ESPON TERRES [Territorialising Resilience: Transforming Europe for an Age of Crisis] - Final report

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Transforming Europe for an Age of Crisis (TERRES)

Final Report // July 2025

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1 Introduction

This report summarises the main findings and outputs of the **TERRES (Territorialising Resilience: Transforming Europe for an Age of Crisis)** collaborative European research project, commissioned by the ESPON EGTC under the ESPON 2030 Cooperation Programme. As a European applied research initiative, ESPON TERRES aimed to advance both the theoretical and practical understanding of territorial resilience by developing a conceptual framework that reflects the current "state of the art" in the field. The project contributes to the evidence base for EU Cohesion Policy and other sectoral policies. It was implemented over a 27-month period by a multidisciplinary consortium of research institutions, involving external experts and engaging stakeholders operating across different territorial levels.

The **context** of the TERRES project is characterised by accelerating and overlapping environmental, economic, geopolitical and social challenges. Climate change, volatile energy supplies, demographic imbalances, global health crises and political instability are reshaping the vulnerability and capacity of places. In such a world of systemic uncertainty, territorial resilience is central to policy discourses at transnational and EU level and is increasingly translated into concrete strategies and actions. To varying degrees, this has also reached sub-national levels, where regions and cities are beginning to integrate resilience thinking into planning and development. Moreover, it has become clearer that change is not only inevitable but can also be positive and deliberate. Spatial resilience therefore refers to the capacity of places to accommodate, adapt and transform in response to different types of disturbances. Rather than focusing solely on recovery, the transformative potential of crises and the importance of systemic change aligned with shared values and long-term sustainability goals are highlighted.

The TERRES project set out to improve the comprehensive, conceptual and practical understanding of territorial resilience, supporting regions in navigating complex, long-term, multi-crisis trajectories. It addressed **three core research questions:**

- Can a ***territorial concept of resilience*** be defined which allows European regions to strengthen absorptive, adaptive and transformational governance capacities in the context of long-term multi-crisis trajectories?
- What practical ***indicators*** can be used to index and map the absorptive, adaptive and transformational resilient governance capacities of European regions?
- What are possible ***best-practice policy responses at regional territorial governance scale*** to 'bounce forward' to more resilient pathways and for coping with current and future crises so that societal well-being and territorial cohesion is preserved?

To answer these questions, TERRES pursued four interlinked **objectives**.

- Developing a robust and operational *conceptual framework* grounded in academic literature, policy analysis, and stakeholder validation, supported by six case studies and 18 Futures Workshops exploring how territorial resilience is understood and enacted in practice.
- Building *a pan-European indicator set* to measure key dimensions of resilience at NUTS 2 level and *analysing regional trends*.
- The creation of a *Territorial Resilience Dashboard (TRD)* to provide a comprehensive overview of measuring and understanding territorial resilience to support stakeholders.
- Finally, formulation of a *Policy Compass*, offering strategic recommendations for embedding territorial resilience into policy across scales – from EU to regional and local levels.

To address the questions and achieve the objectives, the TERRES project applied ***a holistic, multi-crisis approach***, recognising that regions face overlapping shocks and long-term stresses, and that local characteristics can act as strengths or vulnerabilities depending on the context. It adopted a ***beyond-GDP perspective***, acknowledging the limitations of regional economic resilience perspective in capturing socio-cultural, environmental, and institutional dimensions of resilience. Instead of focusing on growth and competitiveness alone, the project embraced a ***co-evolutionary perspective*** linked to normative visions of well-being and sustainability. TERRES also pursued a ***future-oriented approach***, aimed at equipping regions to anticipate and

shape long-term transitions. The project strongly emphasises ***stakeholder-based governance*** ensuring that the framework reflects both conceptual rigour and practical relevance.

The **structure** of this Final Report reflects the comprehensive and iterative approach of the TERRES project, organised into seven main chapters and supported by a set of scientific annexes.

- **Chapter 2** presents the **conception of Territorial Resilience**, detailing the framework developed by the consortium. Building on an extensive literature review, bibliometric analysis, and expert validation, the project set up the boundaries and defined Territorial Resilience through three interconnected criteria. To address the lack of a clear, consistent definition of territorial resilience, the project developed a Glossary to ensure terminological clarity and coherence across all activities and future use, provided in Annex 7.
- **Chapter 3** provides a **policy overview** based on a systematic review of 115 policy documents across international, EU, and national levels. Using a tailored analytical framework, the project assessed how resilience is interpreted, embedded, and operationalised in existing policies. The review highlights variations in emphasis on different (absorptive, adaptive and transformative) and reveals a significant gap between the rhetoric of resilience and its practical application.
- **Chapter 4** presents the **outcomes of six case studies**—Budapest metropolitan area, Catalonia, Central Italy, Teruel, Upper Norrland, and Latgale—and **synthesises the insights gained from 18 Futures Workshops.** They illustrate the diversity of challenges across Europe and highlight the importance of agency, governance capacity, and context-sensitive strategies. Further information on methodology and findings is available in Annex 1 and Annex 2.
- **Chapter 5** focuses on **measuring** Territorial Resilience and offers a detailed analysis of **pan-European trends**. The team developed a Territorial Resilience Capitals Index using 72 carefully selected and benchmarked indicators across five key dimensions. The analysis identify regional typologies and spatial patterns of the synthetic index. Aspects such as data availability, scale limitations, and challenges in measuring governance and social capital are critically discussed. The methodology and recommendations for future data collection is detailed in Annex 3.
- **Chapter 6** introduces the **Territorial Resilience Dashboard (TRD)**, a user-oriented tool designed to support decision-making through interactive maps, comparative metrics, and self-assessment features. The TRD allows policymakers to explore regional resilience profiles, benchmark against other areas, and gain actionable insights. The dashboard also serves as a gateway to the project's core datasets and visual narratives. Instructions for use and technical background are provided in Annex 4.
- **Chapter 7** offers policy recommendations, framed as a "**Policy Compass**" that links conceptual findings with actionable guidance for EU, national, and regional levels. The recommendations draw on policy analysis and the Case Studies and Future Workshops, which are complemented with the TRD, the indicator analysis, and stakeholder inputs.
- **Chapter 8** concludes the report with a summary of key findings, reaffirming the need for a shared, operational understanding of territorial resilience as a cornerstone of territorial development in Europe. Moreover, this chapter provides a guiding for future research, detailed in Annex 6.

Throughout the project, collaboration among partners has been central. The work was carried out by an interdisciplinary consortium, with contributions from **external experts** in spatial planning, regional development, data science, and governance studies. The project benefited significantly from the diverse perspectives and experiences of actors involved at different territorial levels, ensuring the results are both academically robust and practically relevant. Moreover, detailed **stakeholder engagement** was carried out not only in the six case study areas but also across various territorial levels. Insights from these engagements have been integrated throughout the report chapters, with a more comprehensive summary of the process available in Annex 5.

The integration of analytical research, policy review, data modelling, stakeholder input, and visual tools makes the TERRES project a unique and timely contribution to resilience thinking in Europe. As this report shows, developing a territorialised approach to resilience is not only necessary—it is possible, measurable, and actionable.

2 Comprehensive account of the conception of 'territorial resilience'

2.1 Short summary of the methodology

The efforts regarding the conceptualisation of Territorial Resilience followed a structured methodological flow (Figure 1), starting with the first Step of clarification of its conceptual boundaries to distinguish it from related terms and to lay a solid foundation for the literature review and bibliometric analysis. Step 2 applied a bibliometric analysis to map the academic landscape and identify key authors, topics, and trends using SCOPUS data and tools such as Bibexcel and VOSviewer. This analysis was based on 59 publications retrieved from SCOPUS that included "Territorial Resilience" in their abstract, title, or keywords. Step 3 involved a content analysis using the "Five Ws" method proposed by Meerow & Newell (2019), to understand how Territorial Resilience is interpreted and discussed within these publications. Step 4 consisted of analysing the selected publications to identify a preliminary set of indicators related to Territorial Resilience, including the methodological approaches and spatial dimensions (NUTS/LAU), thereby establishing a foundation for the development of TRD indicators. Step 5 involved the first validation meeting with an external expert to assess the methodological soundness and gather feedback for improvement. Step 6 included the organisation of a consortium workshop aimed at refining the proposed TERRES Criteria through internal discussion. Step 7 focused on a deeper analysis of the six publications identified in Step 3 as interpreting Territorial Resilience as a transformative framework. These were complemented by a content analysis of 20 additional publications frequently cited in those six, resulting in a total of 25 key publications. This extended review enabled ESPON TERRES to further develop the three core TERRES Criteria, reframing resilience as a transformative process and a guiding framework for EU policies beyond GDP, particularly for cohesion and territorial development. Step 8 expanded on the literature review findings by fully articulating the three TERRES Criteria, drawing on additional peer-reviewed and grey literature of international relevance:

- Criterion 1: Territorial Resilience should be oriented toward a co-evolutionary governance and planning approach, enabling European regions to simultaneously absorb, adapt, and transform.
- Criterion 2: Territorial Resilience should be reinforced through a combination of top-down and bottom-up governance approaches, requiring both soft and hard governance tools.
- Criterion 3: Territorial systems should be comprehensively defined to include socio-cultural, socio-ecological, and socio-economic dimensions, alongside spatial configurations and infrastructural elements, embracing a multi-scalar and functional perspective.

Step 9 involved a second validation meeting with a broader panel of external experts to confirm the robustness and applicability of the methodological approach. Step 10 explored challenges and opportunities for operationalising the conceptual framework by linking it to indicators, policy tools, and governance practices. Finally, Step 11 involved the creation of a glossary to ensure terminological clarity and consistency throughout the project and its future applications.

Figure 1: The Methodological Steps to Conceptualise and Operationalise Territorial Resilience

Source: elaboration of the project team.

2.2 TERRES conception of 'territorial resilience'

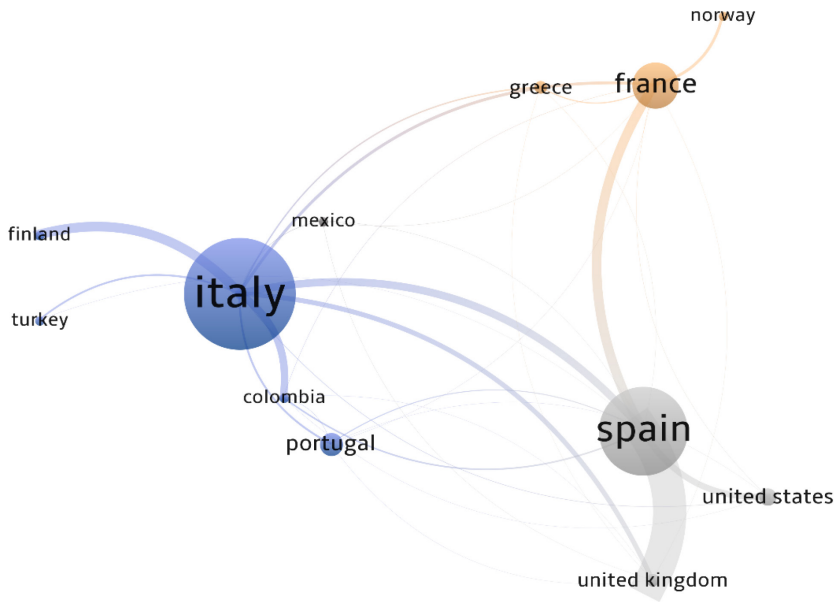
A key element of the project was to develop a holistic and multidimensional framework for territorial resilience, grounded in a critical review of academic literature, latest ESPON studies, and European and international policy documents. This framework offers a shared conceptual and operational foundation, which was then refined through expert input and findings from six case studies. It promotes a common vision of territorial resilience and equips regions and cities to address long-term, multi-crisis trajectories with a future-oriented perspective. Ultimately, it serves as a reference point for aligning spatial planning and governance across scales, contributing to EU cohesion policy and broader territorial cooperation.

This framework highlights how a territorial perspective on resilience differs from other interpretations of the concept. **The territorial conception of resilience differs from other uses of the term, such as urban, regional, or spatial resilience.** The main difference is that Territorial Resilience emphasises a multidimensional, multi-scale, and place-based approach to understanding how systems respond to change. Unlike "urban resilience," which is widely used in Anglo-Saxon literature and often focuses on cities as bounded units, or "regional resilience," which is focused on recovery from economic shocks, the territorial perspective incorporates social, spatial, political, and environmental dimensions simultaneously and transcends fixed administrative boundaries in its analysis.

The results of the literature review highlight another key aspect of the conceptual diversity surrounding resilience: the notion of Territorial Resilience is more prevalent in countries such as Italy and Spain, where the term "territory" holds a broader and more nuanced meaning than in English (look at Figure 2). The reason is likely to originate from a linguistic issue. Epistemologically, the term territory derives from the Latin word "territorium", composed of the noun "terra" and the locative suffix "torium". The word "territory" has

traditionally been of scarce use in the English language and is mainly associated with military jargon to indicate the "territorial control" of an army or nation, or the geographical scope of the institutional mandate of an administrative body.

Figure 2: Network representation of cross-country bibliographic coupling of territorial resilience



Source: elaboration of the project team

Moving to the policy discourse, since the second half of the 2000s, in EU jargon, the word 'territorial' has gained incremental recognition by introducing the territorial dimension of cohesion in the Treaty of Lisbon and its economic and social counterparts. As such, "territorial" cohesion does not refer to a specific scale, implicitly bearing a multilevel understanding of the space and aiming to reduce disparities between the levels of development of places at both the international, interregional, and intraregional scales. The introduction of the so-called place-based approach by the Barca report in 2009, as an agenda for reforming the EU cohesion policy, has further reinforced this understanding of "territorial development" as independent of a specific scale or administrative level (Barca, 2009).

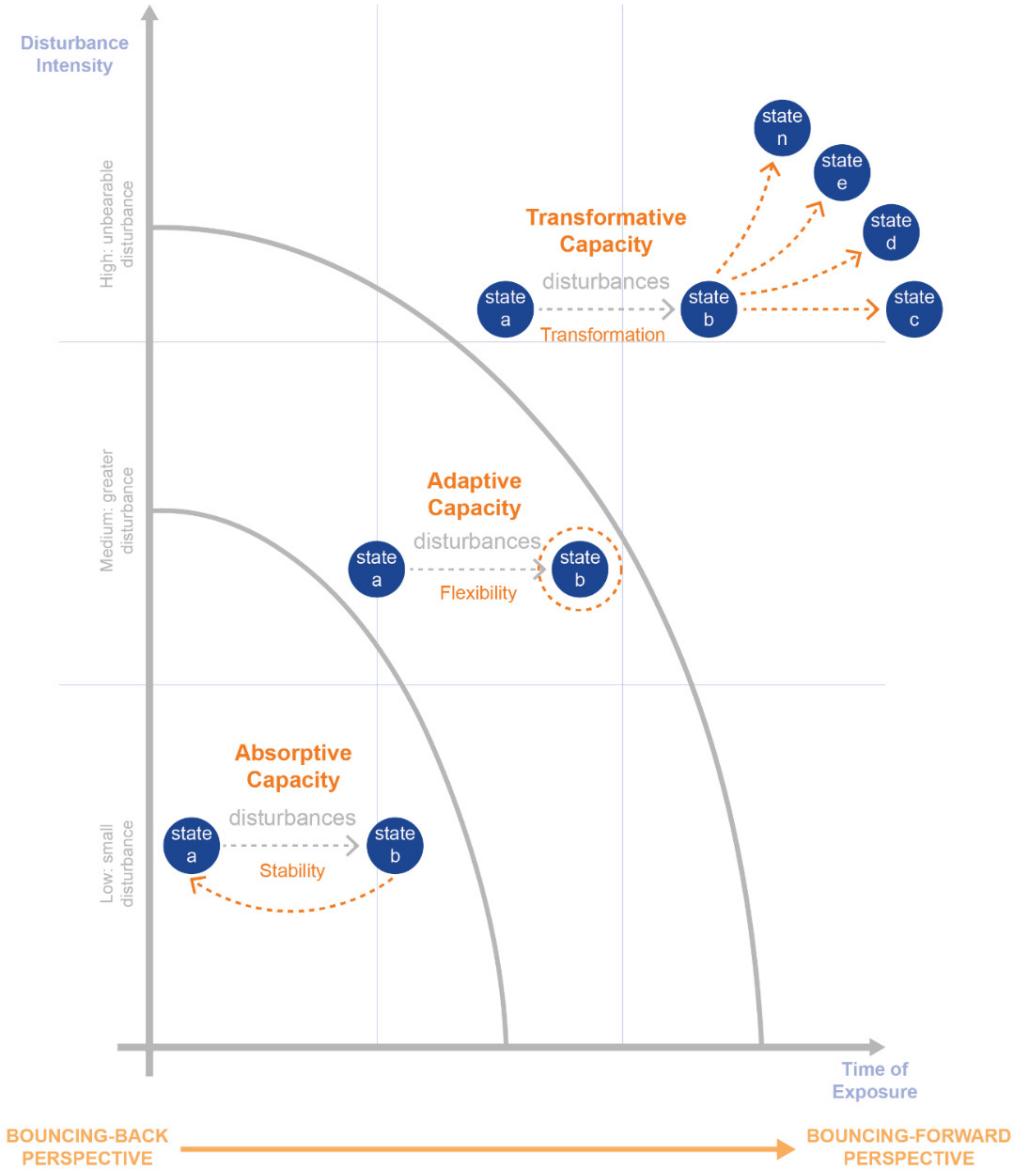
ESPON TERRES Criterion 1 sustains to frame Territorial Resilience in a co-evolutive governance and planning approach. Therefore, Territorial Resilience can allow European regions to simultaneously strengthen their capacity and their chances of resisting external disturbances (**capacity to absorb or absorptive capacity**), adapting to new conditions without crossing an irreversible threshold or tipping point (**capacity to adapt or adaptive capacity**) and moving toward new trajectories of development (**capacity to transform or transformative capacity**).

As in Figure 3:

- **Capacity to Absorb or Absorptive Capacity:** The capacity of the territorial system to return to its previous development path after a disturbance. The territorial system does not change its functions and structure but is able to return to its previous state, preserving its structures and functions. Stating a bouncing-back perspective as this capacity relates to the **stability and resistance** of a territorial system that is able to absorb the impact of shocks without changing their behaviour.
- **Capacity to Adapt or Adaptive Capacity:** The capacity of the territorial system to adapt to disturbances, adjust, and modify the development path without the need for broad system reconfigurations. Allowing continuous development without major qualitative changes in function or structural identity. It requires **flexibility** and involves incremental changes that are necessary to allow territorial systems to continue functioning without major qualitative distress in response to disturbances.

- **Capacity to Transform or Transformative Capacity:** The capacity of the territorial system to absorb disturbances, adapt to them, transform, innovate, and evolve to possible alternative development. It implies a **transformation** of the *status quo* in a **continuous process**, enhancing a bouncing-forward perspective.

Figure 3: Territorial Resilience Capacities



Source: adapted from Brunetta & Caldarice, 2020

ESPON TERRES Criterion 2 suggests that Territorial Resilience requires both soft and hard governance tools. It is not merely the result of a top-down process, but it is a proactive institutional and community shared and co-designed vision to implement collective and individual actions. Therefore, to reinforce the meaning of Territorial Resilience in responding to disturbances and strengthening the coping capacities through structural changes as well as considering the impact of current and future crises on relevant megatrends and emerging issues, ESPON TERRES suggests to reinforce specific dimensions of territorial governance which include: favouring multi-level coordination; Promoting inclusivity, participation, and trust; encouraging experimentation, learning, and innovation; ensuring flexibility and adaptive management; addressing uncertainty and surprise; and finally favouring hard governance tools. These attributes of a governance system can offer several advantages and help to operationalise Territorial Resilience listed in Figure 4.

Figure 4: Attributes of the governance system to address Territorial Resilience

Source: elaboration of the project team

These attributes of a governance system can offer several advantages and help to operationalise Territorial Resilience as explained below:

- **Favouring multi-level coordination:** Multi-level coordination in governance includes vertical integration (across different administrative levels such as the EU, national, regional, and local) and horizontal integration (across sectors at the same level), along with fostering public participation. Vertical integration connects national policies with local initiatives by decentralising policy-making, and horizontal integration fosters transboundary collaboration among neighbouring local administrations, stakeholders, and civil society. This approach enhances resilience by facilitating

tailored and context-specific responses to challenges and improving the efficiency of collaborative actions across different levels of governance. To be operationalised multi-level coordination requires "threefold displacement of state power and control: (i) upwards to international actors and organisations; (ii) downwards to regions, cities, and communities; and (iii) outwards to civil society and non-state actors" (Termeer *et al.,* 2010, p. 29 citing (Pierre & Peters, 2000). Multi-level governance is thus a complex process aiming to integrate diverse policies, actors, and territorial dimensions. Incorporating it into territorial governance offers key benefits: coordinated actions, greater transparency of decision-making, improved effectiveness and efficiency, stronger civic engagement (UN-Habitat, 2022).

- **Promoting inclusivity, participation, and trust:** Inclusivity and participation are essential for governance to reflect on diverse perspectives of all stakeholders, including marginalised and vulnerable groups. A central theme in studying resilience is the varying vulnerability of territories and communities. Different populations experience different levels of vulnerability to short-term and long-term disturbances. As a result, their needs and the conditions required to cope with these impacts can differ significantly and governance systems are responsible for addressing these needs in a way that no one is left behind (Mohabat Doost *et al.,* 2023). In addition, inclusivity and participation provide legitimacy to governance actors and institutions, which is a key source of resilience (Stollenwerk *et al.*, 2021). During crises and reforms, governments face growing pressure to implement more efficient and effective policies (Cerna, 2014). Trust in institutions increases public support for both immediate crisis responses and long-term strategies. Conversely, lack of inclusion can lead to disputes that undermine resilience efforts. These conflicts can be reduced by fostering inclusivity, participation, and trust. To operationalise, practical steps are needed across governance levels. These include establishing forums for open dialogue ensuring multiple centres of authority to bring decisions closer to affected communities, thereby enhancing responsiveness and adaptability and considering vulnerable groups throughout decision-making process (Lebel *et al.,* 2006).
- **Addressing uncertainty and surprise:** This dimension is a precondition for the governance of resilient territories. Resilience-related challenges involve uncertainty and surprise and must be addressed within the territorial governance framework to cope with changing conditions proactively. Different approaches exist to operationalise, including Robust Decision-making (Bertsimas & Thiele, 2014) which provides methods for evaluating policies across a wide range of possible futures, aiming to find and build robust solutions through an iterative, multi-step process. Robustness here is defined as the ability of a system to work satisfactorily under new conditions other than keeping its originally designed functionality (Shortridge et al., 2017). This aligns well with our conceptualisation of resilience, as it allows for the transformation of the system, rather than merely absorbing and adapting to changing conditions to maintain its previous functionality.
- **Ensuring flexibility and adaptive management:** Flexibility refers to the ability of resource management approaches to effectively navigate uncertainty and transform effectively. It contrasts various strategies that attempt to minimise uncertainty and seek false certainty through simplistic solutions (Gunderson, 1999). More flexible governance structures may possess greater potential to deal with disruptive conditions. This could potentially allow for the transfer of lessons to administrative structures, thereby presenting opportunities for integrating forward-looking developments into projects. This is closely connected to and supports the next point fostered by flexible governance systems.
- **Encouraging experimentation, learning, and innovation:** For enhancing the responsiveness of territorial governance to inherent uncertainties and changing contexts, learning and feedback mechanisms are crucial (ESPON TANGO 2013). Territorial governance can encourage learning and

innovation by questioning prevailing social norms, presumptions, and practices (Gupta *et al.*, 2010; Maru, 2010). This is also related to the governance structure since monocentric governance, characterised by only top-down decision-making where outcomes are determined by a single centre of authority, diminishes the experimentation and learning opportunities (Thiel, 2023). Therefore, flexible or softer governance structures often allow for more forward-thinking and innovative solutions. This does not exclude hard governance tools characterised by more top-down approaches but highlights the values of combining them with softer tools and more bottom-up approaches (ESPON, 2018).

- **Favouring hard governance tools:** While he themes of soft governance discussed above is important, the role of a strong, centralised or hard governance system remains crucial. Hard governance tools involve more top-down approaches and robust structures to ensure state recognition, legitimate territorial cooperation and stable, permanent allocation of resources and management capacities at the territorial level, for essential services such as transportation, security, water, and waste management. (ESPON, 2018). Especially in case of abrupt shocks hard governance tools are necessary for efficient allocation of resources, increased effectiveness of implemented resilience measures, and enhanced operational efficiency. These tools also support the development of critical infrastructure, including early warning systems and communication networks, which are essential for effective emergency management and recovery efforts. Therefore, the integration of both soft and hard governance is recommended for Territorial Resilience governance since each of them have strengths and challenges.

ESPON TERRES Criterion 3 suggests that Territorial Resilience should request a more comprehensive definition of territorial systems that includes the socio-cultural, socio-ecologic, and socio-economic dimensions alongside their spatial configurations and infrastructural elements. Accordingly, Territorial Resilience should embrace a multi-scalar and a functional understanding of territorial systems that, due to their fluid nature, shall be tracked through variable geometries characterised by soft, fuzzy boundaries.

The territorial system is often conceptualised within the social-ecological systems framework. The resilience approach is indeed system-oriented and is increasingly being used as an approach to understand the dynamics of social-ecological systems (Folke, 2006). In this perspective, resilience deals with coupled human and environmental attributes that are encapsulated within the territory and significantly affected by the ever-changing system itself (Nelson et al., 2007; Meerow & Newell, 2019). This systemic approach recognises the different scales of space and emphasises the interface between society, environment and culture that generates different forms of activities and processes within territories (Propeck-Zimmermann et al., 2018) As Davoudi et al. (2013) point out, **researchers, planners and policymakers need to understand how their system of interest interacts with other systems beyond its boundaries in order to identify its potential impacts**.

To deepen the interpretation of Criterion 3, the two concepts of multi-scalarity and functional areas are explored as key to understanding and operationalising the fluid and interconnected nature of territorial systems. A multi-scalar perspective highlights the need to build resilience across nested and interdependent geographical and institutional levels, enabling coordination among actors operating at local, regional, national, and transnational scales. This approach supports adaptive management of complex socio-ecological systems and facilitates more coordinated and coherent responses to challenges that transcend administrative boundaries. In parallel, a functional understanding of space recognises that urban, suburban, and rural areas are linked through social, economic, and environmental interactions and must therefore be planned and governed as interconnected systems. Functional areas, defined by real-world interactions rather than fixed administrative borders, provide the flexibility needed to address shared issues through integrated, place-based strategies. Together, these two concepts offer a dynamic view of what we mean by territorial understanding of resilience from a spatial point of view, which supports cooperation and strategic capacity across scales and sectors.

2.3 Bridging the Gap between the Conceptualisation and the Operationalisation of Territorial Resilience

One of the most significant findings that emerged from both the research conducted under this task and the validation meetings with external experts concerns **the lack of consideration of governance in relation to resilience in the academic literature.** The literature predominantly mentions adaptive governance as a useful tool to foster resilience, yet this concept needs to be comprehensively defined. It mainly references only some soft governance tools, which must be integrated more thoroughly to enhance resilience. To address this gap, several steps were taken. First, the concept of 'adaptive management' was explored instead of 'adaptive governance,' which helped clarify the concept. Additionally, more literature and previous ESPON projects, notably ESPON TANGO (2013), were reviewed to develop a better understanding of the attributes of a governance system that can contribute to Territorial Resilience. **Thanks to the Conceptualisation and the Operationalisation of Territorial Resilience, ESPON TERRES aims to contribute to filling this notable gap within the existing literature on resilience.**

As a consequence, we suggest that there is still **a mismatch between the conceptual definition of resilience and how to practically operationalise it within territorial governance praxis** to face some forward-looking trends affecting the EU's capacity to manage climate change and other environmental challenges, technological transformations, pressure on democracy, as well as shifts in demography. **The highly relevant challenge is how to connect the theoretical conceptualisation and the operationalisation of Territorial Resilience.** In order to bridge this gap, ESPON TERRES developed the Criteria for Territorial Resilience assuming a **circular approach** that benefits from and gives benefits to: (1) the **policy and EU documents review** that will serve to understand how the concept is translated into policy-relevant narratives and operational approaches; (2) the **ESPON TERRES Territorial Resilience Dashboard (TRD)** and the relative core set of indicators at the regional scale to analysis and map Territorial Resilience trends; and (3) the **18 Future Workshops** for understanding the practical deployment of Territorial Resilience in Europe.

With reference to the policy and EU documents review, the ESPON TERRES Criteria have been the baseline to define the methodology for deepening the understanding of Territorial Resilience through **a multi-level policy review** – at the transnational level, the EU level, and the national level in ESPON Countries. This review served to understand **how the concept of Territorial Resilience is currently translated into policy-relevant narratives and operational approaches** concerning how much a specific policy contributes to strengthening the territorial system's capacity to resist disturbances (**measuring the capacity to absorb**), how much a specific policy does contribute to strengthening the territorial system's capacity to function without incremental changes (**measuring the capacity to adapt**), and how much a particular policy contributes to transform, innovate, and evolve to possible alternative development in response to disturbances (**measuring the capacity to transform**). It is notable that **most of the policy and EU documents analysed in the project advocate for a transformative approach.** A particular remark is given to the vertical integration enhanced collaboration at all levels of government for aligning and cohering policies and initiatives at both local and national levels. In addition, **promoting better horizontal governance and promoting better (inclusive and multilevel) participation have also been recognised as strategic.** Despite emphasising the importance of adopting a multilevel governance approach to address resilience and suggesting investing in capacity-building and innovative governance models, policies are often vague when **detailing how to operationalise this transformation**.

As for the Territorial Resilience Dashboard (TRD) developed in ESPON TERRES project, the TRD's conceptual model is aligned with the conceptualisation of Territorial Resilience. TRD aims to map the key concepts involved in discussing and assessing Territorial Resilience, including disturbances, capitals, capacities, and territorial governance. **Nevertheless, TRD operationalisation requires integrating qualitative and measurable elements beyond the content in the literature review.** Therefore, the TRD overcomes the conceptual challenges and limitations in the framework of Territorial Resilience. To begin to address these limitations, in addition to the quantitative indicators, the TRD proposes a self-assessment tool of resilient governance that allow supporting qualitative analysis.

3 Policy framework

In increasing environmental and socio-economic challenges, Territorial Resilience has become pivotal in policy discourses across transnational and EU levels. The aim is to critically review existing policy and EU documents to enhance understanding and operationalisation of Territorial Resilience. The Policy Review is crucial as it helps identify and analyse the varying interpretations and implementations of Territorial Resilience across different national contexts, providing a foundation for future policy design and monitoring. The primary goal of this review is to dissect how Territorial Resilience is applied within transnational and EU policy frameworks. It addresses key questions: What are the dominant challenges in implementing Territorial Resilience? How do these challenges vary across different national contexts? Moreover, the review seeks to identify existing policy approaches that can contribute to the planning and monitoring of Territorial Resilience, offering lessons that can guide future initiatives.

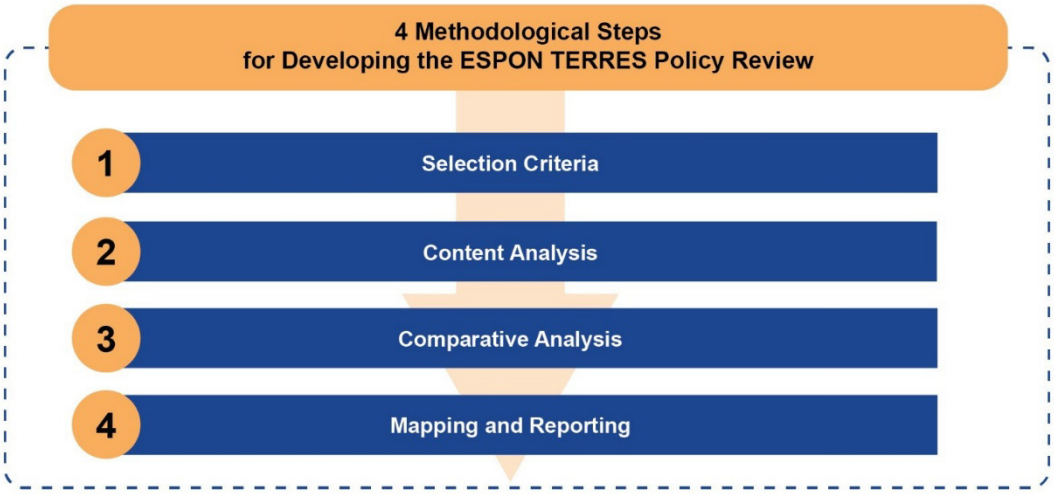
The research questions that the Policy Review aims to answer are:

- How is the Territorial Resilience concept applied and interpreted within the transnational and EU policy discourses?
- What are the dominant challenges and the possible solutions for implementing Territorial Resilience in different national contexts? Is it possible to identify different (macro-)regional perspectives on Territorial Resilience?
- What are the existing approaches to policy design and planning for Territorial Resilience?
- What are the lessons learned that can shape the criteria for planning and monitoring the Territorial Resilience process?

3.1 Summary of the methodology

The methodological approach guiding the review is structured around four interconnected activities: selection criteria, content analysis, comparative analysis, and mapping and reporting. The process begins with a targeted selection of international, EU, and national policy documents, chosen based on their thematic relevance to Territorial Resilience, coherence across governance levels, and overall significance in policy and academic arenas. Each document is examined for its general features, main objectives, and the degree to which it integrates or engages with Territorial Resilience. The content analysis builds on a shared conceptualisation of Territorial Resilience, distinguishing between systemic capacities—absorb, adapt, and transform—and territorial dimensions, which include governance arrangements, spatial framing, and socio-economic and environmental concerns. Governance is analysed in terms of multilevel coordination, participatory mechanisms, and the extent to which it adopts flexible, innovative, and future-oriented models. The spatial dimension is assessed by identifying multiscale, monoscale, or functional approaches to territory, while thematic aspects examine whether policies promote economic efficiency, ecological sustainability, and social well-being. Each policy is evaluated using a scoring system that attributes qualitative values to its contribution to the three systemic capacities, enabling a nuanced understanding of its resilience orientation. These scores are visualised through ternary plots, which depict the balance among absorption, adaptation, and transformation for each document. Comparative analysis is then applied, both horizontally—comparing policies within the same governance level—and vertically—contrasting national approaches with EU frameworks to reveal patterns of alignment or divergence. Finally, results are mapped through a combination of ternary plots and pan-European maps, offering a clear, spatially differentiated picture of how Territorial Resilience is interpreted and pursued across different contexts.

Figure 5: Methodological Steps of the Policy Review



Source: elaboration of the project team

The policy review encompasses an extensive examination of documents adopted across international, EU, and national levels to assess the degree to which the concept of Territorial Resilience is acknowledged and integrated. A total of 115 policies were considered: 9 at the international level, 13 at the EU level, and 93 at the national level (three per country across 31 countries). The selection was guided by three criteria: relevance to urban and territorial dynamics, relevance to systemic change, and alignment with environmental and climate-related challenges. This multi-level and cross-cutting approach enables both horizontal and vertical comparisons, facilitating a nuanced understanding of policy orientations.

3.2 Discussing Territorial Resilience through policy analysis

This policy analysis review investigated the implementation of Territorial Resilience across various policy levels, including the international, EU, and national frameworks. It aimed to assess the integration of Territorial Resilience into policy-making processes and the extent to which its principles have been reflected in the strategies and initiatives adopted at different governance levels.

While this analysis does not provide an exhaustive evaluation of every policy adopted across different levels, it serves as a valuable tool for understanding the broader systemic integration of Territorial Resilience. Examining a range of policy domains, from environmental and spatial planning to economic and infrastructure policies, highlights the various ways resilience thinking has permeated different spheres. This interconnectedness of policy areas that align with the concept of Territorial Resilience reflects the increasing adoption of holistic approaches by governments and institutions to manage risks, enhance adaptability, and promote sustainability. The analysis underscores the value of viewing resilience not as a standalone goal but as a multifaceted principle that cuts across diverse policy sectors.

3.2.1 Transnational and EU Approach to Territorial Resilience

Based on the policy review conducted, this section addresses how Territorial Resilience is applied and interpreted within transnational and EU policy discourses. The analysis of various documents reveals that Territorial Resilience has indeed been incorporated, to some extent, into the policy frameworks reviewed. However, notable differences emerge when examining how this concept is articulated and implemented across different policy arenas.

These differences reflect the varying degrees of emphasis placed on resilience across sectors and governance levels, as well as the distinct priorities of the institutions involved. Some policy arenas may focus more on adaptation and transformation, while others prioritise absorption, reflecting diverse strategic goals and regional needs. This variation highlights the complexity of uniformly applying the Territorial Resilience concept across the transnational and EU policy landscape, as different contexts require tailored approaches.

A comparison of the approaches adopted at the international and EU levels reveals distinct focuses within each (see Table 1). The EU tends to prioritise the transformative aspects of Territorial Resilience, aiming to fundamentally reshape systems to enhance long-term sustainability and resilience. In contrast, at the international level, the emphasis is more on the adaptive dimension, concentrating on strategies that allow regions to adjust and respond to challenges in a flexible manner. In both cases, however, the absorptive capacity—focused on absorbing shocks and maintaining system stability—appears to receive comparatively less attention. This divergence suggests that while both levels recognise the importance of resilience, they approach its implementation through different lenses, with the EU leaning towards transformation and the international discourse favouring adaptation.

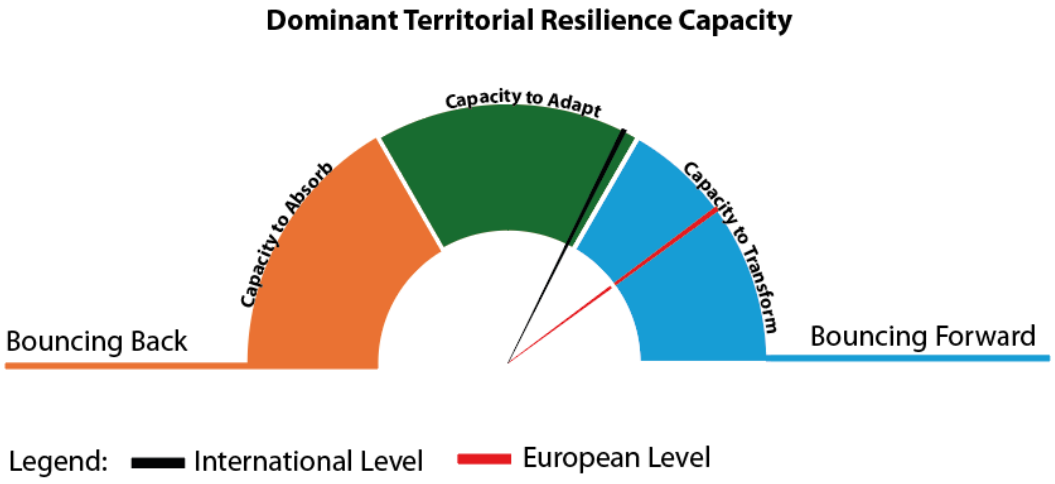
Table 1: International and EU-level prioritisation of Territorial Resilience capacities

Level	Territorial capacity to absorb	Territorial capacity to adapt	Territorial capacity to transform
International	10/18	**16/18**	12/18
European Union	15/26	23/26	**24/26**
Note: The scores indicated here represent the mathematical sum of each level/capacity attributed to the maximum attributable for each level/capacity.			

Finally, when examining the capacity of a territorial system to navigate between "bouncing back" and "bouncing forward" approaches, it becomes clear that multiple strategies are present at the international level (Figure 6). The diverse range of documents analysed reflects the varying degrees of support for Territorial Resilience globally. While some documents advocate for more conservative approaches focused on maintaining stability and returning to a pre-crisis state (bouncing back), others promote a more ambitious agenda aimed at systemic transformation (bouncing forward). This heterogeneity highlights the nuanced and often context-dependent ways in which Territorial Resilience is interpreted and applied internationally.

In contrast, the policies assessed at the EU level reveal a clearer emphasis on the "bouncing forward" approach. The EU appears committed to fostering the conditions necessary for transformative initiatives, encouraging regions and systems to not just recover from disruptions but to evolve and strengthen in response to them. This forward-looking stance underscores the EU's focus on long-term resilience through innovation, adaptation, and transformation, distinguishing its approach from the more varied strategies seen at the global level.

Figure 6: Comparison of Dominant Territorial Resilience Capacity in the International and EU level



Source: elaboration of the project team

3.2.2 National Approach to Territorial Resilience

Based on the policy review, this section answers the following question: What are the existing approaches to policy design and planning for Territorial Resilience?

When analysing the documents at the national level, we can identify various categories of Territorial Resilience approaches, each shaped by the focus on three key capacities: the ability to absorb, adapt, and transform. Rather than providing clear-cut, deterministic results, this analysis highlights the diversity of approaches reflected in the policies that have been adopted. What emerges is not a rigid classification, but a more nuanced understanding of how different capacities are emphasised. Instead of presenting any one approach as exclusive, the analysis introduces the concept of a "dominant capacity" in Territorial Resilience (Map 1). This term captures the idea that, while one capacity may be prioritised, the others are not entirely disregarded but remain integral to the broader policy adopted. This perspective offers a more flexible, layered understanding of how Territorial Resilience is promoted.

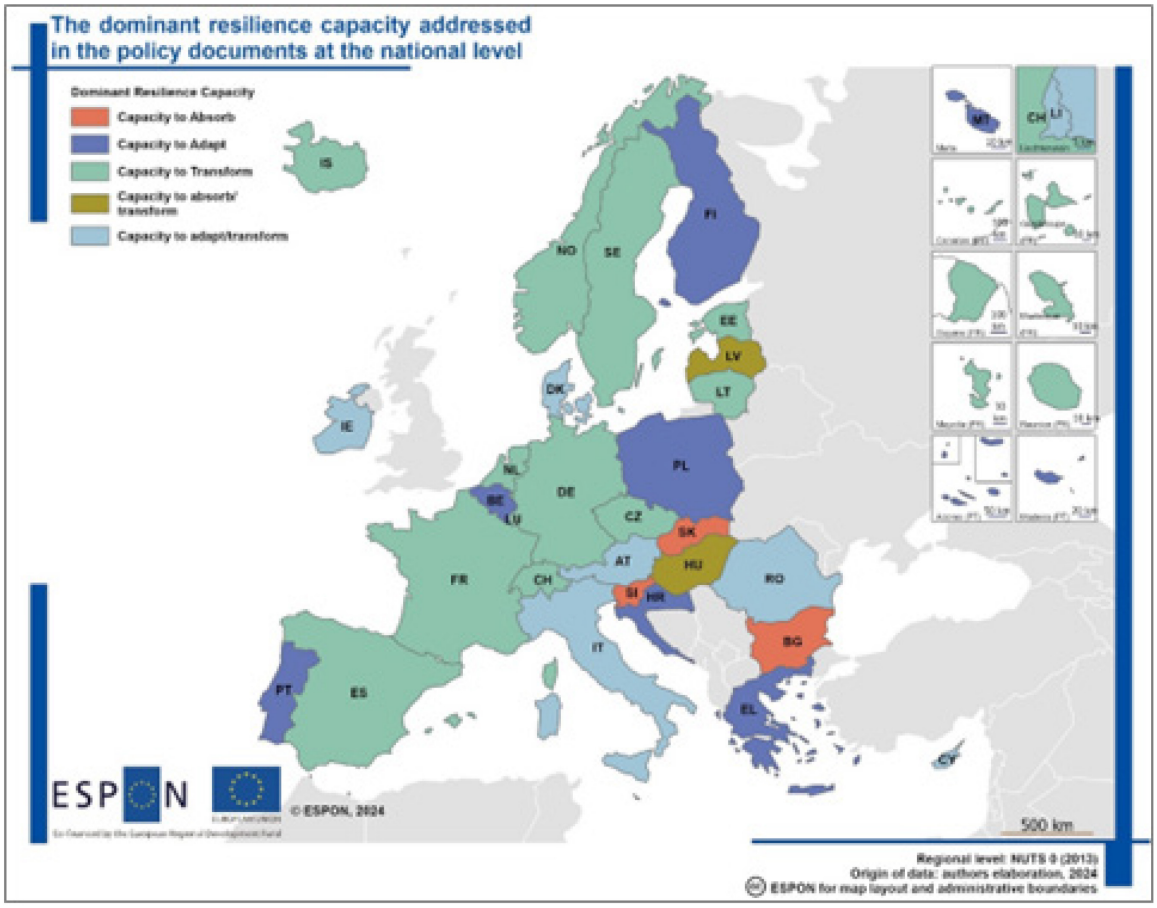
Based, thus, on the dominant capacity of Territorial Resilience, it is possible to distinguish between:

- Category A - a dominant absorptive-oriented approach. This includes initiatives taken by countries to prioritise projects with pronounced absorptive objectives. The countries that seem to adopt this approach are Slovenia, Slovakia and Bulgaria. For instance, Bulgaria's Long-Term Climate Change Mitigation Strategy by 2050 effectively strengthens Territorial Resilience, with strong contributions to absorption through energy efficiency, renewable energy adoption, and infrastructure modernisation. Slovenia's Spatial Development Strategy 2050 contributes strongly to absorptive capacity by emphasising measures to protect natural ecosystems, preserve cultural heritage and protect settlements from natural disasters such as floods and landslides.
- Category B - a dominant adaptive-oriented approach. This encompasses the initiatives to bring some adaptive measures to face systemic challenges. The countries that seem to adopt a similar approach are Finland, Poland, Belgium, Croatia, Portugal and Greece. More specifically, the Smart, Resilient and Climate Neutral Cities initiative excels in adaptability but lacks emphasis on socio-environmental resilience, while the Portuguese national long-term strategy (2019) mainly emphasises resilience as the ability to adapt and respond to climate change vulnerabilities and impacts.
- Category C—dominant transformative-oriented approach. This includes the territory's capacity to introduce transformative initiatives that help it overcome unpredictable challenges. Countries that seem to adopt this approach are the Czech Republic, Estonia, France, Germany, Island, Lithuania, Luxemburg, Norway, Spain, Sweden, Switzerland, and The Netherlands.
- Category D - dominant a mix of absorbing and transformative-oriented approaches. This category includes those contexts that, to face their territorial challenges, consider it necessary to activate different initiatives that, on the one hand, can contribute to absorbing systemic disturbance while, on the other hand, supporting the system to transform. The countries that belong to this category are Latvia and Hungary.
- Category E - dominant a mix of transform and adaptive-oriented approach. This takes into consideration the initiatives that mix differ the different territorial needs. On the one hand, it offers the conditions to activate adaptive measures to face systemic disturbances, while, on the other side, it offers solutions for promoting systemic transformation. The countries in this category are Austria, Denmark, Ireland, Italy and Romania.

While theoretically possible, the following two categories do not emerge when assessing the documents at the country level.

- Category F - dominant a mix of absorbing and adaptive-oriented approach.
- Category G – co-dominance of the three capacities.

Map 1: The dominant resilience capacity at the national level



Source: elaboration of the project team

3.2.3 Challenges of Territorial Resilience

Based on the policy review conducted, this section seeks to address two key questions: What are the dominant challenges and potential solutions for implementing Territorial Resilience in different national contexts? Can we identify distinct (macro-)regional perspectives on Territorial Resilience?

The dominant challenges for implementing Territorial Resilience vary significantly depending on the context.

At the international level, delivering Territorial Resilience properly can be influenced by:

- The conceptual understanding of the different international actors involved. Due to the diversity of actors and agendas, a more flexible approach seems to be appropriate when coming to addressing policies at the international level
- The different countries' expectations and possibilities. As the international level's documents have the ambition to set the general framework for, in this case, delivering Territorial Resilience, it doesn't seem very easy to mediate between different levels of development of the countries involved. The possibilities of operationalising Territorial Resilience seem to be path-dependent.

Due to existing strategic and operative frameworks, delivering Territorial Resilience properly seems easier at the EU level. The common territorial and often financial frameworks offer valuable conditions for coordinating actions to promote territorial resilient initiatives. However, this does not prevent the misunderstandings and misuses of the Territorial Resilience concept.

When examining the country level, it appears clear that the challenges at the local level are different. In some countries, institutional fragmentation and lack of coordination between different governance levels pose major hurdles. Others face resource limitations or political resistance to adopting more transformative resilience strategies. Additionally, there is often a gap in technical expertise and data, making it difficult to design and

implement comprehensive resilience frameworks. More in general, countries' choice in promoting more or less absorptive/adaptive or transformative approaches seem to be influenced by the different institutional contexts, cultures and economic development levels.

From a macro-regional perspective, it is possible to observe different approaches to Territorial Resilience. For example, Northern and Western European countries tend to emphasise transformation and innovation, focusing on forward-looking resilience strategies. In contrast, Eastern European countries may prioritise absorptive capacity due to their historical vulnerability to sudden economic and environmental shocks. Meanwhile, Southern European countries, particularly in the Mediterranean, often strike a balance between adaptation and transformation due to their frequent exposure to climate-related risks. These distinct regional perspectives reflect both geographic and socio-political realities, influencing how Territorial Resilience is understood and implemented across Europe.

3.3 Lessons learnt

Based on the policy review conducted, this section answers the question of what lessons learned can shape the criteria for planning and monitoring the Territorial Resilience process. After reviewing more than 120 policies at the international, EU, and country levels, it can be said that:

- Lesson 1: **Policies and framework documents are often so comprehensive that it can be difficult to clearly determine whether they exclusively promote one specific capacity of Territorial Resilience**. Most of the policies analysed tend to support all three capacities—explicitly or implicitly, directly or indirectly—though to varying degrees. This is particularly relevant when considering their diverse impacts on the ground, which often leads to a more integrated approach when analysing their sometimes-unpredictable effects.
- Lesson 2: **The polymorphism associated with Territorial Resilience capacities seems more of a strength than a risk.** The concept of Territorial Resilience appears to be adaptable to different contexts, needs, and timeframes. For example, it is not always necessary for all contexts to adopt a transformative approach when addressing specific issues, especially when dealing with varying institutional structures and planning conditions. This adaptability is an intrinsic value that should be preserved and promoted. **This suggests adopting a more place-based approach to Territorial Resilience measures, recognising that not all contexts are ready for radical or transformative initiatives**.
- Lesson 3: **Policies are often interconnected, which can help promote a more coherent and consistent application of the Territorial Resilience concept**. This is particularly evident when evaluating how the concept is understood in documents focused on urban and territorial dimensions. The existing vertical (voluntary) coordination between the international Urban Agenda, the EU's Urban and Territorial Agendas, and the documents adopted at the national level demonstrate **a valuable multiscale approach to aligning Territorial Resilience initiatives**.

3.4 Contribution of policy review to the conceptualisation of Territorial Resilience

The Policy Review aiming to deepen the understanding of Territorial Resilience. One of its primary objectives is to inform the Conceptual and Operational Framework for Territorial Resilience by providing evidence-based insights through the examination of policies adopted at the international, EU, and country levels. This review offers valuable perspectives on how different policy frameworks address the complexities of Territorial Resilience across various governance structures.

In this context, the activity involved analysing 115 different policies and framework documents covering a wide range of topics, including urban and regional development, climate change adaptation and mitigation, long-term strategic visions, and planning. These diverse areas are critical to understanding how resilience is built into broader policy agendas. The documents selected for review represent a comprehensive cross-section of initiatives that reflect the evolving approach to resilience at different levels of governance.

By adopting an integrated approach to policy analysis, the review identified patterns, challenges, and gaps across the different policy-making levels. While not an exhaustive review, this analysis provides a nuanced understanding of how Territorial Resilience is addressed across these diverse policy areas. The findings contribute to a broader understanding of resilience and highlight the importance of multi-level collaboration, flexible policy frameworks, and tailored regional approaches to resilience-building.

This process has also underscored the value of combining diverse policy perspectives, facilitating a clearer understanding of how Territorial Resilience can be strengthened and applied more effectively across various national and regional contexts.

In summary, the policy overview suggests that:

- **At the international level**, Territorial Resilience has been addressed with consideration for the varying development levels of different countries. Policies at this level tend to promote a more adaptive approach.
- At the EU level, Territorial Resilience is framed in the context of the ambitious EU Green Deal, which requires structural changes, suggesting a transformative approach.
- At a country level, Territorial Resilience is interpreted through a path-dependent lens, with each country shaping its approach based on its institutional frameworks, social dynamics, and economic conditions. National policies often reflect the historical trajectories of development and governance, meaning that countries with different governance structures or socio-economic profiles may adopt varied strategies. This level of resilience emphasises the importance of contextualised solutions, where local characteristics, challenges, and capacities play a critical role in determining how resilience is built and maintained.

The insights gained from this activity will play a crucial role in shaping the further development and refinement of Territorial Resilience conceptualisation.

4 Overview of case studies and futures workshops

The six case study areas in ESPON TERRES include Upper Norrland (Sweden), Latgale (Latvia), Budapest metro-area, (Hungary), Central Italy, Catalonia and Teruel (Spain). The primary objective of the case study task was to collect comprehensive evidence from the perspectives of policy actors and stakeholders concerning the ongoing trends impacting territorial resilience at global, European, national, regional, and local levels; territorial dynamics and the underlying factors influencing these trends; and various national, regional, and local initiatives implemented to address these trends and their effects. Additionally, the case studies served to develop a narrative about the shock/recovery processes that may not be captured by indicators and statistics alone, thereby providing valuable insights into the conceptual and thematic progress in other tasks. This approach has helped establish a common understanding of territorial resilience within different geographic contexts, highlighting transferable lessons that could benefit similar areas. Further details on each case study's contribution to our understanding of territorial resilience are provided below.

Map 2: Case study regions

Source: Elaboration of the project team.

One of the key goals in ESPON TERRES is to enable a consistent policy framework for territorial resilience building on shared understanding of the theoretical and practical enablers and barriers of territorial resilience. This requires deep stakeholder engagement in the process, drawing on foresight techniques as a mechanism for "probing and learning". In this logic, ESPON TERRES organized a series of Futures Workshops (FWs) in the six case study regions to anchor the concept of resilience in territorial policies and validate it conceptually and operationally. The FWs are the means to engage with key stakeholders in each of the six case study territories to understand the practical deployment of territorial resilience in their respective regions and contexts. The FWs were developed in three iterations (see Annex 2 for a detailed methodology). Each

iteration focused on the following issues: i) the practical deployment of the concept of territorial resilience in each case study territory, ii) the territorial impacts that past crises and stressors had on each case study territory, iii) and the resilience factors that are considered relevant to tackle different types of stressors in each case study territory. Other than shedding light on the abovementioned issues, the FWs allowed stakeholders and researchers to disentangle the relation between disturbances and resilience factors as a first step to be able to identify possible measures to strengthen territorial resilience. In combination, the results of the FWs and the case study work provide a rich empirical foundation for the formulation of policy recommendations targeted at the regional and local governance levels (presented in Chapter 7).

4.1 Results of ESPON Terres Case Studies

This section presents an overview of the outcomes from the series of the case studies held in the ESPON Terres project, presenting the main results of each. For a detailed inventory of the results, please see Annex 1.

4.1.1 Results of individual case studies

The **Budapest Functional Urban Area** in Eastern Central Europe incorporates Hungary's capital and nearby settlements, forming its most populous and economically significant region. It boasts substantial human and social capital, major transport infrastructure, and key institutions. However, innovation and economic productivity lag behind similar metropolitan areas. Challenges include intense suburbanization, urban sprawl, and governance stresses that overburden infrastructure and public services. Fragmented governance, political divisions, centralisation, and insufficient multilevel cooperation weaken the region's ability to handle crises. Regulatory changes and a weak place-based approach further undermine strategic capacity. To address these issues, we propose a framework to enhance cooperation and commitment among governance actors. The investigation on the Budapest case reveals valuable emerging initiatives, some promising forms of cooperation and a high added value of informal connections. The Budapest case highlights the role of proactive actors in resilience, and how learned inertia can be overcome in the face of crises. It is crucial to recognise that arising difficulties can pave the way for broader systemic adaptations, including the rethinking of local life and more flexible governance responses. In the Budapest FUA, several municipalities demonstrated coordination capacity, creativity, and the ability to act flexibly under pressure. In addition, hard governance tools, such as legislation, formulate an influential instrument that supports active responses to develop and enhance adaptive capacity through regulatory tools. The Budapest FUA case study illustrates the urgent need for integrated metropolitan cooperation, sustainable planning frameworks, and enhanced coordination mechanisms. While informal networks and crisis-driven responses have played a role in resilience-building, long-term solutions require systematic reforms, regulatory and financing stability, and a commitment to balanced development. Strengthening the resilience of FUA-related governance is not only about administrative reform—it is a prerequisite for fostering liveability, equity, and sustainability in the region.

Catalonia serves as a case study for addressing climate resilience challenges in the Mediterranean context with a European perspective. It exemplifies translating European policies into local actions at regional and municipal levels, showcasing enhanced collaboration among administrative bodies despite institutional fragmentation. The key results point to the fact that the society organizes itself to be more resilient: The Barcelona Provincial Council addressed territorial coordination gaps by providing technical and financial support to small municipalities for developing local resilience plans and accessing European funding. Initiatives like LIFE Clinomics and LIFE eCOadapt50 improved intraterritorial coordination, recognizing natural risks must be managed beyond administrative boundaries. In addition, effective governance structures bridged local initiatives with regional and European strategies, aligning adaptation and mitigation efforts. Catalonia now uses a dual approach integrating both mitigation and adaptation measures, evidenced by widespread adoption of Sustainable Energy and Climate Action Plans (SECAPs). Participation in European programs has provided resources for climate resilience, as seen in the successful LIFE eCOadapt50 project by Diputació de Tarragona. In the future, sustained financial investment, private-sector engagement, and sectoral vulnerabilities in agriculture, forestry, tourism, and fisheries need to be addressed. Catalonia's model provides valuable lessons for enhancing territorial resilience against climate change. The Catalonian case highlights integrated planning, strong governance, and European cooperation as crucial for building climate resilience.

The **Central Italy** Earthquake Crater serves as a crucial case study in territorial resilience, highlighting socio-economic, governance, and environmental challenges after the 2016-2017 earthquake. The natural

catastrophe worsened the area's existing issues, such as economic decline, job loss, depopulation, ageing population, and poor infrastructure. Additionally, governance and risk management gaps were exposed. This case study highlights the need to shift from restoring pre-disaster conditions to integrating resilience into daily governance and planning. The earthquake revealed the limitations of emergency-driven responses and the importance of proactive, strategic, multi-level governance that promotes inter-municipal collaboration and long-term sustainability. Key lessons learned from the Italian case include the need for a functional approach to spatial planning that transcends administrative boundaries, leveraging local assets such as cultural heritage and environ-mental resources to drive socio-economic revitalisation. The study also highlights the role of research, innovation and knowledge transfer in bridging the gap between theoretical advances and practical implementation of hazard mitigation and spatial governance. Furthermore, it highlights the critical importance of community involvement and participatory governance in promoting inclusive and adaptive resilience strategies. Ultimately, the case study of the earthquake crater in central Italy demonstrates that resilience is about reconstruction and reimagining territorial governance to ensure sustainability, adaptability and preparedness for future crises. By integrating long-term resilience considerations into main-stream planning processes, promoting institutional collaboration and strengthening local capacities, this case provides a model for other marginalised and disaster-stricken territories in Europe seeking to build more robust and future-proof governance frameworks.

The **Latgalian** case highlights the impact of Russia's 2022 invasion of Ukraine and Lukashenko's 2021 migrant influx on EU/NATO border regions. Latgale, on Latvia's border, faces economic marginalisation, population decline, and inadequate institutional support, compounded by failed integration strategies. Despite these issues, Latgale shows resilience through informal networks and grassroots initiatives. Increased support from international donors and the national government offers new development opportunities. However, Latgale's complex identity, influenced by its multi-ethnic population and proximity to Russia and Belarus, poses ongoing political and security challenges. Describing Latgale's territorial crisis and resilience has been challenging due to its deep historical roots. Recent geopolitical crises, such as Russia's invasion of Ukraine in 2022 and Belarus' use of migrants since 2021, have further highlighted Latgale's vulnerability. Despite ongoing socio-economic challenges, Latgale has developed coping mechanisms. Many of its successes are informal and undocumented, demonstrating resilience even amid weak institutions and isolation from global capital. This highlights the importance of tailored, community-centred solutions that address both socio-economic and security concerns, while recognising that while security and security threats are perceived differently by different population groups in Latgale, there is consensus in relation to enhanced socio-economic development. These solutions must advocate for a redefined future(s) of Latgale region that balances local resilience with broader national and international priorities. The crucial question is whether Latgale can transition from merely surviving to thriving.

Teruel, a sparsely populated region in Aragón, is emblematic of Spain's "Empty Rural" crisis. Mechanised farming, mine closures, and the 2008 crash have reduced jobs, services, and household purchasing power, while unemployment remains high. Shrinking schools and clinics drive outward migration, and poor infrastructure—no high-speed rail or complete A-40 motorway—keeps businesses away. Climate change, droughts, and wildfire risks threaten local forests and farms. The study shows Teruel faces deep-rooted issues: long-term depopulation, economic decline, and ageing population, all worsened by environmental challenges. Fragmented governance has led to short-term fixes instead of sustainable strategies, leaving public services, education, transportation, and digital access underdeveloped. The case study in Teruel identifies significant opportunities for a turnaround. Teruel possesses valuable natural and cultural assets that, if effectively harnessed, can drive economic diversification. Initiatives in renewable energy, agro-industrial expansion, digital transformation, and eco-tourism offer promising avenues to stimulate local growth and attract new residents. The establishment of Rural Innovation Hubs and improved coordination among stakeholders could transform these opportunities into tangible benefits, while tailored fiscal incentives and infrastructural investments would help bridge existing gaps. In essence, building territorial resilience in Teruel calls for a long-term place-based strategy that integrates economic revitalization (diversifying the economy through innovation, renewable energy, and agro-industrial initiatives); social renewal (enhancing access to education, healthcare, and housing to improve quality of life and counteract demographic decline); infrastructural upgrades (addressing connectivity issues and modernizing essential services to better link Teruel with major urban centres); and coordinated governance (fostering multi-level collaboration and stakeholder engagement to ensure that policies are responsive to the region's specific needs). Ultimately, reversing Teruel's current

trajectory will require not only a strategic reorientation of policies but also a sustained commitment to innovation and community-driven initiatives. By leveraging its unique strengths and addressing its vulnerabilities in a coordinated manner, Teruel can lay the groundwork for a more resilient, dynamic, and sustainable future.

The **Upper Norrland** case study explores a region encompassing Norrbotten and Västerbotten counties, is distinguished by vast distances, sparse population distribution, and a demographic trend marked by aging and declining population. Upper Norrland is also characterized by its rich natural resources, including extensive forests, numerous rivers, and significant mineral deposits. Upper Norrland is undergoing a green industrial transition, where the region is witnessing substantial investments in sectors like green steel and lithium-ion batteries. These endeavors are anticipated to spur robust regional economic growth and population expansion, enhancing overall competitiveness. However, this transition presents significant challenges, including workforce development, skills supply, population attraction, infrastructure, and housing. Projections suggest a potential population surge of 100,000 individuals in Upper Norrland by 2035, a noteworthy increase considering the combined population of both counties currently hovers around half a million. The Upper Norrland case study found that Sweden lacks effective governance systems to handle crises. It highlighted the need for coordinated, flexible governance to keep up with rapid industrial changes, ensuring sustainable and inclusive growth. The study emphasized better coordination between local, regional, and national governments and involving various stakeholders like communities, industries, and nonprofits. Demographic challenges are also evident, with population declines in rural areas and an aging population making it hard to retain a skilled workforce. Targeted policies are crucial for attracting new residents by offering job opportunities, housing, infrastructure, and social services. Additionally, addressing land use conflicts and ensuring equitable distribution of green transition benefits is vital. Renewable energy projects and new industries have created competition for land, affecting local communities, including the Sami people. Inclusive planning processes are necessary to address these issues. In summary, Upper Norrland needs integrated governance, targeted workforce policies, and equitable benefit-sharing to enhance resilience and ensure a sustainable, inclusive future.

4.1.2 Territorial resilience preparedness

The following table lays out how the individual case studies, with their different shocks and stressors, understood territorial resilience and approaches to managing it. These learnings provide a reliable basis for formulating recommendations for future policy-making (see Chapter 7.3)

Table 2: Interpretations of Territorial Resilience and Management Approaches Across Case Studies

Case	Risk type	Territorial resilience learnings
Budapest	Urban sprawl	Preparing better territorial resilience should involve a forward-looking vision, shared priorities, and the integration of resilience into education, professional training, and legislation, with an anticipatory outlook
Catalonia	Climate change	Territorial resilience preparedness translates as an ability to respond to challenges posed by climatic and territorial shocks through coordinated strategies, innovative public policies, and robust governance, while addressing vulnerabilities and financial limitations.
Central Italy	Natural disaster	Territorial resilience preparedness entails the implementation of adequate disaster prevention measures, comprehensive risk mitigation strategies, and a unified legal and regulatory framework for emergency management.
Latgale	Marginalisation	Territorial resilience preparedness is a complex, ongoing process that involves the decentralization of civil defense responsibilities, the integration of formal and informal networks, the fostering of societal cohesion and trust across diverse populations, while addressing of specific regional challenges.

Case	Risk type	Territorial resilience learnings
Teruel	Economic and social decline	Supporting territorial resilience preparedness requires a comprehensive effort to overcome systemic challenges by strategically pursuing a wide array opportunities, many of which involve leveraging transferable practices for regional revitalisation.
Upper Norrland	Green transition	Territorial resilience preparedness entails a proactive and coordinated management of both the opportunities and significant challenges arising from a green industrial transition, aimed at sustaining regional economic growth and societal well-being amidst pressures on demographics, infrastructure, and the labour force

4.2 Results of ESPON Terres Future Workshops

This section presents an overview of the outcomes from the series of FWs held in the ESPON Terres project, presenting the main results of each of the workshops. For a detailed inventory of the results, the curious reader may refer to Annex 2.

4.2.1 FW1: Defining territorial resilience & mapping regions' risk landscapes

The main objective with FW1 was to develop a **shared understanding of the notion of regional and territorial resilience** and carry out a **risk mapping exercise** with stakeholders.

There were major differences between case study region in conceptualising 'territorial resilience'. While for some participants—e.g., in Budapest region—the term resilience was entirely new, others were highly familiar with it—i.e., Upper Norrland and Teruel, even in relation to the territorial dimension. In most cases, participants come up with a broad understanding of the concept, in the sense that they generally acknowledged that resilience relies on a complexity of different factors and dimensions, including social, economic, environmental, infrastructure, different levels of governance, etc.

Conceptual discussions were useful to define the systems under analysis i.e., the territory as a unit of analysis, its physical boundaries, the sub-systems encompassed by it, etc. Interestingly, in the case of Upper Norrland, participants challenged the relevance of existing administrative boundaries as tools to define the unit of analysis and proposed instead addressing the system's challenges in close connection with developments in neighbouring regions in Norway and Finland. In the case of Teruel, the unit of analysis extended beyond the spatial dimension. Participants identified multiple units of analysis that they considered crucial for understanding territorial resilience. These ranged from a human capital perspective, focusing on the talent in the region, to an economic approach that emphasized companies as the key elements of territorial resilience, and to an administrative perspective that set municipalities as the unit of analysis. Participants also discussed specific indicators to measure resilience according to these diverse perspectives.

The concepts of 'bouncing back', and 'bouncing forward' were discussed in relation to different theoretical understandings of resilience—i.e., i) single equilibrium framework stemming from engineering literature, ii) multiple equilibria framework stemming from ecology studies, and iii) an adaptive resilience framework stemming from evolutionary economics, which understands systems as being dynamic rather than under static states of equilibrium. While this discussion generated interesting reflections, participants struggled to visualise how these different perspectives can lead to define clear objectives and outcomes from resilience policies at the regional and local level. Linguistic peculiarities also conditioned participants' expectations on resilience. For instance, in Hungarian, there are two different terms used to refer to resilience, the word 'alkalmazkodóképesség', which translates to adaptation, and 'ellenálló képesség', which translates to resistance. However, upon discussion, participants in Budapest agreed on the importance of resilience measures that lead to adaptation (or bouncing-forward) rather than aiming solely to resist disturbances or return to pre-crisis conditions.

Once a general shared understanding of the notion of territorial resilience was reached, participants were guided to draw a risk landscape in their regions. Participants helped to carry a broad risk mapping

considering past, present and future disturbances. These could range from major shocks and wild cards to minor shocks and slow-burns, and long-term stressors. Table 3 provides a compilation of the risk landscape of the 6 regions in scope.

Table 3: Risk landscape mapping across case study regions categorised according to hazard type

Hazard type	Findings
Financial	Financial crisis 2008; Economic crisis (2020's) i.e., inflation 2022 (due to war, sanctions, etc.) Municipalities having insufficient resources (LG, UN, BP) Lack of resources for independent media & NGOs (LG) Major company shut down (potential) (UN)
Technological	Cyber-attacks (LG, UN); Hybrid attacks (UN) Artificial intelligence e.g., leading to job losses or aiding fraud and cyber-attacks, (BP, UN, TR) Innovation gaps – resistance to adopting innovative agricultural and economic practices (TR)
Commodity price	Sharp inflation on food - 'Food security' threat (LG) 'Energy crisis' – oil and gas trade disruptions, increasing prices (all cases); closure of Paks nuclear power plant – wild card (BP) Increasing housing costs – 'housing crisis' (BP, UN) Decrease in purchasing power over the last 15 years due to inflation and stagnant wages (TR, CI)
Demand-driven	Shrinking market (due depopulation) (LG, TR) Severe rural depopulation with most municipalities having fewer than 100 inhabitants (TR)
Policy-induced and regulatory	Ineffective public institutions, e.g., outdated policy tools, bureaucratic, lack of technical capacities, etc (CI, LG, TR) Isolation i.e., centralised political system, precarious connectivity, conflicts national-local authorities (LG, BP) "Long distance" between local and state authorities (UN, TR) Broken trade relations with Russia and Belarus – loss of important formal and informal market (LG) Reactive/spontaneous intervention (absence of strategic planning at municipal and metro levels) (BP) New policy and governance tools, e.g., planning programmes, governance mechanisms (Positive shock) – (CI) Closing schools in rural areas & potential closure of university (LG, TR) Lack of cooperation in planning at regional level (UN, BP) Fiscal limitations: insufficient differentiated fiscal policies to stimulate local economies (TR)
Geopolitical	Potential of brewing separatism and alignment with Russia and Belarus (LG) Illegal presence of Russian media channels and propaganda (LG) Hybrid threats e.g., weaponisation of migration (forced), sanctions, cyberattacks, etc (LG, UN) Insecurity, escalation of global conflicts, potential of nuclear war (All cases); military invasion (LG) Disintegration of the EU – 'wild card' Decline in democracy globally/Europe (UN) Se

Hazard type	Findings
Natural / Environmental	Earthquake – past and future (CI) Pandemics & health i.e., Covid-19 (negative and positive effects) Climate extremes i.e., threat food system (LG), drought (TR), heat waves (TR), floods (UN, CI, BP, LG, CL), water scarcity (BP,CL), wildfires (TR,UN,CL) Increased frequency and severity of extreme weather events impacting infrastructures (CL) Large scale infrastructure collapse, e.g. water dam (UN) Golf stream stop – new ice age (UN) Water supply cuts (CL) Energy breakdown (CL) Wind gusts (CL) Coastal erosion (CL) Reliance on non-local energy companies, limiting local economic benefits from renewable energy projects (TR)
Slow / long-term stressors	Demography trends i.e., decline, ageing (CI, LG, UN, TR, BP) High unemployment (LG) Decay and underinvestment in infrastructure (CI, LG, TR, BP) Deteriorating public and municipal services (LG, TR) Low levels of stakeholder/citizen participation (BP, LG); i.e., unempowered actors: 'General sense of hopelessness' (LG) Limited access to (quality) information (LG) Language barrier i.e., information/communication in Russian (LG) Mistrust in public institutions (CI, LG) Corruption & sinuous modus operandi of public institutions (CI, LG) Informality: e.g., illegal building (CI); informal trade and tax avoidance (LG) Insufficient crisis related communication with the central government (LG) Limited capacity to cope with high migration influx (LG) Lacking skills and labour (LG, BP, UN), e.g., Labour market becoming less diverse (UN) Poor economic performance (LG) Increasing segregation (BP) Polarisation between urban/rural and indigenous/non- indigenous (UN) Weak community cohesion and identity (BP) Disorganised urban growth i.e., sprawl, pressure on transport infrastructure, shortage of services (BP) Overtourism (BP) Poorer health (UN) Sense belonging declining (UN) Risk associated with too tightly knit networks potentially stifling new ideas (UN) Large differences between coastal and inland areas (UN) Limited access to healthcare and other essential services compared to urban area (TR) Seasonal fluctuations in economic activity and employment (TR) e.g., rural tourism (TR) Limited economic diversification, (LG, TR, BP) e.g., over-reliance on a few sectors like agriculture and tourism (TR) Industrialisation challenges – Underdeveloped industrial plots with insufficient utilities limiting industrial growth (TR) Uncivil behaviour and vandalism (CL)

Legend: Central Italy (CI), Latgale (LG), Upper Norrland (UN), Budapest (BP), Catalonia (CL), Teruel (TR).
*Items relevant to all regions do not mention any specific region.

Table 3 organises disturbances under different categories drawing on the type of hazard and causality, ranging from economic i.e., financial, commodity-price or demand-drive, to technological, political and geopolitical, and natural and environmental hazards. Risk mapping allowed participants to highlight any type of issue and attribute any degree of intensity and scale based on their own perceptions. Nonetheless, the list of potential risks is non-exhaustive and was based exclusively on participants' contributions, which is expected to be influenced by their professional fields of expertise, values and biases.

With this exercise, participants realised that disturbances are not necessarily exceptional events but rather a very likely occurrence, although some may be more plausible, whereas others are less probable and/or have intensities that surpass the abilities of the existing structures in place to mitigate the negative impacts. In this process, participants were also able to identify the context in which disturbances occur, which is key to understand how the consequences of larger events unfold. In practical terms, the 'underlying landscape of disturbances', mostly including long-term stressors, such as demographic decline, poor infrastructure, or ineffective public institutions, may be key preconditions exacerbating the effects of more unpredictable, and high intensity shocks. Some of the examples of these are the financial and economic crises of the 2008, the Covid-19 pandemic in 2020, and the war in Ukraine since 2022. Despite all the regions have been affected by the mentioned shocks, the unique contexts, including their underlying conditions (both stressors and resilience factors) have led to significantly different outcomes.

Recurrent threats raised across the board were those in connection to climate change and environmental degradation, security, and political instability. Other types of disturbances brought up are more specific to the case study areas. This e.g. includes the series of earthquakes in Central Italy in 2016 and 2017, and the border 'hybrid threats' in Latgale border region with Russia and Belarus—understood as actions with ill intent aimed at destabilising e.g. cyber-attacks, weaponisation of migration, etc. Whilst all regions highlighted issues related to public institutions and governance, these also tend to be specific to their context. Some of these issues relate to the relation between government tiers e.g., centralisation, policy and action coordination, etc. Other issues relate to the way institutions are managed i.e., corruption, inefficiency, nepotism, etc.

Overall, the first FW represented an important first step towards identifying the resilience factors (FWs2) and strategizing on future planning for strengthening resilience in the relevant regions (FWs3). It is interesting to note that during FWs 2 and 3, participants identified new risks or shifted focus from certain threats to others. This denotes how the perceptions of threat are highly time-bound and crises are quickly 'superseded'. For instance, during FW1 there was an equally strong focus on epidemics and the impacts of the war in Ukraine on energy prices, whereas the issue of epidemics was not at the centre of attention in FW2-3 at all, but rather issues related to cybersecurity, and geopolitical instability. Nevertheless, while the focus on global trends and threats seemed to shift rapidly, the focus on idiosyncratic risks—as in those that are more regionally specific—tended to be more recurrently mentioned across workshops.

4.2.2 FW2: Identifying resilience factors (capabilities / assets)

The second round of workshops (FW2) focused on mapping the regions' resilience factors, namely in the form of existing 'capabilities' or assets as well as the missing or desired. These results are listed in Table 4, categorised under different types of 'capitals' i.e. natural, physical, financial, political, social, and human capitals. We acknowledge that this list is far from comprehensive, given that they rely on the fields of expertise of the individuals involved in the workshop and their subjective views. However, the intention was to highlight which of those capitals were considered by the stakeholders involved in the exercise as being particularly crucial for enhancing territorial resilience in their areas.

Table 4: Mapping of resilient factors across regions in the form of capabilities or assents categorised under different types of capitals

Capital	Existing Capabilities/Assets	Missing/Desired Capabilities/Assets
Financial	EU and national funds for regional development (CI, LG, BP, CL, UN, TR) Defence related funding with opportunities for infrastructure with dual purpose (LG, UN) Financially strong industrial sectors (CL, UN) Sizable income generated from tourism (CL) Impactful public-private partnerships (UN, CL)	Support programmes for existing SMEs and assist upscaling/ growth (LG, CI) Better conditions and access to various types of financing – e.g. venture capital and loans. Schemes for public-private partnerships, more developed financial services, access to insurance (LG, UN, BP) Opportunity to keep financial assets in the region – local loan associations, other local-capital based financial institutions (TR, LG) More income and value added generated from tourism and hospitality sector (CI, LG) Reduced co-financing burdens to attract national and regional/ EU funding (LG) More equitable tax systems with more fair distribution of resources to sub-national levels, particularly in resource extraction sectors (UN, CL)
Human	Skilled workforce with high work ethics (UN, CL, BP) Local universities with a focus on regional needs (CI, LG) Multilingual communities (LG, CL) Region-specific skills set – craftsmanship (LG) Strong silver economy potential (BP, LG) Vocational training opportunities (BP, TR, UN) Highly skilled workforce supported by globally recognised universities and research centres (CL) Skills necessary in technology and biotech sectors and a supportive innovation ecosystem to apply them (CL)	Measures to battle brain drain / retain labour (CL, TR, LG) Silver economy support and re-integration in labour market (BP, CL, LG) Improved conditions to retain and attract labour/skills and reduce brain drain (CI, LG, BP) Life-long learning, reskilling, retraining opportunities, vocational training (UN, CI, LG, BP, CL) Retention of young people in the region (TR, LG)
Natural	Biodiversity and relatively unspoiled environment (CI, CL, LG) Renewable energy potential (UN, CL) Intertwined natural and cultural heritage (CI, LG, TR) Forest resources (UN, LG) Agricultural land (TR, LG) Clean and abundant water resources, and ecosystem services related to that (BP, LG, CL) Nature protection sites (LG, CL, TR)	Sustainable farming development (LG, CI) Rural revitalisation (TR, CL) Climate adaptation and ecosystem protection (BP, CI, LG)
Physical	Transport hubs (CL, BP) Digital infrastructure (LG, BP) Industrial zones (UN, TR)	Affordable and adequate housing (BP, UN, LG) Rural connectivity via better roads and railways, public transport development (TR, LG) Infrastructure expansion (BP) and balancing with the needs of tourism (CL,)

Capital	Existing Capabilities/Assets	Missing/Desired Capabilities/Assets
Political	Decentralised governance (CL, TR, CI) Strong local governance, easy to reach political representatives (UN, LG, TR)	Inter-municipal coordination (CI, BP) Reduced national vs local governments' tensions (CL, TR, LG, BP) Enhanced long-term strategic vision (LG, CI, BP)
Social/ Cultural	Strong informal communities and artistic identity (CI, LG) Strong social capital and family bonds (UN, TR, LG, BP) Cultural heritage (CI, CL, LG, BP)	Social cohesion, better integration (LG, BP, CI, UN, TR) Utilisation of informal networks and communities, greater valorisation of the identity of the local community (LG, BP, CI)

Legend: Central Italy (CI), Latgale (LG), Upper Norrland (UN), Budapest (BP), Catalonia (CL), Teruel (TR).
*Items relevant to all regions do not mention any specific region.

In Budapest, capabilities and assets listed under **natural capital** included mainly the ecosystems services retrieved from green spaces, e.g., recreation mostly. Participants in Latgale highlighted clean water, availability of forest resources and high volumes of organic agriculture production. Yet, participants noted insufficient capacities in terms of investment and application of innovation and technology in generating higher added value from the available natural capital. In Teruel, participants also highlighted the ecosystems services that natural resources provide as the means of subsistence to society, yet they highlight the need to introduce new initiatives to preserve natural habitats and biodiversity. Instead, the resource rich Upper Norrland, is extremely efficient in generating value from natural endowment, particularly from mines, forests and renewable energy sources—water and wind. However, this also raises several challenges, not only environmental but economic, and social. Local indigenous communities have a history of conflict with the economic focus of the region on extractive activities. Moreover, stakeholders, including sub-national authorities call for a reform in the fiscal regime to ensure that more benefits remain in the region from the existing industrial activities as well as the rapidly expanding ones (e.g., mining, process industry, wind energy parks, and major infrastructure developments). **Physical capital** as in the need for adequate infrastructure was also raised as a crucial precondition to prevent major disruptions to industry in the event of environmental disasters, boycott, hybrid warfare or even military aggression. Participants in Latgale recognised the excellent internet infrastructure in the larger cities and improved road network as key factors in supporting the regions' adaptability and possibility to affront threats, also in terms of defence and cybersecurity. In Budapest, instead, much discussion surrounded housing availability, and then need for introducing more affordable options. Affordable housing was also mentioned in Teruel as means to attract and retain residents. Multifunctional spaces for both efficiency and community use were also mentioned in Budapest, in addition to energy, water, and mobility infrastructure.

Social capital was also identified as key in delivering the capacities to affront aversity. In Latgale, strong family ties, multilingualism and active communities in cultural activities were signalled as key factors in helping locals in affront the often-lacking institutional support. In Central Italy, strong communities and activism also emerged as crucial in providing bottom-up initiatives to affront the devastating effects of the earthquake and also helping meet the more long-term needs of the community. In Budapest, social capital was a core issue, with both well-established communities and newcomers, who were seen as drivers of community activities. However, frictions between established and new residents brings some challenges. Participants went as far as to claim that the city is experiencing the disintegration of traditional communities and simultaneously the emergence of parallel societies. Measures for societal integration were therefore outlines as a key factor both to prevent conflicts and to enhance communities' capacity to affront challenges that affect them all.

Financial capital was generally discussed in all regions in relation to structural funds available for innovation and economic diversification. More specifically, participants in Central Italy pointed out to the large funding made available in response to the earthquake. Similarly, the sudden spike in defence and security expenditure in Latgale was described as a positive shock with a potential of spilling over many sectors and dual-use infrastructure development. A recurrent issue was the insufficient capacities in making good use of financial resources, either due to knowledge gaps, institutional weakness, or due to the need of more active

facilitators or 'brokers' to mobilise innovations to lead to business opportunities with higher added value and productivity. Latgale, Central Italy and Teruel have several strong industries but have low level of diversification, which was said to threaten the long-term competitiveness of the regions. A high proportion of self-employed in Latgale was mentioned to highlight the high level of resilience and autonomy of the local entrepreneurial ecosystem. Stakeholders in Latgale also noted that the establishment of special economic zones (SEZ) offer opportunities for regional development, yet some are sceptical as these zones are plots of land, which are disconnected to the towns and existing businesses. Like other peripheral regions, Upper Norrland experiences imbalanced distribution of costs and benefits from industrial and especially extractive activities. The fiscal policy is said to favour more urban and densely populated regions despite Upper Norrland being a major economic engine at national level. In contrast, participants in Budapest recognised that the capital region is better off in the national context. However, participants noted that municipalities need additional financial resources to be able to improve infrastructures and services such as water and energy supply. Participants also call for reforms to allow greater financial flexibility in municipal budgets. Furthermore, besides the availability of funding, participants in Teruel highlight the importance of having the capacities to using them adequately to induce economic diversification and ensuring economic sustainability in the long-run.

Political capital, and effective governance mechanisms and instruments was mentioned as an enabler for all other capabilities of all types of capitals. In all cases the call for improved governance mechanisms outlines the key importance of institutional capabilities and capacities in talking all issues of preparedness, adaptability and transformation. Multi-level coordination, both vertically and horizontally was referred in several contexts. Upper Norrland seems to benefit from a stable political landscape, in combination with a dynamic and collaborative culture, as well as the easy access to decisionmakers. Yet, similarly to Latgale and other regions, regions and municipalities in Upper Norrland struggle with insufficient attention from national level. The need for improved vertical coordination is therefore highlighted repeatedly, particularly in the context of top national interests such as access to mineral resources, energy, and security.

Despite some informal connections between municipalities in Budapest metro-area, participants identified the urgent need for strengthening inter-municipal cooperation, coordination and information flow. In the case of Italy, the core issue relates to the Crater area affected by the earthquake which spans across four different administrative regions and many municipalities. The need for more agile mechanisms, both hard and soft, are outlined as crucial to coordinate a more strategic, holistic and flexible action. According to participants, this should include programming, planning and legislative instruments to be able to coordinate efforts in more strategic, coherent, and flexible way, but also to make better use of the community initiatives. Political capital is therefore co-dependent on social capital and responsible authorities' abilities to pick up and support bottom-up initiatives. Strengthening the community capacities should lead to stronger sense of identity which is threatened in places suffering from devastation. Identity was said to be lost partly due to the destruction of the physical and cultural capital, but by the fragmentation of the societal fabric resulting from the physical displacement of residents. Hence stakeholders note the existence of strong community action, but a need to support its capitalisation via immaterial cultural initiatives. Trust, or the absence of it, was also brought up in Central Italy, Teruel, Latgale, Budapest and Upper Norrland as a key precondition to mobilise society into action.

In line with efficiency in the use of instruments and resources, the strategic element entails re-construction that not only recovers preexisting benefits but creates opportunities for future developments, both social and economic. By doing so, the measures should not focus only on remediating the negative impacts of, e.g., the earthquake, but other underlying threats and trends, such as emigration. In this vein, stakeholders in Central Italy emphasise the need of strengthening capacities such as knowledge and innovation transfer mechanisms, innovation brokers for SMEs, incentivise experimentation via more direct involvement of academic institutions in the economy, re-skilling the workforce, and favour labour market dynamism, among other measures. This links to **human capital,** which was discussed in all cases as crucial in enabling adaptation, both in terms of formal education, and practical or tacit knowledge. Surprisingly, most regions considered to have a high level of education and competences in the labour market but noted that the problem lied mainly on upgrading competences and re-skilling workers overtime in connection to global trends as well as changes in the economic structure of regions. In Teruel, participants emphasised that the availability of educational institutions and vocational training programs are essential for continuously develop human capital. However, there are other forms of human capital that need attention outside formal education. For instance, participants in Budapest note that the high quality of education, as well as the improved vocational education, needs to be

complemented with improving technical and management capacities within public administrations. A key capability discussed across cases is 'agency' as in the capacity of individuals and stakeholders to exert influence to shape actions. In Teruel, individual and community-based leadership was considered key to drive transformational change.

Furthermore, stakeholders often drew linkages between types of threats, emphasising how disturbances may trigger cascade effects leading to other disturbances, as well as how underlying stressors exacerbate the impacts of sudden shocks. In the same manner, participants draw linkages between capabilities and capacities, and how they become relevant in addressing disturbances—in various combinations. In Teruel, participants went one step further to discuss the way in which different capacities serve to anticipate or absorb disturbances, or else to help the regional systems to adapt or even transform. Expectedly, participants noted the importance of early warning systems, effective monitoring systems, and generating awareness to be able to 'anticipate potential challenges and opportunities and plan accordingly. At the same time, financial reserves, robust infrastructure, and strong social safety nets were considered vital to withstand immediate shocks. Adaptability and transformative capacities, included flexibility within the institutional system and policies in addition to more structural measures to enable change, economic discovery processes, economic diversification and embracing cultural and social diversity. Participants noted that this requires reforms, re-skilling and long-term foresight.

The intricate interlinkages between threats, resilience factors and actions explain why stakeholders call to work more strategically and holistically with resilience, and in multi-level governance arrangements. Already jumping into the theme of FW3, participants began to address some of the actions and measures needed to strengthen resilience. Interestingly, in Latgale, participants noted the benefits of engaging policymakers, stakeholders and the broader community in scenario building exercises to generate awareness of the degree of preparedness and to identify the roles different actors should (or could) adopt in case of emergencies. However, this issue was addressed more in-depth after the completion of the third round of workshops.

4.2.3 FW3: Identifying capacities - actions to strengthen territorial resilience

The third and final workshop (FW3), focused on the local and regional capacities to respond to disturbances. More specifically, the exercise consisted of thinking more strategically about the goal of resilience measures and identify possible actions. Given that the capabilities and assets identified in FW2 are not enough by themselves in guarantee their effective use in managing crises, the strategic use of agency—as in local actors' capacities to act and shape the mechanisms of response—is crucial.

To facilitate the mapping exercise, participants were asked to distinguish actions with different objectives, i.e. preparedness, mitigation, adaptation and transformation. Discussions revealed that the processes surrounding these different objectives blurred the conceptual and operational boundaries between them. In general, participants perceived the transformation process most distinctly relative to the other three, presumably due to the long-term and disruptive nature of change. However, the results obtained often crossed various categories. Notwithstanding this, we could still identify macro trends in the perceptions of preparedness, mitigation, adaptation and transformation among workshop participants, even when the categories were mixed. Table 5 captures the key results from the FW3 results with limited interpretation to keep the essence of participants' contributions as much as possible.

Table 5: Summary of actions proposed by participants in FW3 in the 6 regions aiming for i) preparedness, ii) mitigation, iii) adaptation and iv) transformation

	Actions (*Proposed by workshop participants)
Preparedness	Invest in environmental hazard monitoring systems, public education, and community training to ensure rapid and effective response to imminent natural events, such as landslides and floods. (CI) Improve governance and cooperation, creating a shared regional vision, modernising infrastructure, and strengthening social resilience through inclusive, long-term planning (BP) Enable multi-level coordination bodies and digital platforms to engage citizens and address regional challenges effectively (TR) Improve climate preparedness by implementing integrated early warning systems for wildfires, droughts, heat waves and coastal risks, while strengthening local emergency response networks and public awareness initiatives (CL) Enhance local entities response capacity thanks to promotion of replicability of good practices from other local neighbour municipalities channelled through regional councils (CL) Promote multilevel governance, developing contingency plans, forming task forces and strengthening cybersecurity can improve preparedness (LG) Promote civil society engagement to build cohesion and trust, addressing misconceptions about regional identity, raising awareness of security and well-being. Improve monitoring of safety and welfare (LG) Strengthen crisis preparedness, by establishing an informal task force with municipalities and regions together to identify vulnerabilities, develop contingency plans, improve infrastructure and cybersecurity, and foster long-term cooperation and resilience (UN)
Mitigation	Introduce regulations to prevent speculation in reconstruction and strengthening seismic protection for historic buildings, with the goal of reducing exposure to hazards during emergencies and limiting damage (CI) Maintain and increase targeted support to existing SMEs in the region that are trying to strive and survive. When necessary, deliver support at individual (not institutional) level. (LG) Invest in climate-smart infrastructure to respond to environmental disturbances/changes and urban planning, create informal task forces to improve cross-sectoral coordination and crisis response (UN) CL is implementing sustainable land use policies to curb emissions and protect natural resources, as well as improving water and forest management, and building climate resilience into the planning of its infrastructure (CL) The provincial councils of CL ensure the correct channelling of European funds to the localities, reinforcing investments in strategic areas, such as the promotion of energy efficiency or renewable energies (CL) Coordinated efforts between national and local governments to address urban sprawl, infrastructure challenges, improve housing, transport and utility systems, to remove subsidies that encourage suburbanisation (BP) Improve ecosystem restoration efforts via climate resilience strategies preventive wildfire infrastructure and improved connectivity Introduce sustainable infrastructure and actions for cutting emissions, such as Carbon capture technologies and payments for ecosystem services. (TR)

	Actions (*Proposed by workshop participants)
Adaptation	Introduce local ownership models for renewable energy, fostering regime change in the use of resources, starting with more responsible forestry practices and ending with more active nature protection NGOs work and circular economy promotion to utilise the side-products from nature-based production processes, and CO_2 capture and benefit for local communities (TR) Adapt to climate change by restoring ecosystems, conserving biodiversity and promoting inclusive governance to ensure that communities and sectors can thrive under changing environmental conditions (CL) Incorporate climate projections into reconstruction plans and promoting long-term land-use planning strategies that consider environmental changes, improving the resilience of infrastructure and communities. (CI) Activating local talent, and reforming education to meet the regional development needs. Consider offering support to individuals who demonstrate the required capacity to implement regional adaptation strategies in instances where institutional capacity is lacking or insufficient. Recognise and support the role of NGOs and communities in self-organisation. Encourage local entrepreneurship through favourable tax policies and improve regional living conditions to retain residents. (LG) Invest in infrastructure to adapt to changing climate conditions. Review the corporate tax system to allocate increased/fair benefits to regions where resources are extracted from. Ensure transparent communication and establish additional support mechanisms for communities to cope and adapt to the presence of new industrial activities. Develop risk-sharing schemes and public-private partnerships to support large-scale climate-resilient investments (UN) Adaptation efforts should emphasise trust building, transparent communication, inclusive decision-making and collaborative governance at all levels of government, with a focus on forward planning and improving the quality of life in urban and rural areas. Improve social services, especially for ageing populations, through long-term adjustments in regulation and financing (BP)
Transformation	Advocate the creation of innovation hubs to support emerging/diversifying local industries such as the bio-economy and renewable energy, and address social cohesion through targeted housing and education initiatives (TR) Activate local entrepreneurial talent by creating a supportive environment for start-ups and innovation. Reform education system to meet regional needs. Establish risk-sharing systems for large investments. Besides formal plans, make sure to involve NGOs, informal community groups and other relevant stakeholders in the region during implementation (LG) Revise the tax systems to retain additional benefits from resource extraction locally and avoid regional discrimination (access to loans, grants and insurance), ensuring that benefits from resource extraction and processing industries remain in the region. This includes covering costs incurred by municipalities and regions for hosting industries (e.g., infrastructure, planning, housing loans) with profits from these activities, rather than relying on income taxes. Ensure a fair distribution of costs and benefits to support local municipalities and regions. Ensure communication about industrial activities is transparent and compensate residents affected (UN) Enhance collaboration among state-owned companies and authorities, define clear responsibilities, and create a national planning authority to improve cooperation (UN) Conduct a systemic shift towards climate-resilient livelihoods and long-term sustainability by supporting rural economic diversification through regenerative agriculture, sustainable tourism, landscape economy and blue economy initiatives (CL) Creating a shared vision for regional development through collaboration between national and local governments (BP) Introducing structural change in governance and spatial planning, such as promoting stronger inter-municipal coordination and creating a long-term spatial vision that replaces competition among municipalities with integrated regional collaboration. (CI) Develop stronger regulatory oversight from the Reconstruction Commissioner to curb speculative practices and ensure reconstruction policies are not only fair but also strategic – to deliver on the future needs of the local populations (CI)

Legend: Central Italy (CI), Latgale (LG), Upper Norrland (UN), Budapest (BP), Catalonia (CL), Teruel (TR).
*Items relevant to all regions do not mention any specific region.

From the perspective of preparedness, mitigation, adaptation and transformation, we could distinguish differences in the way these processes are conceptualised from the viewpoint of the level of governance. In cases related to natural disasters, i.e., Central Italy, Budapest, Catalonia, and Teruel, participants generally focused on local preparedness, starting from the level of local educational institutions and citizen engagement. In contrast, participants in cases more closely related to geopolitical sensitivities, i.e., Latgale and Upper Norrland, focused more specifically on adaptation by e.g., developing cybersecurity and forming multi-level task forces (including informal set-ups) to build up new capacities.

In terms of **preparedness**, participants in all cases raised as a key priority to build awareness of the potential effects of crises on local communities and ways for the community to become active. However, awareness was also said to be crucial for **mitigation, adaptation, and transformation**. In line with awareness, emphasis was centred around the need to create common visions. However, there was a different understanding about the extent to which this already exists in the different regions in connection to specific hazards. In Central Italy, Budapest, Catalonia and Teruel a shared vision around ways to cope with natural disasters and present stressors was seen as missing. Participants, therefore identified the need for strengthening participatory processes and arenas. In contrast, a shared vision was said to be well formed in Latgale and Upper Norrland around the measures needed against security and geopolitical disturbances. Participants in these regions pointed out the need for more targeted actions e.g., around cybersecurity.

In addition, it was often mentioned across regions that there is a significant gap between the mandate that authorities or other actors formally have and their real ability to act. It was argued that authorities, particularly at the local level, often lack the internal capacities to act holistically around prevention, mitigation, adaptation and particularly around transformation. Besides formal responsibilities or mandates, workshops raised the attention about the importance of developing both individual and collective capacities to effectively manage those responsibilities. However, in Central Italy and Latgale participants pointed out the potential of pulling-in external expertise to support municipalities, which were said to be either overburdened, lacking key competences or are generally uncooperative. External professionals were said to be useful in mobilising EU funding in activities supporting innovation and structural transformation, but also in leading participatory processes.

It is interesting to note that, whatever the case and the crisis, **mitigation** was often seen through the prism of the financial control and support mechanisms. This ranged from enabling favourable fiscal policies in the region, to greater control over crisis mitigation funding and removing incentives for sub-urbanisation, to the recognition of the need for public-private partnerships and general large-scale investment in infrastructure to ensure that mitigation could take place. In addition, sustaining current infrastructure that ensures wellbeing and connectivity of citizens was seen as essential in all cases.

Adaptation was seen much more through the prism of planning and governance and, above all, the creation of a participatory culture. Measures aimed at increasing social cohesion, and building social capital and trust were considered crucial for communities to become more prone towards adapting to new conditions. Discussions around adaptation focused more on long-term resilience compared to more immediate-term measures needed for mitigation. This included transparent and strategic communication and the involvement of communities affected by change and crisis in the regions. Communication and transparency were identified in Central Italy as essential for bridging the trust gap between institutions and communities. Higher capacity and professionalism were demanded when implementing risk communication strategies before and after disasters to enhance adaptation and mitigation. Meanwhile, participants in other regions note that stakeholder fatigue can backfire engagement efforts, as typically the same groups of people are called in for consultation for any new development. In the case of Upper Norrland, where a boom of industrial and infrastructure developments is taking place, the Sámi indigenous communities have expressed to be overburdened by the frequency of engagement processes. Meeting and public consultation fatigue was indirectly mentioned also in Latgale as a result of the sudden attention the region has received by many international institutions on the region as a vulnerable external border of the EU. Therefore, participatory culture building should be somewhat 'coordinated' and meaningful to avoid overburdening the communities and maintain the necessary levels of trust.

Finally, **transformation** was more clearly distinguished from the other resilience objectives for the more radical change it entails. For example, discussions revealed actions as well as exogenous developments leading to disruptive innovations, the emergence of new economic activities and start-ups, major institutional innovations, and broader cultural transformation—both individual behaviours and collective organisation capacities. For instance, one idea was the creation of innovation hubs in Teruel, and better exploitation of the opportunities of Special Economic Zones in Latgale. Entrepreneurship was generally characterised with positive eyes as an essential condition to enhance regions' transformative capacity, however, participants also noted also the importance of setting a frame for regulating private actors. For instance, participants in the Upper Norrland region were cautious in depicting the role of business development, emphasising the need for regulation and inclusion as means to minimise the negative externalities, as well as reforms to the tax system to secure more fair distribution of benefits locally. Somewhat similar themes were discussed also in Central Italy, where a pressing challenge highlighted was economic speculation in the reconstruction process when private actors (architects, contractors, companies, and investors) often prioritised profit over long-term sustainability and strategic visioning, leading to a patchwork of uncoordinated rebuilding efforts with strikingly inequal opportunities to different societal groups. Therefore, instead of focusing on building transformative processes, actions in Central Italy are characterised by attempts to solving the side-effects and externalities of transformative economic development (costs and burden imposed on society) and speculative actions (profiting from crisis on society's expense) that lead to growing inequalities in the region. While recognising the necessity to regulate, from a point of view of transformative developments it was recognised that current regional financing in Upper Norrland is insufficient for large-scale experimentation, leading to a loss of momentum. In similar discussions this this situation was echoed in all other cases.

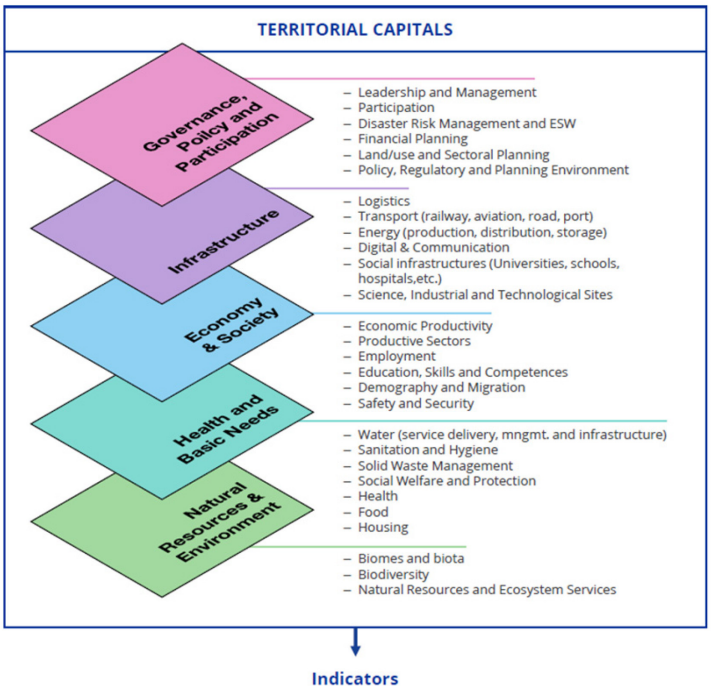
5 Pan-European trends in territorial resilience

Pan-European trends in territorial resilience were analysed by the project team using spatial statistical analysis. The following chapters present the main steps of this process: first, the process of data collection and the operationalisation of the measurement of territorial resilience - emphasising that capacities of territorial resilience are formulated as a hypothesis based on the condition of its capitals, and only indirect measurement is possible and (chapter 5.1), then the spatial patterns of the different dimensions of territorial resilience (chapter 5.2), and finally the spatial disparities and changes over time of the Territorial Resilience Capitals Index, a synthetic index constructed from the available data (chapter 5.3). The final list of indicators and the detailed methodology for data collection, data harmonisation and data analysis are presented in Annex 3.

5.1 Approach and barriers of operationalisation and data collection

The operationalisation of the territorial resilience was a multi-step iterative process. For the definition of measurement method and selection of indicators, the project team used two main approaches. The first is the so-called **top-down approach**: based on the theoretical concept, the project team defined the main themes and dimensions, and the set of indicators to be used in this process. In order to complement the results of the conceptualisation, the project team conducted a background analysis of the relevant existing methodologies and indexes that already have been used, relevant for this topic. Based on that a methodology was developed, which assesses and uses the available indicators in terms of territorial capital and territorial capabilities. This approach grouped indicators into five dimensions (Health and Basic Needs; Infrastructure; Economy and Society; Governance, Policy and Participation; Natural Resources and Environment) and 27 sectors of territorial capitals (see in Figure 7: Structure of the capitals of territorial resilience); for each sector desired outcomes (target) were identified as well. In this context capital refers to various resources and assets that could determine how a system withstand, adapt to, and recover from disturbances or changes. Key types of capitals include natural, economic, physical, technological, human, institutional, and social capital. Capitals were measured by indicators, serving as proxies.

Figure 7: Structure of the capitals of territorial resilience



Source: Elaboration of the project team.

At the same time, the project team also run a complementary **bottom-up analysis** on the data sources and their potential. Hence, the potential data sources were collected and have created a so-called data matrix on the main characteristics of potential indicators. In addition, a preliminary data and metadata collection process were run which involved extensive data collection and metadata collection from Eurostat's Regional Database. Based on these a preliminary indicator list has been prepared; it aimed to collect the data sources, and some other characteristics of relevant indicators under the framework of territorial resilience. This list included almost 500 potential indicators, in total. Subsequently, the project team narrowed down the list of indicators in several steps: similar indicators were merged and then rephrased; indicators that were not thematically appropriate to the evolving concept or connected to any too specified topics were dropped as well as indicators which are only available at national level or not available at public data sources.

The top-down (conceptualisation) and bottom-up (indicator selection) approaches met in the definition of the broad indicator list: the indicators were identified according to the territorial capitals (dimensions) and their subgroups (sectors), assessed in terms of territorial capabilities. Furthermore, other characteristics of the indicators were examined: correlation with disturbances, evidence in literature and data availability and scale suitability. Finally, based on thematic considerations, the fit with the concept of resilience, sufficient spatial and temporal detail of the data the **Final indicator list** was defined, which includes 72 indicators grouped according to the 5 dimensions and 26 sectors (no data for Logistics sector; see in Annex 1). The selection of the indicators was further supported by an examination of the presence of the indicators in the literature and in existing resilience indices. These indicators form the database that the project team collected as extensively as possible by applying different data harmonisation steps.

During this process several obstacles have been identified that make it difficult to measure and evaluate territorial resilience in European regions. Some key elements of territorial resilience are less tangible and therefore difficult to measure and quantify. Other aspects can be measured, or at least approximated by some indicators, but not necessarily at the relevant sub-national levels. Many **obstacles of the operationalisation of the concept** were identified. In the centre of territorial resilience concept are adaptive, absorptive and transformative types of capacities, which are often difficult to evaluate and measure quantitatively through indicators. The level of a territory's capacities is therefore formulated as a hypothesis based on the condition of its capitals. However, some important capital elements cannot yet be properly quantified: cultural and social dimensions, as well as institutional, governance and policy framework. So, all aspects of territorial resilience cannot be quantified using indicators alone, as they only allow to describe the state of territorial systems, but not how the territorial system functions under stresses/shocks.

The **main challenges in data collection** were the different quantity and quality of data available for different topics (dimensions, sectors). While a very wide range of socio-economic indicators were available, the other dimensions suffered from a number of shortcomings: for some dimensions the number of indicators available was limited, for others the quality of the data was a challenge, while in several cases only a proxy set of indicators could be used, which, although linked to an aspect of a sector, were not clearly interpreted in terms of territorial resilience. Finally, although the long term and forward-looking approach is an important aspect in assessing territorial resilience, some of the existing regional data had spatial and temporal data gaps. The data were sensitive to changes in the NUTS system, in many cases data series were broken or data were only available for certain years. Although the project team has partially solved these issues during the data harmonisation, the use of these data for comparisons over a longer time period was limited.

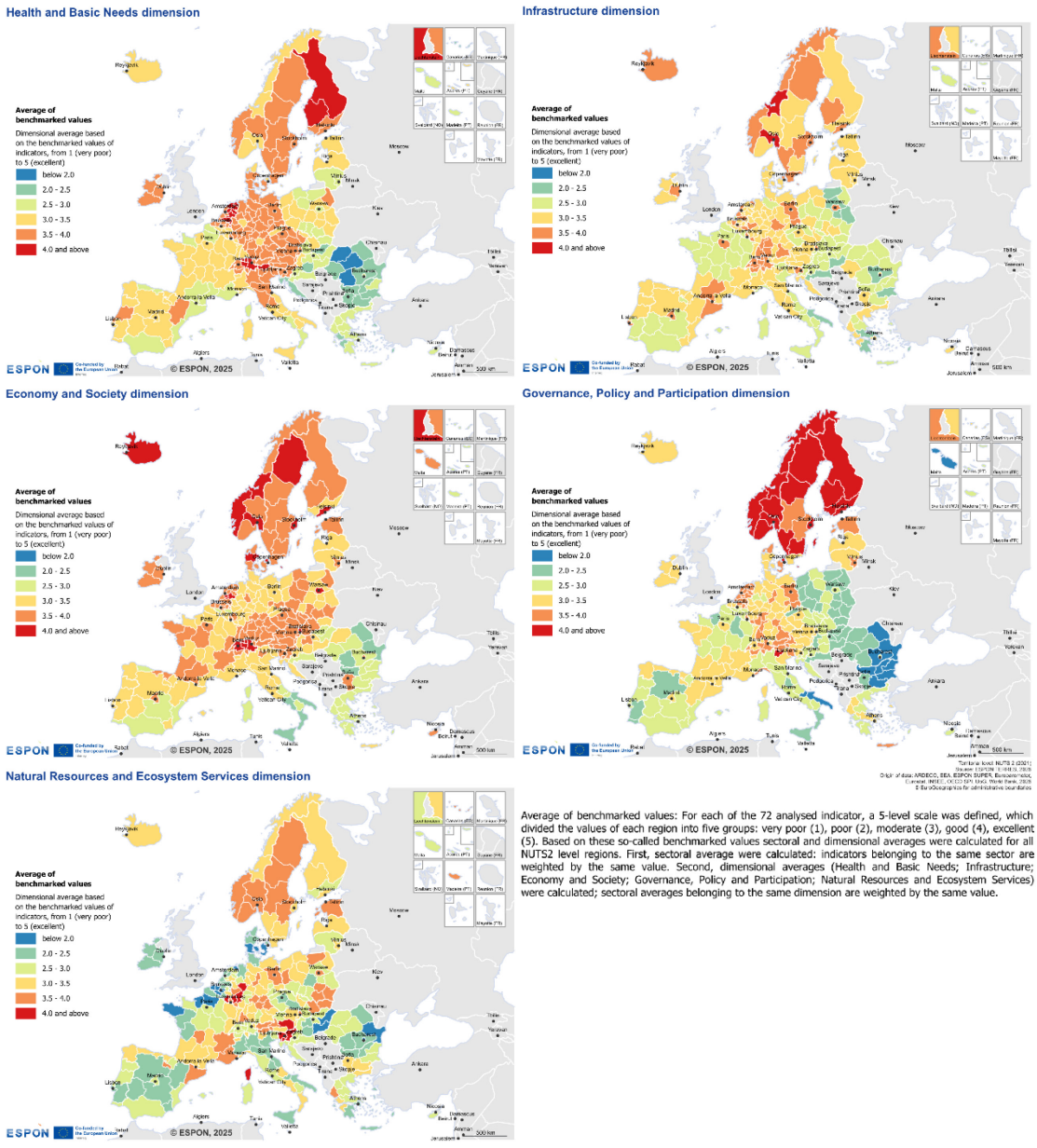
5.2 Regional patterns and tendencies of resilience dimensions

After the compliment of the NUTS2 level database of 72 indicators, the project team benchmarked the selected indicators. For each indicator, a 5-level scale was defined, which divided the regions into five groups based on their values of the selected indicators: very poor (1), poor (2), moderate (3), good (4), excellent (5). Based on these benchmarked values firstly the sectoral averages and then the dimensional averages were calculated (the method see in the Annex 3).

As shown in Map 3, there were many similarities in the spatial patterns of some dimensions. As regards the **Health and Basic Needs dimension**, the highest values were recorded in Dutch, Finnish, and Swiss regions, as well as in the Bolzano region (Italy), while the lowest values were observable in Romanian and Bulgarian

rural areas. In terms of **Economy and Society dimension**, the highest values were recorded in capital regions, as well as in developed regions of Northern Europe, Switzerland and the Netherlands. In this dimension, significant inequalities were observable in East-Central Europe: while some metropolitan regions (Warsaw, Bratislava, Prague) had outstanding values, rural areas (especially in Romania and Bulgaria) had low scores. Certain regions of the Mediterranean area in southern Italy, Greece, and the two Spanish exclaves (Ceuta and Melilla) also had particularly unfavourable values. The **Governance, Policy, and Participation dimension** particularly highlights the differences between certain groups of countries (partly due to the methodological characteristics of the indicators used): In contrast to the exceptionally favourable values of Northern Europe, the values of Romania, Bulgaria, and certain Southern European regions (Molise, Puglia, and Malta) are particularly low. All these things considered, the **Health and Basic Needs, Economy and Society and Governance, Policy and Participation dimensions** all showed **high scores in Northern Europe and West-Central Europe** (Alpine region, Benelux countries, Germany and the Czech Republic), while the **Balkans and some Mediterranean regions showed relatively low scores.**

Map 3: Territorial resilience capacities by dimension



Source: Elaboration of the project team.

The map of Infrastructure dimension was similar with higher values of Northern and Central Europe and lower values in the southeastern part of the Europe, but there was a significant urban-rural divide: while **metropolitan areas were predominantly favourable, rural regions had lower scores on the Infrastructure dimension.** In several countries, there was a noticeable separation of the capital regions and the rural areas surrounding them. There were also relatively **low values for certain geographical peripheries, such as islands, exclaves, and isolated mountainous and coastal regions**.

While a positive correlation can be observed among the values of the first four dimensions, environmental factors are statistically independent of the other dimensions. **This the spatial pattern of the Natural Resources and Ecosystem Services dimension is fundamentally different from the other dimensions:** mountainous areas (Eastern Alps, Carpathians, Ardennes), some islands (Corsica, Madeira) and sparsely populated Northern European regions had more favourable values, due to their environmental richness, their less polluting economic structure, and their relatively low population density. In contrast some metropolitan regions (Bucharest, Budapest, Prague, Bremen) and highly urbanised areas (Northern Italy, Wallonia), North-West European coastal areas, as well as agricultural and/or drying areas in Southern and East-Central Europe had unfavourable values, highlighting the harmful environmental effects of urbanization, industrialization, and climate change.

After analysis of the dimensional values, the available data were subjected to **hierarchical cluster analysis** in order to grouping the European regions based on the indicators. To do this, the project team created clusters of regions with similar characteristics in terms of territorial capacities. Four model runs were conducted differed in terms of the input variables, and these models resulted different maps, depend on the model characteristics (the methodology and the results see in Annex 3). The cluster analyses have produced different results depending on the methodology used to obtain the indicator values, however, there were some characteristics that emerged in each of the models. On the one hand, the **isolation of the Northern European regions**, which stand out along most dimensions, should be highlighted, with the **Alpine region** also being included in some clusters. Three from four models also showed the **separation of the East or South-East Europe** from the other parts of continent. Of particular note is the **separation of metropolitan regions in Central and Southern Europe**, which either formed separate clusters themselves or were linked to clusters other than those in the surrounding regions. Finally, in most models, some **Mediterranean island regions** (e.g. Cyprus, Malta, Corsica) as well as **exclaves** of Ceuta and Melilla, and the **outermost regions** (e.g. Canary Islands, Madeira, Azores) were separated.

All results considered, the different macro-regions of Europe have different characteristics thus the challenges they face may generate different impacts. Northern Europe and the Alpine region had above average scores in most indicators: especially in dimensions of Governance and Economy & Society. In contrast, most regions in East-Central and South-East Europe have markedly unfavourable scores in each dimension: especially in Governance indicators. Which means that tackling future challenges in these areas may be limited by the effectiveness and preparedness of government. **The separation of the Central and South European metropolitan regions should also be mentioned, which illustrates their specific characteristics and challenges.** These regions scored very favourably on most dimensions, indicating that they have significant economic dynamism, social development and good infrastructure. However, many of these regions had unfavourable environmental characteristics (with some exceptions), indicating their poor environmental status and potential vulnerability to the effects of climate change. As for **rural agricultural areas, they were characterised by typically poor infrastructure and governance scores and below average values in the environmental dimension**. In contrast, **mountain areas**, although diverse in most dimensions, typically had a **favourable environmental status**. Finally, **island and outermost regions are also in a special situation in the case of territorial capacities, which can have a fundamental impact on the territorial resilience of these areas.** These regions had particularly diverse territorial capitals: most of these regions had average or below average values in Health & Basic Needs, Infrastructure and Governance, with above average values in the Environmental or in the Economic & Social dimensions. These regions were therefore not only geographically isolated but also had specific characteristics in terms of their territorial capital.

5.3 Synthetic index of resilience capitals

As discussed in Chapter 2, the notion of territorial resilience developed in ESPON TERRES builds on an encompassing theoretical framework. Consequently, **assessing territorial resilience necessitates**

consideration of multiple factors, rather than solely focusing on the capacity of territorial systems to resist, recover, adapt, or transform in response to external shocks or long-term stressors. Moreover, its multi-dimensionality also implies that **the notion of territorial resilience cannot be directly measured but rather necessitates indirect metrics or appraisal tools to assess it.**

In the ESPON TERRES project we have responded to this analytical challenge by developing a multi-scale ***Territorial Resilience Capitals Index***, **which provides a dynamic picture of territorial resilience within the European context.** The index encapsulates multiple dimensions of territorial resilience into a single metric, providing a comprehensive overview of the phenomenon in a holistic way. At the same time, the Territorial Resilience Capitals Index allows for meaningful comparison across areas and time periods, helping to identify trends, patterns and anomalies in territorial resilience capitals over time. However, like any other composite indicator, the *Territorial Resilience Capitals Index* provides an over-simplification of reality and should hence be used judiciously, ideally in conjunction with other perspectives and complementary analyses focusing individually on each of the enablers of territorial resilience.

5.3.1 Methodological overview

The resilience index developed within the ESPON TERRES project is presented as a composite indicator integrating data concerning the following dimensions: Health and Basic Needs; Infrastructure; Economy and Society; Governance, Policy and Participation, and; Natural Resources and Ecosystem Services across 258 NUTS-2 regions in Europe. The index comprises 72 indicators, categorized into 5 main *Dimensions* and 26 *Sectors*, as detailed in Annex 3.

The TERRES *Territorial Resilience Capitals Index* is built using a robust methodology deployed through the following steps:

1. Develop a theoretical framework, identifying important dimensions for territorial resilience (described in chapter 2, and operationalized in chapter 5.1).
2. Build a data model, collating key indicators and data points (detailed in chapter 5.1 and illustrated in chapter 5.2).
3. Data cleaning, identification of inconsistent values, imputation of missing values and removal of statistical outliers.
4. Data transformation, to reduce skewness.
5. Data normalization, comprising standardization and re-scaling.
6. Validation of the data model by means of internal consistency checks.
7. Weighting of the contributing variables, based on their contribution to the overall variance.
8. Data aggregation, using a multiplicative utility function.
9. Robustness and sensitivity analysis, testing index robustness by means of alternative processing and data designs.

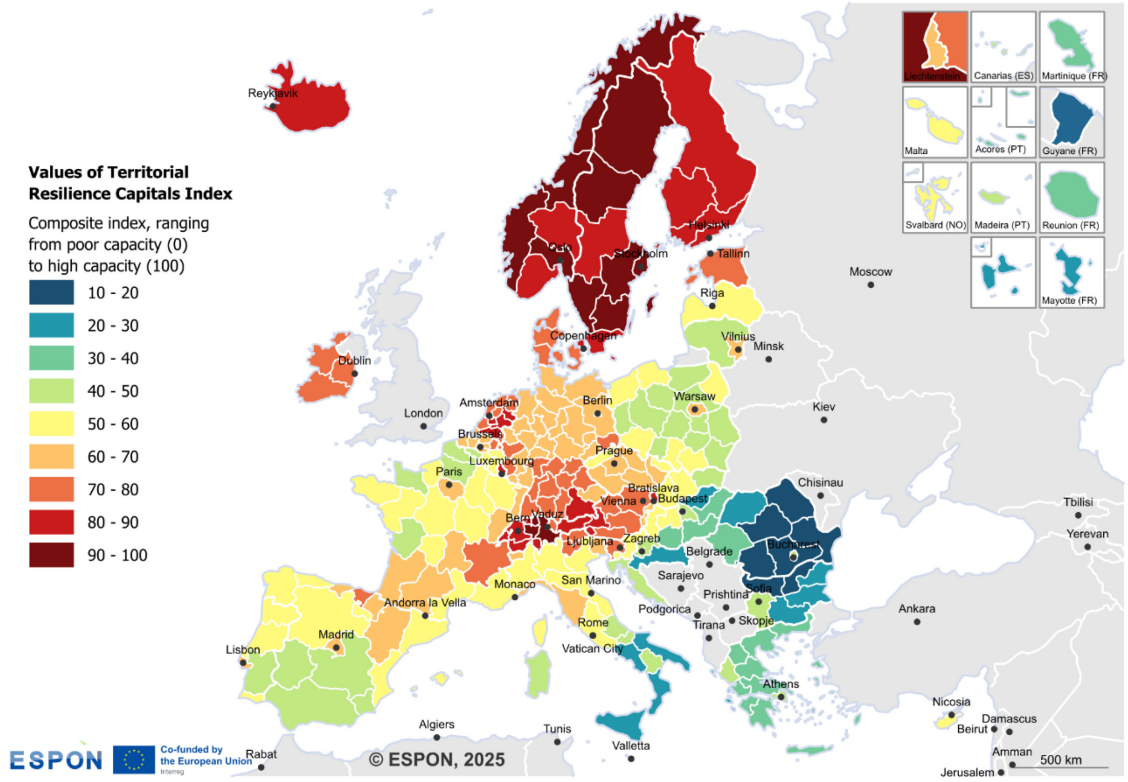
This methodology aligns with best practices and recommendations established by the Competence Centre on Composite Indicators and Scoreboards of the Joint Research Centre at the European Commission (European Commission 2025). It ensures stable and consistent results while minimizing data redundancy and mitigating the potential for compensability among contributing indicators within the final score. A detailed description of the methodology is provided in Annex 3.

5.3.2 Results of the measurement

The *Territorial Resilience Capitals Index* was calculated for the period 2014–2024. Map 4 shows the Territorial Resilience Capitals Index for 2024, representing the most recent time cut with complete data coverage. The index reveals marked North-South and East-West gradients. In 2024, regions with the highest scores are located in Scandinavia and Western Europe. Specifically, Övre Norrland, in the Northernmost part of Sweden, followed by Stockholm, the Capital Region of Sweden, Vestlandet, in The Netherlands, and Zentralschweiz, in Switzerland, exhibited the highest scores on the multi-dimensional resilience scale. Regions leading the Territorial Resilience Capitals Index ranking typically demonstrate superior performance on health and basic needs indicators, including fully-fledged health and sanitation systems, robust household finances, low levels of income inequality, effective governance and participation systems, and sustainable management of natural resources and ecosystem services. Despite these generally strong performances, opportunities for

improvement remain. For example, several leading regions experience high housing costs relative to household income, and others lack diversified industrial structures, potentially undermining long-term economic resilience. Furthermore, demographic challenges, such as high rates of population ageing and integration difficulties related to immigration, are prevalent in many of these regions.

Map 4: Territorial Resilience Capitals Index, 2024



Territorial Resilience Capitals Index: a composite index integrating the 72 indicators of territorial resilience capitals. After the data cleaning, data transformation, data normalisation (standardisation) and an internal consistency check, the indicators were weighted by used a data-driven method based on Principal Component Analysis (PCA) and Factor Analysis (FA). The composite index was then calculated by multiplying each data point by its assigned weight and taking the geometric mean of these values. The results were tested with sensitivity analysis. The results obtained were projected onto a 0-100 range, thus calculating the Territorial Resilience Capitals Index for NUTS2 regions, for each year of 2014-2024. Finally, the regions were ranked by the composite index, and changes in their positions were analysed.

Territorial level: NUTS 2 (2021)
Source: ESPON TERRES, 2025
Origin of data: ARDECO, EEA, ESPON SUPER, Eurobarometer, Eurostat, INSEE, OECD SPI, UoG, World Bank, 2025
© EuroGeographics for administrative boundaries

Source: elaboration of the project team.

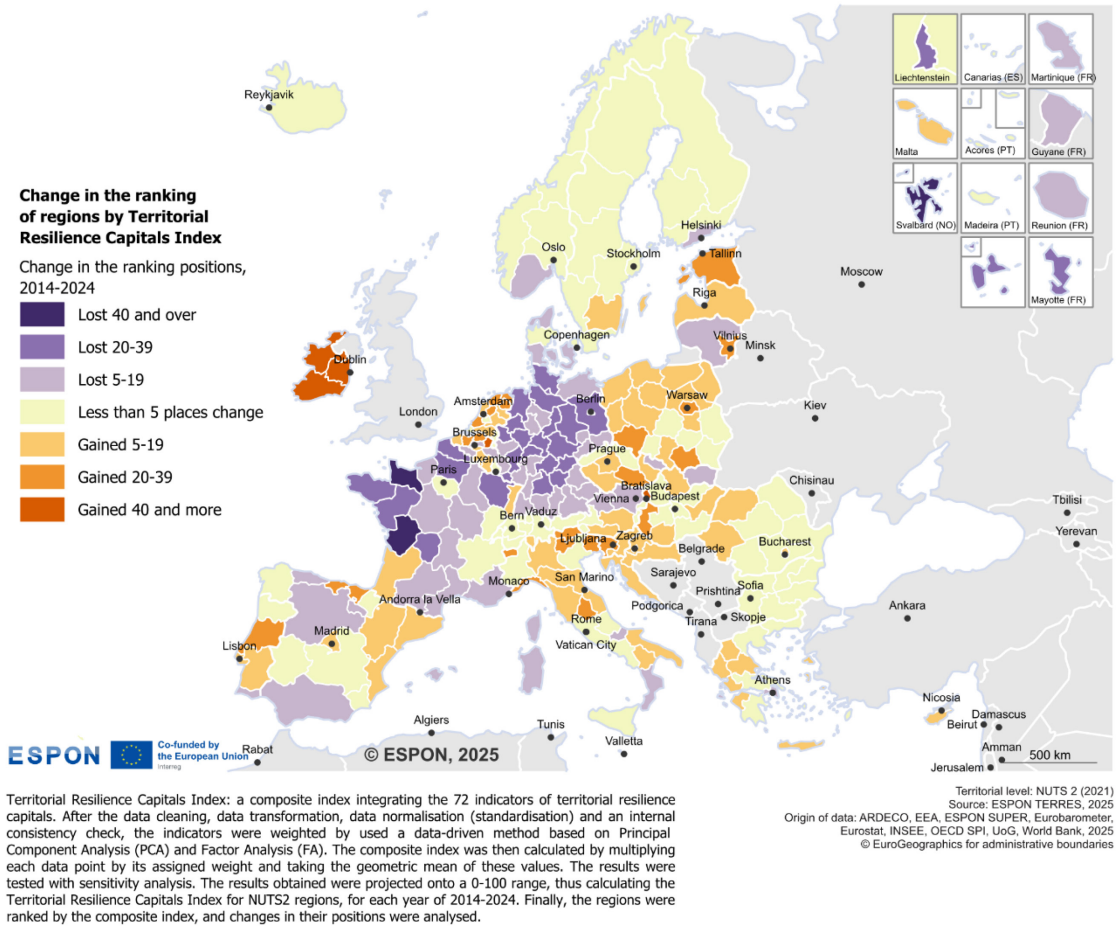
Regions exhibiting the lowest scores on the Territorial Resilience Capitals Index are predominantly situated in the southeasternmost areas of the European Union. Specifically, in 2024, these include Severozapaden (Bulgaria), Sud-Vest Oltenia, Sud-Est and Sud-Muntenia (Romania). Relative to other European regions, many regions in Europe's South-East and the Mediterranean demonstrate underperformance across indicators related to social welfare and protection, transport and infrastructure, and economic and living conditions. However, some of these regions exhibit comparatively strong performance in indicators such as the number of hospital beds and vehicles for collective transport relative to population size, alongside lower greenhouse gas emissions per inhabitant and reduced income inequality and gender gaps in employment.

5.3.3 Temporal trends in the Territorial Resilience Capitals Index

When Interpreting the Territorial Resilience Capitals Index scores, it should be kept in mind that the index is a comparative measure, reflecting regional performance relative to other regions. This implies that a region's satisfactory absolute performance on individual indicators does not necessarily lead to a higher value on its relative Territorial Resilience Capitals Index score, if other regions demonstrate higher values on those same metrics. Conversely, a region's comparatively low absolute score on specific indicators may still represent a strong relative performance if other regions within the sample exhibit poorer absolute values on those same metrics. Similarly, the variation of regional rankings over time does not directly inform on the evolution of resilience capitals, but rather on their co-evolution, relative to other regions. For this reason, regional ranking positions in the *Territorial Resilience Capitals Index* provide more valuable insights than the absolute scores

attained by individual regions. Likewise, examining variations in ranking positions over time offers relevant information regarding the evolution of territorial resilience than looking at the scores as such. Map 5 illustrates the absolute change in regional ranking position between 2014 and 2024.

Map 5: Ranking change of regions by Territorial Resilience Capitals Index, 2014–2024

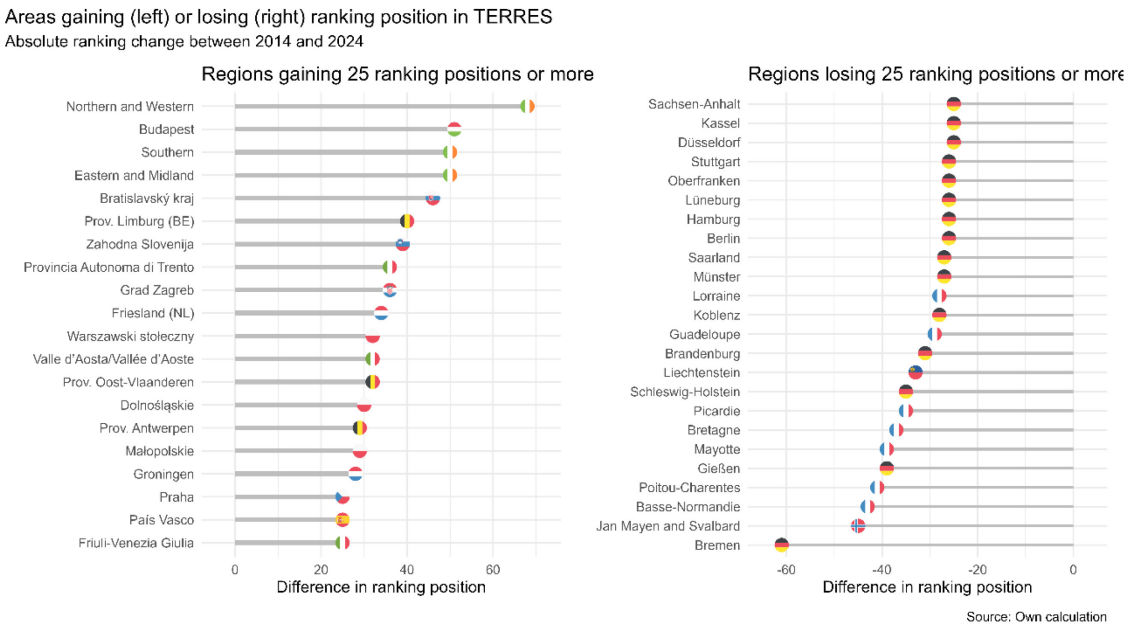


Territorial Resilience Capitals Index: a composite index integrating the 72 indicators of territorial resilience capitals. After the data cleaning, data transformation, data normalisation (standardisation) and an internal consistency check, the indicators were weighted by used a data-driven method based on Principal Component Analysis (PCA) and Factor Analysis (FA). The composite index was then calculated by multiplying each data point by its assigned weight and taking the geometric mean of these values. The results were tested with sensitivity analysis. The results obtained were projected onto a 0-100 range, thus calculating the Territorial Resilience Capitals Index for NUTS2 regions, for each year of 2014-2024. Finally, the regions were ranked by the composite index, and changes in their positions were analysed.

Source: elaboration of the project team.

Map 5 reveals distinctive territorial patterns regarding the evolution of territorial resilience between 2014 and 2024. In some countries, national dynamics dominated the evolution of the *Territorial Resilience Capital Index*, resulting in consistent growth or decline trajectories within regions sharing a national boundary: notably, Austria, Belgium, Germany, Ireland, The Netherlands, and Poland. Conversely, regions in other countries exhibited divergent performances, particularly in Southern and Eastern Europe: including France, Spain, Italy, Greece, Croatia, Slovakia, and Romania. The distribution of ranking changes revealed that 130 regions improved their positions, 119 experienced declines, and 9 remained unchanged between 2014 and 2024. Absolute gains in ranking positions were generally larger, reaching 68 positions in Northern and Western Ireland, compared to declines, which amounted 61 positions lost in Bremen. Regions in continental European countries, especially France and Germany, tended to experience greater declines, while urban regions (often capital cities) in Eastern European countries such as Croatia, the Czech Republic, Hungary, Slovenia, Slovakia, and Poland, alongside several regions in Italy, Belgium, the Netherlands, and Ireland, generally improved their ranking positions between 2014–2024. Figure 8 details the list of regions with gains (left) or losses (right) of 25 or more ranking positions.

Figure 8: Regions with the greatest ranking change of Territorial Resilience Capitals Index, 2014–2024



Source: elaboration of the project team.

As shown in Figure 8, regions within Ireland (Northern and Western, Southern, and Eastern and Midland), Belgian Flanders (Limburg, Antwerp and East Flanders), The Netherlands (Friesland), and Italy (Trento), alongside capital city regions in Croatia (Zagreb), Hungary (Buda-pest), Slovakia (Bratislava Region), and Slovenia (Western Slovenia), exhibited the most significant relative expansion of resilience capitals between 2014 and 2024. In contrast, regions in Germany (Bremen, Gießen, Schleswig-Holstein) and France (Basse-Normandie, Poitou-Charentes, Mayotte, Bretagne and Picardie), together with the Jan Mayen and Svalbard archipelago in Norway and Liechtenstein, lost 25 or more ranking positions between 2014 and 2024. Notably, several of these regions, particularly within Germany, demonstrated relative deterioration in household finance indicators, such as debt arrears and inadequate home heating. Furthermore, other regions experienced relative declines in health-related indicators, including the rate of external causes of morbidity and mortality, as well as governance-related indicators, such as the Quality of Government Index (Bremen, Basse-Normandie) and trust in national government (Basse-Normandie). Interestingly, several regions exhibiting substantial losses in their ranking positions are remote areas and overseas territories (e.g., Mayotte, Guadeloupe, Jan Mayen, and Svalbard), suggesting that insularity and remoteness did indeed undermine resilience capitals during the period under analysis.

6 Detailed account of Territorial Resilience Dashboard

6.1 Overview of the Territorial Resilience Dashboard

The **Territorial Resilience Dashboard (TRD)** is one of the key deliverables of the TERRES project, designed to provide a comprehensive overview and valuable insights into the factors shaping territorial resilience. It brings together interactive data visualizations, analysis and the project's conceptual framework in a single integrated platform. Beyond providing data and definitions, the Dashboard also offers practical recommendations and methodological toolkits to help stakeholders enhance the resilience of their territories. Its main goal is to empower researchers and policymakers – particularly those working at subnational levels – with the tools and knowledge needed to assess, strengthen, and sustain territorial resilience. A Handbook of instructions on the use of the dashboard for policymakers is delivered in Annex 4.

The design of the TRD is based on the outcomes of the user definition process carried out during the TRD Conceptualization phase as well as on the validation of wireframes and functionalities throughout a series of interviews with selected stakeholders (see Annex 5 for the details).

To support efficient development and ongoing evolutionary updates, a low-code platform was chosen for the dashboard's implementation. This approach facilitates faster iterations, reduces the need for extensive custom coding, and enables easier maintenance and future enhancements.

6.1.1 Target group of the TRD and user needs

Identifying and understanding end users was a key step in designing the TRD. Initial user profiles were outlined during the TRD conceptualization phase, then refined through surveys and interviews with stakeholders with different professions (practitioners and researchers) active at different territorial levels (see details in Annex 5). Important to highlight, that interviews with other relevant dashboard developers (JRC Resilience Dashboard, OECD Twin Transition Tracker) revealed **a lack of robust user monitoring systems, highlighting the absence of prior user profiling.** This gap underscores the relevance of the TRD's efforts to better understand its users and tailor functionalities accordingly.

The analysis confirmed that **the TRD's primary audience is policymakers and their supporting experts, especially at local and regional levels.** While EU-level policymakers may also benefit, the tool is mainly designed for subnational governance actors involved in territorial development. Researchers are a secondary target group, while NGOs and private-sector users are additional beneficiaries. The TRD may also contribute to raising awareness among citizens, though this is not its core focus. Further interviews clarified that **policymakers, experts, and researchers often overlap but have distinct needs**.

- ***High-level decision-makers***, elected responsibilities are unlikely to use the dashboard directly, but can be reached indirectly via expert staff, background institutions, or consultancies; clear summaries and aggregated indicators is particularly suited for engaging this group.
- Ultimately, the TRD is designed with ***experts*** in mind to ensure knowledge transfer and facilitate policy action. The TRD can serve as a valuable tool for practitioners, analysts, and applied researchers, equipping them with the necessary data, clear visualizations, and robust methodologies to inform decisions.

Stakeholders stressed **the importance of targeting users at subnational levels, particularly below NUTS 2**, where many potential users operate. These actors often rely on national databases and within-country comparisons, underlining the need for TRD to also engage central institutions and research bodies to promote more consistent and internationally informed resilience policymaking.

The key needs of the potential end-users:

- **Clarify and communicate a comprehensive definition of territorial resilience**, moving beyond narrow economic or environmental views to a more transformative, system-based understanding among both policymakers and experts.
- **Support data-driven policy processes. Integrate diverse datasets, especially on climate risk, social cohesion, and governance.** Ensure adaptability to urban–rural differences with tailored indicator sets. **Provide composite or synthetic indicators** to meet policymakers' need for simplified, comparable metrics. The module should support benchmarking across multiple dimensions: within-country comparisons, international comparisons (e.g. EU average), and between regions facing similar challenges.
- Though NUTS 2 remains a baseline, the module should **provide guidance or tools to support local actors working below NUTS 2 level**, enhancing the module's relevance for territorial planning and collaboration.
- **Deliver clear interpretations of the data and actionable insights** that inform long-term planning and strategy development. Present a balanced approach to measurement, offering comparative regional overviews while clearly communicating the complexity and limitations of quantifying resilience.
- **Engage policymakers through intuitive content** such as infographics, while equipping expert users with detailed data, tools, and methodological guidance. Stakeholders highlighted the importance of written summaries and narratives in making the dashboard accessible.
- **Identify priority areas for intervention** without promoting rushed decisions – emphasizing strategic, long-term planning over short-term fixes.
- **Maintain a user-friendly, streamlined interface**, while ensuring that users receive sufficient support and explanation to avoid misinterpretation or superficial use of the data.

6.1.2 All in all, TERRES project's TRD strength should lie in interpreting and contextualizing the data to make it actionable. Considerations on the technological stack of the TRD

Initially, the development team considered building a custom ad-hoc web application using React, which would have offered full flexibility in terms of user interface and functionality design.

However, since the organization already had access to the ESRI platform, the decision was made to use ArcGIS Experience Builder instead. This approach simplifies deployment and maintenance, and allows the application to better integrate with existing ESRI-based services. Additionally, by hosting the data directly within the ESRI environment, it becomes significantly easier to manage and update datasets without requiring changes to the application itself. This also supports better consistency with the technological ecosystem used in several other ESPON tools, even if not all of them rely on the same stack.

Therefore, the **Territorial Resilience Dashboard** was developed using **ArcGIS Experience Builder**, a web-based platform provided by ESRI that allows for the creation of interactive and responsive geospatial applications without the need for extensive custom coding. Experience Builder offers a modular environment where developers can design user interfaces, integrate maps, charts, and data services, and define workflows using a drag-and-drop editor. It supports both out-of-the-box configurations and advanced custom development.

Technically, **ArcGIS Experience Builder is built on React**, and it exposes a developer framework that allows the extension of its capabilities through custom widgets and themes. The core of this framework is based on **Jimu**, a library developed by ESRI which provides the building blocks for widget development, layout management, state handling, and communication between components. This means that while developers work within the Experience Builder ecosystem, they still benefit from the flexibility and modularity of modern React development.

By leveraging this stack, the team is able to customize functionality when needed, while still aligning with ESRI's ecosystem—ensuring smoother integration, better performance, and long-term maintainability.

6.2 Front-end architecture and UX design

6.2.1 Dashboard modules

Homepage & Navigation

The dashboard opens on a streamlined Home page that acts as the entry point to six main sections—Home, Conceptualisation, Statistics, Narratives, Case Studies, Assessment, and Documentation. Each element of this landing space, from key messages to overall layout and navigation cues, is intentionally provisional so that stakeholders can discuss and refine both wording and usability during the next design iterations.

Conceptualization

This module provides a concise, text-driven explanation of the project's conceptual framework, distilling the methodological background and overall structure into a clear narrative. Wherever helpful, diagrams or other visual aids will be woven in to reinforce the written summary of core ideas.

Statistics Module

The Statistics module is one of the core modules of the dashboard. It helps researchers and policymakers assess the current territorial capitals of the EU NUTS 2 regions using indicators and providing data visualizations for quantitative assessment, aiding in immediate and long-term policy actions, enabling regional comparisons and providing temporal progression data for each region in detail.

It houses three complementary visual-analytics tools. A **Comparison Matrix** lets users compare every region and indicator side-by-side; an **Indicator Map** depicts the spatial distribution of a single metric for two reference years; and a **Region Metrics** panel zooms in on one region, pairing time-series trends with benchmarks against national and EU averages. Interaction is flexible: indicators can be filtered by dimension or sector, results sorted alphabetically or by value, and colour-coded scales (from very high to very low) appear on hover. Because native Azure chart options are limited, all visualisations are embedded via ESRI libraries, with the underlying code fully documented for future maintenance.

Comparison Matrix

The Comparison Matrix is a central feature of the Statistics section that enables users to compare all NUTS 2 regions side-by-side across multiple indicators for the most recent available year. This tool provides an intuitive overview of how regions rank relative to each other within different dimensions.

Users can filter indicators by dimension or sector and rearrange the order of indicators to suit their interests. The colour-coded scale, ranging from very low to very high, helps users quickly identify which regions perform better or worse on specific indicators.

The matrix facilitates the exploration of regional differences and similarities, allowing users to observe patterns and outliers in the data. It supports a better understanding of territorial resilience by providing clear, comparative information in a single view.

Figure 9: View of the Comparison matrix of the Statistics module

Source: extract from TRD under development

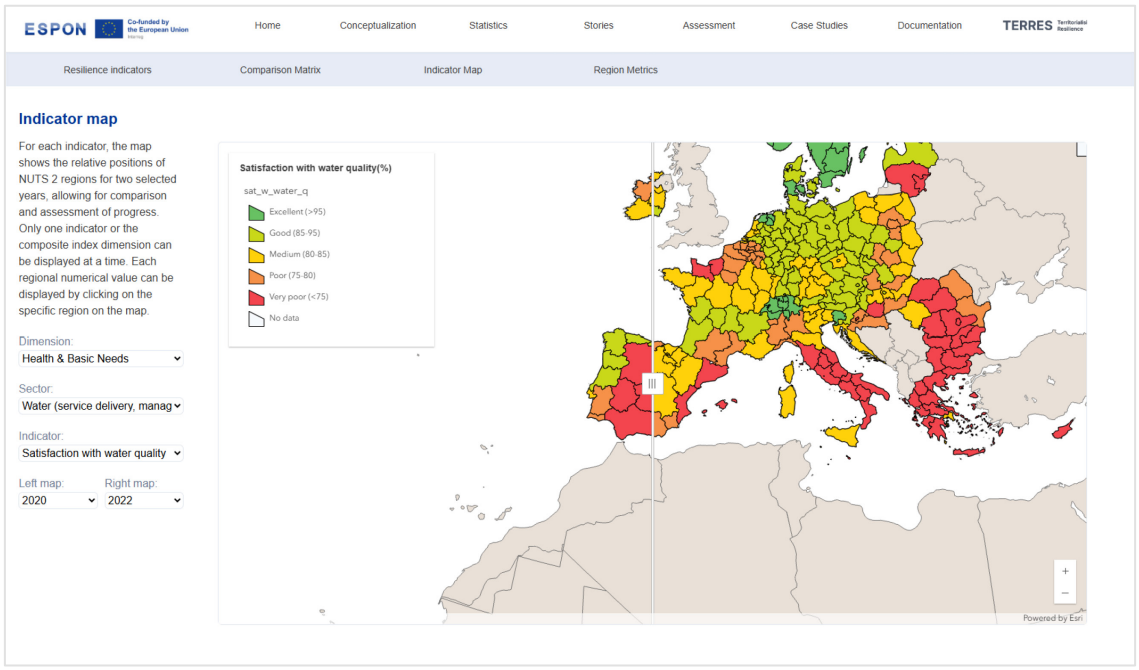
Indicator Map

The Indicator Map provides a spatial visualization of a selected indicator or composite index dimension for two reference years, allowing users to compare and assess regional progress over time. Users can view the relative positions of NUTS 2 regions on the map, with each region colour-coded according to its performance on the chosen indicator.

Only one indicator or dimension can be displayed at a time, simplifying the visualization and helping users focus on specific metrics. By clicking on a region, users can access the exact numerical value for that area, offering detailed insights alongside the visual overview.

This tool supports users in identifying geographical trends and changes, making it easier to observe where resilience has improved or declined between the two years. The Indicator Map complements the Comparison Matrix by adding a spatial perspective to the regional data analysis.

Figure 10: View of the Indicator map of the Statistics module



Source: extract from TRD under development

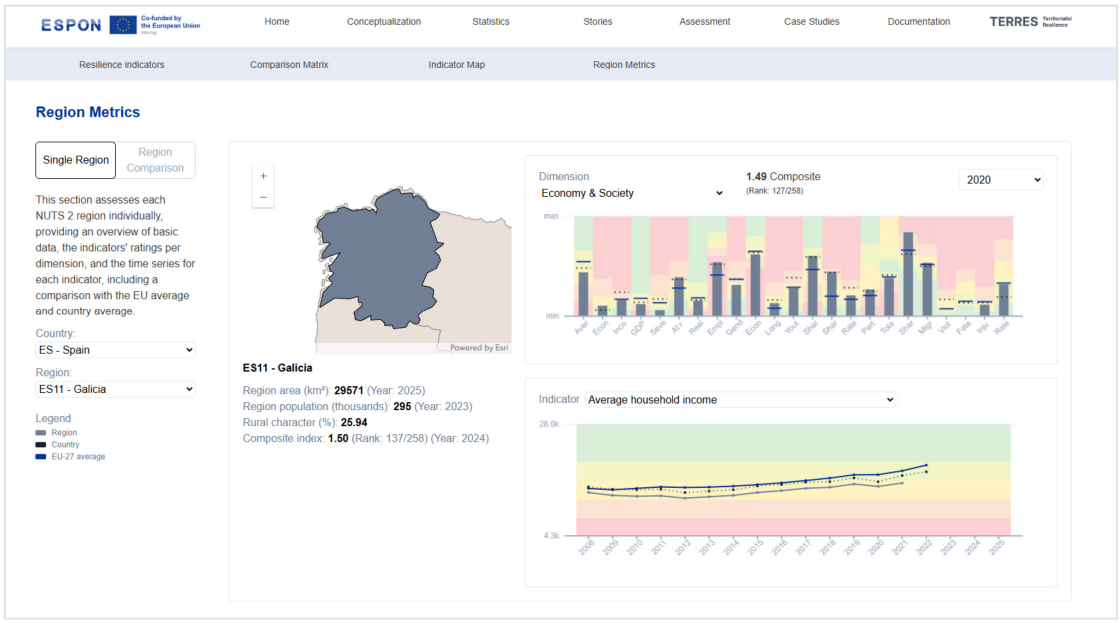
Region Metrics

The **Region Metrics** section offers a detailed view of each NUTS 2 region, allowing users to explore regional resilience data at a granular level. It includes two subviews: one focused on a single region and another enabling the comparison of two regions side-by-side.

The single-region view provides an overview of basic demographic and territorial data, along with ratings of indicators organized by dimension. Time-series charts display trends for each indicator, showing the region's performance over time. In all charts, the national average and the EU-27 average are included as reference lines, providing important context. Additionally, background colour bands indicate value ranges from very low to very high, helping users interpret each indicator's performance visually.

The Region comparison view presents the same set of data and visualizations as the single-region view, but allows users to analyze two regions simultaneously. This side-by-side comparison helps users better understand similarities and differences in indicator values and trends between regions.

Figure 11: View of the Region Metrics of the Statistics Model



Source: extract from TRD under development

Development

During development, **several limitations** were identified when implementing statistical functionalities within Experience Builder:

- **Lack of flexibility in built-in charts**: The default chart widgets allow for basic configurations but do not support advanced customization in terms of design, formatting, or interactive behavior.
- **Limited dynamic filtering capabilities**: Complex or conditional filters based on multiple variables cannot be applied directly from the interface without additional development.
- **Performance issues with large datasets**: When handling extensive datasets, the statistical widgets experience slow loading times and performance bottlenecks.

To overcome these limitations, we developed **three custom widgets**, one for each of the application's main views. These widgets were built using the Experience Builder SDK (based on React), which allowed us to:

To address the limitations of the built-in capabilities in ArcGIS Experience Builder, we opted to develop **custom widgets** using the official **Experience Builder SDK**, which is based on **React**. The development approach focused on maintaining consistency with the native platform while extending its functionality. The approach was structured around two main principles:

- **Full integration with the ArcGIS environment**: all data used by the widgets are consumed directly from the ArcGIS platform via its REST API, so no external API development was necessary. In addition, the **map and the swipe map components** provided by Esri are used. This ensures seamless and fully integrated functionality across the application, with consistent data sources and map behavior.
- **UI and core libraries**: the custom widgets leverage the **Jimu framework**, which provides a comprehensive set of UI components, utilities, and ArcGIS integration tools. This framework ensures seamless visual and functional consistency within Experience Builder, simplifies access to the application context, and streamlines interaction with ArcGIS services—all while supporting modular and maintainable development using React.

The development of the custom widgets and installation of the ArcGIS Environment were carried out following the official Esri documentation, specifically the guides for **creating widgets in ArcGIS Experience Builder** and **adding custom widgets in Web AppBuilder.**

Stories

The Stories module offers a comprehensive European-level overview of key resilience topics, synthesised from literature and case studies, to enable policymakers and researchers explore new perspectives on territorial resilience. Each narrative is supported by a representative case study. Six draft stories—covering themes such as Urban Sprawl, Climate Change, and Systemic Shocks—translate raw data into story-driven insights, each anchored to specific regional examples. These pages combine explanatory text with charts and interactive graphics, and the team is considering renaming the module "Stories" to signal its purpose more clearly.

Case Studies

This area condenses the six regional case studies into brisk overviews that highlight each region's challenges, risks, opportunities, and existing policy responses. Longer, full-length reports will be linked directly, and reciprocal links will connect these summaries to the related narratives to preserve context and avoid duplication.

Assessment Module

The Assessment module assists stakeholders in understanding and evaluating the aspects of **territorial resilience** that are not easily shown through data alone. It offers two practical tools that go beyond numbers and help identify challenges and guide strategy development:

- The **Self-Assessment Tool** enables users to evaluate the preparedness of their governance to manage shocks and stresses. It includes fourteen questions focused on governance capacity and territorial resilience, scored on a five-point scale from best- to worst-case scenarios. The tool generates instant, downloadable results with data visualizations that allow benchmarking the scores against national and EU averages. Feedback is invited on the tool's clarity, usefulness, and any refinements needed before final release.
- The **Future Workshop Tool** provide a participatory method bringing stakeholders together to evaluate current capacities and co-create a shared vision for the future. Accompanied by a methodological guide and toolkit, it promotes a forward-looking approach – helping regions not just react to crises, but prepare for future challenges.

Documentation

Still under construction, the Documentation section will ultimately house the complete methodology, a glossary, detailed indicator metadata, and every formal project deliverable. All materials will be uploaded once the validation process is complete.

6.3 Back-end architecture and data models

The application does not rely on a custom backend service. Instead, all the data logic and storage are handled through **ArcGIS-hosted resources**. The backend consists of **data layers and services published on the ArcGIS platform**, which are accessed via the **ArcGIS REST API** and consumed within the application through **FeatureLayer** objects. This architecture eliminates the need for a separate API or database, simplifying maintenance and ensuring that the application always uses up-to-date, centrally managed data directly from the ArcGIS environment.

Two main types of datasets were uploaded and used to support both the map-based and tabular functionalities of the custom widgets:

- **Hosted Feature Layers:** These layers were created from spatial data files in **GeoJSON format**. They are used to render the map and support geographic interactions such as filtering, selection, and spatial queries. These layers form the basis of all map-based visualizations in the application.
- **Hosted Tables:** These were generated by uploading **Excel or CSV files** containing structured tabular data. While they do not contain spatial information, they are essential for powering statistics, filters, and contextual data displays within the widgets.

Here is a summary table showing all the feature layers and tables used in the statistics module.

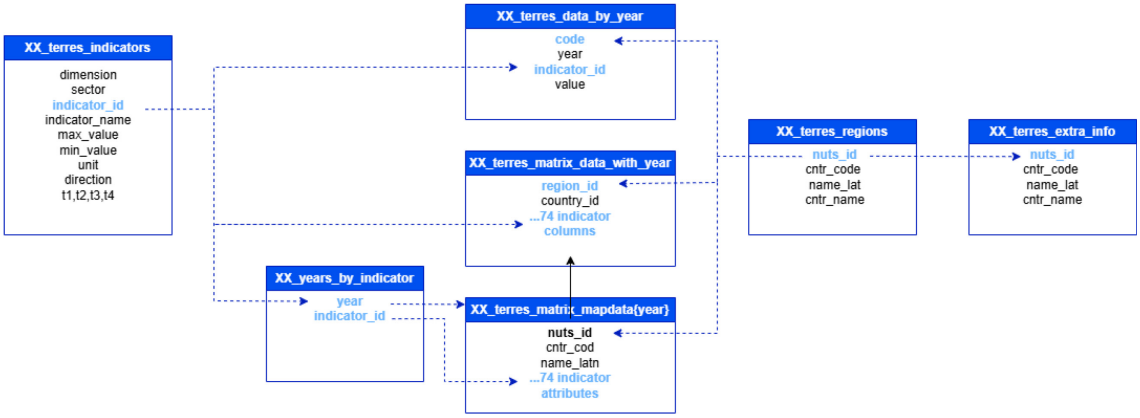
Table 6: Hosted feature layers of the TRD

Feature layer/File name	Description	Columns
XX_terres_regions	Reference table listing all NUTS 2 regions with their associated country metadata. Serves as the geographic base for linking statistical data.	**nuts_id:** NUTS 2 region code **cntr_code:** Country code **name_latn:** NUTS 2 region name **cntr_name:** Country name
XX_terres_indicators	Metadata for indicators including dimension and sector, which are used for filtering in the application. The indicator_name is the display name used throughout the app. The direction column indicates if higher values are positive or negative. Threshold columns (t1 to t4) define value ranges used to categorize indicator results.	**dimension** **sector** **indicator_id** **indicator_name** **max_value, min_value** **unit, direction** **t1, t2, t3, t4**
XX_terres_data_by_year	Time series dataset with indicator values per **NUTS 2** region and year. Each row links to a region in the previous file via code = nuts_id	**code: NUTS 2 region ID** **year** **indicator_id** **value**
XX_terres_matrix_data_with_year	Matrix-style dataset for the coparison matrix widget. Contains region and country IDs plus 74 columns for different indicators. Each indicator's value is a JSON object with value and year like: {'value': 82, 'year': 2024}.	**region_id** **country_id** **74 indicator columns** with JSON values
XX_terres_matrix_data	Similar matrix-style dataset but with numeric indicator values only (without the year info). Used where only the latest or single value is needed.	**region_id,** **country_id,** **74 indicator columns** with numeric values
XX_terres_mapdata_{year} Files from 2008 to 2024	GeoJSON files for each year containing polygons for **NUTS 2** regions. Attributes include nuts_id, cntr_code, name_latn, and indicator values. NOTE: Null indicator values are represented as -999 to ensure correct interpretation by the Esri platform. If an indicator is omitted from a feature's attributes, Esri assigns it the value of the previous item. Conversely, if an indicator is explicitly set to null, Esri interprets it as zero.	**nuts_id** **cntr_cod** **name_latn** **74 indicator value attributes**
XX_years_by_indicator	Dataset listing all the years for which data exists for each indicator. Supports filtering and time selection in the map widgets.	**indicator_id** **year**

Feature layer/File name	Description	Columns
XX_terres_extra_info	Additional regional metrics used in **the Region Metrics** view. Contains demographic and territorial data such as population, area, and rural household distribution for each NUTS 2 region	**CODE (NUTS 2),** **pop: population,** **pop_year** **area: region area, area_year** **all_households,** **households_in_rural_areas,** **perc_rural (percentage of rural households)**

The described data tables are structured as follows:

Figure 12: Data model of the Statistics module



Source: elaboration of the project team

6.4 Challenges and limitations

During the development process, several limitations of the ArcGIS Experience Builder platform were encountered, which are important to consider for future maintenance and scalability:

- **Version compatibility issues**: initially, the ESRI portal environment was running an older version of Experience Builder (from 2021), which caused compatibility issues with the application. These version mismatches led to functionality problems and required workarounds during development. Moving forward, it will be crucial to monitor platform updates and maintain version alignment between the development environment and the ESRI portal to avoid similar disruptions.
- **Translation and localization constraints**: the platform's support for multilingual content is limited. Unlike traditional web development where libraries like i18n can be used for dynamic language handling, Experience Builder does not natively support multiple translations—unless the default (non-developer) version is used. This restricts the flexibility for implementing robust multilingual user interfaces within custom-built applications.
- **Visualization limitations:** the standard version of Experience Builder offers a limited set of visual components and charting options. To meet specific design and data visualization requirements, it was necessary to develop **custom widgets**, increasing development complexity and effort
- **Hosting of custom widgets**: custom widgets developed for the application cannot be deployed directly within the Experience Builder interface and require external hosting. In this case, the custom

components are being hosted on an AWS CloudFront development environment. However, a more permanent and maintainable hosting strategy will need to be defined for production deployment.

6.5 Ongoing development and future deployment

As the application continues to evolve, several aspects related to ongoing development and deployment need to be addressed in coordination with ESPON.

Final **content and complementary documentation** must be reviewed and agreed upon with ESPON prior to the full deployment. This includes validating the datasets, reviewing textual content, and uploading any necessary documentation or metadata to the platform, ensuring the dashboard is complete, accurate, and user-ready.

In addition, it will be necessary to coordinate with ESPON to determine an appropriate and secure hosting solution for the custom widgets that supports long-term sustainability and fits within ESPON's infrastructure

Ongoing maintenance will also require careful monitoring of the ESRI portal version, as it directly impacts the application's functionality. Previous issues caused by the portal running an outdated version demonstrated the importance of ensuring both the portal and the application remain compatible and properly aligned.

Finally, while the current application is functional; future enhancements, such as expanded visualizations and new data layers, can be considered based on feedback and evolving needs.

Close collaboration with ESPON will be essential to ensure a successful deployment and sustainable long-term operation.

7 Recommendations for policymaking

In a rapidly evolving world facing overlapping crises – climate change, energy volatility, demographic shifts, geopolitical instability – territorial resilience has emerged as a policy framework for steering Europe toward more adaptive, just, and sustainable futures. Yet, the Policy Review and the Conceptual and Operational Framework developed in the context of the ESPON TERRES project has shown that resilience remains conceptually fragmented and operationally underdeveloped in many EU strategies.

Acknowledging this gap, which has been highlighted multiple times in the previous section of this report, this policy section draws on the learnings from all the analytical tasks in the project to provide decision and policymakers with actionable recommendations, in so doing hoping that the results of the project will not lie fallow. More in detail, **the section is articulated into three subsections, respectively focusing on**:

- **a macro-level framework aiming at inspiring EU-level actors** (Chapter 7.1),
- **policy advice targeting national level decision and policymakers** (Chapter 7.2), and
- **policy recommendations aimed at regional and local policy makers** (Chapter 7.3)**.**

The first two items focus on how to better embed the concept of territorial resilience into European and national policymaking, providing a new "resilience compass" for the EU cohesion and other policies with territorial relevance. This compass shall complement the objectives of the Territorial Agenda 2030 and provide a new lens for the critical evaluation at the mid-term review of EU Cohesion Policy 2021-2027, as well as to observe how selected EU policies may contribute to enhancing territorial resilience. Moreover, the resilience compass shall identify directions that can facilitate the practical and meaningful implementation of the concept of territorial resilience in the future of the EU cohesion policy and shall target different types of national actors through ad-hoc recommendations on how to strengthen resilience thinking at national level and increase national preparedness to crisis based on the best practices identified in previous tasks. The recommendations included in the third subsection target instead the regional and local policy levels. Such recommendations are based on and aligned with the conceptual framework, operational learnings and tools developed in previous tasks, and build directly on the materials collected in the Case Studies and Futures Workshops research activities.

7.1 A Resilience Compass for EU level policies

The European Union stands at a crossroads: it can either continue framing resilience as a sectoral, reactive concept, or embrace it as a territorial, transformative compass that cuts across silos, empowers local actors, and orients the entire policy machinery toward a more just, adaptable, and sustainable future. Building on the ESPON TERRES findings, this text introduces a **Resilience Compass to guide the EU Green Deal implementation, the EU cohesion and sectoral policies**, grounded in the systematic multilevel and multi-dimensional understanding of resilience conceptualised by the project.

The Resilience Compass provides a territorialised, operational and future-oriented framework for navigating uncertainties and future development models that are resilient and spatially just. It not only complements the goals of the *Territorial Agenda 2030* – particularly the Just and Green Europe pillars – but also offers an evaluative lens for the mid-term review of Cohesion Policy 2021–2027, and a strategic tool for aligning EU sectoral initiatives with place-based resilience objectives.

As such, the Compass is articulated into four sets of policy recommendations, that are aimed at guiding the action of EU-level decision and policymakers. By endorsing the Resilience Compass, EU institutions could advocate an **alternative view on territorial cohesion, intended not merely about balancing growth, but about enabling territorial metamorphosis in the face of polycrises**. The ESPON TERRES framework offers a conceptual backbone and an operational toolbox.

Establish Territorial Resilience as a Core Principle of EU Cohesion Policy

Recommendation 1 – Anchor territorial resilience in the post-2027 Cohesion Policy architecture. EU Cohesion Policy post-2027 should move beyond the competitiveness-convergence dichotomy toward a

resilience-oriented approach to territorial development, embedding the ESPON TERRES tri-capacity framework into policy objectives and investment priorities. Absorptive (shock-resistance), adaptive (incremental change), and transformative (long-term reconfiguration) capacities should guide the development of future framework agreements, programming documents and monitoring frameworks.

Recommendation 2 – Use territorial resilience as a criterion for place-based policy targeting. Resilience concept should inform the territorial allocation of funds. Vulnerability mapping, forward-looking risk assessments, and resilience dashboards like the one produced in the context of the project should support evidence-based decisions on where interventions are most needed. This includes addressing rural shrinkage, polycentric disparities, border disconnections, and functional mismatches, among other challenges.

Recommendation 3 – Integrate territorial resilience indicators in performance frameworks. Current indicators often neglect transformative dimensions and multiscalar interdependencies. EU conditionalities and performance assessment frameworks should incorporate resilience indicators, measuring not only GDP impacts or infrastructure coverage but institutional learning, social capital and the ability to innovate and adapt over time.

Recommendation 4 – Create a Resilience Knowledge Hub under the JRC and ESPON. To consolidate knowledge, the EU could benefit from establishing a permanent Resilience Knowledge Hub to curate evidence, host territorial foresight tools, and provide technical assistance. The creation of the hub requires strengthening the existing tools like JRC Resilience Dashboard by integrating key insights from the ESPON TERRES conceptualisation. In particular, the territorial understanding of resilience offers two complementary criteria that can improve the JRC dashboard specially in the selection of indicators referring to *capacities* and *vulnerabilities*. First, a multi-scalar and functional understanding of territorial systems that reflects their fluid and interconnected nature, beyond existing administrative boundaries. This involves the existence or absence of cooperation mechanisms across different spatial scales and dimensions. Second, a stronger focus on the importance of multi-level governance and recognising the role of both top-down and bottom-up processes, and the interplay between formal and hard instruments (e.g., land use planning, regulation) and soft mechanisms (e.g., trust, participation, shared visions). These additions would allow the dashboard to better support forward-looking, context-sensitive, and transformation-oriented resilience policies, while creating synergies with initiatives like Eurostat and the European Fair Transition Observatory.

Mainstream Territorial Resilience across EU Policies and funding schemes

Recommendation 5 – Embed resilience criteria in funding conditionalities. Regulations governing EU funds (e.g., ERDF, CF, ESF+, CAP) should include territorial resilience-enhancing criteria as ex-ante conditionalities and performance milestones. This includes evidence of inclusive planning, climate adaptation mainstreaming, and capacity-building for long-term transitions.

Recommendation 6 – Conduct a resilience audit of key EU policies. Many EU policies – such as the EU Cohesion Policy, the CAP, TEN-T, Digital Europe etc. – affect territorial resilience, often implicitly. A systematic resilience audit should assess how these policies contribute (or fail to contribute) to absorptive, adaptive, and transformative capacities across European regions. It can identify gaps where policies fail to address resilience – or even undermine it – and recommend adjustments.

Recommendation 7 – Align climate adaptation policies with territorial resilience. The EU Climate Adaptation Strategy provides the overarching policy framework, while NAPs translate this framework into country-level actions. The EU Climate Adaptation Strategy (2021) and National Adaptation Plans should be territorialised, shifting from sectoral risk management to integrated, place-based, and systemic approach. TERRES policy review argues that currently, these policies often focus on sector-specific risks, like agriculture, water management, and health, rather than an integrated, place-based, and systemic approach to resilience. Aligning climate adaptation policies with territorial resilience also requires better synergy between *EU Mission in Horizon Europe: Adaptation to Climate Change*, the *Covenant of Mayors for Climate and Energy*, and EU Cohesion Policy territorial instruments like Sustainable Urban Development (SUD) or Integrated Territorial Investments (ITI).

Recommendation 8 – Address social vulnerability and inequality in resilience-oriented policies. Resilience is not neutral. Historically marginalized communities are often less likely to benefit from absorptive, adaptive, and transformative measures due to limited political influence, resources, and capacity. Moreover,

unequal cost-benefit distribution may cause resistance to transformational policy responses, such as the green transition. Therefore, integrating social equity into resilience is not only an ethical imperative. It is also a pragmatic strategy that enhances acceptance and accelerates resilience-building. EU policies should prioritise social equity, focusing on marginalised groups, youth, elderly, and migrant populations. Resilience actions should be tailored to socio-cultural contexts, with adequate resources for participation and social innovation to address all dimension of equity.

Operationalise Territorial Resilience through Multi-Level Governance

Recommendation 9 – Institutionalise territorial resilience through a EU-wide governance frame. Territorial resilience requires both soft and hard governance tools. Soft governance tools play a vital role in enabling bottom-up community participation in building resilience; an element that is irreplaceable. However, in times of crisis, sustaining grassroots efforts requires institutional support enabling fast and effective action through formal governance tools. EU should support this by favouring stronger vertical coordination mechanisms, that may include harmonised guidelines for member states and regions to define, measure, and act on resilience at NUTS 2 and lower scales

Recommendation 10 – Foster resilience partnerships across levels and sectors. The EU should incentivise multi-level, cross-sectoral coalitions involving local authorities, civil society, knowledge institutions, and private actors. Calls under the EU Cohesion Policy should reward such coalitions, particularly when addressing complex challenges like just green transitions and disaster and risk resilience in more vulnerable territories.

Recommendation 11 – Expand the role of macro-regional strategies and cross-border cooperation. Functional territorial resilience often transcends country boundaries. EU instruments like Interreg, EGTCs, and macro-regional strategies (EUSALP, EUSDR, etc.) should be more explicitly used to support territorial resilience in places with fuzzy geographies, fragile ecosystems, and dispersed vulnerabilities.

Recommendation 12 – Promote experimental governance through pilot actions. EU programmes should support territorial resilience labs or Living Labs, especially in vulnerable or shock-exposed regions. These pilot territories can test co-evolutionary governance models and build institutional learning for territorial resilience, in line with the Mission on Climate-Neutral and Smart Cities and the New European Bauhaus.

Rethink the Territorial Reference Frameworks

Recommendation 13 – Move from administrative to functional territories. While territorial governance operates within administrative boundaries, territorial reference frameworks should increasingly take functional boundaries into account. A shift is needed from rigid NUTS units to functional resilience areas – regions defined by environmental systems, mobility flows, social networks, or hazard exposure. This perspective is essential to implement integrated responses to various short- and long-term stressors, such as climate change, geopolitical risks, or rural decline. At the same time, administrative governance structures should remain flexible enough to establish and support the functional linkages and networks necessary for resilience.

Recommendation 14 – Promote variable geometry and polycentric territorial resilience networks. Enhancing territorial resilience cannot rely on monocentric or sectoral approaches. The EU should support polycentric alliances of small and medium-sized towns, metropolitan peripheries, and inner areas, strengthening their capacity to act collectively, share services, and absorb shocks through distributed systems.

Recommendation 15 – Institutionalise territorial resilience foresight in EU programming. Every EU territory should develop the capacity to anticipate and shape future transformations. To support this, the EU should further embedd territorial resilience foresight into programming cycles, favouring the adoption of scenario planning and anticipatory governance through incentives and conditionality, in so doing helping aligning long-term investments with resilience pathways.

Recommendation 16 – Strengthen the statistical foundations of territorial resilience measurement. Accurate and comparable data are essential for assessing territorial resilience, yet current data collection systems struggle to capture its full complexity – especially at sub-national levels and in some key resilience dimensions. To address these limitations, *Eurostat* should establish a dedicated *Territorial Resilience* dataset as part

of its EU policy indicators, with the integration of environmental, governance, infrastructure, and basic needs indicators from diverse thematic and national sources. Filling gaps caused by NUTS reclassification, applying imputation techniques, and releasing data at more granular territorial levels would further improve data usability. Additionally, *Eurobarometer* should explore using the TRD's self-assessment tool as the basis for public opinion surveys to better understand citizens' perceptions of governance and preparedness. *EEA* should consider both disaggregating national-level data and aggregating fine-scale datasets to produce robust regional-level indicators. Establishing common technical standards for territorial resilience data collection at national level would ensure consistency, support comparability, and strengthen the knowledge base for resilience-focused policymaking across Europe. (Detailed recommendations for future data collection see in Annex 3)

7.2 Strengthening Territorial Resilience through National Action

While the EU provides vision, incentives and normative apparatuses, it is national institutions that must design the territorial infrastructures of resilience, i.e. the norms, policies and coordination mechanisms that allow regions and communities to withstand shocks, adapt to change, and thrive in uncertain futures. **National governments play a pivotal role in translating supranational ambitions, objectives and policies into concrete actions.** While the European Union provides overarching direction and resources through instruments like Cohesion Policy and the EU Green Deal, the effectiveness of these tools ultimately depends on how national and sub-national institutional and policy architectures engage with and operationalise the concept of territorial resilience.

Acknowledging the above, this section offers tailored recommendations to national actors (i.e. ministries, spatial development and planning agencies, and inter-ministerial and interregional coordination structures, policy support knowledge institutions etc.) on how to embed resilience thinking into their activity and, as a consequence of the latter, into the fabric of territorial development. It naturally parallels many of the elements composing the Resilience Compass introduced above, as well as the conceptual definition of territorial resilience produced by the project, which defines it as a system's capacity to absorb, adapt, and transform in the face of disturbances. The goal is to support national preparedness and institutional innovation, in so doing enhancing the capacity of territories to respond to emerging challenges from multi-scalar perspective.

Mainstreaming Territorial Resilience into National Policy Systems

Recommendation 1 – Embed territorial resilience into national development strategies and reforms. National Sustainable Development Strategies, National Operational Programmes etc. should explicitly integrate territorial resilience objectives. This requires moving beyond general commitments to resilience and embedding spatially differentiated approaches that respond to local vulnerabilities, strengths, and interdependencies.

Recommendation 2 – Use territorial resilience as a coherence approach across sectoral strategies. National resilience thinking often remains siloed within climate adaptation, civil protection or security policies. Ministries responsible for energy, health, agriculture, housing, and transport should be brought into a cross-sectoral dialogue, with territorial resilience serving as a coordination principle. National inter-ministerial committees or task forces should be mandated to mainstream resilience across policy domains, with the territorial dimension clearly articulated.

Recommendation 3 – Align resilience goals with multilevel territorial contracts. National governments can act as "brokers of resilience" by developing coordination instruments such as territorial pacts or resilience contracts with subnational authorities. These instruments should define mutual commitments and resources for building absorptive, adaptive and transformative capacities, particularly in areas prone to structural decline, climate hazards, or socio-political fragmentation. The "Room for the River" program in Netherlands can serve as an example, which is an initiative to improve flood resilience through a multi-level, multi-stakeholder approach involving the government, local and regional authorities, and other stakeholders.

Enhancing National Preparedness through Territorial Governance Innovation

Recommendation 4 – Build an adaptive spatial governance and planning and development frameworks that support resilience transitions. Static and compliance-oriented spatial planning frameworks are ill-equipped to deal with nonlinear and multi-scalar crises. National planning governance and planning framework should be revised to include flexibility clauses, risk-based scenarios, and adaptive pathways that

allow local and regional actors to recalibrate development trajectories in a more dynamic and adaptive way. This also entails strengthening the integration between national spatial strategies and climate adaptation plans.

Recommendation 5 – Institutionalise multilevel governance for resilience. Resilience-building requires vertical and horizontal coordination. Multi-level coordination platforms shall bring together municipalities, regions, and national ministries around shared resilience challenges, while capacity-building schemes shall empower subnational actors to develop foresight tools, resilience assessments, and cooperation schemes. The example of countries adopting dedicated resilience observatories or national committees for territorial risk and adaptation -e.g., the Delta Programme and flood risk management policies in the Netherlands, or the development of Local Climate Plans in Denmark that follows a multi-level governance approach- can serve as best practices to replicate.

Recommendation 6 – Reinforce social cohesion and trust as foundations of territorial resilience. Social cohesion is not a by-product of resilience, but its precondition. National policies should support deliberative and inclusive governance models, particularly in territories affected by demographic ageing, depopulation, or migration pressure. This includes promoting participatory budgeting, civic education on risk and resilience and inclusive decision-making processes for recovery and adaptation planning. In addition, when it comes to resilience-oriented investments -such as those supporting the transition to a green economy, urban regeneration, and infrastructure development specially in marginalized or vulnerable territories- it is a core principle to address territorial inequalities and distributive justice to avoid worsening existing social and spatial disparities and also as a means of fostering accountability towards institutions.

Supporting Functional and Flexible Territorial Approaches

Recommendation 7 – Enable the emergence of functional resilience areas. Traditional administrative boundaries often fail to capture the spatial dynamics of shocks and responses. National governments should facilitate the definition and recognition of "functional resilience areas" characterised by shared vulnerabilities (e.g. coastal erosion, flood risk), economic transformations (e.g. industrial decarbonization), interlinked ecosystems (e.g. river basins, rural-urban fringes) and or governance mechanisms. This involves adapting national regulations and funding mechanisms to support variable geometries of cooperation, such as inter-municipal consortia, territorial clusters, or metropolitan governance bodies.

Recommendation 8 – Incentivise territorial cooperation through national funding instruments. Dedicated funds should support joint planning, pooled resources, and shared services among municipalities and regions. National rural or metropolitan development programmes can integrate resilience-enhancing actions, rewarding initiatives that demonstrate horizontal solidarity and systemic impact, for instance, prioritising cross-border or transregional projects tackling shared climate risks, inner areas and regions suffering from infrastructural deficits or demographic decline, networks of medium and small towns aiming to enhance collective resilience.

Recommendation 9 – Promote interoperability of data systems and territorial indicators. National statistical offices should integrate territorial resilience-specific indicators into their regular data collection and monitoring frameworks. In line with the TERRES Territorial Resilience Dashboard, national actors should support the collection of disaggregated data at sub-regional levels where decision-making is relevant and the development of complex indicators, to enable evidence-based policymaking.

Learning from Good Practices and Building Institutional Memory

Recommendation 10 – Systematically collect and share resilience good practices. National coordination units should be set up, aimed at establishing knowledge repositories and resilience portals to share tools, case studies, and templates for action. Particular attention should be given to locally developed adaptation plans, innovative funding blends, and inclusive territorial governance mechanisms that have proven effective in stress-prone areas.

Recommendation 11 – Institutionalise resilience learning across ministries and agencies. Public administration capacity building activities and planning bodies should incorporate resilience education and systems thinking into their training activities. This is crucial to bridge the gap between sectoral and territorial approaches and promote understanding of non-linear change and uncertainty.

Recommendation 12 – Engage in cross-country peer learning and EU-level dialogue. National actors should be encouraged to actively participate in European knowledge platforms (e.g., ESPON, URBACT, and CoR networks) to learn from peers and co-create governance models. The diversity of national contexts is a resource, not an obstacle—functional adaptation areas, recovery strategies, and innovation ecosystems can be exchanged and adapted.

7.3 Regional and local level actionable recommendations

In an era of escalating environmental challenges, economic disruption, and demographic pressures, ineffective risk management and inadequate preparedness are increasingly undermining the ability of regional and local administrations to safeguard their communities and economies. Currently, fragmented governance structures, siloed thinking, and insufficient investment in long-term planning are creating vulnerabilities that threaten the very foundations of regional systems. Failure to address these challenges risks irreversible damage – a collapse of local economies, a decline in population, and a diminished capacity to adapt to a rapidly changing world.

As discussed at multiple stages in this report, territorial resilience is about cultivating a dynamic, adaptable system capable of bouncing forward, seizing opportunities, and ultimately, fostering a more prosperous and equitable future for all. Enhancing territorial resilience calls for a multi-faceted strategy centered on embracing foresight, strengthening collaboration, investing in skills, and actively engaging communities, all underpinned by a clear understanding of the interconnectedness of resilience across multiple domains.

The following recommendations outline a comprehensive roadmap – emphasizing investment in knowledge, fostering social inclusion, and prioritizing local value creation – to unlock the potential for resilient territories, and ultimately, a more secure and prosperous Europe. By implementing the recommendations below, regions and municipalities can adopt a transformative approach to building resilience that not only mitigates risks but also fosters inclusive growth, social cohesion, and community engagement.

Recommendation 1 – Aim for a transformative shift approach to territorial resilience and crisis management. Ineffective risk management and disaster preparedness weaken response capacity and post-crisis management and reconstruction. A reactive approach to crisis management, coupled with a lack of comprehensive strategies, neglects opportunities and reduces response efficiency. Regional and local administrations should invest in monitoring tools and early warning systems, increase public awareness, and provide training to enhance preparedness and ensure rapid, effective responses to natural or anthropic emergencies. Anticipatory measures should be integrated into ordinary regional and local planning processes to raise awareness of potential risks and facilitate recovery within a flexible timeframe. Regional and local plans, particularly those addressing natural hazards and climate change, should combine short-term strategies—such as wildfire prevention—with long-term strategies—like ecosystem restoration. However, territorial resilience extends beyond risk management; resilience thinking should be understood as a framework to capitalize on existing potentials, rather than solely as a risk-preparation or mitigation strategy. Consequently, resilience management should shift from a reactive "bouncing back" approach to a proactive "bouncing forward" paradigm, integrating resilience-building into everyday planning practices and enhancing planning tool efficiency. This transformative shift should also guide reconstruction and recovery processes. For example, the Italian case demonstrates how forward-looking visions on reconstruction can improve perceptions of crisis-affected areas and foster new opportunities to address issues like depopulation. By adopting forward-looking approaches to crisis management, policies can promote affected areas as places of opportunity.

Recommendation 2 – Foster territorial and sectoral cooperation for better horizontal and vertical coordination. Siloed thinking within fragmented and rigid governance structures leads to inefficient planning. For example, in the Budapest Metropolitan Area, excessive centralization has led to overlooked local needs and sporadic inter-municipal cooperation. Similarly, in Upper Norrland, resilience measures are conditioned by broader economic developments, such as green industrialization. The Teruel case highlights how demographic challenges—including an aging population and a lack of skilled labour—call for more holistic planning. These challenges necessitate steering policies that consider the impacts of local plans and programs on other areas, encouraging horizontal cooperation between peer municipalities to address shared territorial and resilience challenges in a coordinated way beyond administrative boundaries. Horizontal coordination of local policies and spatial plans is essential to resolve land-use conflicts—such as those related to urban sprawl in the Budapest Metropolitan Area or renewable energy installations in the Upper Norrland case—and to

improve the operation of physical infrastructure and service provision. Cross-sectoral cooperation should also be ensured through interdepartmental working groups, aligning sectoral policies with resilience objectives. Key areas for cross-sectoral cooperation and spatial targeting include water management, transport planning, local production of renewable energy—including energy communities and building energy renovation, and construction permitting, including responses to unauthorized developments (e.g., utility connections). Given that responsibilities for sectoral policies—such as housing, public services, infrastructure, and energy provision—often fall at different scales, resilience policies should be underpinned by vertical coordination schemes. Regions can contribute to mitigating inefficiencies in local planning frameworks by providing municipalities with governance mechanisms—formal or informal—to foster enhanced cooperation and communication across areas. The national level should encourage territorial cooperation between regions via dedicated governance tools (see also Recommendation 5 at the national level).

Recommendation 3 – Support long-term resilience by investing in training and skill development, and leveraging existing funding schemes. In many instances, regional and local administrations face limited resources, including insufficient funding and skills, hindering their capacity to anticipate risks and build resilience. Targeted financial measures and reforms could support resilience management at the regional and local levels. Investing in risk-sharing mechanisms, where regions and states share the risk of large municipal investments, can encourage greater investment and reduce the financial burden on local governments. Furthermore, tax system reforms should enable a fairer distribution of resources to sub-national levels, particularly in resource extraction sectors (see also Recommendation 8 at the national level). In addition to these measures, targeted financial schemes at the regional and local levels can also play a crucial role. For instance, establishing public-private partnerships to finance large infrastructure projects can spur economic resilience in vulnerable communities. Capitalizing on EU funding mechanisms, such as LIFE and Horizon programs, alongside local funds, can foster resilience policies related to natural hazards, climate change, geopolitical threats, regional development traps, and demographic challenges, representing a low-regret policy strategy that justifies adoption by all European regional and local administrations. The regional level should also contribute to channelling European and national funds to the municipal level. These measures can, in addition to strengthening local capacity, facilitate the dissemination of best practices to other regions, fostering replication and scalability of successful resilience strategies. Beyond funding, case studies consistently emphasize the role of knowledge and skills in territorial resilience. This encompasses sufficient knowledge within public administration and a skilled workforce across all sectors and occupations. Regions and municipalities should engage in existing—local to global—knowledge networks to increase regional and local capacities and skills. In this context, collaboration with local and national universities and technical schools should be reinforced to develop training programs that enhance workforce skills in emerging technologies and address the changing job market, while offering lifelong learning, reskilling, and retraining opportunities for the general population. Finally, knowledge transfer and the sharing of good practices are essential components of territorial resilience. To support this, local authorities should cooperate and maintain common institutional structures for systematic knowledge exchange—such as open information-sharing platforms, best-practice repositories, or dedicated resilience knowledge hubs. These mechanisms enhance the skills of local authorities and ensure long-term capacity building at all levels.

Recommendation 4 – Involve civil society and grassroots initiatives in high-level plans and processes. Fragmented or overly bureaucratic governance structures and limited citizen participation undermine transformative resilience approaches. Regional and local policies geared at resilience building should promote civil society engagement to build social cohesion and mutual trust, particularly in areas with social divides due to language or hybrid identities, such as Latgale and Catalonia. Virtually all of our case studies showed that high levels of social cohesion and mutual trust enable cooperation and collective action, essential for effective crisis response. At the same time, these qualities foster institutional accountability and legitimacy, crucial for timely and targeted interventions. Therefore, engaging civil society and removing barriers to participation for all social groups is key for resilience building. Private sector actors, NGOs, grassroots initiatives, and informal networks should be involved in resilience planning. However, due to the unequal distribution of power between grassroots and institutional actors, enabling effective participation may become a challenging task. In some cases, public participation becomes little more than a matter of formal compliance; in others, institutions may adopt the language of grassroots movements while still pursuing institutional agendas. Hence, local and regional policymakers should collaborate to empower and engage communities to shape decisions by strategically aligning administrative measures with third-sector action and citizen-led

initiatives, while streamlining public consultations reduce participant fatigue. Meaningful public participation—including digital forms—can be incentivized through methods such as participatory budgeting, risk management roundtables, or advisory councils, as well as by involving local councils and associations and active networks within formal planning processes. Institutionalizing community-led action—as demonstrated in the Italian, Spanish, and Latvian cases—is a recommended approach to engage local perspectives, especially those of younger generations, compensate for public institutions' resource limitations and outreach challenges, and better represent local needs. Integrating informal, bottom-up community action with top-down policy frameworks—addressing potential biases—is crucial. Stakeholder engagement through participatory governance models, such as the Catalonian Working Group for Adaptation to Climate Change (METACC), has proven effective in fostering cross-sectoral collaboration and ensuring that resilience strategies address local needs. This innovative approach to participation, often superior to established municipal methods, is particularly valuable in rural areas and demonstrates how resilience policies can be co-designed across wider regions and sectors.

Recommendation 5 – Foster community building, social inclusion, wellbeing, and local acceptance by creating local value and ensuring community benefit. In some cases, territorial resilience is threatened by deep injustices related to economic divisions. Combined with underlying political polarization, latent social conflicts, vested interests, and perceived lack of community benefits, this often leads to transformative resilience frameworks lacking sufficient social support. For example, cases from Teruel and Upper Norrland demonstrate that local populations frequently perceive limited direct benefits from green investment projects in their regions. Regional and local policies supporting systemic transformations, such as energy transitions, should develop frameworks to steer development in a just and inclusive manner, with transparency and accountability. Encouraging non-extractive renewable energy through local ownership or revenue-sharing can genuinely contribute to community development, ensuring that local communities—such as the Sámi people in Sweden—are involved in the process and benefit financially. Payments for ecosystem services can incentivize landowners to conserve natural resources and protect biodiversity while diversifying income. Linking social integration measures with wider socio-economic policies, as demonstrated in the Teruel case, is also key. Policy attention should focus on housing, social services, and education schemes. A housing strategy targeting vacant properties for rehabilitation grants, tax incentives, or low-interest loans can attract professionals, such as doctors or teachers, to those areas. Municipalities in smaller rural areas should offer childcare support to attract young families and expand other social services to strengthen community bonds. Regions and municipalities should also support youth through scholarships, entrepreneurial grants, and supportive networks. Educational support should particularly target vocational training schemes aligned with emerging industries and occupations. Simultaneously, regions and municipalities should develop targeted communication strategies aimed at specific audiences across social and cultural groups—e.g., overcoming potential language barriers. These strategies should contribute to reducing social and political polarization. Information on regional and local transformative resilience projects should be trustworthy, and campaigns should deliver accurate and realistic information on the impacts—both positive and negative—of the strategies and projects. See also Recommendation 6 at the national level.

Recommendation 6 – Foster local innovation systems to reinforce regional economic resilience. Many regions across the EU show limited industrial bases and declining populations over long periods, while others face rapid transformations due to, for example, large-scale green industrialization projects. This combination of long-term stressors and rapid accelerations may undermine regional innovation systems and compromise economic resilience. For example, entrepreneurs and small companies in many rural areas struggle to access advisory services, financing, and knowledge hubs essential for business growth (e.g., Teruel), while local innovation systems in regions undergoing economic transformations are often neglected by large-scale-and frequently foreign-owned-investments. For example, many green industrialization projects in Upper Norrland are disconnected from the local entrepreneurial community, relying instead on external capital, resources, and suppliers. These limitations hinder business innovation and economic diversification. Regional specialization strategies should incentivize local SMEs' participation in large industrial projects with external funding, while fostering locally driven innovation. Regional and local development policies should design tax benefits or grant schemes to support (re)industrialization efforts, leveraging local resources. Tools like Rural Innovation Hubs and other local piloting programs can provide sandbox environments for small businesses to test innovative solutions in emerging sectors, such as the circular bioeconomy, renewable energies, and digitalization. Key investments in enabling infrastructures, such as expanding broadband and 5G networks,

are also crucial to lower digital barriers, enable remote work, and deploy AI solutions. A one-stop-shop model can unify funding, advisory, and training resources for rural SMEs, while capacity-building programs should better equip program managers with the skills necessary to design and deploy a balanced combination of policies and tools. All of these initiatives should benefit from clear and specific goals and monitoring mechanisms.

8 Conclusion and further research

By developing a comprehensive theoretical and operational framework, ESPON TERRES demonstrated that territorial resilience is not only necessary, but also measurable and actionable. The project's overarching aim was to advance both the conceptual and practical understanding of territorial resilience in Europe, providing regions with the tools and knowledge needed to navigate complex, long-term, multi-crisis trajectories. In the following, the main messages, results and open questions of the project are presented.

One of the key outcomes of the TERRES project is the clarification of territorial resilience as **a distinct but integrative and operational conceptual framework** that encompasses absorptive, adaptive and transformative capacities, emphasising co-evolutionary, multi-scalar, place-based systems thinking. The project addressed conceptual unclarity by summarising the academic literature and providing a clear, workable definition with three criteria, supported by a dedicated glossary.

- **A major contribution was highlighting governance as a critical and underexplored component of territorial resilienc**e. ESPON TERRES addressed this gap by developing a more comprehensive and actionable understanding of the governance attributes that contribute to territorial resilience, highlighting the importance of both soft and hard governance tools and their interplay across multiple levels.
- It opens up the possibility for **further research**, as the project found that the distinction between territorial and regional resilience remains blurred in practice. despite theoretical differences, stakeholders across governance levels often use the two terms interchangeably. **This raises open questions about how to communicate and position territorial resilience in policy arenas dominated by economic interpretations of regional resilience**. Moreover, **the challenges of implementing place-based approaches** – particularly in regions with limited institutional capacity – highlight the need to further explore how and under what conditions such approaches can be made more efficient and scalable across different territorial realities, compared to place-neutral solutions.

On the policy side, the project confirmed that while resilience is increasingly referenced in EU and national strategies, it remains conceptually fragmented and operationally underdeveloped. There is a **clear need for practical tools and implementation pathways** that support the effective integration of resilience into territorial governance and policymaking 'on the ground' at all scales, but especially at subnational levels.

- TERRES responded by producing a multi-level **Policy Compass with targeted recommendations for EU, national, and subnational actors.** These highlight the **need to shift from reactive, sectoral approaches to forward-looking, transformative policies** that embed resilience into the architecture of cohesion and territorial development.
- A pressing open question is **how to promote a common understanding of territorial resilience across different, but mainly subnational territorial levels**, while respecting contextual diversity. In this regard, the role of national institutions appears critical: they serve as key reference points for regional and local actors and are thus central to mainstreaming resilience thinking.

Measuring resilience and capturing absorptive, adaptive, and transformative capacities through indicators has proven to be a complex and challenging task in several key respects.

- The project developed **a Territorial Resilience Capitals Index** based on 72 indicators across five dimensions, offering a synthetic yet nuanced view of resilience conditions at the NUTS 2 level. The resulting index reveals persistent and even widening territorial disparities in resilience levels, particularly between Northern/Western Europe and South-Eastern regions. While some overall improvement is observable between 2014 and 2024, the gaps remain significant.
- Importantly, the project acknowledges **the limits of current measurement approaches:** resilience capacities - especially adaptive and transformative - are inherently difficult to quantify. Many aspects, such as governance quality, social cohesion, and institutional learning, are underrepresented or only partially captured by existing datasets. Furthermore, the indicator set is based on proxies and hypotheses rather than direct measurements of system performance under stress.

The **Territorial Resilience Dashboard** summarizes, synthesizes, and presents the work carried out in the project. It addresses some of these above-mentioned policy and measurement challenges by offering qualitative self-assessment tools and interactive analytics.

- The strength of the **Territorial Resilience Dashboard** developed in the project lies in its ability to interpret and contextualize data, making it **actionable for stakeholders and decision-makers at lower territorial levels,** not just operating at NUTS 2 level.
- However, **questions remain about the long-term integration of the dashboard into decision-making, its alignment with other tools** (e.g. JRC Resilience Dashboard), and the potential to incorporate alternative data sources, such as community-generated infrastructure maps, in a reliable and systematic way.
- Moreover, there is a potential demand to define the target groups and their expectations for the Territorial Resilience Dashboard (TRD) more precisely and reliably, in order to better understand user requirements and ultimately **improve the dashboard's practical usability**. This requires broader-sample online surveys, usability testing with real users, and the development of a robust system for monitoring dashboard usage. These steps are essential to enhance the relevance, uptake, and real-world impact of the TRD.

Specific research initiatives are recommended for ESPON's consideration and are presented in detail in Annex 6, which aims

1. **experiment with the assessment and measurement of institutional, governance and policy framework elements of territorial resilience**, based on the Assessment module of Territorial Resilience Dashboard.
2. **develop a methodology to help extract, verify and summarise infrastructure data** from online community mapping applications (e.g. OpenStreetMap) **at regional level.** Although a large amount of relevant data can be downloaded and aggregated at regional level using these applications (e.g. in QGIS using the OSM plugin), in many cases they are only available in different quality from one country or region to another, and their reliability is questionable. For this reason, a methodology should be developed to take into account the data gaps of these data sources and to develop solutions to address them.

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Annexes

Annex 1 – Case studies

Delivered as separate document

Annex 2 – Future Workshop methodology

Delivered as separate document

Annex 3 - Elaborated description of the methodological approach applied for statistical analysis

Delivered as separate document

Annex 4 – Handbook of instructions on the use of the dashboard for policymakers

Delivered as separate document

Annex 5 – Stakeholder engagement

Delivered as separate document

Annex 6 – Future research recommendation

Delivered as separate document

Annex 7 – Glossary

ACUTE SHOCK

A sudden, intense, and often unexpected event that has immediate and significant consequences for human societies, ecosystems, or the environment (100 Resilient Cities, 2019).

ADAPTIVE GOVERNANCE

A process aimed at creating adaptability and transformability in social-ecological and socio-technical systems, providing several enabling conditions for effective resilience enhancement. Because the stability landscape is constantly changing, the "adaptive" part of both governance and management is required in all phases of the adaptive cycle (Walker et al., 2004).

ADAPTIVE MANAGEMENT

Adaptive management is a strategy for managing social-ecological systems in situations characterised by high uncertainty and significant controllability. It focuses on enhancing existing governance systems with elements that promote adaptability, rather than proposing an entirely new governance model (ESPON TERRES, Deliverable 7.2).

BOUNCING-BACK PERSPECTIVE

The ability of the territorial system to return to pre-existing conditions prior to the disturbances (ESPON TERRES, Deliverable 5.1).

BOUNCING-FORWARD PERSPECTIVE

The ability of the territorial system to adapt, change, evolve and transform after a disturbance (ESPON TERRES, Deliverable 5.1).

CAPACITIES

Capacities are built upon various types of capital. Understanding which capitals support each capacity is crucial for forming hypotheses about enabled capacities and determining how governments and stakeholders can enhance them in specific areas. Capacities facilitate short, medium, and long-term responses to disturbances by people, groups, and institutions. Locally available capitals are essential for effective responses, allowing systems to restore functionality by absorbing or adapting to disruptions. Capacities also enable systemic transformations, fostering sustainable and resilient territories in the long term (ESPON TERRES, Deliverable 6.1).

CAPACITY TO ABSORB OR ABSORPTIVE CAPACITY

The capacity of the territorial system to return to its previous development trajectory after a disturbance. The territorial system does not change its functions and structure but is able to return to its previous state, preserving its structures and functions. Stating a bouncing-back perspective as this capacity relates to the stability and resistance of a territorial systems that is able to absorb the impact of shocks without changing their behaviour (ESPON TERRES, Deliverable 5.1).

CAPACITY TO ADAPT OR ADAPTIVE CAPACITY

The capacity of the territorial system to adapt to disturbances, adjust, and modify without leaning towards an undesirable trajectory. Allowing continuous development without major qualitative changes in function or structural identity. It requires flexibility and involves incremental changes that are necessary to allow territorial systems to continue functioning without major qualitative distress in response to disturbances (ESPON TERRES, Deliverable 5.1).

CAPACITY TO TRANSFORM OR TRANSFORMATIVE CAPACITY

The capacity of the territorial system to absorb disturbances, adapt to them, transform, innovate, and evolve to possible scenarios in which the disturbances will no longer cause any negative impact. It implies a change of the status quo in a continuous process, enhancing a bouncing-forward perspective (ESPON TERRES, Deliverable 5.1).

CAPITALS

Capital refers to various resources and assets that could determine how a system withstand, adapt to, and recover from disturbances or changes. Key types of capitals include natural, economic, physical, technological, human, institutional, and social capital. Capitals are measured by indicators, serving as proxies. Capitals can also provide the capacities for necessary transitions when the status quo imposes many limits on adaptation (IPCC, 2022).

CO-EVOLUTIONARY APPROACH

Non-linear dynamics, thresholds, uncertainty and surprise, how periods of gradual change interplay with periods of rapid change and how such dynamics interact across temporal and spatial scales (Folke, 2006). Ensuring that the territorial system operates with the physical, social and institutional dimensions, strengthening absorptive, adaptive, and transformative capacities (ESPON TERRES, Deliverable 5.1).

CHRONIC STRESS

The persistent, long-term impacts and pressures that are on societies, ecosystems, and the environment over an extended period (100 Resilient Cities, 2019).

DISTURBANCES

Any event or trend that might disrupt the functioning of the territorial systems or adversely affect it, including acute shocks and chronic stresses (FAO, 2023).

DIVERSITY

The presence of multiple ways to achieve a given need or fulfil a particular function (ARUP, 2014).

FLEXIBILITY

Flexibility implies that systems can change, evolve and adapt in response to changing circumstances. This may favour decentralised and modular approaches to infrastructure or ecosystem management. Flexibility can be achieved through the introduction of new knowledge and technologies, as needed. It also means considering and incorporating indigenous or traditional knowledge and practices in new ways (ARUP, 2014).

FUNCTIONAL AREAS

Territories delineated by specific criteria, such as socio-economic, spatial, environmental and geographic characteristics, which give them internal cohesion and influence the functional relationships within them. This dimension opposes from the administrative units (CEMAT, 2017; ESPON FUORE, 2020; ESPON CE-FLOWS, 2021).

GOVERNANCE

The exercise of political, economic and administrative authority in the management of a country's affairs at all levels, fostering participation, transparency, and accountability (UNDP, 1997).

INCLUSIVENESS

Inclusion emphasises the need for broad consultation and engagement of communities, including the most vulnerable groups. Addressing the shocks or stresses faced by one sector, location, or community in isolation of others is an anathema to the notion of resilience. An inclusive approach contributes to a sense of shared ownership or a joint vision to build city resilience (ARUP, 2014).

INTEGRATION

Integration and alignment between city systems promotes consistency indecision-making and ensures that all investments are mutually supportive to a common outcome. Integration is evident within and between resilient systems, and across different scales of their operation. Exchange of information between systems enables them to function collectively and respond rapidly through shorter feedback loops throughout the city (ARUP, 2014).

MULTI-LEVEL GOVERNANCE

The arrangements for making binding decisions that engage a multiplicity of politically independent but otherwise interdependent institutional actors (private, public and social) at different territorial levels, and that does not assign exclusive policy competence or assert a stable hierarchy of political authority to any level (Schmitter, 2004).

MULTI-SCALAR

A multi-scalar approach pursues decision-making about planning and management at multiple and nested scales. Multi-scalar refers to the multiple geographical and institutional levels involved in planning and management; nested refers to the reciprocal influence across social, economic and institutional processes at multiple geographical and institutional scales (ESPON TERRES, Deliverable 7.2).

REDUNDANCY

Redundancy refers to spare capacity purposely created within systems so that they can accommodate disruption, extreme pressures or surges in demand. It includes diversity: the presence of multiple ways to achieve a given need or fulfil a particular function. Examples include distributed infrastructure networks and resource reserves. Redundancies should be intentional, cost-effective and prioritised at a city-wide scale, and should not be an externality of inefficient design (ARUP, 2014).

REFLECTIVENESS

Reflective systems are accepting of the inherent and ever-increasing uncertainty and change in today's world. They have mechanisms to continuously evolve, and will modify standards or norms based on emerging evidence, rather than seeking permanent solutions based on the status quo. As a result, people and institutions examine and systematically learn from their past experiences, and leverage this learning to inform future decision-making (ARUP, 2014).

RESOURCEFULNESS

Resourcefulness implies that people and institutions are able to rapidly find different ways to achieve their goals or meet their needs during a shock or when under stress. This may include investing in capacity to anticipate future conditions, set priorities, and respond, for example, by mobilising and coordinating wider human, financial and physical resources. Resourcefulness is instrumental to a city's ability to restore functionality of critical systems, potentially under severely constrained conditions (ARUP, 2014).

ROBUSTNESS

Robust systems include well-conceived, constructed and managed physical assets, so that they can withstand the impacts of hazard events without significant damage or loss of function. Robust design anticipates potential failures in systems, making provision to ensure failure is predictable, safe, and not disproportionate to the cause. Over-reliance on a single asset, cascading failure and design thresholds that might lead to catastrophic collapse if exceeded are actively avoided (ARUP, 2014).

SENSITIVITY

The physical predisposition of human beings, infrastructure, and the environment to be affected by dangerous phenomena. This is linked to a lack of resistance and preparedness of society and ecosystems to withstand harm caused by intrinsic and contextual factors. Consequently, it is plausible that these systems, when impacted, may collapse or suffer significant damage as a result of a hazard even (IPCC, 2022).

TERRITORIAL GOVERNANCE

Formulating and implementing public policies, programmes, and projects for the development of a place/territory that involves integrating relevant policy sectors, coordinating the actions of relevant actors and institutions, particularly considering multi-level interplay, mobilising stakeholder participation, adapting to changing contexts, and addressing place-based/territorial specificities and characteristics (ESPON TANGO, 2012).

TERRITORIAL SYSTEM

A complex socio-ecological and technological system that goes beyond mere spatial considerations, as its understanding is not limited to representing only a physical element of a place that provides natural and material resources, but also includes social constructions and the set of resources, actors and institutions (ESPON TERRES, Deliverable 5.1).

VULNERABILITY

A component of risk and represents the propensity or predisposition of a territorial system to suffer adverse effects, such as pressure and shocks (IPCC, 2022).

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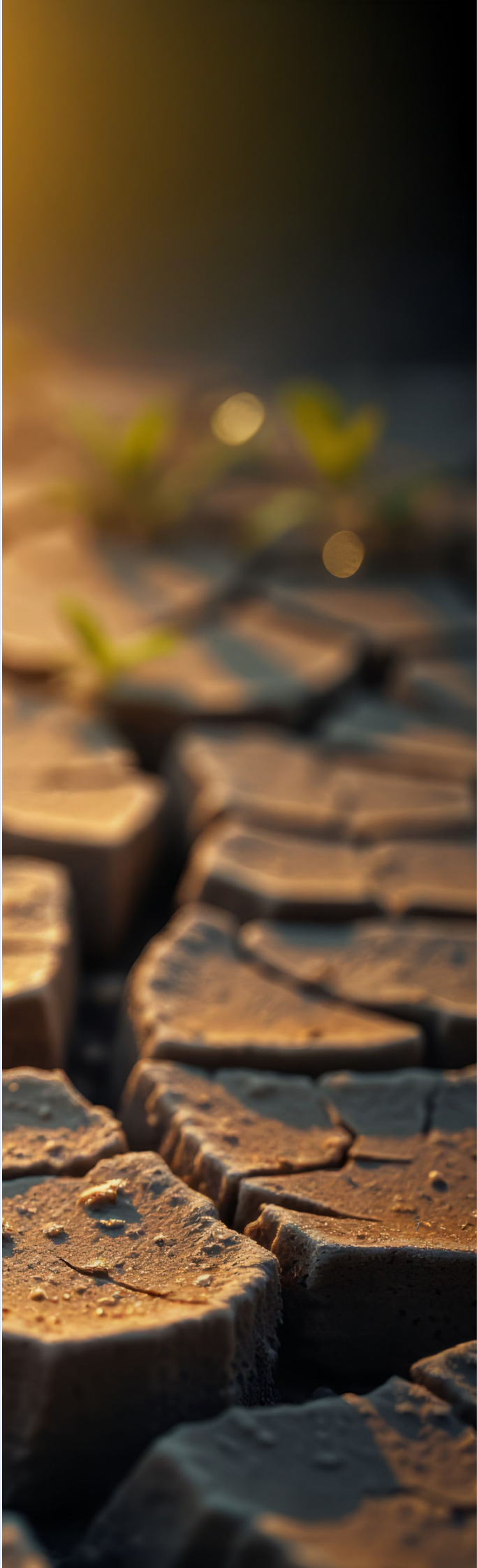

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