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# Towards Green Transition in EU regions

*Smart Specialisation for transformative innovation*

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# Contents

## Abstract

*This report aims to contribute to the development of new models for regional and local authorities aiming to boost support for Green Transition of their economies through smarter innovation policies, using the smart specialisation approach. The report provides a detailed overview of the lessons learnt from five case studies on regions from across the European Union representing a diversity of approaches to using smart specialisation for Green Transition: the Basque Country in Spain, the Centro region in Portugal, the region of East & North Finland, the region of Western Macedonia in Greece and the region of West Netherlands. This report highlights the context-specific aspects of each region and the cross-cutting elements. Drawing together the different elements presented, the conclusion provides a summary overview of the findings and suggests pathways to innovation-led Green Transition for European regions.*

## Acknowledgements

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## Executive summary

The aim of this report is to contribute to the development of new models for regional and local authorities aiming to boost support for Green Transition of their economies through smarter innovation policies, using the Smart Specialisation (S3) approach. The work covered five regions from across the European Union representing a diversity of approaches to using S3 for Green Transition: the Basque Country in Spain, the Centro region in Portugal, the region of East & North Finland, the region of Western Macedonia in Greece and the region of West Netherlands. The full Cases Studies will be published separately.

***Policy context***

Many EU regions now feel the need to adopt more mission-oriented approaches to challenges like Green Transition - representing an evolution from 'technology-push' type policies commonly embodied on the first generation of S3. The ambition they increasingly share for post-2020 is to design and implement transformative innovation policies, which seek not only to increase rates of innovation and its diffusion, but also to add directionality to innovation efforts towards expected societal impacts. This ambition calls for changes in governance and in tools used in the smart specialisation context, as well as in broader national and regional innovation policies.

***Main findings***

Overall, the research showed the five regions are engaged in enhanced strategic efforts, compared to the 2014-2020 funding period, to create their own original pathways towards Green Transition, in which innovation plays a significant role. However, the nature of how these efforts can be measured varies widely between these regions. Notwithstanding the diversity between the Pilot Regions, the following conclusions have been drawn:

- *All three varieties of Green Transition drivers* - the *carrots, sticks* and *sermons* - are identifiable in all the Case Study Regions, in different combinations. *Carrots* are seen in ever increasing demand for green products and services, holding the promise of growth and jobs opportunities in regions able to become frontrunners in this regard. *Sticks* are the regulations forcing changes (e.g. closure of polluting industries) as well as the prospect of tighter regulation to come. The rise of high-level green narratives represent the *sermons*, which speak to politicians, citizens and ecosystem actors, shaping individual and collective agendas.
- **Challenge-driven innovation strategies are being increasingly led by *mission*-type approaches.** Such reorientations are based on longer term visions and holistic ways of achieving system-level Green Transition, rather than simply 'green technology' developments.
- The role of S3 as a driving force for innovation-led Green Transition is highly variable between the Case Study Regions.
- Green Transition is a major transition, requiring correspondingly high levels of funding – its innovation aspects often depend upon major mainstream investments taking place. Bold transformative initiatives need very substantial funding from a range of sources, not least from the private sector.
- Policy experimentation relevant for innovation-led Green Transition is taking place across the Case Study Regions in both 'mission'-type and 'horizontal' modes. New policy instruments are being developed with the aim of supporting well-specified particular 'missions' based on bold multi-technology, multi-actor and multi-sectoral endeavours, with high user-involvement - in some cases in strong synergy with skills development initiatives.
- There has <u>not</u> been a significant increase in citizen involvement, in the Case Study Regions, in developing innovation strategies for 2021-2027, despite their generally broader societal focus. Most strategic Green Transition initiatives are implemented predominantly in business-to-research or business-to-business contexts.
- Increased importance of place-based innovation approaches <u>within</u> the Case Study Regions is noticeable, enhancing the role of local authorities and increasing the scope for citizen participation inside interventions supported. The territorial dimension of Green Transition is experimented in depth

in municipalities and cities. The challenge being addressed here is that of scale-up of successful initiatives to contribute best to wider regional ambitions.

- The relevant authorities across the Case Study Regions display substantial differences in capacity, with low capacity representing an important obstacle to successful innovation-led Green Transition.
- None of the Case Study Regions have yet been able to develop knowledge bases or monitoring systems capable of capturing the full effects of innovation investments on Green Transition.
- The move towards addressing societal challenges in S3 and other innovation strategies remains relatively new and these strategies should not be considered 'set in stone'. Looking to the future, it seems important to reiterate that the Smart Specialisation approach was never meant to embody unidimensional on-paper strategies which could not evolve during their implementation period. The innovation strategies relevant for Green Transition in the Case Study Regions, adopted for the start of the new EU funding period 2021-2027, should be capable of refinement during implementation as circumstances change.

***Related and future JRC work***

This work falls under the mandate of the Smart Specialisation Platform and pursues to contribute to the discussion on the Partnerships for Regional Innovation (PRI), a new approach to place-based innovation policy which builds on positive experiences with smart specialisation strategies.

# 1 Introduction

The aim of this report is to contribute to the development of new models for regional and local authorities aiming to boost support for Green Transition of their economies through smarter innovation policies, using the Smart Specialisation (S3) approach.

Many EU regions now feel the need to adopt more mission-oriented approaches to challenges like Green Transition - representing an evolution from 'technology-push' type policies commonly embodied on the first generation of S3. The ambition they increasingly share for post-2020 is to design and implement transformative innovation policies, which seek not only to increase rates of innovation and its diffusion, but also to add directionality to innovation efforts towards expected societal impacts. This ambition calls for changes in governance and in tools used in the smart specialisation context, as well as in broader national and regional innovation policies.

The JRC in Seville hosts the Smart Specialisation Platform (S3P), established by the European Commission to provide support to EU Member States and regions for the design and implementation of Research and Innovation Strategies for Smart Specialisation (S3). In this context, the JRC collects evidence on S3 experiences across EU regions and countries, covering a large range of topics spanning key S3 design and implementation phases.

The work covered five regions from across the European Union representing a diversity of approaches to using S3 for Green Transition: the Basque Country in Spain, the Centro region in Portugal, the region of East & North Finland, the region of Western Macedonia in Greece and the region of West Netherlands.

This Report provides a detailed overview of the lessons learnt from the Case Studies, highlighting the context-specific aspects of each region and the cross-cutting elements.

The Report is structured in three Chapters:

1. Methodology: conceptual background and work on Case Studies
2. Profile and Green Transition challenges in the five Case Study Regions
3. Innovation strategies and policies for Green Transition: incorporating societal challenges

Drawing together the different elements presented, the conclusion provides a summary overview of the findings and suggests pathways to innovation-led Green Transition for European regions.

# 2 Methodology: conceptual background and work on Case Studies

This first Chapter starts with the presentation of the conceptual background of the study, based on recent developments around 'transformative innovation policies' (Section 1.1). It then discusses the place-based dimension of transformative innovation and highlights key issues to be investigated concerning the role of Smart Specialisation Strategies (S3) in innovation-led Green Transition (Section 1.2). Section 1.3 explains the choice of Case Study Regions and Section 1.4 the methodology adopted in terms of target groups and issues discussed.

## 2.1 Transformative innovation policies: background

At a time when EU regions are deploying new strategies to recover from the Covid crisis and 'build back better' towards more resilient, green and inclusive societies, academics and policy makers alike are devoting sustained attention to the concept of 'transformative innovation policies' (see notably Schot and Steinmueller, 2018 and Kuhlman and Rip, 2018). The concept encompasses innovation policies driven by societal challenges, aimed at achieving wider transformation of socio-technical systems. Such policies seek not only to increase rates of innovation and effectiveness of its diffusion, but also to add directionality to innovation efforts towards expected societal impacts, beyond both scientific and technological impacts and economic returns.

In the context of the European Green Deal (EC, 2019), 'Green Transition' is defined broadly by the European Commission (EC, 2021) as embracing long-term transformations of societal systems towards more sustainable modes of production and consumption. For the purposes of this assignment, innovation-led interventions in pursuit of Green Transition cover a non-limitative list of topics such as: Climate change mitigation and adaptation; Energy transition; Circular economy; Pollution elimination; Sustainable smart mobility; Sustainable manufacturing; Bioeconomy; Sustainable agriculture; Ecosystem and biodiversity enhancement etc. However, beyond thematic interventions, as the Commission highlights, successful Green Transition will require a fundamental transformation of large socio-technical systems, including changes in technologies, infrastructure, legislation, markets and behaviours (EC, 2021).

While traditional innovation policies rest on a market failure rationale and modern innovation policies on an ecosystem failure rationale, transformative innovation policy approaches are deployed to address weak alignment of both demand and supply to societal needs. This is currently the case for Green Transition. Existing policies – including Smart Specialisation approaches – aim to reinforce scientific and technological strengths, in order to achieve a better match with business forces and foster public-private knowledge co-creation. However, in many instances there is no 'market' as such, for the societal challenges that require wider transformation, so innovation ecosystems may be unable to react at the necessary speed and scale. 'Transformative innovation policies' therefore seek to address societal challenges as explicit goals, rather than simply observing them as potential outcomes of innovation efforts. In this regard, recent work by JRC (Nakicenovic et al., 2021) seeks greater systematic linkage between EU innovation policies and the UN Sustainability Goals (SDGs).

One important novelty brought by the new concept of transformative innovation policies is the need to incorporate contributions from a much wider set of stakeholders, well beyond usual 'innovation actors', in both policy design and policy implementation. This broader scope of participation changes the policy process towards one of co-creation, where goals, means and impacts are defined and deployed in a concerted way, neither top-down nor bottom-up, but as a mixture of the two, with enlarged participation. The concept of Responsible Research and Innovation is relevant here: the European Commission defines it as "a process by which societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society" (EC, 2011).

Another noteworthy characteristic of transformative innovation policies is that they need a clear focus on creative destruction: to be transformative, policies need to eliminate legacies from the past, including institutional and cultural ones, in addition to creating opportunities for the future. The approach stands in contrast to traditional innovation policies, which have a dominant focus on fostering new technology-related developments and tend to neglect other framework conditions that favour or hinder transformative change. Changes in consumer behaviour, increased awareness of climate change threats, for example, are part of the transformation agenda, along with the development of new green technologies and clean energy. Moreover, transformative policies have a strengthened focus on experimentation and new, original combinations of

ideas, opening up of space for new actors. The translation of new societal impact goals into correspondingly restructured policy mixes is crucial for turning strategic intentions into policy reality.

Finally, transformative innovation agendas cross over a wide spectrum of policies, extending well beyond research and technology development. They also incorporate demand-side policies, skills development and build synergies with sectoral policies in fields like health, transport, energy, or food, depending on the societal challenge in question. The increased complexity results in a need for stronger policy coordination across different domains.

The concept of mission-oriented policies, as developed by the EU under its new research Framework Programme and by the OECD, is in line with that of transformative innovation policies. The so-called 'missions' are problems or goals of high societal priority. 'Mission-oriented innovation policies' aim to direct scientific, technological and economic development efforts towards societally defined missions in fields as varied as energy, mobility, health and many others. Rather than supporting and funding research, technology development and innovation efforts per se, mission-oriented policy consciously concentrates efforts into support packages geared towards responding to societal challenges (see also Edler et al., 2021).

The Missions under Horizon Europe experiment with a new approach, under which "research and innovation not only stimulate growth and economic activity, but also actively work towards meeting global challenges, by transforming them into concrete, measurable, and most importantly, achievable missions" (EC, 2018).

According to OECD, mission-oriented innovation policies are "co-ordinated packages of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address well-defined objectives related to a societal challenge, in a defined timeframe" (OECD, 2021).

A key aspect of the 'mission' approach emphasised in Horizon Europe, is the need for concrete definition of the expected results from the mission. For the approach to be truly game-changing and not just wishful thinking, there is a crucial need for enhanced monitoring mechanisms to follow-up implementation of the new policy mix and assess its real contribution to the mission's goals.

## 2.2 Analysing the role of Smart Specialisation to support transformative innovation towards Green Transition: the place-based dimension

The literature on transformative and mission-oriented innovation policies has a dominant focus on national-level policies, with a secondary attention to the territorial dimension. Several countries have implemented national frameworks in line with the challenge-driven or mission-oriented rhetoric - e.g. the challenge-driven innovation agenda of Vinnova in Sweden[1] or the mission-driven top sector and innovation policy in the Netherlands[2]. Specifically under this assignment, the aim of the Case Studies was to analyse how S3s, which are place-based strategies, fit the ambitions of transformative innovation policies at sub-national level in practice.

While the roots of the S3 approach lie in closing the technology and innovation gap between the EU and its competitors, by reducing the fragmentation of R&I efforts across EU regions, the concept has recently evolved to take on a more mission-oriented flavour, particularly regarding Green Transition.

> "*Deepening Smart Specialisation also means encompassing the sustainability dimension, which is of key importance to deliver on the agenda of the European Commission and achieve competitive sustainability. In this respect, beyond its economic and social DNA, the green dimension of Smart Specialisation will be further enhanced, in line with the European Green Deal. Altogether, this will pave the way for economically, socially and environmentally robust and modern Smart Specialisation, in a nutshell sustainable Smart Specialisation.*"
>
> Mikel Landabaso, Towards Sustainable Smart Specialisation Strategies[3]

[1] https://www.vinnova.se/en/m/challenge-driven-innovation/

[2] Missiegedreven topsectoren- en innovatiebeleid (MTIB) https://www.bedrijvenbeleidinbeeld.nl/bouwstenen-bedrijvenbeleid/missiegedreven-innovatiebeleid

[3] https://ec.europa.eu/newsroom/jrcseville/items/670313

While it has been argued that the technology-led focus of S3 is rather a 'translation problem' than a founding element of the S3 concept (Miedzinski et al., 2021), there is nevertheless a need to re-think the role of S3 under a challenge-driven frame. The aim of this study is to capitalise on the experience of frontrunner EU regions that have adopted the S3 concept for their first generation of policies in 2014-2020. Such regions have integrated elements relevant to the Green Transition and are now involved in a second generation of strategies.

## 2.3 Choice of Case Study Regions

The research undertaken analysed conditions for developing effective transformative innovation policies at regional level, based on five Case Studies of regions at the forefront of Green Transition.

The following criteria were used in the authors' initial reflection on possible regions of focus:

- Regions that have integrated elements relevant to the Green Transition in their S3 for the 2014-2020 period.
- Regions that are willing to collaborate with the JRC in working towards a transformative innovation approach to support their Green Transition during the new period (2021-2027).
- Regions that are working on monitoring systems for Smart Specialisation.

The study carried out for the European Commission's DG Regio by Prognos, on S3 prioritisation in the EU (Prognos, 2021), was then used to further screen potential candidate regions. The aim was to select regions which stand out as demonstrating a high level of ambition for transformation of their economies, as well as moving towards a challenge-driven approach to support Green Transition in their S3 for the 2021-2027 period.

Based on these considerations, a preliminary list of case studies was proposed to JRC in December 2021. With a view to enlarging the scope for learning from different types of experiences, thematic and territorial diversity in approaching the Green Transition was also sought in the choice of possible cases. This list was validated in discussion with JRC, who sent official invitations to regions to participate in the study in February 2022. The following regions replied positively to the invitation and were included in the study:

- the region of East & North Finland
- Zuid-Holland in the region of West Netherlands
- the Basque Country in Spain
- the Centro region in Portugal
- the region of Western Macedonia in Greece.

Collectively, the Case Study Regions reflect something of the considerable diversity in socio-economic status, innovation performance and governance structure, which exists across the European regional landscape.

## 2.4 The case study work: target groups and issues discussed

Over the months of March and April 2022, in each of the five regions, the experts conducted a programme of interviews over a period of three to four days. The aim was to gain practical understanding, from multiple points of view, of how to bring about genuine Green Transition based on innovation. During the visits, the experts met the following types of stakeholders – either bilaterally, or in groups:

- Main relevant public funding bodies and intermediary organisations supporting the region's innovation ecosystem
- Representatives from each main relevant 'community' involved in the ecosystems – in particular the education/research and business communities
- Beneficiaries of relevant EU and/or domestic public funding policies – including key persons in charge of flagship-type projects for the Green Transition of the region
- 'Society' representatives (e.g. interest groups) / end users affected by transformative innovation-led policy approaches.

**Box 1.** Main topics covered by the interviews

The interviews broadly covered the following five main topics:

**Participatory processes – models and outcomes:** How does a participatory process in strategy development evolve when a challenge-driven approach is adopted? How can R&I actors be more effectively linked with a broader spectrum of 'problem owners' to make societal challenge-driven approaches work in various contexts?

**New governance models and strategic capacity:** How do regional and local authorities adjust governance structures and experiment with new types of leadership, to achieve stronger synergies between policy domains, adopt more demand-led approaches, and deliver more effective multi-level governance? How well do they ensure strong capacity for effective implementation?

**Policy mix evolution:** What is the concrete impact of a challenge-driven approach on the policy portfolio deployed by and in the regions? How are societal changes (and changes in behaviour) promoted? How can the demand for increased experimentation in policy development be reconciled with existing rules for sound management of public resources?

**Flagship projects/initiatives:** The experts looked at projects embodying approaches beyond 'normal' business-research sector collaboration. Key questions were: what are the success factors for such projects to deliver on comprehensive Green Transition goals? What problems/bottlenecks do they face? What tangible outcomes have been achieved so far?

**Monitoring Green Transition at strategic level:** How are smart monitoring systems developing in practice, in the new generation of challenge-driven policies? How far are they and/or new evaluation methods able to capture transition dynamics and help embed lessons learnt into policy development?

A key component of the methodology was the triangulation of findings from the point of view of different regional actors, in order to bring depth to each Case Study. The list and dates of interviews in appended in Annex 1.

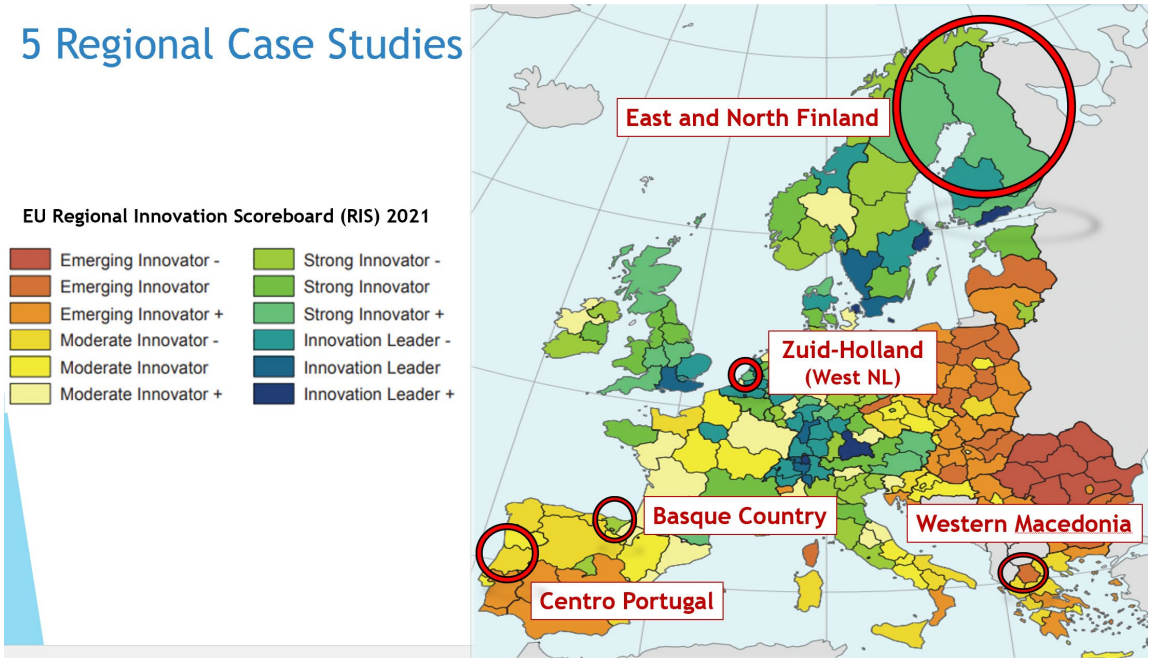
# 3 Profile and Green Transition challenges and drivers in the five Case Study Regions

This Chapter depicts the situation of the five Case Study Regions in terms of socio-economic background and innovation performance (Section 3.1) and Green Transition drivers and challenges (Section 3.2).

## 3.1 Socio-economic background and innovation performance of the five regions

As shown in the map below, three of the Cases Study Regions, East & North Finland, Zuid-Holland and the Basque Country are classed as 'Strong Innovators' in the EU Regional Innovation Scoreboard 2021. Centro is classed as a 'Moderate Innovator' and Western Macedonia as an 'Emerging Innovator'.

**Figure 1**. Geographical presentation of the Case Study Regions in relation to European Innovation Scoreboard 2021




Source (EC, 2021)

Delving further into the socio-economic characteristics[4] of each of the Case Study regions, a fuller picture of their diversity emerges.

**East & North Finland** covers a huge area, with extremely low population density and demographic ageing and decline. The region's GDP per capita is some 92% of the EU average. Its economy remains highly dependent on raw material exploitation, wood and minerals, as well as steel making. Lapland, one of its seven constituent NUTS 3 areas has an important tourism sector. The region is well endowed with knowledge institutions and is visibly innovation-led. The high enthusiasm of its ecosystem actors and their understanding of the importance of internationalisation has bred a certain institutional thickness, despite relatively low capacities on-paper. The East & North Finland NUTS 2 'functional' region is a construct, designed to capitalise on complementarities between its constituent parts, seeking economies of scale and maximising opportunities for international recognition. The region receives relatively high levels of Cohesion Policy funding due to its peripherality and low population density. S3s have been defined both at this NUTS 2 level, as well as at the level of each of the seven NUTS 3 areas. The latter are considered as the 'official' S3, since these reflect the formal administrative level in Finland below national level.

**Zuid-Holland**, by contrast, is heavily urbanised and is one of the most densely populated places in the world. Its population continues to grow. The Province has GDP per capita of 125% of the EU average. It is home to the largest port in the EU and an important horticulture industry. It has major strengths across the key

[4] GDP per capita figures in this section are in PPS at 2019 (pre-COVID 19) values (Eurostat, 2022).

sectors for future growth targeted by the National 'Mission-driven Top Sectors and Innovation Policy', which guides Zuid-Holland Growth Agenda and numerous local strategies. Zuid-Holland is a frontrunner in research and innovation, with major knowledge institutions present and a particularly high success rate under the EU Horizon programme. However, a substantial shortage of skilled workers is a growing concern. Zuid-Holland is the southern part of the West Netherlands NUTS 2 region defined for the purposes of EU Cohesion Policy and covered by the *Kansen voor West* Operational Programme (OP). Although the S3 is defined at the West Netherlands level, the Province-level Growth Agenda – which aligns with the S3 - is the main strategy, supported largely by national public and private sector funding. EU Cohesion Policy Funds play a relatively minor role here, but they finance projects of high quality and value added, representing thereby the 'icing on the cake'.

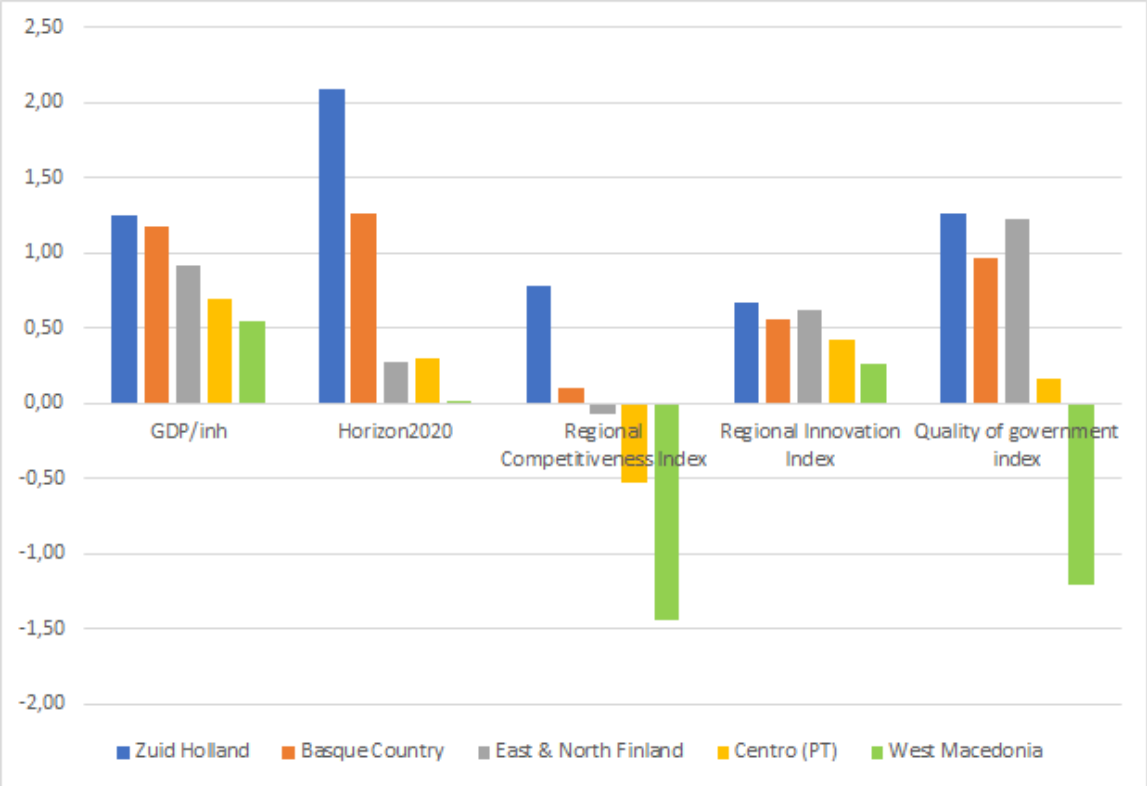
The **Basque Country** is also a relatively densely populated region with growing population. It is a proudly industrialised region displaying strong economic performance and high productivity. Its GDP per capita is 117% of the EU average. There is a high share of employment in industry in the region, relative to Spain overall and the EU average. Basque society is notably cohesive with low risk of poverty and social exclusion. The cooperative movement has a long tradition and particular prominence in the region. It is the only Case Study Region with an autonomous regional government at NUTS 2 level. The Basque Government has wide-ranging budgetary and policy-making powers and a strong tradition of collective work together with higher education and industry players. The Basque Country's regional-level S3 for 2021-2027 is embodied in the transition-oriented 'STIP 2030', which is its main strategic document for directing innovation-led interventions. EU Cohesion Policy Funds are barely needed or used in the region.

**Centro**, the NUTS 2 region in the centre of Portugal, has a relatively low population density, with declining and ageing population, particularly in its rural areas. A situation of territorial fracture is already apparent between these rural parts of the region and its urban centres. Centro has a GDP per capita of just 69% of the EU average and is mainly specialised in traditional industrial sectors - ceramics, glass, cement, forest – which are not generally innovative in character. Yet the region has a strong presence of public research and technology institutional resources, high tertiary education levels and good IT skills overall. Nonetheless, low salaries make it difficult for the region to retain talent, constituting a serious impediment to growth. In Portugal, S3s are defined at both national and NUTS 2 regional levels.

**Western Macedonia** is home to 80% of Greece's lignite industry, supplying over 70% of national electricity from lignite-fired powerplants at its peak in the 1990s and early 2000s. Through the combined effects of EU environmental regulations and carbon pricing under the EU Emissions Trading Scheme (EU ETS), this activity has been phasing out since 2010, with major plant closures. The final plants are due to close in 2028. The domination of the lignite and related power generation industry in Western Macedonia has led to a monoculture situation in the region. The regional population is small and declining significantly due to out-migration. The region's GDP per capita is only 55% of the EU average. There are few innovation actors in the region, both on private and public side. There is an S3 defined at the regional level, but this is not the main strategic force behind the transition foreseen. All key decisions about the transition are taken at the national level. The region itself has little input, or capacity.

The overview of key indicators relevant for innovation-led transition in Figure 2 shows the diversity across the Case Study Regions.

**Figure 2.** Key indicators for innovation-led Green Transition in the five Case Study Regions




**Indicators and sources**

1: GDP PPS/EU average (2019). Source: Eurostat

2: Funds attracted from Horizon2020 as a proportion of total H2020 funding (2022). Source Horizon2020 Dashboard, extract June 2022

3: Regional Competitiveness Index (2019). Source: Annoni and Dijkstra, 2019

4: Regional Innovation Index (2021). Source: EC, 2021

5: Quality of Government Index (2021). Source: Charron et al., 2021

## 3.2 Green Transition challenges in the Case Study Regions

Each of the Case Study Regions is faced with specific Green Transition challenges. For some there is a special focus on a particular element, such as the major hydrogen-based transformations foreseen in Zuid-Holland and Western Macedonia. For the others, Basque Country, Centro and East & North Finland, the challenges are seen as more industry-wide, yet still specific to the region concerned. These Green Transition challenges are summarised by region in Table 1.

**Table 1.** Main Green Transition challenges faced by the Case Study Regions

| Regions | Main Green Transition challenges |
|---|---|
| **East & North Finland** | ○ Oversized carbon footprint generally, due to peripherality<br>○ Need to improve sustainability of mining industry<br>○ Decarbonisation of steel making industry<br>○ Enhancing industrial circularity – particularly in wood/timber/forest sector |
| **Zuid-Holland (West Netherlands)** | ○ Greening of the Port of Rotterdam, through large-scale application of offshore wind power and production/distribution of green hydrogen<br>○ Cleaning the agri-food sector, including decarbonisation of major greenhouse-based horticultural operations at 'Greenport'<br>○ Further improving sustainable mobility<br>○ Increasing the availability of new skills in energy transition related fields |
| **Basque Country (Spain)** | ○ Reducing energy intensity and consumption of fossil fuels in industry generally<br>○ Increasing diversification of primary energy sources, with more renewable energy<br>○ Reducing greenhouse gas emissions in key sectors such as transport and buildings<br>○ Shifting to a circular economy with reduced consumption of raw materials, re-use and recycling of waste across industry – including food and fishery value chains |
| **Centro Portugal** | ○ Green transformation of larger energy-intensive and polluting industries - e.g. cement and ceramics<br>○ Reducing extraction of raw materials, mainly minerals<br>○ Achieving circularity in waste-generating sectors – including the waste sector itself<br>○ Harnessing Green Transition to effectively address territorial/demographic imbalances in the region |
| **Western Macedonia (Greece)** | ○ Implementing the major planned initiative to replace the dominant lignite-based power industry with green hydrogen production and related R&D facilities<br>○ Addressing social impacts of 8,000 direct job losses anticipated from lignite-related closures<br>○ Successful upgrading of lignite power workers' skills for new activities<br>○ Convincing the local population of the benefits of transition and helping them engage positively with it |

# 4 Innovation strategies and policies for Green Transition: incorporating societal challenges

This Chapter provides the overall findings from the analysis of strategies in the five Case Study Regions to foster innovation-led Green Transition. The lessons learned are organised in four parts:

- Section 4.1 "The drivers of Green Transition" looks respectively at the *carrots* and *sticks* having increasingly direct effect on the decisions of private sector actors in relation to Green Transition, as well as related developments in higher level discourse – i.e. the *sermons* which are galvanising and guiding regional players in this regard
- Section 4.2 "Building strategies for innovation-led Transition" reflects on what is needed and whom to involve when defining the aims of challenge-driven strategies
- Section 4.3 "Implementing innovation-led Transition" analyses the pathways and instruments to turn intentions set at design phase into reality
- Section 4.4 "Understanding innovation-led Transition" examines the requirements in terms of policy capacity and the policy intelligence needed to achieve successful Green Transition.

After the introductory Section 4.1, each of the Sections 4.2 to 4.4 starts with a conceptual introduction showing the analytical framework used by the experts, followed by text presenting the horizontal findings across all Case Study Regions. A summary table with the major specific features of innovation-led Green Transition strategies is then presented for each Case Study Region. Finally, reference is made, in Sections 4.2 and 4.3, to a number of more detailed concrete examples from the Case Study Regions, which can be found in Annex 2, as well as in the individual Case Study reports.

## 4.1 Key drivers of Green Transition in the Case Study Regions

If the main drivers of Green Transition for these regions were to be categorised, they could be conveniently grouped in terms of *carrots, sticks,* or *sermons* (Bemelmans et al., 1998)*:*

***Carrots***

In addition to EU funding opportunities through Cohesion Policy and/or Horizon programmes, a key inducement for Green Transition in all of the regions is the increase in demand (final consumer and business demand) for greener products/solutions and for products of local/EU origin reducing external dependency. This translates into greater economic value of green/sustainable products. Such economic perspectives also impact agendas of technology and research organisations, who are increasingly aligning the agendas towards the development of new technologies meeting these evolutions – also adapting to funding channels that are increasingly requiring demonstration of impacts of research and public-private collaborative practices.

Green Public Procurement (GPP) is increasingly used with leverage effect on private sector operators in the Case Study Regions. Centro's Regional Coordination and Development Commission (CCDRC) notably participated previously in an exchange with Netherlands about Circular Procurement. CCDRC now coordinates the Centro Green Deal Network, comprising 12 local public entities in the region.

Some regions have been able to set up regulatory sandboxes, where Green Transition related experiments can be carried out without impediment. The Green Village at the Technological University Delft in Zuid-Holland, for example, has special agreements with relevant regulatory bodies to enable relaxation of building codes and other regulatory frameworks on its site. This has enabled experimentation with new items, such as an urban hydrogen grid, to the benefit of commercial operators and regulators alike.

***Sticks***

Environmental regulations, carbon taxes, bans on plastic, low emission zones and phasing out of diesel engines, new taxes on waste etc. appear as key Green Transition drivers in all Case Study Regions.

The specific case of Western Macedonia illustrates the point particularly well – the rise in carbon prices under the EU ETS has made further exploitation of lignite as a fuel for power generation almost unviable economically. Similarly, in Zuid-Holland, much of the Green Transition agenda is driven by large companies mindful of the potential effects of new environment-related regulation yet to be put in place. Shell, for example is now publicly working towards developing bio-based aviation fuel in the Port of Rotterdam.

The perspective of new regulation is indeed a driver of private sector activity in most of the regions. In East & North Finland, for example, the goal of greater sustainability in mineral extraction and steel making can be said to be encouraged by the prospect of stricter regulation in the future. Interestingly, the role of these industries in future Green Transition is also accepted in the region – for instance mineral (including cobalt) extraction for use in batteries, and the continued need for high-grade steel in the context of a hydrogen-based economy.

***Sermons***

Sermons represent the regions' buy-in to evolving Green Transition discourse at EU, or world level. Items such as the UN Sustainable Development Goals (SDGs) and the European Green Deal have provided a new narrative for regional development, with increased emphasis on society-wide consensus and voluntary commitments by countries and regions.

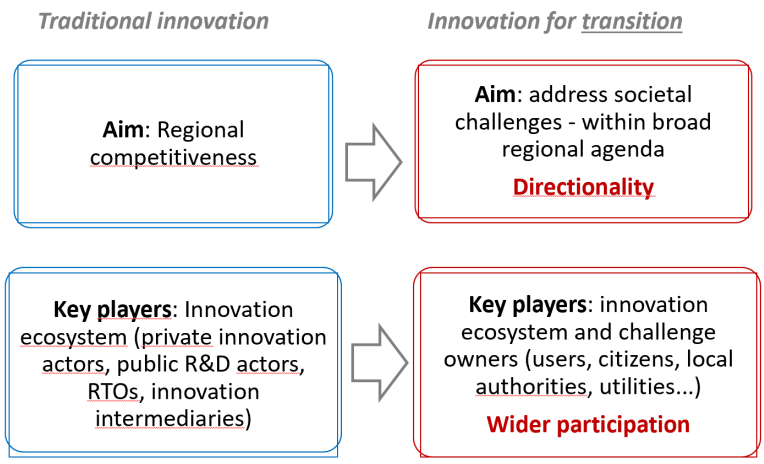
Nowhere, among the Case Study Regions, is the buy-in to EU level orientations and policy initiatives visibly stronger than in the Basque Country. The Basque Green Deal, for example, closely follows the European Green Deal and its Climate Law translates the provisions of the EU Climate Law to the regional perspective. Most of the other regions' strategies make detailed reference to the SDGs and/or European Green Deal, based on Green Transition commitments made by their national governments. The particularly strong engagement by actors in East & North Finland in EU-wide initiatives, provides another example of the importance attached to the EU level as a means of gaining international recognition to help overcome peripherality.

*Carrots, sticks* and *sermons*, then, as Green Transition drivers are evident in all the Case Study Regions. Different regions have different combinations of them and to differing degrees, according to their specific circumstances, but each category is present behind the strategic approach to Green Transition adopted by each region.

## 4.2 Building strategies for innovation-led Green Transition

Figure 3 illustrates the main expected differences between strategy making dynamics for more 'traditional' innovation policies, compared to what might be expected for innovation strategies to promote genuine Green Transition. The design of challenge-driven innovation strategies for EU regions calls both for redefinition of goals - with added directionality in order to link innovation with impacts expected on Green Transition - and for new participative methods – through an enlarged participation in the design processes, including new actors closely linked to the Green Transition challenges.

**Figure 3.** Building strategies for innovation-led Green Transition




Source: The Authors, June 2022

The findings from the field work in the Case Study Regions, in relation to strategy building, are examined here in this context.

**In terms of goals definition, regions are adding 'direction' to their traditional objective of supporting more and better diffused innovation - i.e. they aim to favour innovation that**

**contributes to greening economic activity**. For example, the greening of resource-based value chains that are so important for East & North Finland's economy is one caseof an innovation strategy with added 'green directionality'. Such a reorientation calls for broader and more holistic approaches, aiming to achieve wider system transitions and not only 'green technology' developments. The Mission-driven 'Top Sectors and Innovation Policy' model in the Netherlands exemplifies such wider uptake, adding societal challenges to the existing goal of promoting business-research partnerships. The Basque Country and Centro Portugal regions pursue this kind of objective by adding societal – including green - transitions as transversal goals in their S3. However, adding a new 'direction' to an existing innovation ecosystem supposes that this ecosystem is functioning well. The two regions with lower innovation performance - Centro and particularly Western Macedonia – still have some way to go to build effective regional innovation ecosystems. This may hinder the definition of an innovation-led Green Transition pathway, as individual actors and their coalitions in these regions are not yet strong enough to deploy innovative solutions supporting Green Transition.

**Shared long-term visions – with visible influence of EU policy orientations - is the foundation for defining new regional strategies with added directionality**. Formulating and adopting truly shared visions is not easily achieved. It works best in cohesive regions, such as the Basque country where there is a consensus to maintain the industrial character of the region as well as extended practice of strong collective work. In regions that are less endowed with social capital, like Western Macedonia, the direction for change is largely imposed from outside and the innovation ecosystem is under-developed. The existence of clear joint challenges – such as peripherality in the East & North Finland region – facilitates consensus building around shared directions. Territorial divides, however, can hamper joint vision, justifying Centro's aim of addressing the east-west territorial imbalances at the heart of its S3. In all regions, economic growth and jobs are seen as the ultimate aims of innovation efforts. Nevertheless, it is increasingly understood that shifts in demand towards greener/cleaner products, processes and solutions will change the types of innovation that are needed to create value-added and jobs. The role of companies – in particular large companies such as the energy giants located in the Port of Rotterdam – in endorsing the strategy and contributing financially to its deployment, is therefore crucial.

**At institutional level, wider participation extending beyond the authorities in the field of research and innovation, is needed to form long-term and more integrated visions on the direction for change**. New governance configurations are being experimented with the aim to bring on board Ministries, administrations and agencies in charge of the various fields that are concerned by the system transitions. Examples include the merging of economy and environment competences in a single department in the Basque Country and enlarging the participation in Dutch 'Top Sectors' governance beyond the line ministries.

**Business-research partnerships active in regionally-based value-chains are key drivers in defining innovation-led Green Transition pathways.** In line with the practice in more advanced regions, Green Transition efforts rely principally on triple helix partnerships active in major innovation ecosystems. What is new for these partnerships is the task to define challenge-driven research and innovation agendas - i.e. research and innovation roadmaps incorporating *inter alia* the Green Transition. One example of this is Centro's structure of S3 Innovation Platforms, tasked to define transformative agendas to address societal challenges in each S3 priority area. Under three of the four Platforms, a Green Transition emphasis is clearly apparent.

**Citizens' voices remain only a minor driving force for innovation-led Green Transition**. This is chiefly due to the fact that the strategies analysed in this study embody priorities to promote deep changes in carbon-intensive industries, requiring foremost bold and synergetic involvement of companies and research actors. Citizens and/or end users are generally not involved in Green Transition initiatives where they are implemented strictly in business-to-research institute or business-to-business contexts. However, under the West Netherlands' S3 citizens are increasingly involved at project level in certain sectors.

**Local authorities develop their own strategies and play a growing role as test beds for new solutions, which involve citizens**. In all the Case Study Regions, citizens are increasingly involved in domains with a more meaningful impact on daily lives, such as in the food, healthcare and urban planning sectors, or to find ways to address mobility and circularity challenges. Cities and municipalities seem well placed to call on citizen's ideas and energy to design new initiatives in such fields. The phenomenon is exemplified by initiatives in urban planning in Kozani, Western Macedonia, in local energy transition in Ii and

other 'sustainable municipalities' in East & North Finland, as well as in sustainable mobility in Rotterdam, Zuid-Holland.

**S3 acts as a driving force only in some regions**. As the experts found during earlier work for the European Commission on the role of S3 in Green Transition.

> *"There is rarely a clear linear trajectory of, first design, then implementation of S3. It is usually rather more of a subtle process of S3 being 'implemented' through relevant projects developed sometimes independently, which feed the S3"* (Harding and Nauwelaers, 2021).

Indeed, actors in more advanced regions, with less dependence on EU Cohesion Policy, often do not easily distinguish between S3 and broader innovation strategies. A notable exception here is the Basque Country, which integrates S3 at the heart of the overall R&I strategy, even though it does not need or use EU Cohesion Policy Funds. Also, in East & North Finland, because of the NUTS 2 level S3's role in nurturing functional region value chains, it has a special importance even if it is not Finland's 'official' S3 level. In Centro, the regional S3 plays an important role in helping innovation actors engage in a bottom-up process to identify growth potential in areas of joint technological and business strengths. In these three regions, the addition of a transversal goal to support Green Transition in the S3 domains represents the newer approach for challenge-driven innovation policies. However in the other two regions, Western Macedonia and West Netherlands, S3 plays a marginal role as national directions and funding sources dominate the scene. The West Netherlands S3 provides a complementary contribution to other major interventions by supporting experiments and their scaling-up. Western Macedonia could be viewed as a region attempting to put in practice a 'related diversification' strategy towards Green Transition (see Boschma, 2017), which although in line with S3 philosophy, cannot actually be credited to the deployment of S3 in the region.

**Table 2.** Building strategies for innovation-led Green Transition – findings from the Case Study Regions

| Regions | Key findings |
|---|---|
| **East & North Finland** | ○ The coalition of seven NUTS 3 regions under the East & North Finland umbrella is seen as necessary achieve the critical mass for effective Green Transition, joining complementary competences in clean technologies and low carbon solutions; industrial circular economy, ICT and digitalisation and innovative technologies and production processes.<br>○ Business-research partnerships in key value-chains across the NUTS 2 region are drivers of the Green Transition. Regional authorities at NUTS 3 level play a proactive role by creating strong partnerships to counterbalance their 'political peripherality' in the Finnish (and European) context.<br>○ Directionality of innovation policies has been fostered by the S3 process, whereby triple helices of actors have identified resource-based value chains that are present in the wider region and need to be 'greened' to remain competitive. Related strategies in the region display a strong alignment with EU policies and rely on EU funding sources.<br>○ Cities and municipalities – together with their business development organisations - develop their own strategic plans, with strong focus on innovation and Green Transition. Frontrunner municipalities are networking to develop new solutions for carbon neutrality in transport, housing and energy. Cities also play an important role as test beds for new green solutions.<br>○ While citizen participation is not a major feature of strategy building at NUTS 2 level, participatory processes involving citizens are well developed at municipal levels and in the smaller NUTS 3 regions. |
| **Zuid-Holland (West Netherlands)** | ○ The new national 'Mission-driven Top Sectors and Innovation Policy' provides the high-level framework for guiding and funding Green Transition. It combines an existing aim to foster public-private collaboration with an increased focus on societal challenges. The Knowledge and Innovation Agenda for 'Energy Transition & Sustainability' includes targets, actions and projects of the short- and medium-term aiming at Green Transition. |

| Regions | Key findings |
|---|---|
| | ○ The West Netherlands S3 (which guides the *Kansen voor West* OP) is an amalgam of strategies defined at the level of the four Provinces, with priority domains aligned with the Dutch Top Sectors. The implementation focus, Entrepreneurial Discovery Process (EDP) and related decision making remain in the respective Provinces.<br>○ An established triple-helix partnership stands behind the Zuid-Holland Growth Agenda, the main strategy for the Green Transition of the Province. It builds on effective complementarity between Provincial and city levels of authorities, as well as strong business commitment. The Growth Agenda seeks 'green' impacts ($CO_2$ reduction), as well as economic impacts.<br>○ Citizens' involvement in increasingly required at the stage of project implementation - e.g. it is a new project selection criterion in several ERDF calls. Citizens are more directly engaged in local-level strategies design where the challenges are close to their daily lives, such as for the Rotterdam Climate Agreement or the development of Rotterdam's transition vision 'Towards Social and Sustainable Mobility by 2030'. |
| **Basque Country (Spain)** | ○ The Basque Country has adopted a cross-governmental and holistic approach to Green Transition under its main development strategy 'Agenda Euskadi 2030' and the related Basque Green Deal, ensuring synergies across all relevant policy areas. The region has also adopted a wide range of generic and specific strategies relevant for Green Transition and synergies between these strategies receive strong attention during planning and implementation.<br>○ The Basque Country incorporates societal challenges in its new R&I strategy 'STIP 2030' under three headline transitions – 'energy-climate', 'technological-digital' and 'social -health'. The new Basque regional S3 is embodied in STIP 2030, targeting not only technology, innovation and new business models, but also skills development to match S3 specialisations.<br>○ STIP 2030 is operationalised through dedicated triple helix partnerships embracing each of its strategic and emerging priorities, which develop challenge-driven research and innovation agendas. A quadruple helix participatory process has recently been introduced only at higher level of strategy development in the form of a Multi-Stakeholder Forum for Social Transition, chaired by the President.<br>○ At regional Government level, the competences in economy and environment have been integrated in one single Department, with, as a result, improved coordination between key players and the public agencies Spri (business development), Eve (energy) and Ihobe (environment). Sound cooperation is achieved between the Basque Region, Provinces and Municipalities at strategic and operational levels, to exploit operational synergies, avoid the duplication of functions and maximise the value of resources deployed.<br>○ Sub-regional government entities - municipalities and Provinces - are active in engaging citizens, e.g. the municipality network Udalsarea 2030 forges close links to citizens and the legacy of the long-lived cooperative movement in the Basque Country contributes to a positive dynamic in citizen involvement. |
| **Centro Portugal** | ○ Green Transition is incorporated into the general socio-economic development strategy of Portugal and in the country's Action Plan for a Circular Economy. Additionally, the Portuguese National Recovery and Resilience Plan incorporates cross-sectoral green recovery action lines, framed as 'solutions', covering whole value chains.<br>○ Centro's new S3 for 2021-2027 takes the triple green-digital-social transitions as the starting point for its plans to boost innovation in the region. Each of the S3 Platforms for Innovation defines transformative agendas to address societal challenges. Under three of the four Platforms, a Green Transition emphasis is |

| Regions | Key findings |
|---|---|
| | clearly apparent.<br>○ The regional authority CCDRC is a key agent of change for the innovation-led Green Transition. Even without a dedicated regional level budget, CCDRC is recognised by stakeholders as the leading orchestrator of partnership activity to promote innovation and the front door to EU Cohesion Policy and national funding.<br>○ Centro has developed its own Circular Economy Agenda. In this context, CCDRC notably coordinates the Centro Green Deal Network - in which participants commit to launch pilot Circular Procurement tenders and share knowledge gained from these experiences with the network.<br>○ Centro's S3 encourages as strong involvement of local level actors, with the goal to support more balanced territorial development. CCDRC seeks to establish a distributed governance model for the organisation of local EDPs around a specific challenge/need associated with each value chain targeted, in the context of green, digital and/or social transition. |
| **Western Macedonia (Greece)** | ○ Western Macedonia intends to engage in a ground-breaking shift towards a green hydrogen-based future, in order to replace its failing mono-industrial economic model, based on lignite extraction and use for power generation. The strategy is to capitalise on existing skills and infrastructure, to support a radical regional transformation towards a green energy hub, opening up considerable new employment opportunities to replace lignite-based jobs lost.<br>○ The key strategy for the green transition of Western Macedonia is the national Just Transition Development Plan (2021-2027). Western Macedonia will benefit substantially from the Just Transition Fund (JTF), taking around 63% of Greece's entire JTF allocation, amounting to just over €1bn. All of the JTF interventions will be managed nationally, under the new Just Transition Coordination Authority.<br>○ The region itself is institutionally 'thin' and is lacking social capital. Important domestic decisions and resources relevant for Green Transition in Western Macedonia are made at national level. Large companies and utilities are the primary actors of the energy transition. The Region itself has little room for manoeuvre to initiate new development directions.<br>○ The regional S3 appears as only as a minor factor in Western Macedonia's Green Transition. Due to its weak innovation potential, the region has not been engaged in a truly knowledge-based development strategy so far.<br>○ Western Macedonian citizens' awareness of environmental challenges and engagement with sustainable development is low. Due to resistance to change, or pessimism, people are leaving the region rather than building a new future there. New approaches towards co-creation with citizens are nevertheless emerging at local level, for example in the city of Kozani, which has recently been accepted by the EC for the Horizon Europe mission '100 Climate Neutral and Smart Cities by 2030'. |

Further detailed examples from the Case Study Regions are presented in Annex 2, in the boxes on interesting practices, featuring the following initiatives:

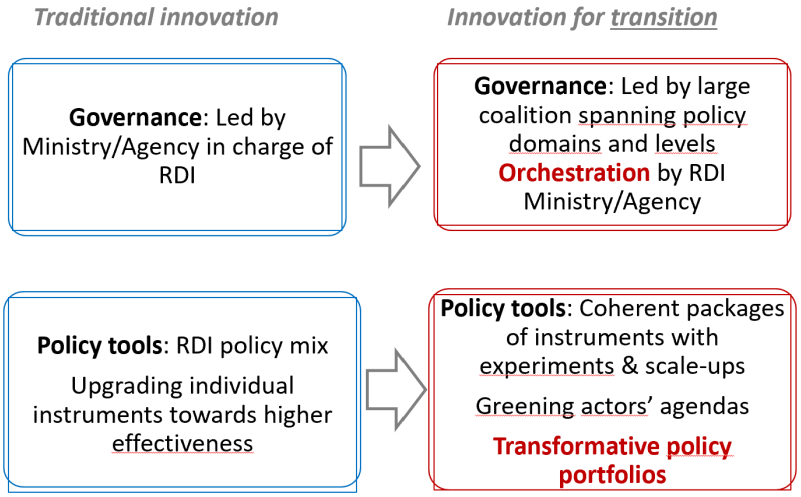
- East and North Finland
  - Good practice in participative processes: The Green Transition Committee of Lapland.
- Zuid-Holland
  - Green Transition featuring prominently in the Province's Growth Agenda.
- Basque Country
  - Societal challenges as transversal goals in STIP 2030, the overall strategy including the S3.

- Centro Portugal
  - Three societal challenges acting as horizontal drivers in the new S3 2021-2027.
- Western Macedonia
  - An emerging regional actor for knowledge-based Green Transition: the Cluster of Bioeconomy and Environment (CluBE).

## 4.3 Implementing strategies for innovation-led Green Transition

As illustrated in Figure 4, effective implementation of strategies to bring about innovation-led Green Transition, in contrast with traditional innovation strategies, calls for a considerably more broad-minded approach on behalf of policy-makers. Rather than a single RDI ministry or agency simply leading implementation, that body would be expected to orchestrate coalitions of actors to manage the implementation process collectively. Instead of just upgrading individual policy instruments to try and address evolving transition challenges, transformative policy portfolios will be needed, made up of coherent packages of mutually supporting instruments, allowing space for experimentation and favouring scale-up of successful pilot actions. Progressive greening of the agendas and missions of different innovation actors across the board can be expected to facilitate their evolution towards more collective multi-faceted implementation scenarios for Green Transition.

**Figure 4.** Implementing strategies for innovation-led Green Transition




Source: The Authors, June 2022

This Section examines the different experiences of the Case Study Regions in this regard, as they develop new implementation solutions to make Green Transition actually happen.

**In all cases, innovation-led Green Transition strategies are being implemented through multi-level policy mixes**. This is a natural situation for those regions that are highly dependent from the national level, as is the case of all Case Study Regions except the Basque Country. A logical configuration would be for national funds to support major investments, infrastructure, research activities at low TRL, with the role of the regions being to support experimentation and connections in the ecosystems, which have a higher localised impact. In reality, though, there is no such standardised division of responsibility between the regional and national roles. In West Netherlands, for example, the focus of the regional ERDF support is shifting from experimentation towards scaling up to achieve greater impacts, whilst in East & North Finland it is the national instruments that are used to promote local innovation systems. Some difficulties with aligning national funding channels with regionally developed Green Transition pathways are evident in the Case Study Regions. In Finland and Portugal, regional actors have experienced mismatches between the two levels in this respect, potentially reducing the effectiveness of regionally determined transition strategies.

**New instruments are being developed to support bold integrated projects geared towards system transition**. The cross-domain character of major transformative initiatives does not sit well with a fragmented landscape of policy instruments, where each support only one part of the system to be transformed, or a limited portion of the TRL scale, or only a specific sector or technology. To address this problem, new instruments are being developed that aim to support bold multi-technology, multi-actor and multi-sectoral endeavours. Such is the case of the Basque Country's 'Cross-Cutting Tractor-Effect Initiatives', or in West Netherlands, of the green meta-project GroenvermogenNL and the MOOI scheme associated to the new 'Mission-driven Top Sectors and Innovation Policy'. In East & North Finland it is the value-chain approach that helps to direct support towards larger integrated, rather than smaller scattered, projects. A general characteristic of such integrated interventions is that user-involvement is accorded a high importance. Another remarkable new development is the link between the technological and the skills dimensions of transition. Most of the Case Study Regions are making particular efforts to integrate higher education and vocational training actors into the implementation mechanisms of the strategies.

**In parallel, some regions are experimenting with different ways of 'greening' existing public funding schemes as well as strategic agendas of key research actors**. CCDRC, Managing Authority for the EU Cohesion Policy OP for Centro region, is introducing new experimental project selection criteria (e.g. relating to circularity), to give greater priority to applications more likely to contribute to the Green Transition. The introduction of a criterion of 'compliance with S3 domains' is another way to 'green' existing policy instruments, as the S3 lends itself such an approach. This is working most visibly in the Basque country, since the region has placed S3 at the core of its overall R&I strategy, which has a strong emphasis on Green Transition throughout. Also in the less advanced Case Study Regions, new developments are taking place to better align research agendas of regional university laboratories with Green Transition aims and engage in higher TRL projects closer to business and societal needs.

**Above all, Green Transition requires major funding to become reality**. In most regions, Green Transition will require deep transformation of regional economies, touching on many fields beyond research and innovation. Accordingly, bold transformative initiatives need very substantial funding from a range of sources. The greening of the Port of Rotterdam, for example, will simply not take place without a combination of huge private investment and major national support. The regional Growth Agenda of Zuid-Holland is specifically tailored to make sure that the necessary national funds will flow into the region for this purpose. Western Macedonia – with its White Dragon initiative – is also a case in point requiring € multi-billion external funding. The fact that the White Dragon has ultimately not been retained by the EC as an IPCEI project now creates uncertainty over the whole endeavour of Western Macedonia's Green Transition.

**Table 3.** Implementing strategies for innovation-led Green Transition – findings from the Case Study Regions

| Region | Key findings |
|---|---|
| **East & North Finland** | ○ The main policy tool to implement the 'green transformation' goals of the NUTS 2 level S3 is the national support available to innovation ecosystems and clusters.<br>○ Transformative policy portfolios in East & North Finland are characterised by:<br>- Main emphasis on achieving sustainability in businesses and developing new business solutions responding to new market demands<br>- High TRL level projects in order to ensure economic impact<br>- Use of advanced IT to support digital transition of companies and industries<br>- Tight cooperation between at least one (and often several) university or research units, together with companies, with a sustained effort to involve SMEs<br>- Cross-regional collaboration based on complementarity of expertise along value-chains |

| Region | Key findings |
|---|---|
| | - Combination of ERDF funds at regional level for feasibility or demonstration or low TRL projects, with national resources (e.g. Business Finland) for scaling-up and higher TRL (with also EU funds)<br>- Strong involvement in EU-level programmes (Interreg, Horizon, LIFE etc.) and networks.<br>o There is currently no dedicated policy instrument at the level of East & North Finland NUTS 2 region to implement cross-regional value chain projects nurturing Green Transition emerging from the S3 at this level.<br>o Under the EC Pilot Action 'Regions in Industrial Transition' a new funding instrument was experimented with at the NUTS 2 level during 2019-2020. The pilot instrument supported regional-level projects demonstrating green industrial applications in the timber, wood and forest sector, to be scaled up later using national public resources. |
| **Zuid-Holland (West Netherlands)** | o Public funding to support Green Transition in West Netherlands and Zuid-Holland comes chiefly from national sources, in particular the recently established €20bn National Growth Fund and the Dutch National Fund for Green Investments. Provincial budgets and ERDF funding account for considerably smaller proportions of the total.<br>o The Zuid-Holland Growth Agenda is implemented through 'system interventions', crossing policy domains: for example the meta-project GroenvermogenNL, funded by the National Growth Fund, aims to scale up an ecosystem around green hydrogen and green chemistry, embracing also infrastructure and land planning, a wide spectrum of research and innovation from TRL 2 to TRL 8, as well as substantial human capital development. The national MOOI scheme specifically targets system innovations that offer an integrated solution to users' problems.<br>o In this context, ERDF funding is increasingly geared towards scaling-up and close-to-market innovations to achieve broader societal impacts. There is a shift in funding instruments towards higher TRL, less focus on start-ups and more on proof-of-concept and scale-ups and support to 'fieldlabs 2.0' closer to market, with more SMEs and greater involvement of end users. |
| **Basque Country (Spain)** | o A main change agent, with its strong orchestrating power, is the Basque Country Government itself. Omnipresent throughout the regional landscape of policy development and implementation for Green Transition, it holds the levers to support most of the drivers of the transition.<br>o Policy instruments increasingly incorporate Green Transition in their funding models. New 'green' criteria are included in funding schemes regulations.<br>o A new transformative policy portfolio is being developed in the form of 'Cross-Cutting Tractor-Effect Initiatives', inspired by the Horizon Europe 'Missions', with the aim to build sizeable multi-disciplinary initiatives in strategic interface areas with potentially substantial social impact. The spirit of experimentation is embodied most visibly in the region's plans for these Initiatives.<br>o With the 'super-clusters' – i.e. the creation of bridges between cluster organisations and encouraging companies and research institutions to cooperate across clusters – the Basque Country is lifting its renowned cluster strategy to a new dimension.<br>o The Basque Research and Technology Alliance (BRTA), with its evolving |

| Region | Key findings |
|---|---|
| | network of technology centres, has been reoriented towards a results-based model, working closer to market (TRL 5-9). Mandates and strategic research agendas of its members have been redefined to respond better to the region's needs.<br>○ Experimentation around sustainable cities and municipalities is taking place at local level. Local authorities use and generate new knowledge for place-based Green Transition and promote the culture of urban sustainability. The Urban Klima initiative has built up a complete multilevel governance on climate change adaptation, circular economy, efficient use of resources and natural heritage. |
| **Centro Portugal** | ○ Innovation support instruments and funding schemes are designed and operated principally at the national level, with the Foundation for Science and Technology (FCT) and the National Agency for Innovation (ANI) as main funding agencies. They notably support 'Collaborative Laboratories' (CoLABs) - associations of public and private research entities, established to address complex, large-scale development issues (e.g. the circular economy), whilst ensuring positive social impact and economic added-value.<br>○ Synergies between national- and regional-level S3s still need to be developed. For the 2014-2020 period, Portugal's national S3 was not well informed by regional S3s and did not promote inter-regional cooperation.<br>○ The universities are key players with progressively greener agendas for research and education. Engaging increasingly in higher TRL-levels, the research outcomes are coming closer to societal needs. The bridging organisations between public research institutes and companies are also increasingly incorporating environmental objectives, such as clean energy and/or circular economy, in their agendas.<br>○ Under Centro's Regional OP (ROP) 2014-2020, the Managing Authority CCDRC had little scope to launch Calls to specifically address regional needs and opportunities related to Green Transition under the mainstream Thematic Objectives for Research Technological Development and Innovation and SME Development. This was due to strong national level control over the implementation process in these fields. The requirement for 30% of ERDF to contribute to the achievement of the climate objectives is expected to encourage greener projects under the new ROP for 2021-2027.<br>○ CCDRC experimented with the use of new criteria able to introduce directionality in projects, e.g. 'circularity' criteria, however the weight of the criteria in the evaluation process has proven insufficient so far to influence choices.<br>○ Inter-municipal communities and cities together with CCDRC and universities are beginning to develop "green" place-based initiatives, where there is more freedom to tailor ERDF support. These initiatives have the dual goal of fostering innovation in important sectors of national importance and securing regional/local development. |
| **Western Macedonia (Greece)** | ○ Huge public and private investments are foreseen to support Western Macedonia's transition to a green hydrogen-based economy, combining EU, national and regional and private funds - over €7.4bn in total for the period 2020-2030. On top of infrastructure investments, this will also embrace an extended portfolio of domestic instruments, including subsidies and special aid |

| Region | Key findings |
|---|---|
| | schemes for targeted 'energy Municipalities', with higher aid intensities, complementary employment programmes and studies and funds for repurposing power plants and post-mining land use.<br>o The 'White Dragon' initiative was also to bring development of a specialised innovation hub for hydrogen, green energy and environmental technologies, to accompany the transition. However, this initiative has not been retained by the EC as an IPCEI project. While some parts of White Dragon are still expected to be implemented, this setback is likely to slow the speed of Green Transition of the region.<br>o Unlike regions with more distributed innovative potential, Western Macedonia is not engaged in a multiplicity of experimental initiatives covering various facets of the Green Transition. However, some seeds for change are apparent in the recently expanded University of Western Macedonia and at the Centre for Research and Technology Hellas, which are devoting efforts in developing innovation-led Green Transition agendas. |

Further detailed examples from the Case Study Regions are presented in Annex 2, in the boxes on interesting practices, featuring the following initiatives:

**East & North Finland**

- A municipality initiative for Green Transition: EcoSairila and Blue Economy Mikkeli - Combining municipal and industrial material cycles with water circularity

**Zuid-Holland**

- Greening the Port of Rotterdam: Strategic mix of initiatives for a very bold transformation

**Zuid-Holland**

- Experimentation and scaling up through Fieldlabs: Technical University Delft Campus – The Green Village

**The Netherlands**

- Mission-driven Research, Development and Innovation (MOOI): Supporting large-scale, high impact projects

**Basque country**

- 'Greening' research and innovation funding schemes

**Basque Country**

- Transformative policy portfolio in the form of new 'Cross-Cutting Tractor-Effect Initiatives'

**Basque Country**

- Net Zero Industrial Super Cluster

**Basque Country**

- Combining People, Planet and Prosperity goals in regional initiatives: the Opengela project

**Centro Portugal**

- Biocant - a biotech innovation ecosystem in its own right

**Centro Portugal**

- BLC3 and CECoLAB - Technology and Innovation Campus for bioeconomy and circular economy

**Western Macedonia**

– Transformation of the region into a green energy hub: Difficult start for the White Dragon initiative

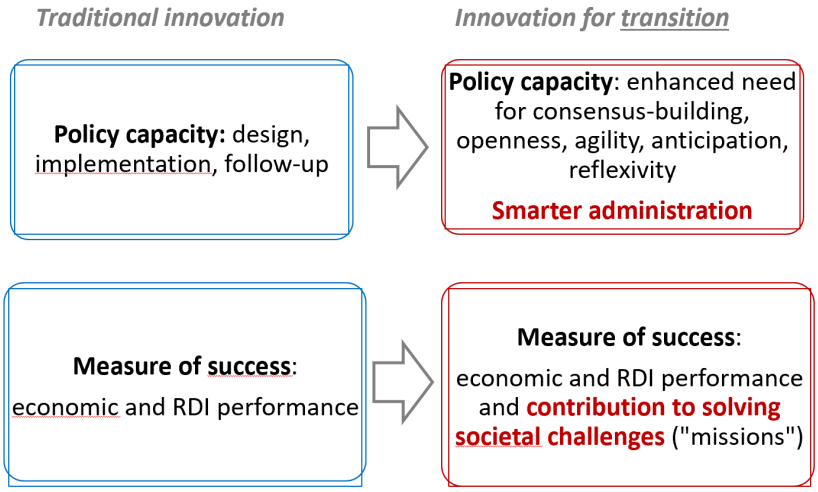
**Western Macedonia**

– The Centre for Research and Technology Hellas (CERTH)

## 4.4 Understanding innovation-led Green Transition

Figure 5 attempts to show differences in the level of strategic understanding required for successful innovation-led Green Transition, compared to more traditional innovation strategies. Above all, reliable policy intelligence is called for to enable agile evidence-based decision making to refine strategic and implementation approaches as circumstances evolve. The depth of policy intelligence needed implies a smooth background functioning of robust monitoring and evaluation systems capable of capturing transition dynamics in a societal context.

**Figure 5.** Understanding innovation-led Green Transition




Source: The Authors, June 2022

This final analytical Section looks into the efforts deployed so far, by the Case Study Regions, in building up Green Transition policy-relevant evidence bases and monitoring and evaluation capacities, as a basis for 'smart' implementation management in this regard.

**Designing and implementing innovation-led Green Transition strategies requires strong capacity, which few regions have**. Conducting deep systemic transformation involving large sets of actors, from various domains and policy levels, requires strong capacities from the responsible regional authorities. In this context, the institutional autonomy and strong powers, including regulatory and financial, enjoyed by the Basque Country Government flanked by several strong agencies, are clear assets. The Basque Government is able to play an orchestrator role that fits well with the strategy's ambition. Smaller administrations in centralised states, such as the Western Macedonia's authorities or the NUTS 3 regions making up East & North Finland, do not possess such wide competences or extended staff resources. A way forward for the latter is to join forces and find synergies within the wider coalition of seven NUTS 3 regions. The CCDRC in Centro also faces such limitations and is trying to nurture its capacities by engaging in EU-level learning networks. Indeed, most of the Case Study Regions demonstrate high openness to external views and influences and a readiness to learn from experiences elsewhere in the EU and further afield. Combining forces with local level authorities to mitigate the lack of capacities at regional level, is a practice found in many of the regions too. In Zuid-Holland the work of Provincial authorities is well-supported by InnovationQuarter, an innovation-focused regional development agency, jointly owned by public and private actors in the region.

**Regional authorities are building up knowledge bases to better understand Green Transition challenges and opportunities, but more needs to be done in this regard**. Weak internal capacities combined with the complexity and novelty of Green Transition challenges make the task of orchestrating effective Green Transition Strategies by regions a substantial endeavour. Some regions like Western Macedonia highly depend on external analyses and advice (e.g. from World Bank, OECD, EC) with the risk of limited absorption capacity of these inputs. Others engage in creating their own knowledge sources in the form of region-specific observatories like in Centro or the Basque Country. National knowledge bases are also used, with the problem that regional disaggregation is not always available. Most regions also order specific studies, with higher chance of concrete application, when these are linked to an established strategy – such as mapping opportunities for industrial symbiosis in the framework of Centro's circular economy Agenda. Regular interaction with academics or think tanks is becoming common only in the more advanced regions like Zuid-Holland – using meta-data worked through by the University of Utrecht to provide evidence for regional S3 priorities, or the Basque country – relying on the regional Deusto University for continuous advice on policy orientations and for strategy evaluations.

**Smart 'Green Transition' oriented monitoring systems still need to be properly developed**. In all Case Study Regions, monitoring systems for innovation strategies are being built and upgraded, with various levels of sophistication. However, they are all still oriented towards research and innovation outcomes in a traditional sense. In several regions, separate efforts are being deployed under other strategies – particularly those explicitly linked to the SDGs - to measure Green Transition evolutions. The next step ahead is to create linkages between these monitoring efforts to match the cross-domain ambition of Green Transition strategies with relevant monitoring tools.

**Table 4.** Understanding innovation-led Green transition – findings from the Case Study Regions

| Region | Key findings |
|---|---|
| **East & North Finland** | ○ The NUTS 3 regional administrations in East & North Finland are of small size. Nevertheless, capacity at regional and municipal levels is impressive – often supported by participation in numerous projects, many of which are funded by ERDF.<br>○ National bodies equip authorities in the region with knowledge bases, data and studies relevant to monitor evolutions in their main sectors, as well as the state of the environment.<br>○ Innovation projects relevant for Green Transition are monitored by the funding bodies concerned. However, the division of work between regional and national bodies is not conducive to monitoring outcomes and impacts of projects in an integrated way.<br>○ Green monitoring indicators are a requirement for innovation projects in each of the NUTS 3 regions, however there is no centralised East & North Finland monitoring, at NUTS 2 level, to measure aggregated outcomes of this type.<br>○ Individual NUTS 3 and city level authorities are developing dashboards to follow-up on the 'green' achievements of their strategies. |
| **Zuid-Holland (West Netherlands)** | ○ Implementation of Green Transition in Zuid-Holland is supported by an innovation-focused agency, InnovationQuarter, owned by the Province and public and private shareholders. InnovationQuarter stimulates innovation by consortia building, developing innovation programmes, financing start-ups and scaleups with revolving funds and attracting inward investment by companies that fit within the ecosystems.<br>○ Zuid-Holland's strategy benefits from in-depth original analytical work conducted by regional universities and international organisations. |

| Region | Key findings |
|---|---|
| | Policymakers in the region are connected to and call upon expertise both from within and outside the region. Work carried out at Utrecht University[5] is used to confirm/qualify chosen S3 domains using sophisticated 'big data' type analysis. There is also macroeconomic analysis of the impact of the Growth Agenda by Erasmus University Rotterdam[6] and OECD reviews on policy approach[7].<br>o Effective monitoring of Green Transition and its dynamics is not yet well developed. Monitoring of S3 relies on EC Cohesion Policy common indicators, which generally reflect classical innovation outcome measurement. Indicators set at national level under the 'missions' can provide reference for regional monitoring, provided that a regional disaggregation of these targets becomes available. |
| **Basque Country (Spain)** | o The Basque Government's autonomy is matched by particularly strong financial and human capacities and effective public sector collaboration. Government capacity is supported by established agencies with high stability and proven track records of achievement: SPRI for economic development, Innobasque for innovation, Ikerbasque for science and Ihobe for environment. An appetite to learn from foreign experiences also contributes to government capacity.<br>o The Basque Government is well equipped with intelligence tools to further evidence-based planning and programming of relevant initiatives: Innobasque collects and analyses all data on R&I and performs analyses of key industrial sectors; Ikerbasque maintains and analyses data on scientific activity in the region under Ikerboost, the Basque Science and Technology Observatory; Orkestra, an economic research institute part of the Deusto University, hosts three Basque Observatories - on Competitiveness, Vocational training and Digital Economy and Society – and produces in-depth annual Basque Competitiveness Reports; EnergiBasque collects detailed R&D expenditure and employment data by energy field; environmental data covering all relevant areas - air, soil and water pollution, GHG (greenhouse gas) emissions, waste flows, biodiversity etc. are produced by the Government.<br>o The regional Government regularly calls upon the Basque academic community and beyond for independent evaluations of their policies. Local authorities also benefit from policy intelligence tools - e.g. Ihobe's Local Sustainable Development Observatory.<br>o Despite advanced monitoring practices, there is still a gap to bridge between the R&I indicators used for monitoring STIP 2030 and indicators capturing evolutions in societal challenges under the SGDs. |
| **Centro Portugal** | o The lack of political and budgetary autonomy limits administrative capacity at the regional level. The regional administration makes extensive use of opportunities for policy learning in EU-funded projects (Horizon, Interreg).<br>o CCDRC benefits from a wide knowledge and database to underpin its work, in |

5 (Balland and Boschma, 2020)
6 (Provincie Zuid-Holland, 2021)
7 (OECD, 2021a).

| Region | Key findings |
|---|---|
| | the form of a central data platform (CCDRC Datacentro), which gathers data on a large set of indicators, from a variety of sources, on the situation of the region. The availability of such comprehensive regional datasets enabled Centro to evolve towards an evidence-based approach in its first generation regional S3 for 2014-2020.<br>o Detailed data relevant for Green Transition have been collected during preparation of the new S3 for 2021- 2027 - e.g. to understand material flows in order to develop industrial symbiosis initiatives. The evolution continues in the work of the Innovation Platforms involved in delivering the new S3.<br>o Centro's monitoring system analyses projects funded under EU Cohesion Policy according to S3 priorities, but it is not really a strategic monitoring system capable of capturing Green Transition dynamics. |
| **Western Macedonia (Greece)** | o The context of institutionally weak regional administrations in Greece acts as a bottleneck to the Region playing a strong role in consensus-building and orchestrating the innovation ecosystem. With the Regional Governor associated to the national Just Development Transition Steering Group and a new vice-governor for the green transition appointed, both in 2021, the Region now at least has identified leaders for its Green Transition strategy.<br>o The region mainly relies on external studies - in particular by the World Bank[8] and also a Horizon 2020 project[9] - for understanding the major energy-related transition challenges. While this approach is amply justified due to the breadth and depth of these challenges, the need for permanent observatories and analytical capabilities anchored in the region remains largely unmet.<br>o With the establishment of the regional RIS3 Unit, the situation in terms of policy monitoring in the region is gradually changing, with increased capacity for the Region to follow-up implementation. Efforts are ongoing to create information tools on regional research and innovation projects.<br>o A new development is underway in the form of a specific tool for monitoring skills needs, the new Employment Enhancement and Monitoring Portal.<br>o Overall, though, the monitoring approach is mainly one of compliance with EU Cohesion Policy common indicators. |

8 (World Bank, 2020a 2020b and 2020c)
9 (TRACER, 2020)

# 5 Summary and Conclusions

This report aimed at understanding the evolutions in different regions' innovation policies, when moving towards more challenge-driven models. Focusing on Green Transition as a key societal challenge, the research investigated how regions are refining their strategic approaches and related delivery methods – particularly under Smart Specialisation Strategies (S3) - to promote innovation-led Green Transition most effectively for the new 2021-2027 EU funding period.

The five Case Study Regions differ not only in terms of economic performance and institutional power, but also in terms of innovation potential. All of them face Green Transition challenges specific to their geographic situations, economic specialisations and associated carbon footprints. Basque Country has the greatest autonomous regional institutional power. Zuid-Holland is able to shape national policy implementation to its particular needs and East & North Finland is also gaining power based on voluntary bottom-up coalition of lower geographical level administrative units. Centro Portugal has significantly less power at the regional level, whilst for Western Macedonia almost all key decisions for Green Transition are taken at the national level. Interestingly, among the Case Study Regions, those with the least institutional power at regional level generally have the lowest economic performance and innovation potential. Basque Country, Zuid-Holland and East & North Finland are classed as Strong Innovators in the 2021 EU Regional Innovation Scoreboard, while Centro Portugal is classed a Moderate Innovator and Western Macedonia only an Emerging Innovator.

Notwithstanding the diversity between the Pilot Regions, the authors seek here to draw conclusions relating more to the commonalities in approach, which emerge from the research undertaken, and which could have broader applicability. In this regard, the following ten key conclusions have been drawn:

1. **All three varieties of Green Transition drivers - the *carrots, sticks* and *sermons* - are identifiable in all the Case Study Regions, in different combinations.** *Carrots* – in addition to new domestic and EU funding opportunities - are seen in ever increasing demand for green products and services, holding the promise of growth and jobs opportunities in regions able to become frontrunners in this regard. *Sticks* are the regulations forcing changes, such as closure of high GHG emitting and/or polluting industries, as well as the prospect of tighter regulation to come. The rise of high-level green narratives - not the least those originating from the EU - represent the *sermons*, which speak to politicians, citizens and ecosystem actors, shaping individual and collective agendas.
2. **Challenge-driven innovation strategies are being increasingly led by *mission*-type approaches.** Such reorientations, in the spirit of EU Horizon Missions, add direction to more traditional strategic objectives of simply supporting more and better diffused innovation. They are based on longer term visions and holistic ways of achieving system-level Green Transition, rather than simply 'green technology' developments. Of the Case Study Regions, *mission*-type approaches are most evident in Zuid-Holland and the Basque Country.
3. **The role of S3 as a driving force for innovation-led Green Transition is highly variable between the Case Study Regions**. In three of the regions – Basque Country, Centro and East & North Finland - the new S3s for 2021-2027 see the addition of a transversal goal to support Green Transition across their domains of specialisation. In the case of the Basque Country, where S3 is fully embedded in the region's innovation policy and the regional Government controls most of the levers and relevant funding sources, S3 indeed plays the crucial role for innovation-led Green Transition. For East & North Finland, the 'extra' S3 at NUTS 2 level helps encourage cross regional value-chain approaches to Green Transition objectives, although the 'official' S3s are adopted at the level of its seven constituent NUTS 3 areas. However, neither Centro, nor East & North Finland have full control over the national funding instruments available, which are not always aligned to the needs of their regional S3s. In the other two regions, Zuid-Holland and Western Macedonia, S3 plays only a marginal role as national directions and funding sources dominate the scene. In the case of Zuid-Holland, the S3 is adopted at the higher West Netherlands geographical level to meet the related Enabling Condition for EU Cohesion Policy funding and has low visibility for Zuid-Holland actors.
4. **Green Transition is a major transition, requiring correspondingly high levels of funding – its innovation aspects often depend upon major mainstream investments taking place.** Green Transition calls for deep transformation of regional economies, touching on many fields beyond research and innovation. Bold transformative initiatives need very substantial funding from a range of sources, not least from the private sector. Even where a region receives high levels of EU Cohesion Policy Funds,

as in the case of Western Macedonia, these are not sufficient alone to drive the transition forward and secure top quality innovation opportunities. The contribution of major private actors is essential. Strategies are planned and implemented in all the Case Study Regions through multi-level policy mixes, in which public resources can be expected to have a strong leverage effect on private funding. However, in such scenarios, if certain public funds fail to come forward as foreseen, there is a heightened risk of collapse of entire initiatives, which can have negative knock-on effects on R&I-driven Green Transition aspirations.

5. **Policy experimentation relevant for innovation-led Green Transition is taking place across the Case Study Regions in both 'mission'-type and 'horizontal' modes.** In line with the cross-domain character of major transformative initiatives, new policy instruments are being developed with the aim of supporting well-specified particular 'missions' based on bold multi-technology, multi-actor and multi-sectoral endeavours, with high user-involvement - in some cases in strong synergy with skills development initiatives. The Basque Country's planned 'Transversal tractor-effect initiatives' linking S3 domains, or the strategic greening of the Port of Rotterdam in Zuid-Holland, represent rich examples of such major targeted interventions. More horizontal-type approaches can also be seen in the regions, which seek different ways of greening existing public funding schemes across the board as well as strategic agendas of key research actors. Centro, for example, has introduced new green criteria in institutional and competitive funding schemes in the context of its own Circular Economy Agenda.

6. **There has <u>not</u> been a significant increase in citizen involvement, in the Case Study Regions, in developing innovation strategies for 2021-2027, despite their generally broader societal focus.** Partnerships working on building the new generation of S3 and related innovation strategies have remained largely triple helix in character, rather than extending to embrace actors of the fourth helix. Most strategic Green Transition initiatives are implemented predominantly in business-to-research or business-to-business contexts. Some of the Case Study Regions have nevertheless seen greater involvement of other ministries and agencies responsible for other fields concerned by system transitions, who have not traditionally been part of the innovation ecosystem. Citizens and/or end-users, however, *are* increasingly involved at the project level, especially in regions where interventions support innovations higher up the TRL scale.

7. **Increased importance of place-based innovation approaches <u>within</u> the Case Study Regions is noticeable, enhancing the role of local authorities and increasing the scope for citizen participation inside interventions supported.** The territorial dimension of Green Transition is experimented in depth in municipalities and cities. The challenge being addressed here is that of scale-up of successful initiatives to contribute best to wider regional ambitions. In this context, local territories increasingly act as testbeds for new green solutions in areas such as food, healthcare, urban planning, mobility and circularity, all areas that are closer to citizens' daily lives. It is at this local level that chances of more citizen involvement seem greatest.

8. **The relevant authorities across the Case Study Regions display substantial differences in capacity, with low capacity representing an important obstacle to successful innovation-led Green Transition.** Whilst some of the regions have visibly strong capacities to orchestrate deep systemic transformation involving actors from various domains and policy levels, others are stretched decidedly thinly in this regard. Again, strength of regional level implementation capacity bears a strong relationship to regional institutional autonomy. Some of the regions have found diverse ways to compensate for the lack of internal capacity. East & North Finland presents an interesting case here. The capacities of its constituent NUTS 3 authorities appear relatively modest, particularly in view of the vast geographical areas they need to cover. Yet East & North Finland manages to punch far above its weight in terms of implementation capacity, through its strong culture of inter-authority collaboration and irrepressible openness to international networking and learning from foreign practice.

9. **None of the Case Study Regions have yet been able to develop knowledge bases or monitoring systems capable of capturing the full effects of innovation investments on Green Transition.** Existing monitoring systems in the Case Study Regions are generally geared to monitor innovation policies in a traditional sense and comply with EC requirements for Cohesion Policy funding. There are noteworthy developments in policy intelligence sources visible in the Basque Country, as well as interesting experiments with *big data* approaches in Zuid-Holland. However, there is a distinct lack overall of systems capable of capturing the full effects of planned innovation interventions on Green Transition

dynamics, to match the increasing sophistication of regional strategies in this context. This is the principal weak point to emerge from the research in the Case Study Regions.

10. **The move towards addressing societal challenges in S3 and other innovation strategies remains relatively new and these strategies should not be considered 'set in stone'.** Looking to the future, it seems important to reiterate that the Smart Specialisation approach was never meant to embody unidimensional on-paper strategies which could not evolve during their implementation period. The innovation strategies relevant for Green Transition in the Case Study Regions, adopted for the start of the new EU funding period 2021-2027, should be capable of refinement during implementation as circumstances change. Efforts deployed by pioneer regions to foster more society-aware approaches in their innovation strategies can be expected to come under greater scrutiny by the communities they aim to address, as well as beyond, as citizens and end-users become more involved. This itself constitutes a growing challenge for the regional authorities responsible for innovation-led Green Transition.

Overall, the research showed that all five Case Study Regions are engaged in enhanced strategic efforts, compared to the 2014-2020 funding period, to create their own original pathways towards Green Transition, in which innovation plays a significant role. However, the nature of these efforts, how the strategies are effectively to be brought to life and how their outcomes can be measured varies widely between these regions. The variety is further detailed in the individual Case Study reports for each of the five regions, which accompany this overall Final Report on the assignment.

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## List of abbreviations and definitions

| | |
|---|---|
| EC | European Commission |
| EU | European Union |
| EU ETS | EU Emissions Trading Scheme |
| GHG | Greenhouse gas |
| GDP | Gross Domestic Product |
| JRC | Joint Research Center |
| OP | Operational Programme |
| OECD | Organisation for Economic Co-operation and Development |
| NUTS | Nomenclature of territorial units for statistics |
| R&I | Research and Innovation |
| S3 | Smart Specialisation |
| S3P | Smart Specialisation Platform |
| SDGs | Sustainability Goals |
| TRL | Technology readiness levels |

## List of boxes

## List of figures

## List of tables

## Annex 1. Lists of interviews

| **Region 1.** Wester Netherlands | | |
|---|---|---|
| *Date and location* | *Interviewees* | *Position* |
| 14.03.2022 - Rotterdam | Ruud van Raak | Head Managing Authority Kansen voor de West |
| | Stijn van der Walle | Policy Coordinator – Team Strategy and Programming - City of Rotterdam |
| | Ron Boschma | Professor – University of Utrecht |
| 15.03.2022 – Rotterdam | Wouter van Neerbos<br>Diederick Jaspers | CEO Obbotec N.V.<br>CTO Obbotec N.V. |
| 15.03.2022 – The Hague | Koen de Pater (virtual) | Ministry of Economic Affairs and Climate |
| | Djoeke Altena | Senior Adviser public affairs – Economic Board Zuid Holland |
| | Angelique Erkelenbosch | Business developed circular economy - Industry Transformers at Innovation Quarter |
| 16.03.2022 - Delft | Marjan Kreins | Director – The Green Village |
| 17.03.2022 - The Hague | Jean-Christophe Spapens | Manager European and International Affairs- Province Zuid-Holland |
| | Linco Nieuwenhuyzen | Secretary – Economic Board Zuid Holland and Strategy Manager Innovation Quarter |
| | Jan Jacob Vogelaar | Adviser strategy - Innovation Quarter |
| **Region 2.** Western Macedonia | | |
| *Date and location* | *Interviewee* | *Position* |
| 22.03.2022 - Kozani | Kasapidis George | Regional Governor Western Macedonia |
| | Tsioumaris Grigoris | Vice Regional Governor of Green Transition |
| | Ntio Eufrosini | Vice Regional Governor of Entrepreneurship |
| | Papadimitriou Thanasis | Tourism Dept. of Region of Western Macedonia |
| | Mavromatidis Dimitris | Director of Regional Development Fund of Western Macedonia |
| | Mahairas Vasileios | RIS3 Office of Western Macedonia |
| | Zourla Aphrodite | RIS3 Office of Western Macedonia |
| | Sidiropoulos Anastasios | Director of Green Transition of ANKO SA |
| | Theodoulidis Theodoros | Rector of the University of Western Macedonia |
| 22.03.2022 - Amyntaio Power Plant | Grompanopoulos Konstantinos<br>Zarkas Alexandros | Management Director of PPC SA<br>Project Manager of Northern Greece - PPC SA |
| 23.03.2022 - Ptolemaida | Grammelis Panagiotis<br>Margaritis Nikos | Centre for Research & Technology (CERTH) |
| 23.03.2022 - Amyntaio/Alpha Estate | Nikou Konstantinos | Wine Cluster Amyntaion Oinos |
| 23.03.2022 - | Koulidis Dimitrios | Solergon/Greece 2028 |

| | | |
|---|---|---|
| Filotas | | |
| 23.03.2022 - Kastoria | Evangelou Christina | Hellenic Fur Federation |
| 23.03.2022 - Kozani | Mitliagas Ioannis | President of Kozani Chamber of Commerce & Industry |
| 24.03.2022 - Kozani | Papadopoulos Ioannis | Head of Managing Authority of Western Macedonia |
| 24.03.2022 - Florina | Tiriakidis Vasilis | B&T COMPOSITES |
| 24.03.2022 - Kozani | Fallas Ioannis | CluBE |
| | Pitenis Dimitris | Pitenis Bros S.A. |
| 31.03.2022 - (virtual) | Moussouroulis Kostis | Chairman of the Steering Committee for National Just Transition Programme |

| **Region 3.** Basque Country | | |
|---|---|---|
| *Date and location* | *Interviewee* | *Position* |
| 05.04.2021 Vitoria-Gasteiz | <u>Lehendakaritza - Basque Presidency</u> | |
| | Cristina Uriarte | Commissioner for STI |
| | Carlos Peña | Advisor |
| | Iker Atxa | Director of Social Innovation |
| | <u>Education</u> | |
| | Adolfo Morais | Deputy Minister for Universities and Research |
| | Miren Artaraz | Director of University policy and Coordination |
| | Rikar Lamadrid | Director of Technology and Advanced Learning |
| | Iñigo Araiztegi | Director for Internationalization at TKNIKA |
| | Pilar Alonso | Director for Applied Innovation to Strategic Environments at TKNIKA |
| | Mari Jose Barriola | Director for Biosciences and Sustainability at TKNIKA |
| | Ruth Mayoral | Director for Strategic programmes at EUSKAMPUS |
| | Mikel González | Senior Researcher at BC3 and Associated Professor at UPV/EHU |
| | <u>Euskadi Creativa - Basque CCIs</u> | |
| | Andoni Iturbe | Deputy Minister for Culture |
| | Aitziber Atorrasagasti | Director of Culture Promotion |
| | Josean Urdangarin | Technician responsible of Basque DCC |
| | Tomás Iriondo | Director of Cluster GAIA |
| | Alexander Boto | General Director of IHOBE |
| | Edu Uribesalgo | Director of Innovation and Sustainability at TERNUA |
| | <u>Innobasque - Basque Innovation Agency</u> | |
| | Leire Bilbao | Managing Director |
| | Alaitz Landaluze | Director of innovation policies |
| | Idoia Bidaurrazaga | Project Manager at INNOBASQUE |
| | Virginia Matesanz | Marketing Director at Basque Country FOOD Cluster |

| **Region 3.** Basque Country | | |
|---|---|---|
| *Date and location* | *Interviewee* | *Position* |
| 06.04.2022<br>Bilbao | <u>Economic development, sustainability and environment</u> | |
| | Arantxa Tapia | Minister for Economic development, sustainability and environment |
| | <u>Smart Industry and Cleaner Energies</u> | |
| | Estibaliz Hernaez | Deputy Minister of Innovation, Technology and Digital Transformation |
| | Mikel Amondarain | Deputy Minister for Industry |
| | Alberto Fernandez | Director of Technology and Innovation |
| | Cristina Oyon | Director of Technology, Innovation and Sustainability of SPRI |
| | Agustin Saez | Strategy, Market and Technology Director at TECNALIA |
| | Nuria Gisbert | General Manager of CIC- EnergiGUNE |
| | Ainara Ratón | Strategic Initiatives at SPRI |
| | Isabel Busto | Deputy CEO of ZUCHETTI Spain and member of Cluster GAIA |
| | Aitor Atutxa | Managing Director of MAIER R&D Unit |
| | Josu Aranguren | SENER |
| | David Carrascosa | Operations Director at SAITEC |
| | José Luis Villate | Director for Renewable Energy, Energy Efficiency and Circularity at TECNALIA (BRTA) |
| | Jon Kepa Gerrikagoitia | Science and Technology Manager at BRTA |
| | <u>Personalised Health</u> | |
| | Marian Ibarrondo | Director of Health Research and Innovation |
| | Lorea Mendoza | BIOEF, Basque foundation for health Innovation and Research |
| | Joseba Laka | ICT Division Director at TECNALIA (BRTA) |
| | Nekane Murga | Director of Precision Medicine and Advanced Therapies at OSAKIDETZA |
| | Unai Ayala | Researcher and Lecturer at MONDRAGON UNIBERTSITATEA |
| | Pedro Carrascal | Managing Director of FUNDACIÓN ESCLEROSIS MÚLTIPLE EUSKADI |
| 07.04.2022<br>San Sebastian | <u>Healthy Food</u> | |
| | Bittor Oroz | Deputy Minister of Agriculture, Fisheries and Food Policy |
| | Elena Gutierrez | Innovation manager at HAZI |
| | Rikardo Bueno | Managing Director of BRTA |
| | Carlos Garbisu | Chief Executive Officer at NEIKER (BRTA) |
| | Marta Aranguren | Innovation Department at UDAPA |
| | Sebastian Echebastar | ECHEBASTAR Group |
| | Xabier Irigoyen | Director of Science at AZTI (BRTA) |
| | <u>Ecoinnovation</u> | |
| | Amaia Barredo | Deputy Minister for Environmental Sustainability |
| | Alexander Boto | General Director of Ihobe |
| | Ander Elgorriaga | Ecoinnovation Officer at Ihobe |

| **Region 3.** Basque Country | | |
|---|---|---|
| *Date and location* | *Interviewee* | *Position* |
| | Joseba Bilbatua | Innovation and Technology Manager at MONDRAGON CORPORATION |
| | Efren Feliu | Climate Change Adaptation Manager at TECNALIA (BRTA) |
| | <u>Sustainable Cities</u> | |
| | Ignacio de la Puerta | Director of Territorial Planning and Urban Agenda |
| | Rufino Hernandez | University of the Basque Country |
| | Olatz Grijalba | University of the Basque Country |
| | Jon Ansoleaga | General Manager of Cluster ERAIKUNE |
| | Andoni Hidalgo | Representative of OPENGELA |
| | Alex Carrascosa | Consultant and Facilitator at Fundación EDE |
| | <u>Province Councils and Municipalities</u> | |
| | Ainara Basurko | Deputy for Economic Promotion of Bizkaia Province Council |
| | Jabier Larrañaga | Deputy for Economic Promotion and Strategic projects of Gipuzkoa Province Council |
| | Sebastian Zurutuza | Chief Strategy Officer of Gipuzkoa Province Council |
| | Ana Oregi | Delegate Councillor of the Department of Territory and Climate Action of Vitoria-Gasteiz |
| | Jon Gurrutxaga | Director General of Innovation of Gipuzkoa Province Council |
| | Ander Arzelus | External Action Manager of Gipuzkoa Province Council |
| | Imanol Zabaleta | General Manager of Environmental Studies Centre of Vitoria-Gasteiz |
| | Ines Anitua | CEO of AIC Automotive Intelligence Center |
| | Agate Gorrayola | Technical Secretariat at UDALSAREA 2030 |

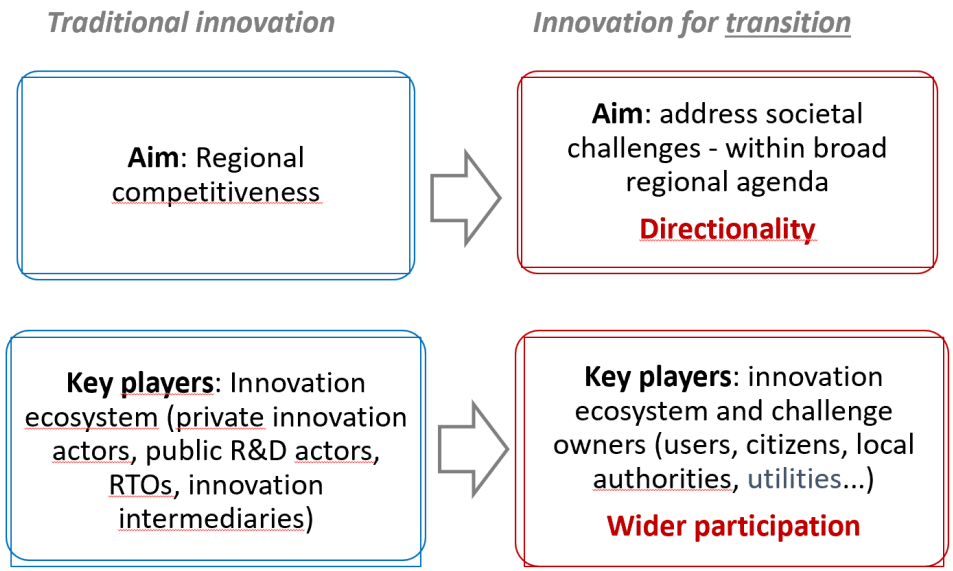
| **Region 4.** East and North Finland | | |
|---|---|---|
| *Date and location* | *Interviewees* | *Position* |
| 25.04.2022 - Rovaniemi | Päivi Ekdahl | Development director, Regional Council of Lapland, Region of Lapland |
| | Riikka Tanskanen | Project Manager, Regional Council of Lapland, Region of Lapland |
| 26.04.2022 - Rovaniemi | Ilkka Nykänen | Business Joensuu, North Karelia |
| | Jarkko Räty | MITY, Kainuu |
| | Jukka Kömi | Professor, University of Oulu, Northern Ostrobothnia |
| | Maria Vuorensola | Specialist, City Coordinator, BusinessOulu, Northern Ostrobothnia |
| | Jouni Kaipainen | Head of Biovalley Finland Kokkola University Consortium Chydenius, Central Ostrobothnia |
| | Hanna-Leena Pesonen | Regional Council of Lapland, Region of Lapland |
| 27.04.2022 - Rovaniemi | Eero Antikainen | Kuopio Water Cluster, Pohjois-Savo |
| | Panu Jouhkimo | EcoSairila Mikkeli, South Savo |
| | Mervi Nikander | Head of Economic Growth and Development, City of Kemi |
| | Pentti Malinen | Regional Mayor of Kainuu |

| | | |
|---|---|---|
| | Juha Purmonen | Manager Cluster Photonics Finland |
| | Jouni Pykäläinen | Head Green Hub in North Karelia, University of Eastern Finland |
| | Sami Sopanen | Head, Innovation Platform Noheva in Savonlinna, City of Savonlinna |
| | Lasse Pulkkinen | South-East Finland University of Applied Sciences |
| | Petteri Vanninen | Luke - Natural Resources Institute Finland |
| 28.04.2022 - Rovaniemi | Tiina Rajala<br>Päivi Keisanen | Regional Development Managers - Northern Ostrobothnia |
| | Timo Ylikangas<br>Mirva Männikkö | Regional Development Managers - Central Ostrobothnia |
| | Jouni Ponnikas | Regional Development Manager - Kaainu |
| | Eira Varis | Regional Development Manager - North Karelia |
| | Satu Vehreävesa | Regional Development Manager - North-Savo |
| | Merja Olenius | Regional Development Manager - South-Savo |
| | Hanna Hietajärvi<br>Sari Turtiainen | Business Analysts, Centre for Economic Development, Transport and the Environment (ELY-KESKUS) |
| | Petri Kuisma | Lapland University of Applied Sciences |
| | Kari Aalto | ENF Office in Brussels |
| **Region 5.** Centro Portugal | | |
| *Date and location* | *Interviewees* | *Position* |
| 19.04.2022 - Coimbra | Teresa Jorge | Head, Division Cooperation and Promotion, CCDRC - Comissão de Coordenação e Desenvolvimento Regional do Centro |
| | Sophie Patricio | Adviser, Division Cooperation and Promotion, CCDRC |
| | Ana Pires | Adviser, Division Cooperation and Promotion, CCDRC |
| | Carlos Silveira | Adviser, Division Cooperation and Promotion, CCDRC |
| | Alexandra Aragão | Professor, University of Coimbra and Coordinator of the Working Group 1 (Valorisation of natural endogenous resources) of Centro RIS3 |
| | Alexandra Rodrigues | Director, Department of Regional Development, CCDRC |
| | Jorge Brandão | Member of the Managing Board of the Regional Operational Programme |
| 19.04.2022 – Cantanhede | Joana Branco | Executive Director, Biocant - Technology Transfer Association |
| | Delfina Moreira | Director at Biocant Park |
| | João Pedro Neto | Director at Biocant Park |
| | Bruno Ferreira | CEO, Biotrend |
| 20.04.2022 - Aveiro | João Veloso | Vice-rector, University of Aveiro |
| | Pedro Almeida | General Director, Innovation and Science Park (PCI) of University of Aveiro |
| | Teresa Franqueira | Director, Design factory |
| | Victor Ferreira | President of the Cluster Sustainable Habitat Sustentável and Coordinator of the Working Group 2 (Development of sustainable industrial solutions) |

| | | |
|---|---|---|
| | | of Centro RIS3 |
| | Filipe Teles | Pro-rector, University of Aveiro and Coordinator of the Working Group 4 (Promotion of territorial innovation) of Centro RIS3 |
| | André Costa | Municipality of Aveiro |
| | Vasco Lagarto | Director, Cluster TICE.PT |
| | 8 Representatives | Heads of Research units of University of Aveiro |
| | Marta Marques | Head, UACoopera, Cooperation unit of University of Aveiro |
| 21.04.2022 - Coimbra | António Cunha | Deputy Director of the LAS – Laboratory of Automatics and Systems, IPN - Instituto Pedro Nunes and Coordinator of the Working Group 3 (Mobilisation of technologies for the quality of life) of Centro RIS3 |
| | João Paulo Dias | Deputy Director of the LED&MAT – Laboratory for Wear, Testing & Materials, IPN |
| | Paulo Santos | Executive Director of the IPN Incubator |
| | Jorge Corker | Senior researcher of the LED&MAT – Laboratory for Wear, Testing & Materials |
| | Jorge Coelho | Head of Department of Chemical Engineering of the Science and Technology School of University of Coimbra |
| | Guilherme Bastos | CEO EcoXperience |
| 21.04.2022 - Oliveira do Hospital | João Nunes | Head of BLC3/CECOLAB |

**Annex 2** Examples of interesting practice from the Case Study Regions

## Building strategy for innovation-led Green Transition




Source: The Authors' presentation to AESIS 'Impact of Science' conference, Leiden June 2022

## Examples from the Case Study Regions

**East and North Finland**

**Good practice in participative processes: The Green Transition Committee of Lapland**

**Zuid-Holland**

**Green Transition featuring prominently in the Province's Growth Agenda**

**Basque Country**

**Societal challenges as transversal goals in STIP 2030, the overall strategy including the S3**

**Centro Portugal**

**Three societal challenges acting as horizontal drivers in the new S3 2021-2027**

**Western Macedonia**

**An emerging regional actor for knowledge-based Green Transition: the Cluster of Bioeconomy and Environment (CluBE)**

**East and North Finland**

**Good practice in participative processes: The Green Transition Committee of Lapland**

The Green Transition Committee of Lapland is based on the Lapland's Green Deal roadmap. It aims to foster wide participation in implementing the objectives of the region's Green Deal, through co-creation involving municipalities, industries, educational and research institutes, clusters, public funders and representatives of nature conservation.

The Committee provides a platform for common ideas and dialogue and enables cross-sectoral brainstorming. One of the principles is that each stakeholder group must recognize the impact of its activities on the objectives of other stakeholders. This actively promotes cross-sectoral dialogue.

Source: Regional Council of Lapland - Lapin liitto

**Zuid-Holland**

**Green Transition featuring prominently in the Province's Growth Agenda**

Zuid-Holland's Growth Agenda has five main pillars, which align themselves with Missions of the national Mission-driven Top Sectors and Innovation Policy:

- Knowledge and innovation ecosystems and key technologies
- Industry and new value chains
- Energy infrastructure, sustainable energy sources and raw materials
- Mobility and logistics transition
- Human capital and lifelong Learning

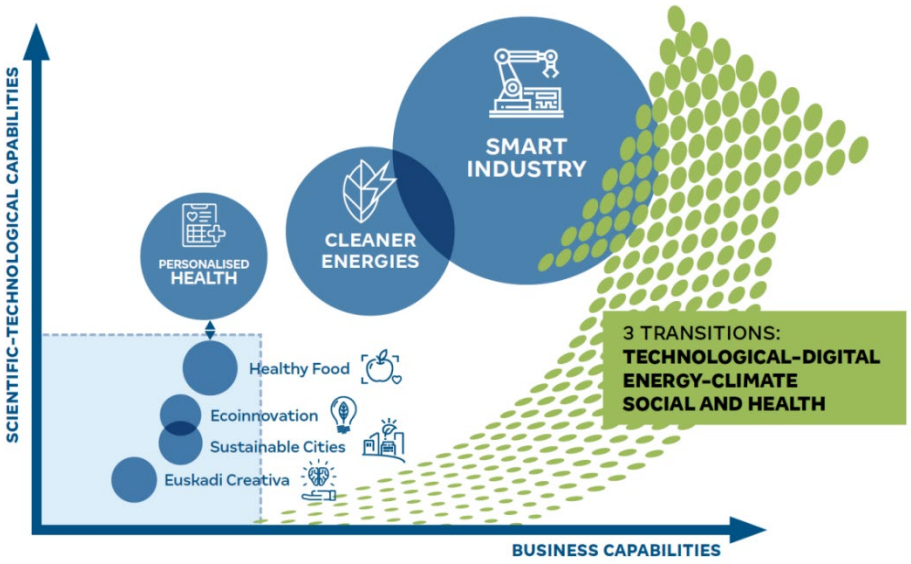
The Growth Agenda seeks to foster cross-sectoral synergies between these pillars. Whilst Green Transition can have relevant elements in all of them, the pillar 'Energy Infrastructure, sustainable energy sources and raw materials' is the one that addresses Green Transition most directly. The Growth Agenda states that the region holds an enormous potential to realise this transition, *'due to the strength and size of its business actors, innovation ecosystems, knowledge institutions and infrastructure (...) for developing new, green products, energy sources and sustainable materials as well as business models to replace old ones'*.

The Growth Agenda calls upon central Government to set up the right framework conditions for the energy transition, including suitable capital and finance for large-scale production, transport and development projects; infrastructure for hydrogen, heat and renewable electricity; human capital that is skilled and mobile, underpinned by stable and adequate regulations favouring investment and innovation. Through the Growth Agenda, Zuid-Holland requests support from the National Growth Fund for large projects, especially for the development of a major Hydrogen hub.

Source: Provincie Zuid-Holland 2021

**Basque Country**

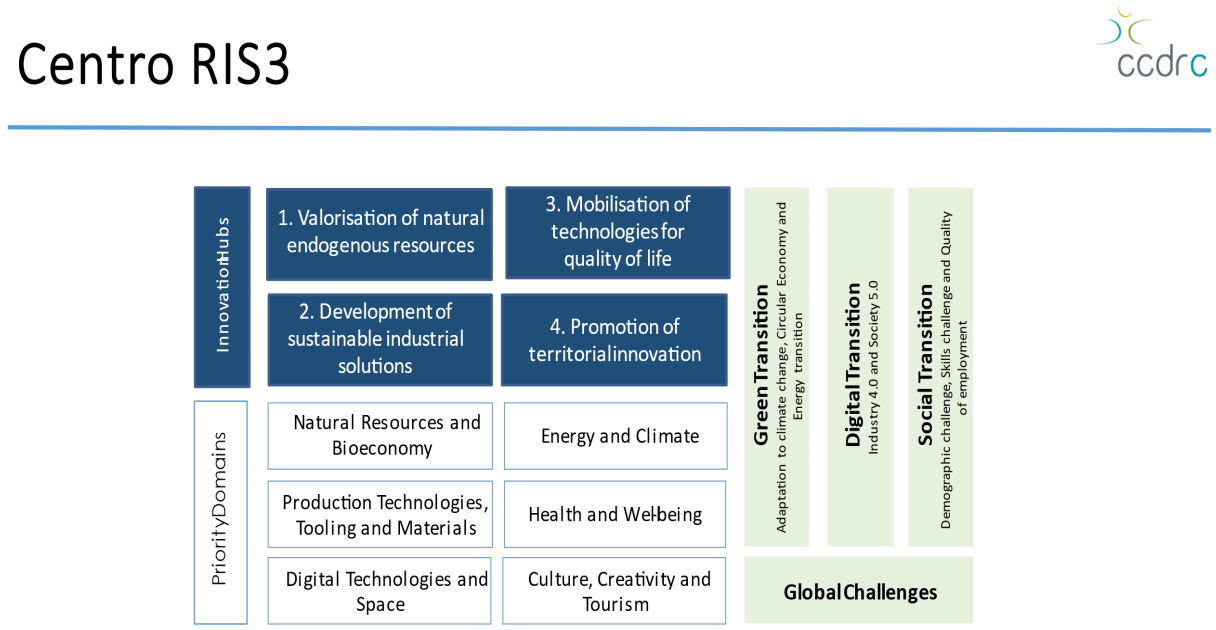
**Societal challenges as transversal goals in STIP 2030, the overall strategy including the S3**




Conceptual schematic showing STIP 2030's strategic priorities and areas of opportunity in relation to scientific, technological and business capabilities to be enhanced under the strategy. Source: (Basque Government, 2021)

**Centro Portugal**

**Three societal challenges acting as horizontal drivers in the new S3 2021-2027**




Source: CCRDC, 2022

**Western Macedonia**

**An emerging regional actor for knowledge-based Green Transition: the Cluster of Bioeconomy and Environment (CluBE)**

CluBE was founded in 2014, as a Bio-energy cluster, which has since developed into a broader 'Bioeconomy and Environment' cluster, whilst retaining a strong focus on innovation. CluBE has 16-18 staff and 40 members, priding itself on bringing together what it calls a *quintuple helix* - featuring government, business, education, environmental NGOs and other NGOs. CluBE itself has expertise in proposal preparation and implementation, stakeholder engagement (mainly local and regional but also National and European), replication, coordination of demo sites, communication and knowledge transfer, as well as mobilisation of entrepreneurship.

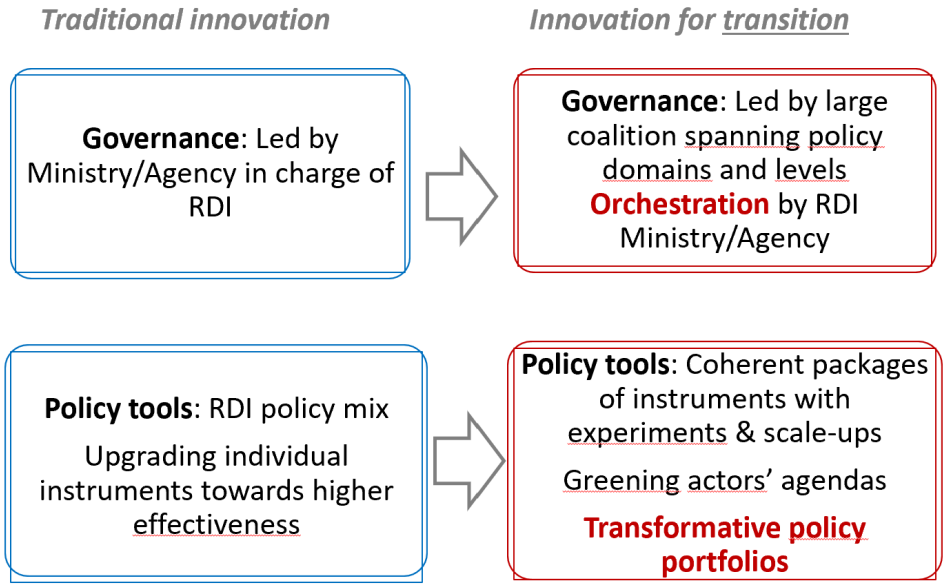
The membership of CluBE embodies vast experience in bioeconomy, biomass, bioenergy and green hydrogen. CluBE has some 17 research projects currently under management in these fields, including a large number of Horizon 2020 and Horizon Europe projects. The organisation participates in various EU level networks, notably including the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) – Hydrogen Valleys Partnership. It also plays a role in the major high-level projects – for example being instrumental in preparation of the White Dragon and Kozani 100 Climate-Neutral Cities bids.

A not-for-profit company, CluBE does not charge fees to its members. Instead, it is entirely self-funded from the research projects it plays a part in winning. CluBE's Director believes this formula keeps the organisation competitive and agile, highlighting also the value of discussion and interaction in preparing project proposals which finally turn out not to be successful.

CluBE will design reactive and urgent upskilling and reskilling programmes for the Western Macedonia Region, which will be specific to hydrogen technologies for the whole hydrogen value chain. It is also putting in place a vocational skills training programme to support the development of circular bioeconomy in the agri-food sector.

See: www.clube.gr

## Implementing strategies for innovation-led Green Examples from the Case Study Regions Transition




**East & North Finland**

A municipality initiative for Green Transition: EcoSairila and Blue Economy Mikkeli - Combining municipal and industrial material cycles with water circularity

**Zuid-Holland**

Greening the Port of Rotterdam: Strategic mix of initiatives for a very bold transformation

**Zuid-Holland**

Experimentation and scaling up through Fieldlabs: Technical University Delft Campus – The Green Village

**The Netherlands**

Mission-driven Research, Development and Innovation (MOOI): Supporting large-scale, high impact projects

**Basque country**

'Greening' research and innovation funding schemes

**Basque Country**

Transformative policy portfolio in the form of new 'Cross-Cutting Tractor-Effect Initiatives'

**Basque Country**

Net Zero Industrial Super Cluster

**Basque Country**

Combining People, Planet and Prosperity goals in regional initiatives: the Opengela project

**Centro Portugal**

Biocant - a biotech innovation ecosystem in its own right

**Centro Portugal**

BLC3 and CECoLAB - Technology and Innovation Campus for bioeconomy and circular economy

**Western Macedonia**

Transformation of the region into a green energy hub: Difficult start for the White Dragon initiative

**East & North Finland**

**A municipality initiative for Green Transition: EcoSairila and Blue Economy Mikkeli – Combining municipal and industrial material cycles with water circularity**

In Mikkeli, a municipality of 55.000 inhabitants in South Savo, an investment of €100m has been devoted to an innovative concept - 'wastewater treatment plant as resource factory'. The location of EcoSairila at the outskirts of the city combines: a wastewater treatment plant using advanced systems based on membrane bioreactors, a water reclamation plant, a waste treatment and recycling centre, a biogas plant, an industrial zone providing renewable energy, recycled material and recycled water and an international centre of expertise focusing on water research. The initiative combines the strengths of public research (two universities) and companies active in automation and smart solutions and wastewater treatment, working together with the public water facility and city authorities.

The initiative benefits from international, transnational, national, interregional and regional projects funds: ERDF, HORIZON, COSME, Academy of Finland, as well as the 'innovation ecosystem development program' of the Finnish Ministry of Economic Affairs and Employment. It is a member of the S3 Platform 'Water Smart Territories' with 20 regions.

The cluster Blue Economy Mikkeli (BEM) utilises the wastewater treatment plant's infrastructure, research, development, testing and piloting environments, as well as services to generate innovations and new business. BEM helps start-ups and SMEs to develop and commercialise new ideas and innovations. BEM brings together training actors to offer a variety of training modules and products for water supply and water circular economy, from which a new Master programme on water technology has been developed. BEM attracts new business and activates new sources of financing.

Source: Mikkeli Development (2022)

**Zuid-Holland**

**Greening the Port of Rotterdam: Strategic mix of initiatives for a very bold transformation**

**The Port of Rotterdam is a strong engine of growth for the Province, the country and Europe**. Beyond its essential logistics function, the industrial cluster Rotterdam-Moerdijk is of crucial importance for the whole domestic economy. It provides direct and indirect jobs for about 400,000 persons and generates €13 billion of annual value-added for the Province.

**Economic activity in the Port of Rotterdam is highly dependent on fossil fuels.** The Port of Rotterdam covers a vast 42 $km^2$ area, including the deep-draught container terminal built several km out into the sea - one of the few places in the world capable of accommodating the very largest container ships. The Port owes much of its current existence to the transportation, refining and storage of fossil fuels and to the petrochemical industry. The Port is home to four large oil refineries and as well as major gas and coal related infrastructures. Oil pipelines lead directly from the Port to Antwerp and the Ruhr area. Although wind turbines are increasingly in evidence across the skyline, only 6% of operations in the Port are currently powered by renewable energy.

**Greening the Port of Rotterdam is a giant and multi-faceted endeavour**. A drive through the distinctive pipework and smokestacks Rotterdam Port's industrial complex today, is enough to invoke deep reverence for the ambition of its Green Transition strategy and the scale of the task ahead. Three interlinked ecosystems are targeted for the greening of Port: hydrogen; electrification; and circularity.

**New flagship investments are foreseen in green electricity and green hydrogen production as well as in circularity and biofuels**. The Port will become the landing point for high volumes of electricity from new giant offshore wind parks to come on stream – 3 GW by 2030 to 10 GW by 2040. This will not only power the conversion of the Port's industry from fossil fuel use to clean electricity, it will also be used for producing green hydrogen, as will certain industrial by-product flows. By opting for very large-scale production to reduce unit costs, the Port aims to become a major international hub for distribution of green hydrogen. This activity is led principally by large companies in the Port, such as Air Liquide, Vopak, Shell, BP, ExxonMobil, Gasunie, AirProducts, Eneco and Nouryon, which have recently announced substantial investments. In addition, as regards circularity, the Port seeks to develop into an international 'waste-to-value hub', concentrating similarly on high-volume import, export, distribution and valorisation of residual flows, $CO_2$ and sustainable biomass. In this context, Shell is planning related investment in the Port complex for the production of bio-based aviation fuel.

**A variety of other green projects are being developed in the Port industrial complex**. The above flagship greening investments come on top of numerous relevant actions already underway. The development of a 20MW shore power connection for large vessels berthed in the Port, for example, enables them turn off their engines and still vital keep systems running, resulting in significantly lower emissions and noise levels. A symbiotic network between industrial companies in the Port, allowing them to share residual heat has also been developed and is being further expanded. Via an underground pipeline, residual heat from the Port will be used to heat homes and businesses elsewhere in Zuid-Holland.

**The Green Transition of the Port builds on strategies at municipal and Provincial levels**. The greening of the Port takes place in the context of the Zuid-Holland Growth Agenda and the Rotterdam Climate Agreement. This strengthened partnership between key stakeholders has already overseen the establishment of various key ecosystem components, such as the Fieldlab for Industrial Electrification and the development of new clusters and value chains, notably in the field of chemical recycling and bio-refining, including the creation of circular pilot/demo facilities. The Port Authority and the Municipality are also setting up a new partnership on post-consumer textiles, of which the Port is a substantial importer and exporter. Among other things, this initiative will investigate the business case of chemical recycling for non-reusable textile.

**The bulk of funding for the transformation of the Port will come from national public, as well as large-company sources, with EU Funds providing complementary support**. The actual implementation of major 'greening' initiatives for the Port area will rely heavily on national funds. The 'GroenvermogenNL'[i] is a major hydrogen project to be financed by the national Growth Fund. Some of the hydrogen projects in the Port are also on the European IPCEI list. At regional level the Kansen voor West OP provides complementary investments complying with S3 priorities, e.g. in circular innovation or for the Fieldlabs. The Just Transition Fund covering the Port area will also provide additional support.

Source: Provincie Zuid-Holland, 2022

**Zuid-Holland**

**Experimentation and scaling up through Fieldlabs: Technical University Delft Campus – The Green Village**

Zuid-Holland is home to three universities in the 2021 global top 100 ranking – Technological University (TU) Delft, Leiden University and Erasmus University Rotterdam - which all play crucial roles in the Province's innovation ecosystem. On the campus of TU Delft, the 'Green Village' is a fieldlab of special significance for Green Transition, where researchers, government bodies, companies and citizens can work together on innovations in the fields of: Sustainable building and renovation; Energy transition; Climate adaptive cities.

The Green Village was set up with ERDF support from the *Kansen voor West* OP 2014-2020 and currently exists on a range of research project financing and fees from companies using its services. 50% of the projects in the Green Village originate from the university and 50% from companies. Mainly these are lower TRL innovations in the earlier stages of market development.

The Green Village site features a DC electricity grid, a low temperature district heating circuit and a dedicated hydrogen grid, with plans for further testbed infrastructure. There are eight built and fully equipped homes in the Green Village, usually with 10-12 persons living in them, who act as testers of the different systems installed. The Green Village has special agreements with relevant regulatory bodies to enable relaxation of building codes on the site.

Strong emphasis is placed on the role of the Green Village in partnerships with specialist laboratories and companies throughout the country, as well as in communities of practice, for example with housing cooperatives, to boost mutual learning and further scale up innovations.

Source: The Green Village https://thegreenvillage.org/en

*"Green Transition will not fail in Zuid-Holland because of lack of technology or innovation. However, it could fail if we don't pay careful attention to the more mundane aspects. How rules are formulated, how consumers pay their bills and how many capable people with screwdrivers we have available, could turn out to be equally, if not more important…"* Director of Green Village – TU Delft.

**The Netherlands**

**Mission-driven Research, Development and Innovation (MOOI*): Supporting large-scale, high impact projects**

The Mission-driven Research, Development and Innovation (MOOI) scheme supports large projects with integrated solutions that contribute towards achieving the climate goals. MOOI stimulates innovative solutions to reduce $CO_2$ emissions in the Netherlands and ensure the energy system is ready to process large amounts of renewable electricity.

The emphasis in MOOI is on cooperation and an integrated approach, to help innovations have a greater chance of success. Parties within an 'innovation chain' develop a joint project of considerable size. They focus on a specific theme. For example, this may concern "Offshore wind", "Renewable energy on land", the "Built environment" or "Industry". Whilst many schemes focus on the development of innovative products and processes, the MOOI scheme specifically targets system innovations that offer an integrated solution to users' problems. Various parties in the chain work together across sectors. Preferably, they also include end users, such as suppliers, users, local stakeholders.

* The word 'mooi' means 'beautiful' in Dutch

Source: https://www.rvo.nl/subsidies-financiering/mooi

**Basque country**

**'Greening' research and innovation funding schemes**

The Basque Government has revised its rules in order to incorporate the Green Transition dimension in funding decisions in the field of research and innovation. For example:

The regulation of HAZITEK, the main support program for industrial and technological R&D (>€90m), has been revised in 2022. Among the project requirements is that their scientific-technological activities must be located in the RIS3 areas of STIP 2030. Among the evaluation criteria is the environmental and social impact, which incorporates the contribution of the project to the energy-climate and social transitions. Its weight is 15% of the total score for competitive R&D projects, and 10% for strategic R&D projects.

The regulation of AZPITEK (€7m), the program that gives support to the BRTA centres for their provisioning of scientific-technological equipment and infrastructures includes, among the evaluation criteria, the contribution and alignment with the STIP/RIS3 (10 points out of a total of 100) and the socioeconomic impact and its contribution to the technological-digital, energy-climate and socio-health transitions (10 points).

Source: Basque Country Government 2022

**Basque Country**

**Transformative policy portfolio in the form of new 'Cross-Cutting Tractor-Effect Initiatives'**

A new experimental instrument to support STIP 2030 implementation is the introduction by the Basque Government: 'Cross-Cutting Tractor-Effect Initiatives' aim to support bold multi-actor, multi-technology approaches which forge links between S3 domains. Although there were 'Tractor Initiatives' previously, these were only within individual domains. The evaluation of STIP 2020 indicated that this might represent a missed opportunity to maximise possible cross-domain synergies (Basque Government, 2021). The new instrument also responds to another recommendation for the STIP2020 evaluation, namely to develop new instruments to support strategic projects.

The new transversal approach - inspired by the Horizon Europe 'Missions' - will build sizeable multi-disciplinary initiatives in strategic interface areas with potentially substantial social impact. Participation in larger-scale European projects is expected, for example through the new Missions of the Horizon Europe programme. Cross-Cutting Tractor-Effect Initiatives are planned in the broad areas of healthy ageing, electric mobility and circular economy. These focus areas may evolve as the initiative develops over time. Currently these initiatives are at design stage.

A governance system has been created for the Cross-Cutting Tractor-Effect Initiatives, which centres around General Committees for each focus area. These Committees notably include members of the most relevant Steering Groups for STIP 2030 priorities, to foster joint strategic planning and the identification of transversal tractor-effect projects. Similar to the EU Missions, bold objectives have been set in each focus area and funding of the related projects is expected to be through existing channels, but new dedicated channels may be created if needed.

Source: Basque Country Government 2022

**Basque Country**
**Net Zero Industrial Super Cluster**

As one of the four regional initiatives invited to be part of the World Economic Forum Net Zero Industrial Clusters initiative, the Basque Net Zero Industrial Super Cluster seeks to capitalise on accelerated decarbonization of energy supply and energy efficiency gains in key industrial sectors.

Phase 1 of the Supercluster is based on collaboration between the Basque Government, large energy companies Iberdrola and Petronor and industrial cluster associations of the region. The first key target sectors will be oil refining, cement production, steel making and pulp/paper. The Supercluster will then broaden to encompass other sectors. In the short term, the work consists of:

- Identifying the industrial processes with the highest energy consumption in the five prioritised industrial subsectors.
- Specifying possible technologies and measures to reduce $CO_2$ emissions associated with energy consumption in these processes.
- Evaluating the current or potential value chain in the Basque Country for the development and supply of the technologies and measures identified.
- Identifying and defining possible pilot and demonstration projects for the application of technological solutions in the industrial processes analysed.

The multiplier effect resulting from increased collaboration and symbiosis between Supercluster members, in the scale-up of sustainable industrial process, is expected to generate substantial new market opportunities.

Source: EnergiBasque 2022

**Basque Country**
**Combining People, Planet and Prosperity goals in regional initiatives: the Opengela project**

Opengela is a project driven by the Basque Government which looks to improve the quality of life in cities through urban regeneration. It consists of the creation of neighbourhood offices which, as one-stop-shops, will provide advice and support to the communities through the whole process of renovation of their apartment buildings. The idea is to improve neighbourhood quality of life, with better energy efficiency, universal accessibility and better safety, such as protection against fires.

CINEA (the European Climate, Infrastructures and Environment Executive Agency) values Opengela for its ambitious energy-savings, the creation of local experiences and employment, the scalability of its processes and financing and the support in provides for vulnerable communities of owners.

This project, financed by the EU Horizon 2020 programme, began with a pilot phase in two neighbourhoods: Otxarkoaga (Bilbao) and Txonta (Eibar). More than 700 people are currently participating in the programme. Reductions of more than 50% of CO2 emissions have been achieved in the 460 buildings covered and €3.6m of private investment attracted so far. 10 Basque municipalities are implementing the initiative, covering some 1,800 dwellings. There has been substantial interest from other countries in applying the Opengala model.

Source: https://opengela.eus/

*"The fundamental tenet of Opengala is to always put the residents first and making them part of the process."* Director of Territorial Planning and Urban Agenda, Basque Country Government

**Centro Portugal**

**Biocant – a biotech innovation ecosystem in its own right**

Biocant is located in the Municipality of Catanhede, between the university cities of Coimbra and Aveiro. It is a joint initiative between the two Universities, the Municipality and Centro Region. Its mission is to enable knowledge valorisation through technology transfer and support to start-ups and companies in health sector. It plans to be a model for future 'green' biotech-based growth in the region.

Development of the site was generously supported by EU Cohesion Policy Funds. Today it boasts high-quality infrastructure and specialist biotech equipment, which is modular and versatile, governed by a shared infrastructure policy. The park houses university biotech laboratories and 40 companies, representing some 35% of Portuguese biotech enterprises, including spin-offs from the University of Lisbon, which have decided to locate there.

Biocant provides complementary services to its resident companies, such as support for business development and internationalisation as well as access to finance through a specialised venture capital fund. Biocant has been successful in attracting human resources from Portugal because of its scientific and research environment, as well as good living conditions. There is considerable space available for companies to further expand in the lush green surrounding countryside. The park plays a local development role by bringing people and talent to this small town, thereby contributing to more balanced regional development. Biocant regularly delivers science awareness activities for young people in the local area.

See: https://www.biocant.pt/

**Centro Portugal**

**BLC3 and CECoLAB – Technology and Innovation Campus for bioeconomy and circular economy**

The BLC3 is a non-profit association founded in 2010 with the aim of enhancing research and technology transfer related to Green Transition, to support economic development primarily in rural areas. The BLC3 campus is itself located in relatively rural surroundings in Oliveira do Hospital, to the east of Coimbra, and was established with the support of EU Cohesion Policy Funds.

BLC3 specialises in the development of bioindustries, biorefineries and bioproducts, using largely agricultural waste, forest resources and contaminated effluents as building blocks for higher-value products and materials. In 2016, BLC3 won the EC-DG Regio RegioStars award in the category 'Sustainable Growth: Circular Economy' for a project which created 24 R&D sub-projects and four new spin-offs in these fields.

The campus comprises four operational modules - R&D Centre, Incubation Centre, Support Centre for Innovative Ideas and Projects and Business Hosting Centre. Many projects are developed in the agri-food sector. Construction of a full-scale biorefinery demonstrator is nearing completion on the site, which also houses CECoLAB.

CECoLAB is one of Portugal's recognised national 'CoLAB' centres of excellence. Its aim is to develop sustainable market solutions, following the circular economy model, with high impact on national strategic value chains. CECoLAB comprises three technology platforms: Industrial Biotechnology; Sustainable Separation Processes and Green Chemistry; and Ecodesign. It provides consultancy services for companies in circular economy and circular (re)design, classification of waste and by-products, legal studies and training.

BLC3 and CECoLAB demonstrate strong commitment to the local community surrounding the campus. Together, they have been responsible for bringing over 30 qualified young people to live and work in the area.

See: http://blc3.pt/index.php and https://cecolab.pt

**Western Macedonia**

**Transformation of the region into a green energy hub: Difficult start for the White Dragon initiative**

The 'White Dragon' mega-project prepared by a group of companies, had been proposed as an EU Important Project of Common European Interest (IPCEI), with full support of the regional authorities. This pan-European project is designed to kick-start a European market for green hydrogen and contribute to the transition away from fossil fuels in both heavy industry and heavy transport. In June 2022, it was learnt that White Dragon has not been accepted by the European Commission as an IPCEI and the fate of the project is still to be fully worked out.

In May 2021, a group of companies, representing the largest energy concerns in the country, submitted to the Greek Government and the EU, their €8bn investment proposal for White Dragon - the development of an integrated green hydrogen project in Greece which covers the entire hydrogen value chain.

White Dragon will use GW-scale renewable electricity to produce green hydrogen, by electrolysis, in Western Macedonia. Hydrogen will then be stored directly short-term and indirectly through injection to existing natural gas pipeline. Subsequently, via high temperature fuel cells it will provide green electricity to the country's power grid. Heat generated as a by-product, could initially have a complementary use in the district heating networks of West Macedonia, as well as in other applications that require heat and/or cooling in the future (industries, data centres, greenhouses, etc.).

White Dragon's key building blocks include:

- PPC - which owns large tracts of land and will develop major photovoltaic production facilities.
- Skills - some of which are in the region (engineers, technicians in powerplants).
- Existing infrastructure: pipeline, transmission and distribution network.

The National Natural Gas Transmission System will initially be prepared so that it can receive increasing rates of hydrogen. The construction of an exclusive hydrogen backbone pipeline in Greece is also proposed to provide infrastructure for hydrogen refuelling stations. Hydrogen is also flexible and can be transported for large end users, such as mobility companies, refineries, or fertilizer producers.

Information source: CLUBE 2022. Picture source: World Hydrogen Leaders: "White Dragon" project of the month – Industry-news.gr

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