, while increasing synergies between different stakeholders in a particular policy area. The approach aims to offer citizens seamless rather than fragmented access to services and to enhance local integration.

Different country approaches to WoG reflect the actions and effects of competing strategies and dynamic forces pulling in different directions, such as the drive to decentralise decision-making in the context of NPM reforms, often coming in conflict with the centre's tendency to strengthen its capacity to coordinate policy development and implementation. In the US the interest for a WoG approach revolved around collaborative public management, management of boundaries and networks in the administration, and the design and implementation of cross-sector collaboration. In Europe, the European Commission has adopted the WoG as part of its holistic approach to sustainability and the SDGs, which comprises several strands (Figure 4).


Figure 4. European Commission's WoG approach to address SDGs. Source: European Commission[21]

[21] https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-holistic-approach-sustainable-development_en?msclkid=6cc14e20a93711ec9f8774d19e24a067

Other examples include Ireland's national framework for action *Healthy Ireland: a framework for improved health and Well-being 2013–2025*[22] which tackles major lifestyle issues that lead to negative health outcomes, the work conducted by the Partners for Review (P4R) network in Germany[23] to create a coordinating structure to incorporate the SDGs into the actions of all areas of government and to bring various government institutions together to develop and implement integrated policies as part of the 2030 Agenda, Finland and Sweden's actions to strengthen their security and re-build civil defence as a part of the total defence system[24], etc.

In implementing a WoG approach, several perspectives can be adopted, both at national and subnational levels, subject to the degree of cohesion and homogeneity within the government, including a structural perspective, a cultural - institutionalist perspective and a 'myth' perspective (Christensen and Lægreid, 2007).

Furthermore, implementing a WoG approach can be a complex exercise that requires a careful balancing act between existing features of the governance system and new features aimed to improve collaboration, coordination and effectiveness cross government department and agencies. Several guiding principles and steps could be followed to that effect, taking into account both benefits and issues requiring caution, as described in detail in the Fiches 24 *"Guiding principles Whole-of-Government approach implementation"* and 25 "Steps towards a Whole-of-Government approach".

Kivimaa and Morgan (forthcoming) identify in the integrated governance literature several types of government experimenting with new governance mechanisms to promote a WoG approach, which are characterized by different types of cross-cutting work at macro, meso, and micro levels:.

- *Macro-level* cross-cutting work refers to joining up policies, strategic planning processes, and financial decisions;
- *Meso-level* work concerns managerial joining up and relationships between services and functions in a region or intermediaries between public organisations at the national level;
- *Micro-level* work refers to collaboration between service providers and users at a local level (Keast, 2011)

These cross-cutting levels exhibit different degrees of horizontal integration along a continuum running from co-operation through to full blown holistic government (Connell et al, 2019), as illustrated in Table 3. A rough rule of thumb identified in the literature suggests that the more wide-ranging and intensive the mode of cross-cutting work, the greater its potential to disrupt existing systems and the more resources it will demand (Kivimaa and Morgan, forthcoming)

[22] https://www.euro.who.int/__data/assets/pdf_file/0018/412821/Ireland-Healthy-Ireland-wog.pdf

[23] http://www.partners-for-review.de/wp-content/uploads/2019/04/Whole-of-Government-P4R-Discussion-paper-2019.pdf?msclkid=6cc2208aa93711ecabe3a22f00785116

[24] https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653632/EXPO_STU(2021)653632_EN.pdf?msclkid=e37cd57aa93d11ec82fb84ccc8ef779d

Table 3. Different Modes of Cross-Cutting Working

| Mode | Co-operation | Coordination | Collaboration | Integration | Holistic government |
|---|---|---|---|---|---|
| Level of challenge to the status quo | Low | → | → | → | High |
| Characteristics | Departments take account of each other's goals and share information.<br><br>Linkages are temporary, informal, resource-light, and usually at a junior level. | Departments contribute to agreed, specific, programme of actions which align their activities in order to achieve shared goals.<br><br>Strongly instrumental and task-oriented. | Departments see themselves as interdependent and work towards system change.<br><br>Requires new terms of engagement based on shared goals, joint dialogue, and trust. | Departments are reconfigured.<br><br>Embeds new systems and policy instruments which are not dependent on key individuals to sustain them. | Government starts with a clear and mutually reinforcing set of objectives framed in terms of outcomes and then works back from there to identify instruments to achieve those outcomes. |

*Source*: Kivimaa and Morgan, forthcoming (based on Keast et al, 2007; Keast, 2011; Rayner and Howlett, 2009).

## 3.4 Transformative government

The WoG concept is closely related to that of *transformative government*, which focuses on solving societal problems by orchestrating socio-technical transformation. It finds legitimacy in representing particular 'weak' interests that are not sufficiently represented by politics, the market, or societal collaboration and has a number of specific features (Braams et al 2021), such as:

- Focus on broad societal objectives for long-term sustainability, such as the SDGs.
- Vision of the civil service as system architects and catalysts who search for systematic, sustainable change, aligning social and environmental challenges during the transition.
- Capacity to handle the urgent need for systemic and sustainable change, holding people responsible for creating and fixing problems and considering socio-ecological resilience as a core value.
- Focus on rethinking and deepening of the relationship between political-administrative relations and democratic dynamics in transitions, rather than using urgency and necessity that may lead to technocracy and authoritarianism.

For a transformative government, the organizational capacity to execute transition tasks, defined as the "*ability to anticipate and influence change, make informed and intelligent policy decisions, attract, absorb, and manage resources, and evaluate current activities to guide future action"* (Morison 2010, p. 65) is of the essence. It generally refers to implementing innovative ideologies and practice, rather than executing routine practice. A transformative government acts on multiple planes and performs tasks that can be synthesised in five broad categories, each with its own sub-tasks: *(i) Give direction; (ii) Create governance; (iii) Support the new; (iv) Destabilize the unsustainable; and (v) Develop internal capabilities and structures*.

For a successful transition and legitimacy of a transformative government, execution of these tasks needs to be aligned with several public administration 'traditions', in the sense of normative

frameworks of evolving public values and narratives that are acceptable to the civil servants and the governance systems in which the tasks are embedded. Stout (2013) identifies three 'traditions': *(i) constitutional*, *(ii) discretionary and (iii) collaborative*, with different perspectives on how to solve problems, on the role of civil servants and government legitimacy.

The rationale for this alignment between government transition tasks and public administration culture resides in the fact that within the government, civil service plays an essential, yet underappreciated role in performing a variety of activities linked to successful transition outcomes. There are possible tensions and/or synergies that may arise between these transition tasks of government and established institutional 'traditions' of public administration need to be addressed. Literature reports identify varying disconnects between some of these traditions and transitions tasks (Figure 5). This disconnect requires close attention, to find effective ways of introducing transition tasks in government.

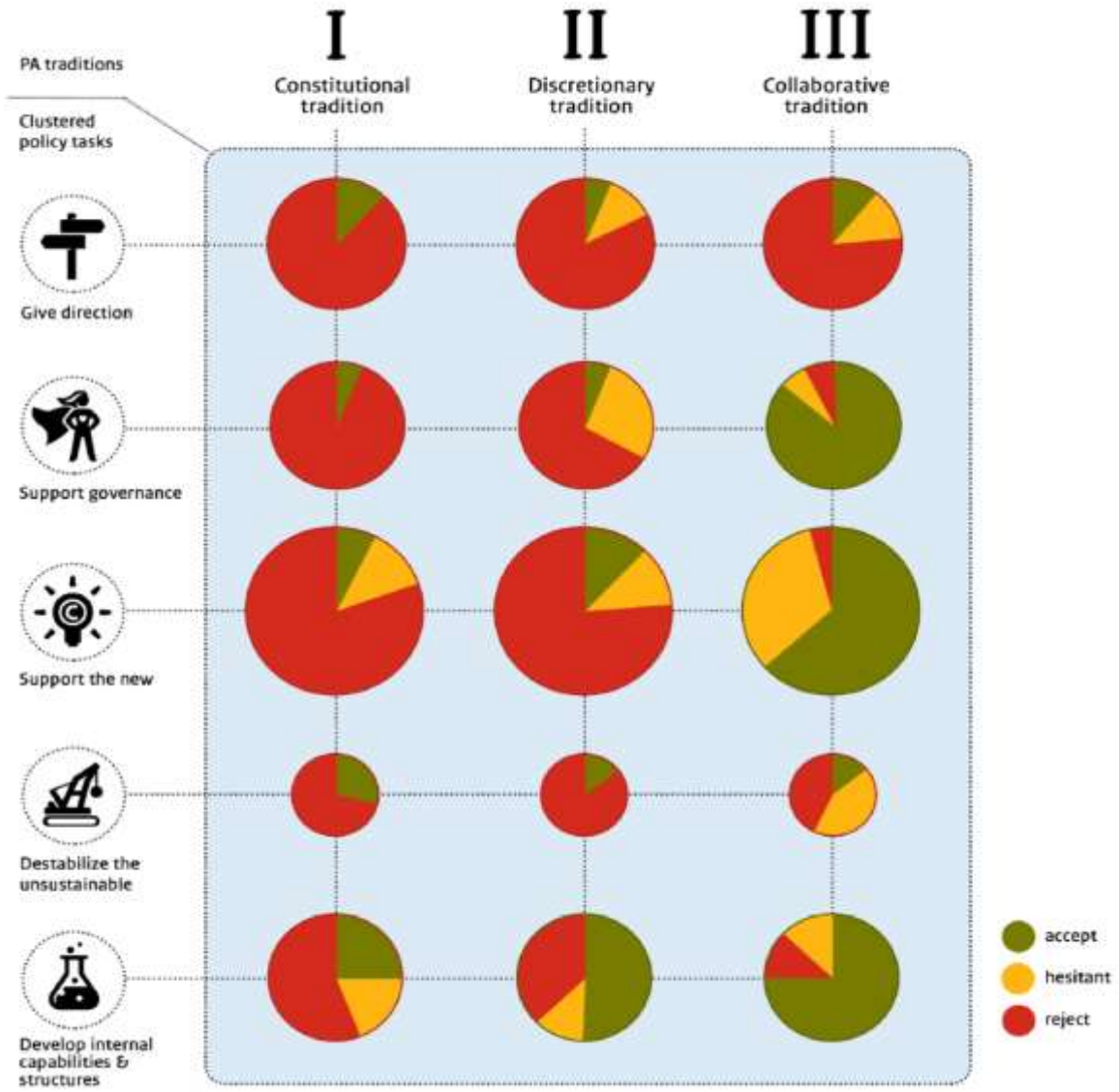



Figure 5. Accepted/rejected ratio of transitions tasks in public administration traditions''. *Source*: Braams et al (2021), p. 200

Assessing the organizational capacity for performing transition tasks is difficult and there few tools for this purpose. Brown (2008) developed a typology of five levels of organisational capacity for executing sustainable transition tasks specifically for local government organisations, ranging from a very basic level of capacity *(Project)* to a very high level of capacity *(Integrated)*. The framework

broadly indicates where a local government organisation is positioned along the continuum of desired sustainable practices. Another tool adapted an assessment grid originally developed for non-profit organisations for the evaluation of organisational attributes, including for local government organisations, based on seven variables of intra-organisational capacity: aspirations, strategy, organisational skills, human resources, systems and infrastructure, organisational structure and culture (McKinsey & Company, 2001). Combining these two tools, propose an 'organisational attributes profile' for assessing organisational characteristics of organisations engaged in transition policy programmes was proposed (Bos and Brown, 2014.) The tool offers insight into organisational capacity and provides an in-depth overview of organisational context in which sustainable transition efforts take place.

## 3.5 Transformative innovation policy (TIP)

Transformative Innovation Policy (TIP) is a broad term encompassing both frameworks of understanding (such as system innovation or the 'third framing') and, importantly, *normative approaches* to instituting transformative change by both public policy makers or other agents of change (including collective initiatives by citizens).

TIP covers a family of policies for bringing about system-level change in direction of societal goals (including prosperity and the environment). Despite their long-term ambitions, in practice TIP approaches can be seen as layered upon, but not fully replacing, earlier policy paradigms of R&I policy (Schot and Steinmueller, 2018) (Figure 6). In fact, TIP maintains within its toolbox a strong legacy of an economic, firm-centred and technology-oriented approaches (Diercks et al. 2019).

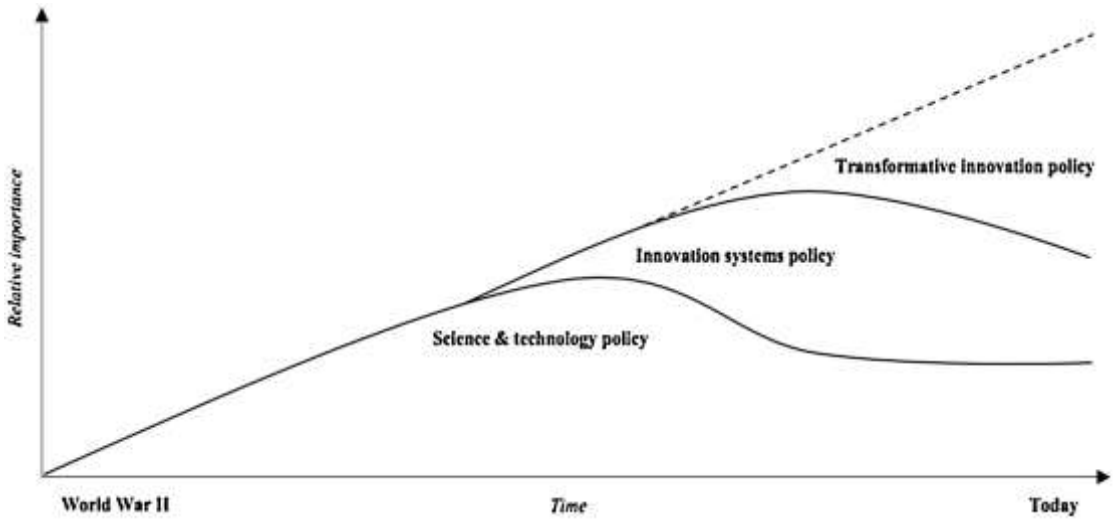



Figure 6. Consecutive policy paradigms layered upon but not fully replacing each other. *Source*: Diercks et al. (2019), p. 881.

Nevertheless, there are significant differences between the predominant economic policy agenda of the 'traditional' innovation policy paradigm and the broader societal focus of TIP (which includes prosperity among other goals), along several dimensions (Table 4). For example, participative social innovation is variously seen as a complement (Geels, 2021) or as an alternative (Diercks et al., 2019) to expert-led policies for technological change. TIP requires the intervention of a much broader and more diverse set of actors, social, institutional and behavioural changes, and a broader use of demand-side policies complementing supply-side activities (Diercks et al., 2019).

Table 4. Differences between an economic and societal policy agenda

| | Economic policy agenda | Societal policy agenda |
|---|---|---|
| Policy objective | Singular focus on economic competitiveness, growth and jobs | Additional objectives such as national prestige, strategic priorities or societal challenges |
| Policy domain | Part of economic and industrial policy | Relevance for and impact on other policy domains |
| Policy logic | Only positive outcomes of innovation | Acknowledging both positive and negative outcomes of innovation |

*Source*: Diercks et al. (2019), p. 882

In recent years, TIP has been the focus of a growing body of literature that draws on the one hand, on studies of socio-technical transitions and on the other, on studies of mission-oriented innovation policy. A certain convergence has been noted over time in the way these two schools of thought have addressed the main features of TIP, evolving to a similar understanding of the key differences between TIP and previous innovation policy generations. Haddad et al (2022) summarise these differences in a set of five main characteristics: (i) focus on grand challenges and inclusive growth, (ii) directionality as a key feature, (iii) multi-faceted policy interventions, (iv) involvement of a broader set of actors and global networks; and (v) Multi-level governance.

When examined across all the stages of a complete policy cycle (e.g.: 1. Agenda-setting; 2. Policy formulation; 3. Legitimation; 4. Implementation; 5. Monitoring and evaluation; and 6. Policy learning), these characteristics led to some interesting observations. First, that TIP is more evident in some stages (e.g. agenda-setting, due to the increased focus on directionality) than in others (e.g. legitimation of various transformative policies), while other stages do not distinguish clearly between policy formulation and policy implementation. Secondly, several gaps have been identified, that cut across the different stages of the policy cycle, such as little analysis of the actual role and contribution of different stakeholders in relation to the transformative challenges, relatively little clarity on what TIP capabilities entail and how they could be built up (flexible and "playful" policy experimentation appeared as a prominent way, although still underexplored) and more focus on TIP policy mixes (Haddad et al. 2022).

## 3.6 Experimentalist policy

Although TIP places a strong emphasis on experimentation to advance understanding of how to manage the necessary transition towards balanced societal development paths, there is still little clarity on actual ways to enable experimentation and the capacity of organisations and individuals to foster experimentation. In transitions literature, experimentation provides temporary spaces for multiple actors (government, business, knowledge producers, users, etc.) to work together on a variety of new pathways, accepting uncertainty and failure as part of the learning process.

They can experiment on new shared expectations and visions, new networks, new markets (niches) that may eventually grow sufficiently as to coagulate into new regimes and challenge dominant practices in mainstream markets and institutions. For that to happen, a strategic niche management process is necessary, that can protect niches and connect to them to various forms of experimentation (Table 5), holding at bay certain selection pressures (shielding), learning, networking and supporting innovation (nurturing) and making niche innovations competitive (empowering) (Smith and Raven, 2012).

Table 5. Processes of strategic niche management and how they connect to experimentation

| SNM process | Connection to experimentation |
|---|---|
| Articulation of expectations and visions | Different actors participate in projects and experiments based on their expectations, contributing to niche development. Expectations provide direction to learning processes and attract the attention of more actors and resources. This process is successful if more actors began sharing the same expectations, and expectations become more specific, e.g. based on tangible results from experiments |
| Building of social networks | In early niche development, social networks are weak. Networks are built, via experimentation and intermediary activities, to create a constituency behind the niche by facilitating interactions and providing resources. The process is successful when networks are broad, orientated towards deep learning and regular interaction is supported. |
| Learning on multiple dimensions | Niche development relies on different types of learning, e.g. technical, market, cultural and policy learning that can be supported via a range of experimentation. This learning needs to go beyond the gathering of facts and data to changes in cognitive frames and assumptions. The process is successful when it connects technological change to societal embedding in local contexts, covers multiple dimensions and is reflexive. |

*Source:* Kivimaa and Rogge (2022)

Recent research extends the ground for experimentation to the innovation policy realm, arguing in favour of *policy experimentation* as a way to improve the design of public policies and associated instruments, mobilise new resources for desirable societal transformation, encourage innovation initiatives leading to transitions, design and evaluate institutional arrangements, and better understand the connection between policy experimentation and institutional change in its co-evolution with technology and actors in transitions (Kivimaa and Rogge, 2022).

Experimental policy engagements (EPEs) have been proposed to facilitate the role of public governance in transitions, by informing decision-making, enabling processes of social learning, developing alternative pathways and enacting desirable futures (Ghosh et al. 2021). Figure 7 summarises approaches to experimentation in the early phases of TIP, while Table 6 provides further details on the mechanisms by which experimentation can influence policy development.


Figure 7. Approaches on experimentation in the early phases of TIP. *Source*: Kivimaa and Morgan (forthcoming)

Table 6. Mechanisms for broader impacts from experimentation

| Mechanism for influence | Description | Sources |
|---|---|---|
| Upscaling / growing | First stage implies increasing the number of participants to an experiment and extending the scope and length of the experiment. Second stage involves increasing the adoption of experiments' outputs (e.g., knowledge and learning, policy-relevant output, technological or service output, new practices). Third stage refers to an emergence of a new governance regime, modelled in a sequence of or parallel experiments, replacing existing regime(s). | (Ghosh et al., 2021; Naber et al., 2017; Turnheim et al., 2018) |
| Replicating | Intentional facilitation of replicating experiments (their main concept or some of its part, e.g., policy output, actor-configuration) in other contexts (sectors or locations), e.g., via a funding or capability building programmes or intermediary actors. This requires recontextualization of the experiment by anchoring to local context. Potential for transformation by chains of similar experiments with cumulative influence. | (Ghosh et al., 2021; Naber et al., 2017; Turnheim et al., 2018) |
| Circulation | Experiments are linked to other ideas and initiatives by identifying and promoting the circulation of ideas, people, blueprints, and technologies, e.g., with the means of intermediary actors, organising training, mutual visits. Circulation is a more informal activity that will support the more structured mechanisms of upscaling and replicating. It is about the free but somewhat coordinated flow, reuse and modification of information, knowledge, and learning, and most strongly connected to the ideas of the experimentalist governance approach. In this fluid way, new actors-networks may emerge at the cross-section of different experiments as an outcome of the flow of ideas and resources. | (Ghosh et al., 2021; Naber et al., 2017; Turnheim et al., 2018) |
| Institutionalisation | Mainstreaming the rules and practices created in the experiment, making a temporary experimental policy more permanent (stopping its experimental status). For EPEs that are not direct policy experiments, the policy-relevant output can become embedded in formal and informal governance structures. For all types of experiments, the practices initiated, new actor-network-configurations or technological or service configurations can become widely accepted and embedded. More broadly, experiments may shape wider institutional context, contributing to the transformation by initiating processes of deinstitutionalisation of dominant, unsustainable configurations. | (Fuenfschilling et al., 2019; Ghosh et al., 2021; Kivimaa and Rogge, 2022; Naber et al., 2017; Turnheim et al., 2018) |

*Source:* Kivimaaa and Morgan (2022)

In the PRI context, experimental governance will need to address the challenge of vertical and horizontal policy coherence in the multilevel governance framework, empowering actors at the lower policy levels to become co-producers of their PRI priorities and recognising their inter-dependence with the higher policy levels and the strategic directionality they can provide.

## 3.7 Intermediaries for sustainability transitions

Kivimaa et al (2019) define transition intermediaries as *people or organizations that can accelerate the change towards more sustainable socio-technical systems, through shifts in relations between actor groups, between infrastructures, and between technologies and application contexts*. They can link actors (both new entrants and incumbents), activities, skills and resources connected to these actors, can create momentum for change, new collaborations around niche technologies, ideas and markets, and can disrupt prevailing socio-technical configurations.

They can emerge specifically to intermediate a transition process (e.g. to coordinate local actions with the sustainable strategy of a city region for urban renovation or to promote low-carbon transition by municipalities), or can be established actors (organisations, individuals) who take intermediary roles, although they were not initially set up to intermediate (e. g. to advance energy-efficient buildings, renewable energy technology, etc.). Other intermediaries emerge in response to large-scale institutional change, to failures in markets and innovation systems to address sustainability concerns or new technologies related to transitions, to market restructuring, to new modes of regulation, to fill institutional gaps.

Transition intermediaries operate between experimental and innovative local projects and the global level, between consumers and producers, or by policy advocacy, mobilising political programmes to support a particular niche. They can aggregate learning from individual projects and translate best practice, resources, standards and global visions to influence the formation of new projects and the selection environment. They can link niche actors with dominant socio-technical structures, can aid in negotiating change by assisting in the building of alliances, and bring in supporters from the dominant regime. Intermediaries can also act as brokers between multiple priorities, interests and knowledge pools for creating a shared vision and activities for the transitions.

Kivimaa et al (2019) provide a typology of *five types of transition intermediaries* based on the multi-level perspective (MLP) of transitions, which has been the most explicit treatment of intermediaries. The typology is based on a literature review on the emergence of intermediaries, context of intermediation, goals of intermediation, normative position, and development over time:

1. *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.
2. *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 with a range of niches or the whole system.
3. *Niche intermediary*: typically working to experiment and advance
4. *Process intermediary*: facilitates a change process or a niche project rather than broader niche (or technology innovation system) 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.
5. *User intermediary*: translates new niche technologies to users, and user preferences to developers and regime actors, qualifying the value of technology offers available.

The five types are not mutually exclusive. The first three types have a relatively strong change agency (and mandate) to pursue sustainability transitions from either the whole system or niche perspective. The fourth type has weak agency, functioning as a facilitator, while the fifth type can have strong or weak agency. These kinds of intermediaries could be essential to consider in the development of the PRI concept. Relevant questions to reflect on include what kind of intermediary actors and platforms

will be needed to support the partnerships and what activities will such intermediaries need to conduct.3.8 Challenge-driven (or mission-oriented) innovation policies

Challenge-oriented (or mission-oriented) innovation policy starts with well-defined societal goals and designs its research and innovation as well as regulatory measures around such goals to address them in a timely manner. Such policies consider the whole innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, ranging across various policy fields, sectors and actors (OECD, 2021). In many case such a transversal approach is needed to achieve the SDGs (Diercks et al., 2019). Figure 8 (next page) shows an example of such approach. In contrast to traditional innovation policy, it aims at building policy coordination and joint ownership with stakeholders, and guiding directionality to tilt actors in the market towards societal grand challenges (Mazzucato et al., 2020).

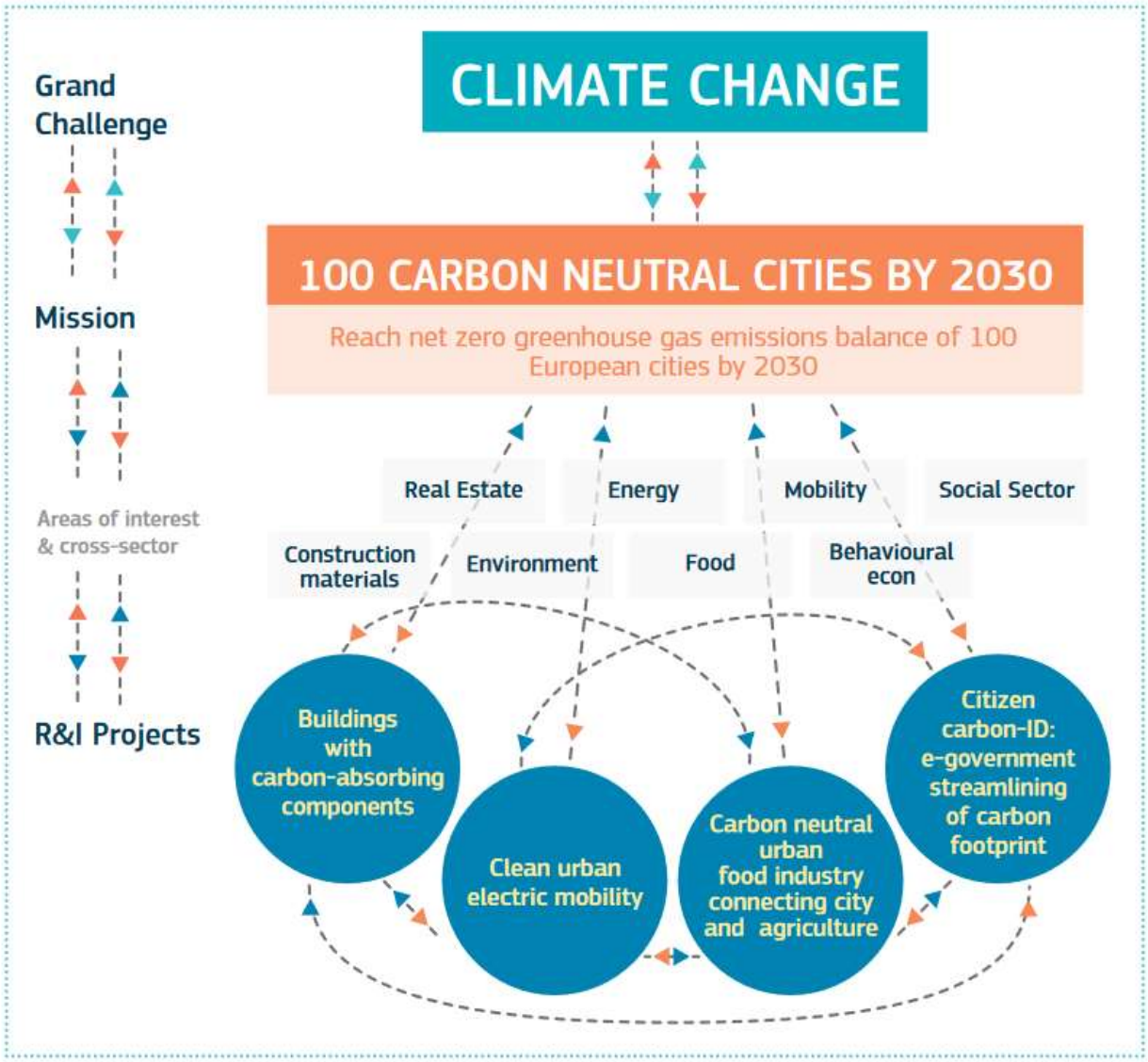



Figure 8. Challenge-driven innovation. *Source*: Mazzucato (2018), p.22

Mazzucato et al. (2020) propose the ROAR (Routes, Organisations, Assessment and evaluation, Risks and rewards) framework to advance such transformative policies, envisioning the role of the state as 'market co-creating' and 'market-shaping'. It promotes strategic thinking about the desired direction or *Routes*, the structure and capacity of public sector *Organisations*, the way in which policy is *Assessed*, and the incentive structure for both private and public sectors, or *Risks and Rewards* – see details in Fiche 7 "*Challenge-oriented innovation*" of the Playbook.

The OECD (2021) has recently analysed 'mission-oriented innovation policies' (MOIPs), across a large number of countries and governance levels. MOIPS are seen as a new type of systemic intervention that are gaining popularity in response to pressing societal challenges. MOIPs aim to tackle some persistent weaknesses within many R&I governance systems, notably the lack of holistic strategic orientation and policy co-ordination, and fragmented policy mixes. In common with PRI, their design principles take into account the new tasks of government relevant to transitions, emphasise pluralism in shaping the goals, autonomy about their achievement, and a policy mix that is allowed to vary according to the goal.

Table 7. Mission-oriented innovation policies design principles

| MOIP dimension | Main task to be achieved | Definition of the MOIP feature |
|---|---|---|
| Strategic orientation | Informing and selecting specific societal challenge(s) and strengthening legitimacy of focused policy intervention towards clear and precise objectives | *Legitimacy*<br>• A consensus is found among a wide group of stakeholder (including citizen) regarding the need and relevance of the mission |
| | | *Directionality*<br>• The policy is guided by clear and well-informed orientations and strategic guidance formalised in a mission |
| | | *Intentionality*<br>• Specific and well-articulated need-based goals, with clear timeline and milestones, are derived from the mission |
| | | *Flexibility*<br>• The targets and means of intervention to meet them can be revised at different stages of the process when needed |
| Policy co-ordination | Coordinating the strategies and activities of the different institutions involved in the policy | *Horizontality*<br>• The plans and activities of policy bodies covering different policy fields are coordinated to achieve the mission |
| | | *Verticality*<br>• The plans and activities of policy bodies at different levels of government are coordinated to achieve the mission |
| | | *Intensity*<br>• The decisions regarding the intervention (objectives, modalities, level of resources) are taken collectively by the involved policy bodies and are binding to them |
| | | *Novelty*<br>• The plans and activities of different policy bodies and stakeholders are co-ordinated (*e.g.* via a portfolio approach) so as to cover and experiment various alternative solutions to achieve the mission |
| Policy implementation | Ensuring he consistency and effectiveness of the modes of intervention and resources of the public and private partners mobilised to achieve the policy objectives | *Policy mix* consistency<br>• The policy encompasses a diverse and consistent set of policy interventions (technical, financial, regulatory, etc.) to support different disciplines, sectors, areas and markets, across the innovation cycle, as needed to achieve the mission |
| | | *Fundability*<br>• Public and private stakeholders involved in the different facets of the initiatives (phases of the innovation process, sectors, markets, etc.) are mobilised to commit resources for the achievement of the mission |
| | | *Evaluability*<br>• The policy is endowed at the outset with input and output indicators as well as evaluation procedures adapted to its systemic nature, in order to assess its results and learn from its implementation in view of continuous improvement |
| | | *Reflexivity*<br>• Evaluation and monitoring results are used to inform decision-making and reform the initiative (revision of objectives, adaptation of governance and operating procedures, etc.), as needed to achieve the mission |

*Source:* OECD (2021, p. 17)

In view of the potential of challenge-oriented approaches to operationalise the concepts of system-level and transformative innovation, recent contributions have reflected on how the challenge-oriented approach to innovation applies to regional innovation systems. This literature emphasises the role of spatial scale of governance in facilitating public, community and citizen consultation and engagement, as well as in helping clarify stakeholder roles and responsibilities (McCann, forthcoming). In recognition of this role, the concept of 'challenge-oriented regional innovation system' (CoRIS) (Trippl, 2022) has been proposed, building on and extending upon the concept of regional innovation system (RIS). CoRIS aims to critically rethink the purpose of RIS and place-based policies in light of grand societal challenges (Tödtling et al. 2021). This reflection has produced conclusions that deviate from the conventional RIS approach, as described in Table 8.

Table 8. Conventional RISs and challenge-oriented RISs: key differences

| | Conventional RIS | Challenge-oriented RIS |
|---|---|---|
| Purpose of innovation | Economic growth and competitiveness of the regional economy | Place-based problems and needs related to grand societal challenges |
| Types of innovation and their effects | Innovation in the regional corporate sector: technological, organizational, marketing innovation<br><br>Focus on positive effects (strong pro-innovation bias) | Innovation in the regional corporate sector and in other realms (public sector, civil society, regional and urban communities: technological, user, social, institutional innovations)<br><br>Focus on multi-dimensional effects of innovation (bright and dark sides) |
| Actors, networks, institutions | Firms, universities, government, intermediaries knit together in stable (local and non-local) networks and embedded in a static multi- scalar institutional landscape | Conventional RIS actors and 'new' innovation agents (civil society, public sector actors, users, etc.) knit together in/influenced by dynamically developing networks and evolving institutional configurations at multiple scales |
| Production and application side | Supply side (generation/production of innovation in the region) | Supply side and demand/application side (experimentation, diffusion, upscaling of innovation in the region) |

*Source:* Trippl (2022) based on Tödtling et al. 2021, p. 6

In a nutshell, the CoRIS approach adopts a more critical view of innovation, considers societal directionalities of change, opens up to new innovation actors at different territorial scales, and places more attention to the demand or application side (Tödtling et al. 2021). As such the CoRIS approach exhibits considerable overlap with the directions espoused by PRI and can offer useful guidance for its long term development. Trippl (2022) helpfully envisages two, not necessarily mutually exclusive, routes for policy development in keeping with CoRIS:

(i) Reorientation route: Mobilisation and reorientation of existing RIS structures to develop innovative solutions to place-based problems and needs. The essence of this route is the repurposing of existing assets. Therefore, the capacity of territorial stakeholders to revalorise existing assets is central. A degree of continuity may also serve to curb potential resistance

from incumbents and may be an appropriate response if there is limited legitimacy from the population for the transition (Trippl, 2022).

(ii) Transformation route:[25] This route involves the construction of new challenge-oriented structures and is more about disruption and the addition of new elements. Following this route entails a greater inclusion of new or neglected stakeholders, the creation of new networks and the dissolution of old ones, as well as reform and institutional change. Building up a CoRIS involves also phasing out unsustainable practices. This can be difficult as it requires protection from vested interests and reorienting existing incentive structures (Kivimaa and Kern 2016).

Which route might be taken depends on many factors. The territory's challenges and the configuration of pre-existing RIS structures would likely condition the trajectory. Advanced regions with the least to gain from transformation, may be inclined to take reorientation route, whereas regions that are lagging behind would simultaneously have a lot to gain from transformation but would struggle to develop capacities for it. Indeed, recent work suggests that readiness to tackle societal challenges differs considerably across regions (Cappellano et al. 2021). Regions that are less economically developed often face considerable sustainability and inclusiveness challenges, as they tend to be among the most vulnerable to climate change-mitigation strategies (McCann and Soete, 2020). They require very tailored approaches to their unique challenges. For example, in rural areas most knowledge-intensive business opportunities are linked to activities and actors that tend to differ from the prevailing business models, experience, supply chains or development trajectories (Rubizmo 2018), which implies that the kinds of opportunities for sustainable development differ considerably across territories (McCann, forthcoming).

## 3.8 Responsible research and innovation

Responsible research and innovation (RRI) is a recent approach aiming to guide the development of science policy, but also with obvious repercussions for innovation policy that aims to avoid contradictions and promote long-term societal well-being. It aims to align research and innovation with the expectations, values and needs of society, and brings together societal actors during the whole research and innovation process. The goal is to create a research and innovation ecosystem that strives for sustainable, ethical and socially desirable scientific outcomes. Responsibility is shared among actors who are all involved in the process and thus there is a wide range of stakeholders in the creation process. A general framework would provide a set of core principles and a roadmap which would guide regions in the ambition to develop a sustainable research and innovation ecosystem.

To fully exploit the research and innovation funding potential, the EU has embedded the RRI in the H2020 programme in order to maximise RRIs efforts and bridge the gap between science and society. In practice, RRI is implemented through six policy building blocks, namely, Public engagement, Open access, Gender equality, Ethics, Science education, and Governance. Figure 9 provides some elements of how to make RRI work in practice.

[25] Importantly, the distinction between reorientation and transformation is an ideal-type, analytical one. In real-world (policy) contexts, CoRIS development may well reflect characteristics of both routes.

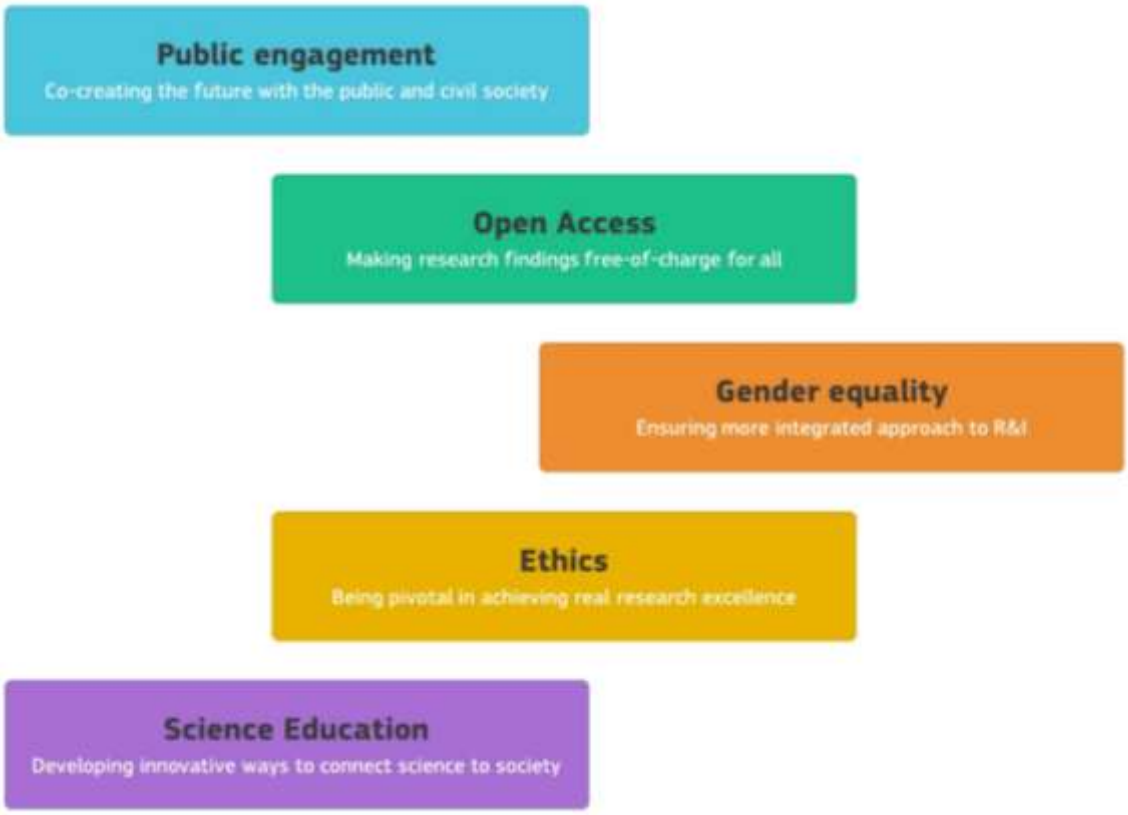



Figure 9. How to make Responsible Research and Innovation work in practice.

## 3.9. Multiple-value creation[26]

Multiple value creation is oriented towards the creation of multiple types of value through the creation of new value networks (e.g. between businesses and NGOs), and through the use of design thinking and settlement methods for dealing with interdependent costs, benefits and risks. It invariably requires societal innovation (Diepenmaat et al., 2020) and boundary work in terms of exploring, negotiating, disrupting and realigning organisational boundaries (Velter et al., 2020). Examples of multiple value creation are:

- nature-inclusive agriculture (in which farmers are involved in nature regeneration, and the production of healthy, environmentally sound food);
- the involvement of social enterprises in the collection of consumer goods and the repair of those goods for new types of use (avoiding waste, new resources and creating employment opportunities for people with work impairments and a history of unemployment;
- the use of wood as a timber frame as an alternative to cement.

Multiple value creation tends to be neglected by economic theory, innovation research and largely neglected by business because of a narrow sectoral focus, leading them to disregard benefits to be had from serving functional needs outside their sector. In recognition of the importance of multiple-value creation, a new generation of indicator frameworks (Fiche 23 "*Measuring and monitoring resilience*"), funding taxonomies (e.g. ESG, EU taxonomy for sustainable activities, Fiche 60), and evaluation techniques, such multi-criteria analysis, are now gaining in popularity (see Fiche 29 "*Working backwards to create multiple value: the case of NutriAlth3D*"). Creating multiple values

[26] This section has benefitted from earlier inputs by Prof. Rene Kemp.

should ultimately result in improved long-term societal wellbeing, but it is important that these are in tune with the value frameworks of local societies.

Drawing on citizens' perceptions and priorities Maye et al. (2022) argue that there is a strong EU-wide public desire to create a new approach to the regional economy and rural development that reflects what citizens truly value, which they call 'rural-urban economies of well-being' (McCann, forthcoming) (Box 6). Perceptions of wellbeing by citizens across different territories vary considerably, depending among others, on the economic development trajectory of the locality. As a consequence opportunities and mechanisms for creating multiple value will differ place-by-place.

Box 6. The concept of 'rural-urban economies of well-being'

Maye et al. (2022) identify five dimensions of well-being: (i) services, (ii) proximity, (iii) circularity, (iv) ecosystems, and (v) culture that underpin and strengthen rural-urban relations and foster a more integrated approach to economic development (Figure X).

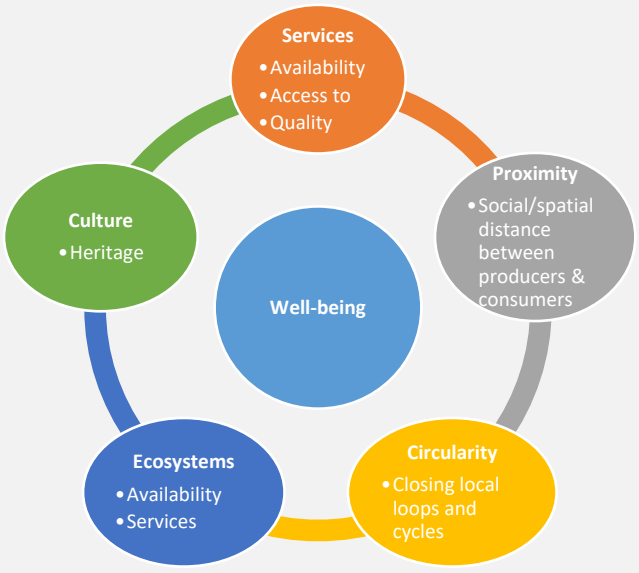
The *services dimension* is represented by their availability, access to and quality, primarily linked to the public infrastructures, social services, but also to business models and food systems.

The *proximity dimension* relates to reducing the social or spatial distance between the producers and consumers of goods and services, and this links directly into the *circularity dimension*, which focuses on the closing of local loops and cycles and enhancing the local circular economy.

The *ecosystems dimension* relates to their availability and services, which describe the extent to which natural capital features of biodiversity, soil, water, landscape, and climate change mitigation play in enhancing these natural capital aspects.

Finally, the *culture dimension* focuses on the role of culture and heritage in strengthening rural-urban relations. While these five different dimensions are all considered to be important, it is the dimension of services which is considered by citizens to be the most basic and essential foundation for enhancing local wellbeing (Maye et al. 2022).

The five dimensions of rural-urban economies of well-being




*Source*: based on Maye et al. (2022)

*Source:* McCann (forthcoming)

## 3.10. Social-ecological resilience [27]

Social-ecological resilience is generally understood as the capacity of a system to withstand change while maintaining essentially the same identity (Biggs et al., 2012), a definition with roots in the physical sciences (applying e.g. to the properties of materials). The understanding of resilience from a socio-ecological perspective has evolved and is increasingly seen as the capacity to absorb shocks while pursuing new development pathways. According to Bevilacqua et al. (2020) in a situation of structural change, resilience can be seen as a trade-off between adaptation (changes within pre-existing systems and pathways) and adaptability (the ability to develop new pathways). Literature on social-ecological resilience has identified seven principles for building the resilience of systems which are relevant to local and regional actions and policies: maintain diversity and redundancy; manage connectivity; manage slow variables and feedbacks; foster complex adaptive systems thinking; encourage learning; broaden participation; and promote polycentric governance systems (Biggs et al., 2012).

Perspectives combining resilience, transformations and sustainability are highly relevant to the PRI concept. The dynamic understanding of resilience as the capacity to maintain the course of a specific regional transformation pathway rather than return to a previous state can be a useful quality to aspire to. It could help identify the capacities needed to dynamically adapt the region so that it is more likely to transform. Social-ecological resilience research emphasises the importance of considering and experimenting with a sufficient variety of innovations in view of the need to consider the risks and uncertainties, for example, investing in several niches developing alternative solutions to the same challenge. This ensures diversity and redundancy and implies the acceptance of what may appear like inefficient "duplication" to a policy maker focused on short-term economic gains (Chorafakis and Pontikakis, 2010). However, from the point of view of a policy maker concerned with resilience, it can be seen as an investment in emerging future opportunities and systemic risk reduction. Research on resilience emphasises the importance of combining local and external sources of knowledge and social learning. For the ODP focused on the local resilience challenges, it could mean opening the process to make it more inclusive, especially those who have limited power in the current system.

[27] This section is based on the literature review conducted by Miedzinski et al (2021) and inputs by Michal Miedzinski.

# 4 Key considerations for the long-term development of PRI

This section outlines some key considerations for policy development in order to get closer to the long-term goalposts of PRI, namely to:

- Deliver effective solutions to pressing societal challenges within defined timeframes;
- Use resources in ways that generate co-benefits for the economy, society and environment;
- Draw linkages across multiple stakeholders and policy domains, exploit synergies and address tensions;
- Revise and reform policy and regulatory instruments to improve coordination and amplify impact.

The section draws on actionable insights of studies of transformative innovation policy, sustainability transitions and new industrial policies as well as JRC research and deliberations with practitioners about their application. The considerations apply as much to the continuous development of existing policies and instruments, as to the initiating of new ones under PRI.

## 4.1 Consider the needs of the territory through the lens of transition

It can be helpful to perceive the planning period as one of transition, in view of the deep and inevitable change affecting large parts of our production and consumption systems. In this context, policy planning needs will include the provision of support to established actors to plan for the new realities as well as support to emerging actors who could develop new advantages for the territory (Hill, 2022). A key need will be to offer bridges for workers and vulnerable social groups so that the territory makes full use of its human potential and that nobody is left behind (Fiche 6, "*Sustainable development as a transition*"). Taking a transition view of policy making also implies beginning to think about how to transition our monitoring and evaluation frameworks, our policy instruments, our institutions and the ways we engage with stakeholders so that they are fit for the challenge of sustainability and long-term societal wellbeing.

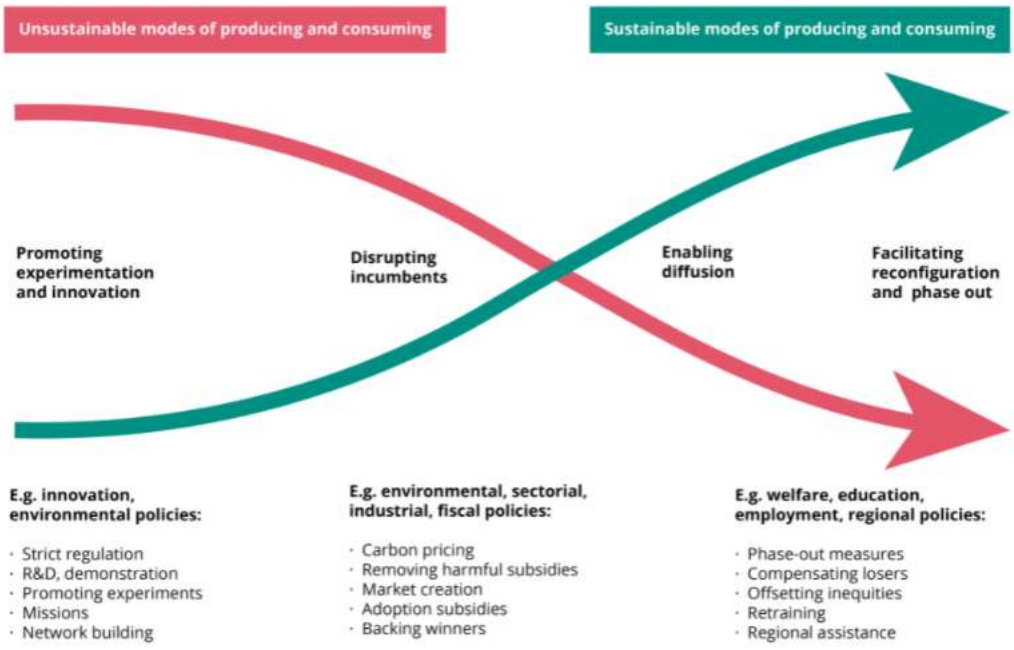



Figure 10. Unsustainable and sustainable modes of producing and consuming compared. *Source*: Adapted from European Environment Agency (2019b) and Loorbach (2014)

It is important to recognise that transitions are complex, messy and will proceed unevenly. As the transition advances, complexity will invariably produce unforeseen outcomes. Making our economies and societies more sustainable may well result in trade-offs for the economy and society, especially in the absence of preparation. Some of these may be pre-empted by favouring paths that have a fair chance to result in co-benefits but transitions will always be messy and uncertain (Smith et al., 2005).

To avoid contradictions, truly sustainable development directions would shun the singular goal of economic competitiveness (which smuggles within it the goal of excess private profits) and adopt long-term societal well-being as the ultimate goal of policy (Ashford and Renda, 2016). It is especially important to recognise early on the role of social policies in alleviating some of the costs of the transition, which historical experience suggests cannot be mitigated with skills policies alone (Caldecott et al., 2017). Early attention to the social dimension of the transition should be part of innovation planning, as it can curb resistance to change that often stands in the way of grasping the new opportunities. These realities call for anticipation, collaboration, vigilance and reflexivity in view of emerging needs.

It is also important to accept that progress will be uneven. Transitions can appear to be slow, stalled, or moving in the wrong direction yet can advance quickly without much warning as critical bottlenecks are overcome and positive feedback accelerates the diffusion of key technologies. Policy makers should keep sight of the long term goals over policy horizons that go well beyond funding cycles. They should ensure that overall goals are shielded from short term turbulence, whilst remaining open to pivoting the pathways towards these goals.

## 4.2 Adopt a broader framing of innovation, which varies according to the goal

The new direction towards sustainability and long-term societal wellbeing requires, more than ever, that we adopt a broader definition of innovation. Although there is widespread recognition that innovation is about much more than science and technology, in most places this recognition has not yet resulted in the broadening of governance systems for (system-level) innovation or in balanced packages of policy support. The still predominant goal of innovation policy, to deliver economic growth and competitiveness, has focused policy attention in narrow tasks such as support to knowledge-intensive companies to perform R&D and on the provision of public infrastructures (e.g. universities, skills, collaboration structures).

While these tasks continue to be very important, re-orienting innovation policy towards societal goals, requires broadening up our view of the system that needs to change in each territory. Innovation scholarship (Schot and Steinmueller, 2018; Mazzucato et al. 2020; Borrás and Edler, 2020; Gosh et al., 2018; Borrás and Schwaag-Serger, 2022) and leading policy practice (Azoulay et al., 2018; European Environment Agency, 2019a; European Commission, 2020b; Hill, 2022; Fernandez and Romagosa, 2020; OECD, 2015; OECD, 2021) nowadays emphasise a broader framing of innovation that places producers (not just of knowledge, but of also goods and services of all kinds) and consumers (or users) at the centre of innovation policy In addition to supporting companies and knowledge producing organisations, this new framing of innovation draws our attention to the need for *systemic change*. The objective of policy in this context is to re-configure the system so it meets the new societal purposes.

Framing the system is important because it reveals *structure* - taking a broader framing can help recognise new (or newly relevant) interconnections. Interconnections can be powerful points of policy leverage: in interconnected nodes, by influencing one node of the system, you can influence other nodes too[28] (Meadows, 2003). Framing also reveals *perspective*, and perspective can allow projections.

[28] For example, in the green transition, EVs are complementary investments to renewables which are complementary to energy storage, which are complementary to smart grids etc. In another example in the digital

Changing perspectives can alter the goal of a system. The framing of the system is therefore itself a powerful lever of transformation, if recognised and shaped appropriately early on.

A broader framing does not encompass *everything*: it is sufficient to consider what is inside the system that needs to change only according to the societal goal (e.g. sustainability, competitiveness, or social cohesion) (Schot and Steinmueller, 2018). Goals that are in keeping with the territory's cultural values and material conditions have a better chance of opening up transformation pathways that gather widespread support (Boon and Edler, 2018). Public policy can have *control* over some nodes of the system and exert *influence* over others. Influence can grow over time if the right partnerships are forged. Keeping in mind the broader frame of the system that needs to change, allows one to think strategically about the right stakeholders to influence and to seek the right partnerships. In complex systems leverage comes from operating within the controllable and influenceable boundaries of public policy. One cannot do much about the much larger part of the system than can neither be controlled nor influenced: there policy leverage comes from filtering only the necessary information, and using it to plan strategically (Meadows, 2003; OECD, 2015; Impower, 2019; Hill, 2022).

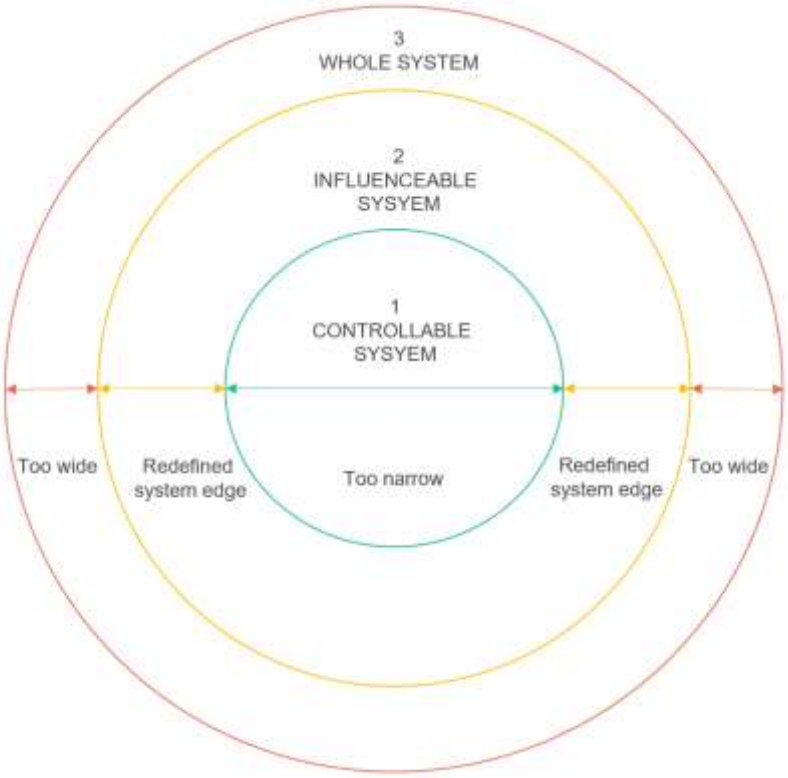



Figure 11. The distinction between control and influence. *Source*: Impower (2022: https://www.impower.co.uk/edgework )

## 4.3 Unlearn loaded framings

Adopting broader and variable framings of innovation according to the goal sometimes requires *unlearning* loaded framings of innovation currently in widespread use. Framings can be 'loaded' in the

transition, ICT investments are complementary to advanced manufacturing which is complementary to investments in sensors and data, which are complementary to digital marketing, which is complementary to soft skills etc. These connections will not be appreciated if one applies a framing that only examines knowledge producers.

sense that they can carry within them the seed of a particular goal, while diverting our attention away from other worthwhile goals. Research and innovation policy makers have learnt to be alert of loaded framings, in the past by avoiding the 'linear' mental model of innovation, recognising that innovation is much more complex and systemic than what can be measured by traditional statistics on innovation inputs (e.g. R&D funding) and outputs (e.g. patents, product/process innovations etc.). However, framings hold such a powerful sway over the way we see the world that we don't often realise they are framings at all (Meadows, 2003). Vigilance is warranted again, as our framings for fostering collaboration - such as the quadruple helix - may now not suit all goals. A quadruple helix framing remains useful of course if the goal is to get universities and business to collaborate to produce globally competitive innovation. Yet it can be problematic for other societal goals, as it assigns unconditional pre-eminence to universities, businesses and government and assigns all other stakeholders to a residual civil society category. In reality we do not know what actors are important for a goal unless we examine a particular system. For example, users of technology, financiers, regulators, professional associations, trade unions, educators, consumers or workers may also deserve equal or greater attention. Appreciating meaningful connections in a system requires more finely defined groups of actors which will differ in each case.

Another example of a framing we need to be alert about is Technology Readiness Levels (TRLs), as it can condition us to think about only new *technology* solutions. 'Projects' is yet another framing: offering public support only in the form R&I projects can condition the types of collaboration that seem possible e.g. by excluding actors who do not engage in systematic innovation activities or who do not meet the eligibility criteria of a particular fund. The correct framing will vary from system to system and has to be discovered through examination.

## 4.4 Work backwards from goals with broad coalitions of stakeholders

It is common for stakeholders of a persistent or 'wicked' problem to have conflicting understandings of the issues and views to its possible solution (Impower, 2019; Hill, 2022). This is why it is so important to create spaces for open deliberation that can allow stakeholders to come closer to shared understandings of the root causes of territorial problems (see Box 7 – The Theory of Change Method). Experience with participatory governance methods, such as the Entrepreneurial Discovery Process in the context of Smart Specialisation, places many EU regions in a good position to begin such discussions.

### Box 7. The 'Theory of Change' Method

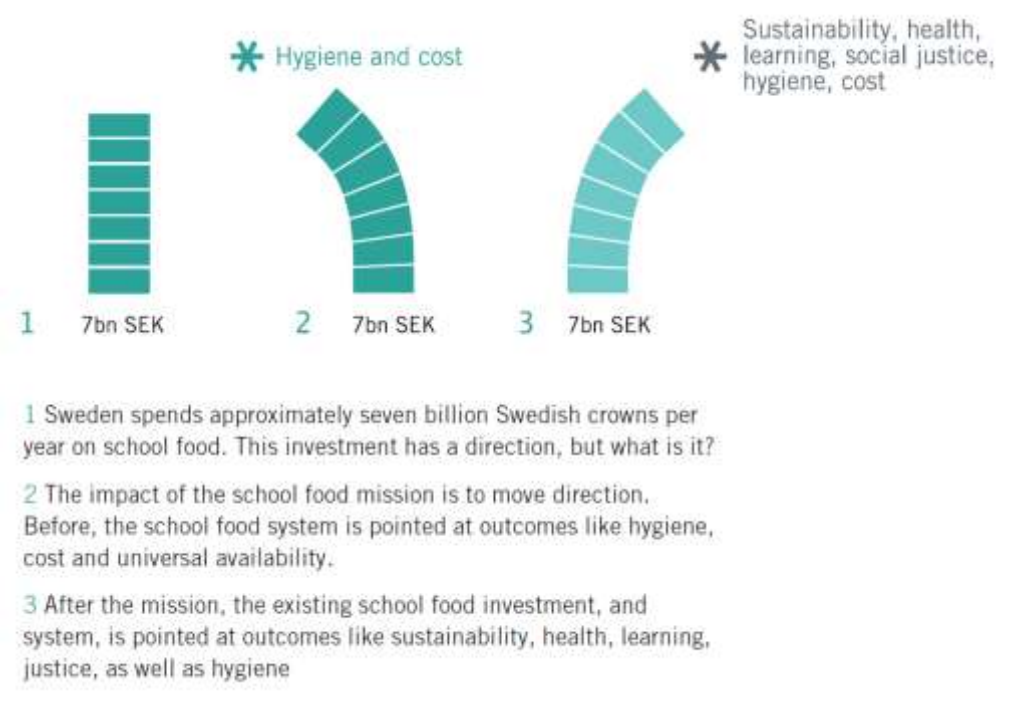
A Theory of Change (ToC) is a method commonly used to understand the strategy and approach of an intervention, be it a project, programme or any other type. As the name indicates, it is a "theory", based on certain assumptions about how the world works which can be theoretically-based or based on particular experiences or worldviews. This is equivalent to the idea of a "framework" or "model" which is used as a basis for the ToC. The "theory" of a ToC describes how and why change happens in a specific context and as a result of certain actions. A Theory of Change can be generic (about a general issue, e.g. how innovations are adopted) or specific (e.g. how a new transport solution can be adopted in a given local and temporal context). Co-developing a ToC that they can agree with can be a first step in the development of a mission among groups of stakeholders united by a common goal. An agreed ToC can then facilitate working backwards from common goals in pathways that are autonomous yet coherent.

*Source:* Palavicino et al. (2022)

Working closely with stakeholders to agree on strategic goals can be hard work. It can comprise of extensive collaborative processes, open-ended discussions, several iterations of systems maps,

drawings of relationships, re-framings of a problem and alternative scenarios. But as argued by Hill (2022), it is worthwhile to spend this time up-front, so that it can be saved later, by producing more considered contexts and more legitimate goals which can have the qualities of being resilient, cost-effective, engaged, organised, meaningful and valuable - see Box 8.

Box 8. Pointing school food towards new goals




Sweden spends approximately seven billion SEK per year on school food. Although rarely stated explicitly, this resource is 'pointed at' outcomes like hygiene and cost. Elsewhere, free school food might be described as a cost in the system; yet what if it was considered an investment in a system? With some work, perhaps this existing investment could be 'pointed at' new outcomes—learning, sustainability, resilience, public health—in addition to hygiene? Given that achieving such outcomes could involve folding food into the curriculum, engaging kids in menu design, cooking and serving food differently, it could be a case of retrofitting new activities into an existing system. Sweden already has school cooks, chef training schools, relatively well-equipped school kitchens and schools, and so on—fortunately, the country does not have to throw an existing system away and build a new one from scratch. Beginning to produce system change could imply training chefs differently in those schools, devising a new curriculum, changing the timetable. Although new practices always cost something, this is not an expensive process (in fact, it may save money, though it is not necessarily wise to start system change with that objective). Again, 'the system' is already in place: what if it could be pointed at different North Stars?

*Source:* Hill (2022, p. 122)

Once the outlines of visionary goals are in place, the task of policy becomes to work backwards from identified goals with relevant stakeholders, to open pathways up so that the goals may be realised Breaking paralysing[29] deadlocks involves opening viable paths both for incumbents and for vulnerable

[29] "Actions that can create enabling conditions for positive tipping include targeting smaller populations, altering social network structure, providing relevant information, reducing price, improving performance, desirability and accessibility, and coordinating complementary technologies. Actions that can trigger positive tipping include social, technological and ecological innovations, policy interventions, public investment, private investment, broadcasting public information, and behavioural nudges." (Lenton et al., 2022).

social groups. But it takes creativity and context specific knowledge to identify positive pathways relevant to the territory and co-creation to make them happen. In developing a direction it is important to work out the reasons for the transition and also use high-quality evidence to co-develop shared understandings of the opportunities as well as the risks. Hardly anyone would want to join forces or pay for something costly unless they have an idea what to expect in return. There are good reasons to believe that co-benefits from the transition are possible even in less developed regions (Box 9 shows many examples from developing countries), but they are not likely in the absence of preparation and a preparedness to act. As guarantors of public interest, governments have a role to play in supporting development of the evidence base about costs and benefits from the transition and to promote evidence-based deliberations about promising paths and managing the risks[30].

Box 9. Social-technological-ecological innovation

Innovations in social-ecological systems (Olsson & Galaz, 2012) can trigger positive feedback(s) in a desired direction (Marten, 2005; Pereira, Drimie, Maciejewski, Tonissen, & Biggs, 2020a). For example, feeding schoolchildren in Kenya boosted community agroforestry (Borish, King, & Dewey, 2017). Recreation of earthen dams to trap monsoonal rains in Rajasthan, refilled aquifers, supporting dry season irrigation, successful cash crop production and community rejuvenation. Social-technological innovations can also create virtuous cycles. For example, the Net-Works partnership between a business and a charity has created a supply chain that engages coastal communities in the Philippines and Cameroon in collecting and selling discarded fishing nets, which are recycled into nylon yarn for carpet manufacture (Khoo, 2018). This also benefits ecology because abandoned fishing nets can continue to trap marine life. Such innovations have the potential to trigger positive tipping points.

*Source:* Lenton et al. (2022)

## 4.5 Complement, strengthen and reform governance

The new direction is also a time to reconsider the role of public administrations in governance models that extend well beyond the boundaries of the public sector. One of the key lessons from the implementation of S3 that was itself an ambitious initiative, is that it is important to identify and address capacity constraints in public administration early on. It will be important to consider carefully any gaps and to strengthen existing capacities so that they are better suited to the transformation goals.

Goals-oriented policy requires more intense collaboration between government departments and levels. In each territory, the ambition of goals-oriented policy should be linked to the capacities of the system to undertake the extensive coordination necessary. Social and administrative innovations will be needed that strike a good balance between the need to plan jointly and the need to deliver the vital tasks that government is already committed to. International experience with Whole of Government (WoG) approaches suggests that success hinges on clearly defined *leadership*, a *shared understanding of goals* as well as *autonomy* about precise ways of approaching the goals in each policy context. For example, the Marshall Plan, arguably one of the better-known examples of a WoG approach to delivering an ambitious mission, came to be seen not as much of a 'plan' but rather a: "*...brilliant series of improvisations*" (Deloitte, 2019). If all three — leadership, shared understanding, autonomy — are in place, budgets in other policy domains can be effectively converted into system innovation

[30] This includes fighting misinformation as part of attempts to frustrate sustainability transitions within defined timeframes such as greenwashing (treating sustainability as a public relations exercise rather than focusing on real-world impact) or woke-washing (alleging social trade-offs where they do not exist) (see Lamb et al., 2020 for examples).

budgets, increasing the total commitments to agreed goals by orders of magnitude (Hill, 2022, p. 124).

Over the long period that will be necessary to put in place appropriate governance arrangements for the new direction, decision makers will also need to consider administrative reform. Reform challenges existing roles and tasks within government and for this reason can be resisted. The stark choice then is to layer additional roles and structures on top of existing ones, or whether contrarily, to dismantle old structures and build new ones. Layering can introduce conflicting or contradictory goals, resulting in compromise outcomes (Edmondson et al., 2019) yet deep reform can damage trust and lead to disruption. Transition thinking applies here too and evidence about what works is always a good point of departure in discussions aiming to reach agreement over possible reform roadmaps.

## 4.6 Diagnose development bottlenecks and deploy a tailored policy mix

There is no single pathway to sustainable territorial development and the forms of appropriate support will very much depend on identified challenges and relevant diagnostics. Rigorous diagnostics can be important to improve the impact of efforts, and PRI requires considerable extension of policy intelligence capacities. Developing the evidence base and policy intelligence capabilities more generally (e.g. though a comprehensive M+E framework that is suitable for the goal of long-term societal wellbeing, context-specific studies, and diagnostic tools such as the POINT reviews – Fiche 6 - and the Priority compass - Fiche 7 and S3 for SDGs – Fiches 2 and 3) will be crucial. Participatory governance, consultation and joint deliberation with stakeholders can also contribute by providing more information about needs.

It is important to use evidence and stakeholder inputs to deliberate alternative future scenarios and transition pathways, which can help make plans more resilient to possible disruptions over the long timeframes any transition entails. Stakeholders have different visions of and expectations about the future. In the context of strategy and policy design it is, therefore, key to, understand these different visions and expectations towards future and encourage collective deliberation of alternative transition pathways. Encouraging openness in possible transition pathways is important as it acknowledges the underlying complexities and uncertainties. By contrast, early closure on a singular view of the future underestimates uncertainties and is likely to undermine future resilience (Stirling, 2014, p. 2008).

Increasing the relevance of the global impulses for transformation to local policy makers and stakeholders can be achieved by translating them into corresponding local impacts. Scholars and experts have approached this issue through localisation of SDGs and connected sustainability challenges[31] (ESPON 2020, Siragusa et al., 2020; Siragusa et al., forthcoming; EC 2022; UN 2016). No part of society can handle these challenges alone: there is a need for context-dependent partnerships if we are to balance across the dimensions of sustainable development and achieve the 2030 Agenda. Evidence-informed identification of localised challenges can be very important in promoting a broad understanding of the appropriate framing of the system and helping identify the relevant stakeholders that need to be mobilised (Nakicenovic et al, 2021).

PRI entails the transformation of already strong sectors and capability accumulation towards sustainability and other societal goals. However, some existing comparative advantages no longer

[31] The Global Sustainable Development report, developed every three years by top scientists for the UN Secretary General states that the actions to achieve the necessary transformations "can be undertaken by a more diverse group of people and organizations than governments of United Nations Member States alone. At the local, national and international levels, new key development actors are emerging and gaining greater power and influence. Innovative and powerful partnerships can result from collaborations between traditional stakeholders and emerging actors. The success of the 2030 Agenda thus depends on the cooperation of governments, institutions, agencies, the private sector and civil society across various sectors, locations, borders and levels." (from: https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf ).

serve societal goals (e.g. fossil fuels extraction and use). Different territories will require very different directions either supporting further specialisation, diversification from existing strengths and even new path creation (Asheim, 2019) (e.g. for regions with too few or too common priorities). The risks associated with new path creation can be lowered if the paths are linked to inevitable public investments (e.g. in energy distribution and storage) or to changes in local demand conditions some of which already being steered by other policies and can be foreseen (e.g. more pervasive digitalisation, distributed models of energy generation, sustainable mobility etc.).

The transition will require massive public and private investments in skills and infrastructure. A large share of these investments will be directed to the adaptation and diffusion of existing technologies. Such pervasive diffusion is a momentous occasion for all territories to develop capabilities in the new economy that are in keeping with their existing production specialisation and also their unique demand conditions. On the occasion of the transition, public policy can support adaptation and local business capability development, while promoting innovations that explicitly aims to make sustainability solutions affordable for the majority of local consumers (see Fiche 52 – Innovation policies for affordability).

Historical experience suggests that the construction of large public infrastructures and the acquisition of foreign technology played a key role in the development of new productive capabilities in middle-income economies (Amsden and Hikino, 1994; Bell and Pavitt, 1995). Tailored public policy can ensure that SMEs use the occasion of diffusion investments to upgrade both their innovation and their productive capabilities. This can be achieved by offering support for broad-based business innovation for SMEs (Fiche 40) and through support for the development of dense inter-firm networks of learning and development (Bell, 2009).

As emphasised by so-called *new industrial policies* an appropriate policy mix should include regulatory and other demand-side instruments (Warwick, 2013; Andreoni, 2016; Andreoni and Chang, 2019). A broad framing and coordinated action across portfolios that consider sequences of interventions (e.g. regulate or support demand first, support business innovation investment later) can bring the industrial system close to tipping points of transformational change (Sharp and Lenton, 2020). The example of Norway in using a demand-side policy (support for the diffusion of electric vehicles) as springboard for innovation-led industrial diversification can be a source of inspiration (Box 10 below):

### Box 10. Demand and innovation policy: advanced mobility testbeds in Norway



Norway turned an original supply-driven industrial policy from the 1990s to an innovation-driven globally attractive test-bed for the future mobility systems with electric and automated vehicles. This has been achieved through policy pivoting, with a strategy adapting and learning. When the original industrial strategy to manufacture Norwegian electric vehicles failed, the government maintained a determined environmental strategy with comprehensive demand-side stimulation for electric vehicles.

From 2018 onwards, this policy is coupled with regulatory sandboxes for self-driving vehicles. With the inflow of world-wide leading automobile and tech-firms, the innovation strategy has pivoted to a systemic investment in the future mobility system combining systemic data management infrastructure with fuel stations. New start-ups are emerging.

# List of Boxes



# List of Figures



# List of Tables

# List of acronyms

| | |
|---|---|
| 3D | Three-dimensional |
| AI | Artificial Intelligence |
| BAT | Best Available Techniques |
| CBA | Cost-benefit Analysis |
| CDI | Challenge-Driven Innovation |
| CHOIRs | CHallenge-Oriented Innovation paRtnerships |
| CoR | Committee of the Regions |
| CoRIS | Challenge-oriented Regional Innovation System |
| CoVE | Centre of Vocational Excellence |
| CPR | Common Provisions Regulation |
| CSOs | Civil Society Organisations |
| DIH | Digital Innovation Hub |
| EC | European Commission |
| EDIHs | European Digital and Innovation Hubs |
| EDP | Entrepreneurial Discovery Process |
| EEA | European Environment Agency |
| EGD | European Green Deal |
| EGDIB | European Green Deal Investment Plan |
| EIB | European Investment Bank |
| EIE | European Innovation Ecosystems |
| EIF | European Investment Fund |
| EIT | European Institute of Innovation and Technology |
| EOSC | European Open Science Cloud |
| EPEs | Experimental Policy Engagements |
| EPO | European Patent Office |
| ERA-LEARN | European Research Area for Research and Innovation |
| ERASMUS | European Community Action Scheme for the Mobility of University Students (EU's Programme for education, training, youth and Sport) |
| ERDF | European Regional Development Fund |
| ESIFs | European Structural and Investment Funds |
| ET | Emerging Techniques |
| EUSF | EU Solidarity Fund |
| EV | Electric Vehicle |
| FDI | Foreign Direct Investment |
| FP7 | Seventh Framework Programme |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GPP | Green Public Procurement |
| H2020 | Horizon 2020 |
| HE | Horizon Europe |
| HPC | High Performance Computing |
| I3 | Interregional Innovation Investments |
| ICT | Information and Communications Technology |
| ILO | International Labour Organisation |
| IPBES | Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services |
| IPCC | Intergovernmental Panel on Climate Change |
| IEA | International Energy Agency |
| IPCEI | Important Project of Common European Interest |
| IRENA | International Renewable Energy Agency |
| IT | Information Technology |
| JRC | Joint Research Centre |
| KICs | Knowledge and Innovation Communities |
| KTO | Knowledge Transfer Office |
| M+E (M&E) | Monitoring and Evaluation |
| MCA | Multi-criteria Analysis |
| MCDA | Multi-criteria Decision Analysis |

| | |
|---|---|
| MFF | Multiannual Financial Framework |
| MLP | Multilevel Perspective |
| MS | Member State |
| NGEU | Next Generation EU |
| NGOs | Non-governmental Organisations |
| NPM | New Public Management |
| NSDS | National Sustainable Development Strategy |
| NSF | National Science Foundation |
| NUTS | Nomenclature of Territorial Units for Statistics |
| O&M | Operation and Maintenance |
| ODP | Open Discovery Process |
| OECD | Organisation for Economic Cooperation and Development |
| P4R | Partners for Review |
| PCP | Pre-commercial Procurement |
| PO | Policy Objective |
| POINT | Projecting Opportunities for INdustrial Transitions |
| PP | Public Procurement |
| PPI | Public Procurement of Innovation |
| PPP | Public–private Partnerships |
| PRI | Partnerships for Regional Innovation |
| R&D | Research and Development |
| R&I | Research and Innovation |
| REACT-EU | Recovery Assistance for Cohesion and the Territories of Europe |
| REPAiR | REsource Management in Peri-urban Areas |
| RES | Renewable Energy Systems |
| RIS3 | National/Regional Research and Innovation Strategies for Smart Specialisation |
| RRF | Recovery and Resilience Facility |
| RRI | Responsible Research and Innovation |
| RRP | Recovery and Resilience Plan |
| RTD | Research and Innovation |
| RTOs | Research and Technology Organisations |
| S3 | Smart Specialisation Strategies |
| SDGs | Sustainable Development Goals |
| SME | Small and Medium-sized Enterprise |
| SNM | Strategic Niche Management |
| STI | Science, Technology and Innovation |
| STS | Socio-Technical System |
| SUD | Sustainable Urban Development |
| SWOT | Strengths, Weaknesses, Opportunities and Threats |
| TEDv | R&I Territorial Economic Data Viewer |
| TIP | Transformative Innovation Policy |
| TPI | Transformative Policy Initiative |
| ToC | Theory of Change |
| TRLs | Technology Readiness Levels |
| TT | Transition Task |
| TWI | The World in 2050 |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNSGSA | UN Secretary-General's Special Advocate for Inclusive Finance |
| VET | Vocational Education and Training |
| WoG | Whole-of-Government approach |
| WTO | World Trade Organisation |

# References


Abernathy, W.J. and Clark, K.B. (1985) Innovation: Mapping the Winds of Creative Destruction. *Research Policy*, 14, pp. 3-22.

Amsden, A.H. and Hikino, T. (1994), "Project Execution Capability, Organisational Know-How and Conglomerate Corporate Growth in Late Industrialisation", *Industrial and Corporate Change*, 3.1, pp. 111-147, https://doi.org/10.1093/icc/3.1.111

Andreoni (2016), "Varieties of Industrial Policy: Models, Packages and Transformation Cycles", in Noman, A. and Stiglitz, J. (eds), *Efficiency, Finance, and Varieties of Industrial Policy*, Columbia University Press: New York, pp. 245–305, doi: https://doi.org/10.7312/noma18050-009

Andreoni, A. and Chang, H.-J. (2019), The political economy of industrial policy: Structural interdependencies, policy alignment and conflict management, *Structural Change and Economic Dynamics*, 48(C): 136-150, Elsevier.

Aranguren, M.J., Magro, E., Navarro, M. and Wilson, J.R. (2019), "Governance of the territorial entrepreneurial discovery process: looking under the bonnet of RIS3", *Regional Studies*, 53(4), pp. 451-461.

Asheim, B.T., (2019), "Smart specialisation, innovation policy and regional innovation systems: what about new path development in less innovative regions?", *Innovation: The European Journal of Social Science Research*, Vol. 32(1), pp. 1-18 DOI: 10.1080/13511610.2018.1491001

Ashford, N. A., and Renda, A. (2016), ""Aligning policies for low-carbon systemic innovation in Europe", CEPS special report.

Azoulay, P., Fuchs, E., Goldstein, A.P., Kearney, M. (2018), "Funding Breakthrough Research: Promises and Challenges of the "ARPA Model"", NBER Working Paper, https://www.nber.org/papers/w24674

Barbero J., Diukanova, O., Gianelle, C., Salotti, S. and Santoalha, A. (2021), "Economic modelling to evaluate Smart Specialisation: an analysis of research and innovation targets in Southern Europe", *Regional Studies*, DOI: 10.1080/00343404.2021.1926959

Bell, M. (2009), "Innovation Capabilities and Directions of Development", STEPS Working Paper 33, Brighton: STEPS Centre, https://steps-centre.org/wp-content/uploads/bell-paper-33.pdf

Bell, M. and K. Pavitt (1995), "The Development of Technological Capabilities", in I. U. Haque (ed) Trade, Technology and International Competitiveness, Washington D. C.: The World Bank

Bevilacqua, C., Ou, Y., Pizzimenti, P. & Anversa, G. (2020). 'Contextualizing Transition: A Multiscale Approach to Making Resilience-Oriented and Place-Sensitive Strategies', New Metropolitan Perspectives, Springer

Binz, C., Coenen, L., Murphy, J. T. & Truffer, B. (2020). 'Geographies of transition – From topical concerns to theoretical engagement: A comment on the transitions research agenda', *Environmental Innovation and Societal Transitions*, Vol. 34, pp. 1-3.

Biggs, R., Schlüter, M., Biggs, D., Bohensky, E. L., BurnSilver, S., Cundill, G., Dakos, V., Daw, T. M., Evans, L. S., Kotschy, K., Leitch, A. M., Meek, C., Quinlan, A., Raudsepp-Hearne, C., Robards, M. D., Schoon, M. L., Schultz, L., West, P. C. (2012). 'Toward Principles for Enhancing the Resilience of Ecosystem Services', *Annual Review of Environment and Resources*, Vol. 37(1), pp. 421-448.

Blok, V. (2014), "Look who's talking: Responsible innovation, the paradox of dialogue and the voice of the other in communication and negotiation processes", *Journal of Responsible Innovation*, 1 (2), 171–190. doi:10.1080/23299460.2014.924239

Borrás, S. and Edler, J. (2020), "The roles of the state in the governance of socio-technical systems' transformation", *Research Policy*, Vol. 49, pp. 1-9, https://doi.org/10.1016/j.respol.2020.103971

Borrás, S. and Schwaag-Serger, S. (2022), "The design of transformative research and innovation policy instruments for grand challenges: The policy-nesting perspective", Science and Public Policy, ttps://doi.org/10.1093/scipol/scac017

Bos, J.J. and Brown, R.R. (2014), "Assessing organisational capacity for transition policy programs", *Technological Forecasting and Social Change*, 86, pp. 188-206

Braams, R. B., Wesselinga, J. H., Meijerb, A. J., and Hekkert, M. P. (2021), "Legitimizing transformative government. Aligning essential government tasks from transition literature with normative arguments about legitimacy from Public Administration traditions", *Environmental Innovation and Societal Transitions*, 39, pp. 191-205.

Brown, R.R. (2008), "Local institutional development and organizational change for advancing sustainable urban water futures", *Environmental Management* 41(2), pp. 221-233

Caldecott, B., Sartor, O., Spencer, T., (2017), "Lessons from previous 'Coal Transitions: High-level Summary for Decision-Makers", Coal Transitions: Research and Dialogue on the Future of Coal Project, IDDRI and Climate Strategies, https://coaltransitions.files.wordpress.com/2016/09/coal_synthesisreport_v04.pdf

Cappellano, F., Makkonen, T., Dotti, N., Morisson, A. and Rizzo, A. (2021), "Where innovation meets directionality: an index to measure regional readiness to deal with societal challenges", *European Planning Studies*, DOI: 10.1080/09654313.2021.1976114

Chorafakis, G. and Pontikakis, D. (2010), "Theoretical underpinnings and future directions of European Union research policy: a paradigm shift?", *Prometheus: Critical Studies in Innovation*, Vol. 29(2), pp. 13-161

Christensen, T. and Lægreid P. (2007), The Whole-of-Government Approach to Public Sector Reform, *Public Administration Review* 67 (6): 1059-1066.

Colgan, A., Kennedy, L.A. and Doherty, N. (2014), A Primer on implementing whole of government approaches, Centre for Effective Services: Dublin

Deloitte (2019), Deploying the whole of government: How to structure successful multi-agency international programs. https://www2.deloitte.com/us/en/pages/public-sector/articles/deploying-the-whole-of-government.html

Diepenmaat, H., Kemp, R., Velter, M., (2020) "Why Sustainable Development Requires Societal Innovation and Cannot Be Achieved without This" Sustainability: 12(3):1270. https://doi.org/10.3390/su12031270

Diercks, G., Larsen, H., & Steward, F. (2019). "Transformative innovation policy: Addressing variety in an emerging policy paradigm". Research Policy, 48(4), 880-894

Erdos, K. and Foray, D. (forthcoming). Smart specialization strategies for sustainability (S4)– between planning and entrepreneurial discovery, Concept paper, JRC.

Edmondson, D.L., Kern, F., Rogge, K.S. (2019), "The co-evolution of policy mixes and socio-technical systems: Towards a conceptual framework of policy mix feedback in sustainability transitions", Research Policy 48(10), https://doi.org/10.1016/j.respol.2018.03.010

ESPON (2020), "Structural Change in Coal Phase-Out Regions", ESPON Policy Brief, Luxembourg, November

European Commission (2020a). Science, Research and Innovation Performance of the EU 2020. A fair, green and digital Europe. Luxembourg: Publication Office of the European Union. https://ec.europa.eu/info/sites/default/files/srip/2020/ec_rtd_srip-2020-report.pdf

European Commission (2020b). Supporting sustainability transitions under the European Green Deal with cohesion policy. Toolkit for national and regional decision-makers. Luxembourg: Publication Office of the European Union. https://ec.europa.eu/regional_policy/en/information/publications/guidelines/2020/supporting-sustainability-transitions-under-the-european-green-deal-with-cohesion-policy-toolkit-for-national-and-regional-decision-makers

European Commission (2021), "Study on prioritisation in smart specialisation strategies in the EU : final report", Directorate-General for Regional and Urban Policy, Publications Office, https://data.europa.eu/doi/10.2776/60867

European Commission (2022), Directorate-General for Research and Innovation, Prevost, S., Benavente, D., Stevenson, A., et al., Transitions performance index 2021 : towards fair and prosperous sustainability, https://data.europa.eu/doi/10.2777/09602

European Environment Agency (EEA) (2022), "Economic losses and fatalities from weather- and climate-related events in Europe", https://www.eea.europa.eu/publications/economic-losses-and-fatalities-from/economic-losses-and-fatalities-from, doi: 10.2800/7654

European Environment Agency (EEA), (2019a). "Sustainability Transitions: Policy and Practice", Luxembourg: Publications Office of the European Union

European Environment Agency (EEA), (2019b). The European Environment. State and Outlook 2020 Report. Luxembourg: Publications Office of the European Union, 2019. https://www.eea.europa.eu/soer/publications/soer-2020

Fagerberg, J. (2018), "Mobilising innovation for sustainability transitions: A comment on transformative innovation policy", *Research Policy*, 47, pp. 1568-1576.

Fedeli, V., Lenzi, C., Briata, P. and Pedrazzini, L. (2019), *EU Regional and Urban Policy: Innovations and Experiences from the 2014–2020 Programming Period*. Springer Nature.

Fink, L. (2022), "The Power of Capitalism", https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter

Fuenfschilling, L., Frantzeskaki, N., & Coenen, L. (2019). Urban experimentation & sustainability transitions. *European Planning Studies*, *27*(2): 219–228.

Geels, F. W. (2004), "From sectoral systems of innovation to socio-technical systems Insights about dynamics and change from sociology and institutional theory", *Research Policy*, 33, pp 897–920

Geels, F. W. (2002), "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study", *Research Policy*, 31 (8-9), pp.1257-1274.

Geels, F.W. (2021), "From leadership to followership: A suggestion for interdisciplinary theorising of mainstream actor reorientation in sustainability transitions", *Environmental Innovation and Societal Transitions*, Volume 41, December 2021, pp. 45-48

Georghiou, L., Renda, A. and Tataj, D (forthcoming), "Lessons from evaluations of the effects of smart specialisation on convergence and regional development. Skills for transition and the role of networks and local firms in the creation of industrial networks for value creation". Concept paper, JRC.

Ghosh, B., Kivimaa P., Ramirez M., Schot, J., Torrens, T. (2021), "Transformative Outcomes: Assessing and Reorienting Experimentation with Transformative Innovation Policy", *Science and Public Policy*, Volume 48, Issue 5, pp. 739–756

Grin, J. (2008), "The multilevel perspective and design of system innovations", In: van den Bergh, J.C.J.M., Bruinsma, F.R. (Eds.), *Managing the Transition to Renewable Energy – Theory and Practice from Local, Regional and Macro Perspectives*, Edward Elgar: Cheltenham, pp. 47–79.

Grundel, I. and Dahlström, M. (2016). A Quadruple and Quintuple Helix Approach to Regional Innovation Systems in the Transformation to a Forestry-Based Bioeconomy. *Journal of the Knowledge Economy* 7, 963–983.

Guzzo, F., and Gianelle, C. (2021). *Assessing Smart Specialisation: Governance*. EUR 30700 EN, JRC123984. Luxembourg: Publications Office of the European Union.

Guzzo, F. and Perianez Forte (2019), I., Smart Specialisation at work: evidence from the Peer and eXchange and Learning workshops, EUR 29993 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-13885-3, doi:10.2760/424435, JRC118899.

Guzzo, F., Gianelle, C., and Marinelli, E. (2018). Smart Specialisation at work: the policy makers' view on strategy design and implementation. Joint Research Centre, Seville.

Haddad, C. R, Nakić, V., Bergek, A. and Hellsmark, H. (2022), Transformative innovation policy: A systematic review, *Environmental Innovation and Societal Transition*s, Volume 43, June 2022, pp.14-40.

Hassink, R. and Gong, H. (2019). Six critical questions about smart specialization, European Planning Studies, Vol. 27(10), pp. 2049-2065, doi: 10.1080/09654313.2019.1650898

Hill, D. (2022). *Designing missions: Mission-oriented innovation in Sweden*, VINNOVA

Iacobucci, D. and Guzzini, E. (2016). Relatedness and connectivity in technological domains: Missing links in S3 design and implementation. *European Planning Studies*, 24(8), 1511–1526.

Impower (2019). *The Edgework Manifesto: How to Deliver Sustainable Change in Complex Public Services*, Impower Consulting.

Incaltarau, C., Pascariu, G. C., & Surubaru, N. C. (2020). Evaluating the determinants of EU funds absorption across old and new member states–The role of administrative capacity and political governance. *JCMS: Journal of Common Market Studies*, *58*(4), 941-961.

International Energy Agency (IEA), (2020), "Sustainable Recovery: World Energy Outlook Special Report", International Energy Agency, Paris

International Renewable Energy Agency (IRENA), (2020), "Global Renewables Outlook: Energy transformation 2050", International Renewable Energy Agency, Abu Dhabi

Keast, R., K. Brown and Mandell, M. (2007), "Getting The Right Mix: Unpacking Integration Meanings and Strategies", *International Public Management Journal*, 10(1), pp. 9-33

Keast, R. (2011), "Joined-Up Governance in Australia: How the Past Can Inform the Future", International Journal of Public Administration, 34(4), pp/ 221-231

Kivimaa, P. and Kern, F. (2016), "Creative Destruction or Mere Niche Support? Innovation Policy Mixes for Sustainability Transitions", *Research Policy*, 45: 205–217

Kivimaa, P., Boonc, W., Hyysalod, S., Klerkxe, L. (2019), Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda, *Research Policy* 48:1062–1075.

Kivimaa, P. and Morgan, K. (forthcoming), "Multilevel Governance, Experimentalist turn and sustainable Transitions", Concept Paper for JRC Scientific Committee on Partnerships for Regional Innovation (PRI).

Kivimaa, P. and Rogge, K. S. (2022). Interplay of policy experimentation and institutional change in sustainability transitions: The case of mobility as a service in Finland. *Research Policy*, *51*(1), 104412. https://doi.org/10.1016/J.RESPOL.2021.104412

Koundouri, P., Schwaag Serger, S., Plataniotis, A. (forthcoming). Sustainability and Resilience through Transformative Innovation Policy, at National and Regional Level.

Kulve, H. and Rip, A. (2011). Constructing productive engagement: Pre-engagement tools for emerging technologies. Science and Engineering Ethics, 17(4), 699–714. doi:10.1007/s11948-011-9304-0

Lamb, W.F., Mattioli, G., Levi, S., Timmons Roberts, J,. Capstick, S., Creutzig, F., Minx, J.C., Müller-Hansen, F., Culhane, T., Steinberger, J.K., (2020), "Discourses of climate delay", *Global Sustainability*, Volume 3, e17, DOI: https://doi.org/10.1017/sus.2020.13

Lenton, T.M., Benson, S., Smith, T., Ewer, T., Lanel, V.,Petykowski, E., Powell, T.W.R., Abrams J.R., Blomsma, F. and Sharpe. S. (2002), "Operationalising positive tipping points towards global sustainability", *Global Sustainability*, 5, e1, 1–16. https://doi.org/10.1017/sus.2021.30

Loorbach, D (2014), "To Transition! Governance panarchy in the new transformation", https://drift.eur.nl/nl/publicaties/transition-governance-panarchy-new-transformation/

Marinelli, E. and Perianez Forte, I. (2017) Smart Specialization at work: The entrepreneurial discovery as a continuous process. JRC Technical Reports, S3 Working Paper Series No. 12/2017. Publications of the European Union: Luxemburg.

Marinelli, E., Fernández, T., Pontikakis, D., (2021), "Towards a transformative Smart Specialisation Strategy: lessons from Catalonia, Bulgaria and Greece", EUR 30642 EN, Publications Office of the European Union, Luxembourg, 2021, doi:10.2760/286969, JRC124128

Maye, D., Keech, D., Knickel, M., Wiskerke, H., and Reed, M., 2022, Synthesis Report, Deliverable 3.3, ROBUST Horizon Europe Research Programme

Mazzucato, M. (2016). "From market fixing to market-creating: a new framework for innovation policy", Industry and Innovation, 23(2), 140-156

Mazzucato, M., (2018), "Mission-oriented research & innovation in the European Union", European Commission, Available online at https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf, Last accessed 24 March 2022

Mazzucato, M., Kattel, R. and Ryan-Collins, J. (2020), "Challenge-Driven Innovation Policy: Towards a New Policy Toolkit", Journal of Industry, Competition and Trade, Vol. 20, pp. 421–437, https://doi.org/10.1007/s10842-019-00329-w

McCann, P. (forthcoming), "Multilevel governance and division of labour: what is the role of regions, national governments, EU Commission, industry, academia, civil society and what can each do concretely", PRI Scientific Committee Concept Paper

McCann, P., Soete, L. (2020). Place-based innovation for sustainability, 7 July 2020, No JRC121271, JRC Working Papers, https://s3platform.jrc.ec.europa.eu/en/w/place-based-innovation-for-sustainability

McCann, P. and Trippl, M. (forthcoming), "Citizens and communities: How to address inclusiveness in sustainability transitions? How to tailor S4 sustainability transitions to different types of European regions?", PRI Scientific Committee Concept Paper

McCann, P. (forthcoming), "Multilevel governance and division of labour: what is the role of regions, national governments, EU Commission, industry, academia, civil society and what can each do concretely", Concept Paper for JRC Scientific Committee on Partnerships for Regional Innovation (PRI).

McKinsey & Company (2001). Effective capacity building in non-profit organizations. Venture Philanthropy Partners. Available at http://www.vppartners.org/sites/default/files/reports/full_rpt.pdf

Meadows, D. (1999), "Leverage Points. Places to Intervene in a System", The Sustainability Institute, http://www.donellameadows.org/wp-content/userfiles/Leverage_Points.pdf

Meadows, D. (2003), *Thinking in Systems: A Primer*, Chelsea Green Publishing

Miedzinski, M., Ciampi Stancova, K., Matusiak, M. Coenen, L. (2021). Addressing Sustainability Challenges and Sustainable Development Goals via Smart Specialisation. Towards a Theoretical and Conceptual Framework, EUR 30864 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-42380-5, doi:10.2760/410983 JRC126448

Miedzinski, M., Coenen, L., Larsen, H., Matusiak, M., Sarcina, A. (forthcoming), "How can Smart Specialisation strategies address sustainability challenges to contribute to the Sustainable Development Goals? Reflection framework and lessons learned from practitioners in the EU and beyond to strengthen sustainability dimension in Smart Specialisation strategies", JRC Scientific and Technical Report

Morison, P. J. (2010). *Management of urban stormwater: advancing program design and evaluation,* doctoral dissertation, Monash University.

Naber, R., Raven, R., Kouw, M., & Dassen, T. (2017). Scaling up sustainable energy innovations. Energy Policy, 110(September), 342–354. https://doi.org/10.1016/j.enpol.2017.07.056

Organisation for Economic Cooperation and Development (2015), System Innovation: Synthesis Report, Directorate of Science, Technology and Innovation, https://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/sites/default/files/general/SYSTEMINNOVATION_FINALREPORT_0/index.pdf

Organisation for Economic Cooperation and Development (OECD) / Eurostat (2018), *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, https://doi.org/10.1787/9789264304604-en

Organisation for Economic Cooperation and Development, (2021), "The design and implementation of mission-oriented innovation policies: A new systemic policy approach to address societal challenges", OECD Science, Technology and Industry Policy Papers, https://doi.org/10.1787/23074957

Palavicino, A., Matti, C., and Witte, J., (2022), "Motion Handbook: Developing a Transformative Theory of Change", Transformative Innovation Policy Consortium (TIPC); Utrecht University Centre for Global Challenges

Perianez-Forte I. and Wilson J. (2021), "Assessing Smart Specialisation: The Entrepreneurial Discovery Process", EUR 30709EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-37823-5, doi:10.2760/559139, JRC124405.

Pontikakis, D., Fernández Sirera, T., Janssen, M., Guy, K., Marques Santos, A., Boden, J.M. and Moncada-Paternò-Castello, P. (2020) Projecting Opportunities for INdustrial Transitions (POINT): Concepts, rationales and methodological guidelines for territorial reviews of industrial transition, EUR 30375 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-22152-4, doi:10.2760/590389, JRC121439.

Radosevic, S. (2017), "Advancing Theory and Practice of Smart Specialization: Key Messages", in Radosevic, S., Curaj, A., Gheorghiu, R., Andreescu, L. and Wade. I. (eds), Advances in the Theory and Practice of Smart Specialization. http://dx.doi.org/10.1016/B978-0-12-804137-6.00015-2

Rayner, J. and M. Howlett. (2009), "Introduction: Understanding integrated policy strategies and their evolution", *Policy and Society*, Vol. 28(2), pp. 99-109

Roman, M., Fellnhofer, K., (2022), "Facilitating the participation of civil society in regional planning: Implementing quadruple helix model in Finnish regions", Land Use Policy, Volume 112, 105864, ISSN 0264-8377, https://doi.org/10.1016/j.landusepol.2021.105864

Rubizmo (2018) Anticipated Futures for Modern Rural Economies: Short Policy Brief, RUBIZMO Horizon Europe Research Programme, September

Schot, J. and Geels, F. (2008), Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy, *Technology Analysis & Strategic Management* 20 (5): 537–554.

Schot, J., and Steinmueller, W. E., (2018), "Three frames for innovation policy: R&D, systems of innovation and transformative change", Research Policy 47, Science Policy Research Unit (SPRU), University of Sussex, UK

Sharp, S. and Lenton, T.M., 2020 (2021), "Upward-scaling tipping cascades to meet climate goals: plausible grounds for hope", Climate Policy, DOI: 10.1080/14693062.2020.1870097

Siragusa, A., Vizcaino, M.P., Proietti, P. and Lavalle, C. (2020), European Handbook for SDG Voluntary Local Reviews, EUR 30067 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-15402-0, doi:10.2760/257092, JRC118682.

Siragusa, A. et al. (forthcoming), European Handbook for SDG Voluntary Local Reviews 2022 Edition, JRC Scientific and Technical Report

Smith, A., Stirling, A. and Berkhout, F. (2005), "The governance of sustainable socio-technical transitions", Research Policy, 34, pp. 1491-1510

Smith, A. and R. Raven (2012), What is protective space? Reconsidering niches in transitions to sustainability, *Research Policy* 41 1025– 1036.

Stirling A. (2014), "Transforming power: Social science and the politics of energy choices", *Energy Research & Social Science*, Volume 1, pp. 83-95

Stout, M. (2013), *Logics of legitimacy: Three traditions of public administration praxis*. Boca Raton, FL: CRC Press

Thapa, R., Iakovleva, T. and Foss, L. (2019) Responsible research and innovation: a systematic review of the literature and its applications to regional studies, European Planning Studies, 27:12, 2470-2490, DOI: 10.1080/09654313.2019.1625871

Tödtling, F. & Trippl, M., (2018). 'Regional innovation policies for new path development – beyond neo-liberal and traditional systemic views', European Planning Studies, Vol. 26(9), pp. 1779-1795.

Tödtling, F., Trippl, M. and Desch, V. (2021) New directions for RIS studies and policies in the face of grand societal challenges. European Planning Studies (in press). https://doi.org/10.1080/09654313.2021.1951177

Trippl, M., Zukauskaite, E. and Healy, A. (2020). Shaping smart specialization: the role of place- specific factors in advanced, intermediate and less-developed European regions. *Regional Studies*, 54(10): 1328-1340. https://doi.org/10.1080/00343404.2019.1582763

Turnheim, B., Kivimaa, P., & Berkhout, F. (eds.) (2018), *Innovating Climate Governance Moving Beyond Experiments*, Cambridge University Press.

UN (2016), "Roadmap for localizing the SDGs: implementation and monitoring at subnational level", https://sustainabledevelopment.un.org/content/documents/commitments/818_11195_commitment_ROADMAP%20LOCALIZING%20SDGS.pdf

Varga, A., Sebestyén, T., Szabó, N., Szerb, L. (2020), "Estimating the economic impacts of knowledge network and entrepreneurship development in smart specialization policy", *Regional Studies*, 54:1, 48-59, DOI: 10.1080/00343404.2018.1527026

Velter, M.G.E., Bitzer, V., Bocken, N.M.P., Kemp, R., (2020), "Sustainable business model innovation: The role of boundary work for multi-stakeholder alignment", Journal of Cleaner Production, Volume 247, 119497, ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2019.119497

Warwick, K. (2013), "Beyond Industrial Policy. Emerging Issues and New Trends", OECD Science, Technology and Industrial Policy Papers No. 2.

Weber, M. and Rohracher, H. (2012) Legitimizing research, technology and innovation policies for transformative change, *Research Policy* 41 (6): 1037-1047

Wieczorek, A. J., Raven, R. and Berkhout, F. (2015), "Transnational linkages in sustainability experiments: A typology and the case of solar photovoltaic energy in India", *Environmental Innovation and Societal Transitions*, Vol. 17, pp. 149-165.

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