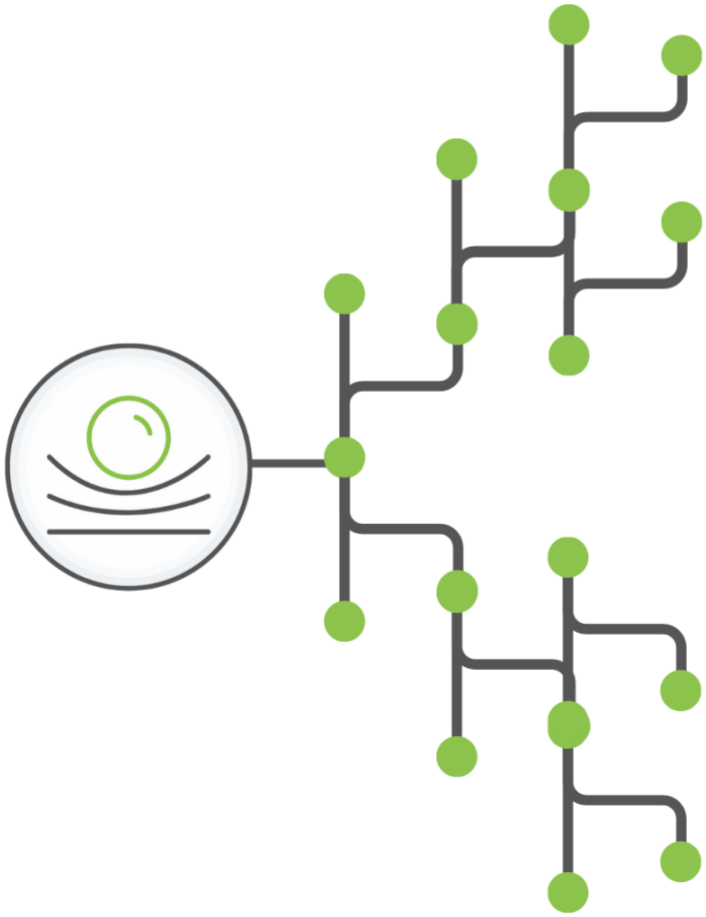
REGILIENCE

Regional Pathways to Climate Resilience



Prioritisation strategy

Strategic Framework for Regional Climate Adaptation and Resilience

APRIL 2024

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 101036560.

Project Acronym:	**REGILIENCE**
Programme	HORIZON2020
Type of Action	Coordination and Support Action
Grant Agreement number	101036560
Start day	01/11/2021
Duration	48 months
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Document information

Document Factsheet	
Full title	Deliverable 4.3 Prioritisation strategy
Work Package	WP4
Task(s)	T4.3 Guidance for supporting regional climate resilience pathways
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Date	April 2024

Document dissemination Level

Dissemination Level	
X	PU - Public
	PP - Restricted to other programme participants (including the EC)
	RE - Restricted to a group specified by the consortium (including the EC)
	CO - Confidential, only for members of the consortium (including the EC)

Document history

Version	Date	Main modification	Entity
V0.1	18.7.2023.	Draft version distributed for quality review	REGEA
V0.2	28.3.2024.	Internal Quality review	R-CITIES
V0.3	11.4.2024.	Review by the project coordinator	IEECP, Fresh Thoughts

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How to cite this report: REGILIENCE (2024). Prioritisation strategy, by Josipa Arapović and Tomislav Novosel. Weblink

About

REGILIENCE is committed to supporting the European Green Deal and the EU Mission "Adaptation to Climate Change" by fostering the adoption of regional climate resilience development pathways.

The project develops, compiles, shares, and promotes tools and scientific knowledge to support European regions in identifying and addressing their climate-related risks. We work closely with sister projects, such as ARSINOE, IMPETUS, and TransformAr to enhance the capacity of 7 focus regions to tackle the unavoidable impacts of climate change.

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036560.

Project partners

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Glossary

Adaptation Pathways[1]	A series of adaptation choices involving trade-offs between short-term and long-term goals and values. These are processes of deliberation to identify solutions that are meaningful to people in the context of their daily lives and to avoid potential maladaptation.
Adaptive capacity[1]	The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences.
Adaptive Policymaking	Structured approach to designing dynamic adaptation policies that incorporate monitoring, evaluation, and periodic adjustments.
Baseline[1]	The baseline (or reference) is the state against which change is measured. A baseline period is the period relative to which anomalies are computed.
Climate Resilience	Ability of systems, communities, and businesses to anticipate, prepare for, respond to and recover from climate change impacts.
Climate Resilient Development Pathways[1]	Processes that strengthen sustainable development and efforts to eradicate poverty and reduce inequalities while promoting fair and cross-scalar adaptation and mitigation. They raise the ethics, equity, and feasibility aspects of the deep societal transformation needed to drastically reduce emissions to limit global warming (e.g., to well below 2°C) and achieve desirable and liveable futures and wellbeing for all.
Indicators	A measure of performance in achieving a certain output, outcome, or objective.
Interventions	Actions taken to build climate resilience through policies, programs, infrastructure projects, etc.
Maladaptation[2]	Maladaptation refers to the process that an intentional adaptation action may lead to negative effects which increase vulnerability, diminish wellbeing, or undermine sustainable development. This can happen the same or other regions, systems, sectors, or social groups than those targeted by the adaptation action.
Monitoring and Evaluation[1]	Mechanisms put in place to respectively monitor and evaluate efforts to reduce greenhouse gas emissions and/or adapt to the impacts of climate change with the aim of systematically identifying, characterising and assessing progress over time.

1 IPCC, 2023: Annex I: Glossary [Reisinger, A., D. Cammarano, A. Fischlin, J.S. Fuglestvedt, G. Hansen, Y. Jung, C. Ludden, V. Masson-Delmotte, R. Matthews, J.B.K Mintenbeck, D.J. Orendain, A. Pirani, E. Poloczanskaa, and J. Romero (eds.)]. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 119-130, doi: 10.59327/IPCC/AR6-9789291691647.002.

2 https://regilience.eu/self-assessment-tool-for-maladaptation/

Nature-based Solutions[1]	Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
Real Options Analysis	Framework to evaluate costs and benefits of adaptation options while considering value of flexibility for future adjustments.
Resilience[1]	The capacity of interconnected social, economic, and ecological systems to cope with a hazardous event, trend, or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure.
Risk Assessment[1]	The qualitative and/or quantitative scientific estimation of risks.
Transformation Pathways[1]	Trajectories describing consistent sets of possible futures of greenhouse gas (GHG) emissions, atmospheric concentrations, or global mean surface temperatures implied from mitigation and adaptation actions associated with a set of broad and irreversible economic, technological, societal, and behavioural changes. This can encompass changes in the way energy and infrastructure are used and produced, natural resources are managed, and institutions are set up and, in the pace, and direction of technological change.

Executive Summary

To enhance resilience, regions must proactively assess risks, engage stakeholders, evaluate options, target interventions, and monitor outcomes.

This prioritisation strategy provides practical guidance to support regional authorities in advancing their climate resilience goals. Developed under the REGILIENCE project, it distils key lessons and tools from work focused on transformational pathways, decision support matrices, and assessing regional needs.

The strategy aims to aid complex decision-making processes for climate adaptation and resilience. It offers a structured approach for regions to evaluate risks and opportunities, leverage analytical frameworks, implement iterative planning processes, and monitor progress. Promising practices and case studies provide actionable recommendations tailored to regional contexts.

Intended for regional policymakers, planners, practitioners and decision-makers, this strategy complements European Commission efforts on climate adaptation. It promotes co-creation, enabling tool uptake, and integration of resources into the Climate-ADAPT Regional Adaptation Support Tool. By highlighting risks, exploring methodologies, outlining processes, and providing adaptable frameworks, this strategy empowers regions with state-of-the-art knowledge to advance their resilience goals.

With this strategy, we aim to support regional stakeholders and communities in guiding and supporting regional climate resilience pathways, by focusing on systemising and communicating activities and knowledge from REGILIENCE and other Innovation Action projects and aligning the results with the real-world needs of the key stakeholders. This deliverable provides a practical guidance to support regional authorities in advancing their climate resilience goals and promotes co-creation, enabling tool uptake, and aims to aid complex decision-making processes for climate adaptation and resilience for the regions.

Gender statement

The need for gender mainstreaming arises from persistent inequalities in power distribution and access to services and opportunities between people of different sex and/or gender identities. As demonstrated by literature[1] and advocated at the European and international arena[2], this influences the understanding and perception of climate change dynamics and effects. Women and men, but also people in the LGBTQI+ community, are differently affected by the accelerated change of climate. Only by taking into consideration their diverse visions can scientific research reach meaningful and universal conclusions that properly inform climate action.

For these reasons, the REGILIENCE consortium is committed to including gender and intersectionality as a transversal aspect in the project's activities. In line with EU guidelines and objectives, all partners – including the authors of this deliverable – recognise the importance of advancing gender analysis and sex-disaggregated data collection in the development of scientific research. Therefore, they commit to paying particular attention to including, monitoring and periodically evaluating the participation of different genders in all activities developed within the project, including workshops, webinars, and events but also surveys, interviews and research, in general. While applying a non-binary approach to data collection and promoting the participation of all genders in the activities, the partners will periodically reflect and inform about the limitations of their approach. Through an iterative learning process, they commit to plan and implement strategies that maximise the inclusion of more intersectional perspectives in their activities. Within this deliverable, gender aspects were also considered by aiming towards being gender-neutral in all activities, such as workshops, interviews, and surveys.

1 Introduction

Climate change poses an urgent threat to regions across Europe, with rising temperatures, extreme weather events, and other impacts increasingly affecting communities. To build resilience and adapt to a changing climate, regions must take proactive steps to assess vulnerabilities, prioritise actions, and implement adaptive strategies.

This prioritisation strategy provides European regions with practical guidance and resources to advance their climate resilience goals. Developed under the REGILIENCE project, it distils key lessons, learnings, and tools developed by the EU Climate Adaptation Mission projects (ARSINOE, IMPETUS, REGILIENCE, and TransformAr) to empower regions in shaping their climate-resilient futures.

The strategy aims to support regional leaders in navigating complex decision-making processes related to climate adaptation and resilience. It offers a structured approach to evaluating risks and opportunities, engaging stakeholders, assessing options, and monitoring outcomes. By outlining methods, resources, and case studies, this strategy enables regions to make informed choices, target interventions, and maximise the impact of investments for a more sustainable future.

The intended audience includes regional and local policymakers, urban planners, resilience practitioners, and other decision-makers involved in climate adaptation. The strategy provides actionable recommendations tailored to regional contexts across Europe. It further complements the efforts of the European Commission and projects within the EU Climate Adaptation Mission cluster including ARSINOE, IMPETUS, and TransformAr.

This document comprises key chapters on risk assessments, enablers for action, practical frameworks for implementation, and monitoring approaches. By highlighting risks, exploring analytical tools, outlining stepwise processes, and providing adaptable frameworks, it empowers regions with state-of-the-art knowledge to advance their resilience goals. The strategy promotes a flexible and iterative approach, encouraging learning and adjustments over time.

With climate change accelerating, European regions must act decisively to build resilience and safeguard communities. This strategy equips local decision-makers with the understanding and resources to develop context-specific solutions, accelerate adaptation, and create climate-resilient pathways for a just and sustainable future.

1.1 Contributions to Objectives, Targets, and Indicators

The activities performed under T4.3 contribute to several REGILIENCE objectives, Impact targets and Key Performance Indicators and are key to ensuring the useability and replicability of the developed tools and solutions.

1.1.1 REGILIENCE Objectives

T4.3 contributes to two different objectives of the overall project. The activities support the overall objective of the REGILIENCE project and are key for reaching objective 4 of the project:

- Overall objective: to foster the adoption and wide dissemination of pathways of systemic change towards regional resilience.
- Objective 4: Support the social acceptance and implementation of the European Green Deal's roadmap towards a climate-resilient society and economy.

1.1.2 REGILIENCE Impact Targets

The activities of T4.3 contribute to the overall REGILIENCE impact targets and especially to:

- 600 citizens have improved their knowledge and capacities on climate resilience pathways. The prioritisation strategy equips regional authorities with practical guidance and tools to assess risks, engage stakeholders, and target interventions effectively, thus facilitating the co-design of climate resilience pathways as outlined in this impact target.
- 20000 citizens are more aware and engaged with climate resilience. By providing structured guidance and actionable recommendations tailored to regional contexts, the prioritisation strategy contributes to the development of successful regional climate resilience pathways, which can serve as inspiring examples for other regions, aligning with this impact target.

1.1.3 Key Performance Indicators

The work performed within T4.3 contributes to several KPIs of the REGILIENCE project, especially:

- 30 sharing and learning activities on climate resilience pathways have been carried out.
- 152 citizen engagement activities on climate resilience have been carried out.

2 Prioritisation Strategy: Context and Approach

This chapter outlines the prioritisation strategy approach, including key objectives, target audience, structure and aspirations that guide the process. It provides an overview of the document's objectives, target audience, and structure, while framing the intent of the strategy. This chapter highlights the importance of resilience pathways, defines key concepts, and references the definitions made within other key project documents. By establishing the context and approach, we set the stage for understanding the aspirations and considerations underlying the prioritisation process for climate resilience.

2.1 Objectives

The primary objectives of the prioritisation strategy are to guide decision-making processes, resource allocation, and action planning for climate resilience within the regions. By providing a systematic approach to prioritise interventions, the strategy aims to optimise the allocation of limited resources, enhance effectiveness, and maximise the impact of resilience-building actions.

Resilience pathways serve as a fundamental concept within climate resilience planning. They are strategic approaches that guide regions and sectors in building resilience and adapting to the impacts of climate change. These pathways provide a framework for identifying and prioritising actions that enhance adaptive capacity, reduce vulnerabilities, and ensure long-term sustainability.

The primary objectives are to support regional authorities in:

- Assessing risks and opportunities related to climate impacts.
- Making informed decisions on resource allocation and actions.
- Developing and integrating climate considerations into planning.
- Monitoring, evaluating and iteratively enhancing interventions.

By providing a systematic prioritisation process, the strategy aims to facilitate targeted, effective, and coordinated climate resilience planning.

2.2 Target Audience, and Structure

The target audience includes regional and local policymakers, urban planners, resilience practitioners and other decision-makers involved in climate adaptation and sustainability. The practical guidance is tailored to regional contexts across Europe. It is designed to support informed decision-making and facilitate the integration of resilience considerations into existing planning processes.

The structure of this document follows a logical progression, guiding readers through the various stages of the prioritisation strategy. Each chapter builds upon the previous one to provide a comprehensive framework for climate resilience planning and implementation. The subsequent chapters delve into risk assessment, engagement processes, and action implementation.

2.3 Aspirations for Climate Resilience Planning and Prioritisation

The prioritisation strategy is driven by a set of overarching aspirations for climate resilience planning and prioritisation. These aspirations serve as guiding principles and highlight the desired outcomes of the strategy. They include:

- Integration: The strategy aims to integrate climate resilience considerations into existing development planning processes, policies, and practices to ensure a holistic approach.
- Equity: Recognising that climate change impacts disproportionately affect vulnerable communities, the strategy promotes equity by prioritising actions that address social, economic, and environmental injustices.
- Adaptive Capacity: Building adaptive capacity is crucial for resilience. The strategy seeks to enhance the ability of regions and sectors to anticipate, respond, and recover from climate-related challenges effectively.
- Innovation: Encouraging innovation and fostering collaboration among various stakeholders are central to the strategy. It emphasises the importance of exploring new technologies, practices, and approaches to enhance resilience.

By keeping these aspirations in mind, the prioritisation strategy aims to empower regions and sectors in their efforts to proactively address climate change impacts, prioritise actions, and implement effective resilience-building measures.

In the subsequent chapters, we will delve into the practical aspects of risk assessment, stakeholder engagement, and action implementation, providing a comprehensive framework for developing and implementing climate resilience strategies.

3 Highlighted Barriers for Resilience Pathways

The highlighted barriers for resilience pathways focus on the crucial outcomes of barriers that have been brought up by practitioners within the survey, workshops, and interviews conducted under REGILIENCE project. Stakeholders and key target audience in the preliminary prioritised regions were identified, including decision-makers and political representatives, citizens/NGOs, representatives from businesses and private sector, universities, and research centres. Moreover, practitioners from other regions were included in the survey. The approach to collecting baseline information relied on a semi-qualitative method, including a literature review to inform the development of an online survey and 30 interviews. Both the survey and the interview sessions included questions aimed at better identifying and quantifying, to some extent, the needs, and resources necessary for the stakeholders to actively participate in the engagement process and embrace the innovation packages within their regions. As a follow-up, a series of personalised interviews was organised to gain a more profound insight into the regional requirements within specific targeted contexts.

By addressing these highlighted barriers and challenges, regions can strengthen their resilience pathways and enhance their capacity to adapt to climate change. Table 1 synthesises key barriers for climate resilience pathways highlighted across four categories: lack of awareness and political will, governance and processes, personnel and financial resources, and knowledge and expertise. Identifying and understanding these barriers is essential for regions to develop targeted strategies and actions that effectively build resilience and adaptive capacity. By summarising the highlighted barriers, the table provides an accessible overview of the vulnerabilities and challenges European regions should address to progress their climate adaptation efforts. Proactively mitigating these barriers will empower regions to accelerate resilience planning, leverage opportunities for action, and drive progress towards more sustainable futures.

Table 1: A table summarising the key barriers highlighted in the document:

Barrier Category	Specific Barriers
Awareness and Political Will	• No common vision on future targets • Lack of political support, will, and/or ambition • Lack of public awareness/acceptance • Lack of engagement of certain stakeholders and citizens
Governance and Processes	• Lack of cooperation • Limited regional and national coordination • Lack of monitoring for adequate implementation
Personnel and Financial Resources	• Lack of (qualified) personnel • Lack of financial resources
Knowledge and Expertise	• Lack of knowledge to counter certain interests • Lack of available data

3.1 Lack of Awareness and Political Will

The successful implementation of climate resilience and adaptation actions in regions depends on raising awareness about climate-related risks and fostering strong political will. Lack of awareness among citizens and limited political support can hinder the adoption of necessary measures. It is crucial to effectively communicate and conduct awareness campaigns that highlight the economic benefits and importance of adapting to climate change.

3.1.1 No Common Vision on Future Targets

To ensure political support and mobilise resources for implementing climate resilience plans, it is essential to establish a common understanding of territorial systems and a shared vision for long-term objectives. Without a unanimous opinion on how to address climate challenges, there is a risk that resilience plans may lack ambition or be compromised through negotiations. Therefore, fostering a common vision is crucial to drive local action and foster synergies among ongoing initiatives.

3.1.2 Lack of Political Support, Will, and/or Ambition

Political decisions often involve prioritising different needs and objectives, which can lead to compromises. The lack of political will and ambition, especially regarding climate and energy aspects, can limit the extent of climate resilience efforts. Active political support is vital for vertical and horizontal cooperation among stakeholders. Enhancing political commitment and ambition is necessary to overcome obstacles.

3.1.3 Lack of Public Awareness/Public Acceptance

In some regions, there may still be low awareness or strong opposition to environmental and energy issues. Low participation and opposition can impede the successful implementation of climate resilience measures. A participatory process that engages local stakeholders and considers different viewpoints can generate awareness, support, and acceptance for actions and measures. Adopting a bottom-up approach that involves citizens can lead to solutions that align with their needs and interests.

3.1.4 Lack of Engagement of Certain Stakeholders and Citizens

The integration of regional resilience planning often requires collaboration with various stakeholders, including utilities, network operators, private companies, and citizens. However, coordination and cooperation with these stakeholders may be limited or challenging due to conflicting interests. It is crucial to involve relevant stakeholders from the beginning of the planning process to address potential resistance and ensure effective collaboration.

3.2 Governance and Processes

Effective governance and streamlined processes are essential for the successful implementation of resilience and adaptation measures in regions. However, institutional fragmentation, lack of

cooperation, and overlapping competencies can hinder the development of integrated policies and climate resilience planning.

3.2.1 Lack of Cooperation

Insufficient coordination among departments responsible for climate change mitigation and adaptation can result in a fragmented approach. Different departments often operate independently with specific agendas, impeding the integration of resilience and adaptation measures. Improved coordination, communication, and interdisciplinary working groups are necessary to break down silo thinking and foster collaboration among departments.

3.2.2 Limited Regional and National Coordination

Neglecting coordination and collaboration across administrative boundaries can hinder effective regional planning, particularly in areas such as energy, mobility, and budget allocation. Embracing a metropolitan approach that encompasses multiple regions and municipalities can overcome these limitations and promote integrated spatial planning.

3.2.3 Lack of Monitoring for Adequate Implementation

Inadequate monitoring of the implementation process is a prevalent issue that can hinder the realisation of ambitious resilience and adaptation plans. Post-adoption reviews are essential to ensure the effective execution of national and regional plans. Long-term enforcement and monitoring mechanisms are crucial for maintaining the initial ambition and effectiveness of climate resilience measures.

3.3 Personnel and Financial Resources

The availability of qualified personnel and sufficient financial resources plays a significant role in the success of resilience and adaptation planning in regions.

3.3.1 Lack of (Qualified) Personnel

Smaller regions often face challenges due to limited staffing and a lack of specialised experts in resilience, climate mitigation, and adaptation. The absence of dedicated personnel trained in resilience and adaptation can constrain the capacity of regions to undertake additional tasks. Overcoming this obstacle may require external support or capacity-building initiatives.

3.3.2 Lack of Financial Resources

Financial resources strongly influence the planning process's course and duration. Insufficient financial support can limit the participation of experienced individuals and hinder the implementation of participation processes. Adequate budgetary resources are crucial for the successful execution of measures and actions. Establishing dedicated budgets for climate resilience and adaptation initiatives and exploring innovative financing and funding schemes can enhance the region's ability to transition to more sustainable practices.

3.4 Knowledge and Expertise

Insufficient knowledge and expertise, both internally and externally, can impede the integration of resilience and adaptation measures in regional planning processes. Building capacity among stakeholders and leveraging EU-level projects can contribute to knowledge exchange and enhance awareness.

3.4.1 Lack of Knowledge to Counter Certain Interests

Even with dedicated staff assigned to spatial, energy, and mobility planning, there may be a gap in knowledge, particularly regarding emerging issues, technologies, and trends. This knowledge gap can lead to inadequate responses to advocacy groups and their interests, which may not align with the public's best interests.

3.4.2 Lack of Available Data

A thorough analysis of the local situation and territorial system is vital for informed decision-making. However, data is often lacking, insufficient or not shared among relevant actors. Establishing a common repository for data and defining clear methods and responsibilities for its collection, storage, and updating can prevent data loss, duplication, or misinterpretation, facilitating an integrative planning approach.

4 Enablers for Action

Tackling complex climate change impacts requires approaches that provide flexibility and support smart decision-making under uncertainty. Analytical frameworks enable regions to plan and prioritise climate resilience actions effectively. This chapter explores key methodologies European regions can utilise as enablers for informed decision-making.

4.1 Adaptation Pathways

The Adaptation Pathways approach offers a robust framework for climate resilience planning under uncertainty. It maps out alternative routes to achieve adaptation goals as conditions evolve over time.

The approach begins by assessing climate impacts under different scenarios and timeframes. Then, near-term actions are identified that can meet adaptation objectives now. Monitoring indicators are established to signal when actions are no longer sufficient as impacts intensify. This triggers a shift to alternate actions as needed (Haasnoot, et al., 2013).

Adaptation Pathways enable flexibility to update plans periodically based on new information. It facilitates stepwise decision-making that builds preparedness and avoids lock-in.

The Thames Estuary 2100 Project (TE2100) in the United Kingdom provides a practical application of using Adaptation Pathways for flood risk management. The plan analysed flood management options under varying sea-level rise scenarios through 2100. This allowed the development of an initial action plan aligned with current and medium-term needs. Trigger points were set for specific sea level increases to prompt re-evaluation and shifting to alternative actions if required[3] (Reeder & Ranger, 2011).

4.2 Adaptive Policymaking

Adaptive Policymaking offers a structured process to build flexibility into adaptation policies and strategies. The steps include:

- Assess current state and define adaptation goals.
- Develop initial policy options to achieve goals.
- Improve robustness by incorporating contingencies.
- Establish monitoring mechanisms and indicators.
- Identify actions to take based on monitoring signals.

This approach of continuous monitoring, evaluation and improvement builds adaptive capacity to respond to changing conditions. It enables iterative decision-making as new information on climate risks emerges (Ranger, et al., 2010).

The German Adaptation Strategy[4] applies Adaptive Policymaking principles. The first monitoring report was completed in 2015, which informed an update of the strategy in 2020. Future monitoring on a 5-year cycle will allow for periodic adjustment of actions based on lessons learned and developments (Commission, 2013).

3 https://www.gov.uk/government/publications/thames-estuary-2100-te2100/thames-estuary-2100-te2100

4 https://www.bmuv.de/en/topics/climate-adaptation/overview-climate-adaptation/german-strategy-for-adaptation-to-climate-change

4.3 Real Options Analysis

Real Options Analysis (ROA) provides a framework to evaluate the costs and benefits of climate adaptation options under uncertainty. It aims to quantify the value of keeping options flexible for future adjustments as new information emerges.

ROA considers multiple alternate adaptation actions, models uncertain climate variables, and analyses trade-offs via decision trees. Mathematical techniques help estimate the worth of retaining flexibility to incorporate new learning prior to irreversible decisions (Skougaard Kaspersen, et al., 2017).

For instance, ROA could compare the costs and benefits of a coastal town constructing a seawall now versus waiting 5 years for improved flood projections before deciding. Beyond just the seawall costs, ROA values keeping the "wait and see" option open for an informed decision later (Kwadijk, et al., 2010).

By incorporating forward-looking frameworks like Adaptation Pathways, Adaptive Policymaking, and Real Options Analysis, European regions can design and implement flexible, low-regrets climate adaptation strategies suited to an uncertain future.

Key Features of Real Options Analysis:

- Evaluating Flexibility: ROA explicitly accounts for the value of flexibility in decision-making. It recognises that the ability to revise and adapt strategies over time can yield economic advantages, especially in uncertain and dynamic environments. This assessment considers the costs and benefits associated with deferring decisions, revising adaptation measures, or adopting alternative strategies based on new information.
- Uncertainty and Risk Analysis: ROA acknowledges the inherent uncertainty in climate change and adaptation. It incorporates risk analysis techniques to quantify and incorporate uncertainties related to climate projections, future impacts, and the effectiveness of adaptation measures. By explicitly addressing uncertainty, ROA provides decision-makers with more nuanced insights into the potential value of adaptive flexibility.
- Decision Trees and Option Valuation: ROA utilises decision trees to represent different decision pathways and potential outcomes based on uncertain future events. By assigning probabilities to various scenarios, decision-makers can estimate the value of each option and identify the optimal choice. Option valuation techniques, such as the Black-Scholes model, are often employed to estimate the economic value of keeping options open and the potential benefits of adapting decisions to changing circumstances.
- Iterative Decision-Making: ROA recognises that adaptation strategies may require periodic review and adjustment over time. It promotes an iterative decision-making process where decisions are reassessed as new information becomes available, technology advances, or the climate risk landscape evolves. This iterative approach allows decision-makers to seize opportunities and respond effectively to changing conditions.

By incorporating ROA into the assessment of adaptation strategies, decision-makers can better capture the economic value associated with flexibility, enhanced risk management, and robust decision pathways. ROA complements traditional CBA by providing a more nuanced understanding of the economic benefits of adaptive actions, considering the inherent uncertainties and complexities of climate change adaptation.

It is important to note that the successful application of ROA requires a thorough understanding of the uncertainties and risks associated with the specific adaptation context. Accurate estimation of probabilities, reliable data, and collaboration among stakeholders with diverse expertise are critical for conducting a robust ROA. Additionally, ongoing monitoring and evaluation efforts are necessary to update the analysis as new information emerges, ensuring that decisions remain adaptive and responsive to evolving conditions.

In summary, Real Options Analysis offers decision-makers a valuable tool for assessing the economic benefits of flexibility and adaptive decision-making in the face of climate change. By considering multiple options and accounting for uncertainties, ROA enhances the understanding of the economic value associated with adaptation strategies and supports more informed and resilient decision-making.

5 Available Tools and Models

The strategy aims to highlight the tools developed or under development by the EU Climate Adaptation Mission projects (ARSINOE, IMPETUS, REGILIENCE, and TransformAr) that can be used to increase climate resilience and environmental sustainability in European regions. The strategy focuses on fostering co-creation, enabling tool uptake, and identifying tools for integration into the Climate-ADAPT Adaptation Support Tool (AST) across various steps of the adaptation process.

5.1.1 Preparing the Ground for Adaptation:

ARSINOE Data Catalogue: The ARSINOE Data Catalogue[5] serves as a centralised repository for collecting and hosting datasets related to climate adaptation. It allows users to upload, access, and filter datasets, supporting data preparation for the adaptation process. The catalogue facilitates data sharing and collaboration among stakeholders, providing a comprehensive resource for understanding climate-related information.

5.1.2 Assessing Climate Change Risks and Vulnerabilities:

REGILIENCE Risk-Solution Matchmaking Dashboard: The Risk-Solution Matchmaking Dashboard[6] is a decision-making support tool designed for regions seeking to evaluate optimal solutions tailored to their unique requirements while advancing their climate-resilient strategies. It initially assesses hazards across various regions using different scenarios, provides solutions addressing specific needs, and offers an overview of regions with similar hazard profiles, aiming to facilitate knowledge and best practice exchange among regions.

IMPETUS Hot Spot Identification and Prioritisation Service: The Hot Spot Identification and Prioritisation Service[7], developed by the IMPETUS project, utilises data from various repositories to identify areas and regions vulnerable to climate change risks. By analysing climate projections, socio-economic factors, and environmental indicators, stakeholders can prioritise actions based on the identified hotspots. This tool supports risk assessment and enables targeted adaptation efforts in different scales.

5.1.3 Identifying Adaptation Options:

IMPETUS Resilience Knowledge Boosters: The Resilience Knowledge Boosters tool[6], developed by the IMPETUS project, combines human and digital dimensions to engage stakeholders in knowledge sharing, decision-making, and co-designing resilience measures. By integrating data from climate and society models, earth observations, and resilient solutions, it generates regional adaptation pathways and innovation packages. This tool enhances collaboration and facilitates the identification of effective adaptation options.

5.1.4 Assessing Adaptation Options:

5 https://catalogue.arsinoe-services.eu/geonetwork/srv/eng/catalog.search#/home

6 Will be available at: https://regilience.eu

7 https://impetus.eddy-expert.com/

Cascading impacts and permutable services modelling tool: This modelling tool[8], developed within the ARSIONE project, assesses the direct and cascading impacts of climate-related hazards on various services and sectors. It evaluates the effectiveness of mitigation and recovery strategies at the regional level. The tool introduces the concept of permutation of service nodes, enabling a fast resilience assessment method. By understanding the interdependencies between services, stakeholders can make informed decisions regarding adaptation measures.

System Dynamics Modelling (SDM) tool: The System Dynamics Modelling tool[8], developed by the ARSINOE project, aids in understanding complex, dynamic systems and supports policy design for adaptation. By modelling and analysing the interactions and feedback loops within a system, it quantifies interlinkages, stresses, and effects. SDM helps decision-makers evaluate the potential outcomes of different adaptation options and explore scenarios, leading to informed and robust decision-making.

5.1.5 Implementing Adaptation:

Traffic Impact Assessment Model: The Traffic Impact Assessment Model[8], modified within the framework of the ARSINOE project, combines flood outputs with traffic simulation software to assess potential disruptions and impacts on traffic flows during flood events. By capturing the localised impacts of flooding on road networks, this model aids in implementing adaptive measures to mitigate traffic disruptions. It provides valuable insights for infrastructure planning and decision-making related to climate change adaptation.

5.1.6 Monitoring and Evaluating Adaptation:

Distributed Hybrid Modelling for Climate Resilience Analysis: This modelling framework[8], developed by the ARSINOE project, integrates multiple individual models to conduct resilience analysis from a system thinking perspective. By combining system dynamics, discrete event simulation, and agent-based simulation approaches, it enables effective communication among models. The framework facilitates monitoring and evaluating adaptation measures, allowing stakeholders to assess their effectiveness and make necessary adjustments.

5.1.7 Additional Tools:

Playbook for transformational adaptation: The Playbook for transformational adaptation[9], developed by the TransformAr project, provides a step-by-step guidance for co-developing adaptation pathways. It facilitates stakeholder engagement and workshop activities, enabling collaborative decision-making and action planning. The playbook can be used in conjunction with other tools to enhance the effectiveness of adaptation processes.

Maladaptation self-assessment tool: The Maladaptation self-assessment tool[10], developed within the REGILIENCE project, helps regional planners assess the risk of maladaptation in chosen adaptation actions. It provides a checklist for identifying potential risks and examples of thorough adaptation

8 Will be available at: https://regilience.eu

9 https://transformar.eu/storage/2023/05/PLAYBOOK-TransformAr-2023..pdf

10 https://regilience.eu/self-assessment-tool-for-maladaptation/

planning. This tool supports the identification of potential pitfalls and enables stakeholders to design adaptation strategies that minimise the risk of unintended consequences.

Choice experiment survey for understanding the acceptance of transformational adaptation solutions: This survey-based tool[11], developed by the TransformAr project, assesses the acceptance and preferences of citizens for climate change adaptation solutions. It provides insights into citizens' readiness to invest in sustainable solutions.

Socio-economic impact assessment of adaptation solutions: This tool[12], also developed by the TransformAr project, employs various methods, including downscaling of macro-economic models and societal cost-benefit assessments, to understand the socio-economic consequences of climate adaptation solutions. It helps in evaluating the benefits and trade-offs of different options.

11 https://transformar.eu/storage/2024/01/TransformAr-D6.1.pdf

12 Will be available at: https://regilience.eu

6 Framework for Taking Action

In this chapter we will provide an overview of everything we have addressed before and highlight suggested process and steps for increasing climate resilience and environmental sustainability.

This framework for action encompasses an ongoing process of evaluation, assessment, and learning to gauge the effectiveness of the actions being implemented and their progress towards achieving the envisioned outcomes and goals of the region. The continuous cycle of monitoring informs the planning and implementation stages, leading to enhanced results.

The framework for actions required to realise the vision, desired outcomes, and goals of the regions can be summarised as follows:

Governance and Regulation: Adapt leadership, policies, by-laws, strategies, and institutional arrangements to integrate climate change response into mainstream practices. This includes creating an enabling environment for climate-resilient and carbon-neutral development and fostering adaptive governance approaches that encourage broader societal involvement.

Planning and Visioning: Develop climate-responsive and transformative planning strategies and incentives that involve relevant sectors, departments, and external stakeholders. This collaborative approach provides strategic guidance for the development of climate-resilient and encourages behaviour change.

Infrastructure and Assets: Implement integrated actions for infrastructure development and maintenance, striking a balance between green and grey infrastructure. Incorporate nature-based solutions to minimise the risk of stranded economic assets and mitigate the impacts of extreme climate events.

Behaviour Change and Communications: Promote behavioural changes among all stakeholders and social partners (government, labour, industry, and civil society) regarding decision making, planning, and management in response to climate change. This involves education, mobilisation, and sensitisation efforts to foster a social contract for climate resilience and carbon neutrality.

Training and Skills Development: Provide targeted training and skills development programs for staff and partner organisations within the regions to enhance their ability to effectively respond to climate change in their respective areas of work.

Collaboration and Partnerships: Collaborate with international, national, and local organisations focused on climate resilience and adaptation, while also forging effective partnerships with other levels of government and the private sector. These collaborations are crucial for implementing impactful responses.

Research, Data, and Knowledge Management: Establish programs to stay abreast of scientific advancements and knowledge in the field of climate resilience and adaptation.

Effectively manage and utilise data, information, and knowledge products to support decision-making processes within the region.

7 Mechanisms for Integrating Climate Resilience at the Regional Level

Given the complexity of systems in each of the region, their connections with local, national, and global systems beyond their control, and the internal and external shocks and stresses to which they are subject, regions should take a flexible, dynamic, and iterative approach to developing and implementing climate actions. Regions should acknowledge that the actions presented in their climate action plans are subject to change and that there are uncertainties regarding outcomes and expected impact.

Although there is no prescribed process for implementing suggested interventions, there are common approaches that can be adapted depending on the size of the region, resilience planning and development needs of authorities and stakeholders.

This chapter presents five potential mechanisms that provide opportunities for regions to integrate climate resilience considerations into their decision-making and implementation of actions. These mechanisms are: i) establishing the baseline; ii) capacity building; iii) defining and prioritising short-term and long-term interventions; iv) developing and implementing an improvement plan and v) monitoring, evaluation, and learning. Figure 1 visually represents the key steps involved in operationalising climate resilience initiatives at the regional level.

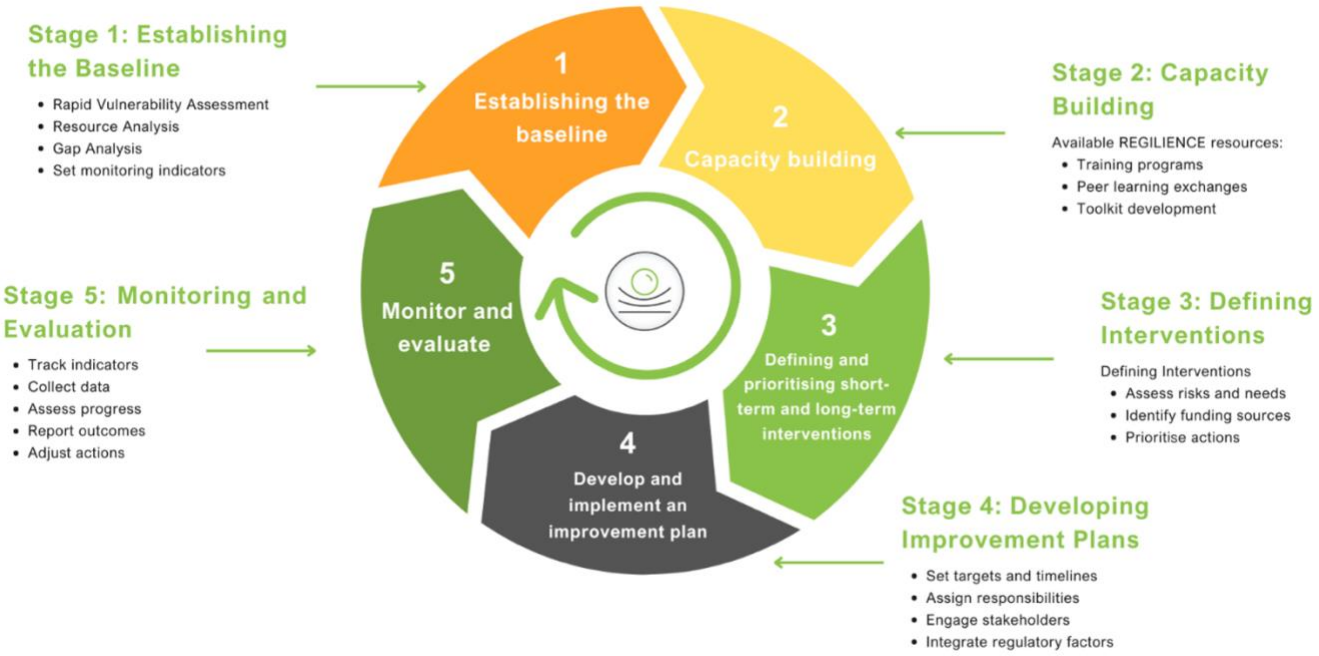

Figure 1: The key steps involved in operationalising climate resilience initiatives at the regional level

7.1 Establishing the Baseline

In this subchapter, we will explore the crucial role of establishing a baseline in monitoring and measuring improvements towards environmental sustainability. The baseline serves as a reference point against which progress can be evaluated, allowing for a comprehensive understanding of the current state and identification of areas for improvement. This chapter will provide a general overview of the necessity of the baseline and discuss key components such as the Rapid Vulnerability Assessment (RVA) analysis, analysis of resources and capacities, and analysis of existing gaps.

7.1.1 The Importance of the Baseline

To effectively address environmental sustainability, it is essential to have a clear understanding of the existing conditions and challenges. The baseline provides a snapshot of the current environmental status, enabling stakeholders to assess the magnitude of issues and track changes over time. It serves as a starting point for regions and for developing strategies and interventions that can lead to enhanced climate resilience and sustainable development.

7.1.2 Rapid Vulnerability Assessment (RVA) Analysis

The RVA analysis is a crucial component of establishing the baseline. It involves a systematic assessment of vulnerabilities and risks associated with climate change and environmental degradation. By identifying the specific areas, sectors, and communities that are most susceptible to these risks, the RVA analysis provides valuable insights into the priority areas for intervention. It also helps in understanding the potential impacts of climate change on ecosystems, infrastructure, and human well-being.

7.1.3 Analysis of Resources and Capacities

Understanding the available resources and capacities is fundamental to establishing the baseline. This analysis involves evaluating the existing infrastructure, financial resources, technological capabilities, and institutional frameworks that can support environmental sustainability initiatives. By identifying strengths and weaknesses, it becomes possible to leverage available resources effectively and address gaps in capacity that may hinder progress.

7.1.4 Analysis of Existing Gaps

The analysis of existing gaps complements the RVA analysis and resource assessment by identifying the areas where improvements are needed to enhance environmental sustainability. These gaps may include inadequate infrastructure, limited financial resources, policy gaps, institutional weaknesses, or lack of public awareness and participation. By identifying these gaps, stakeholders can prioritise interventions and allocate resources to bridge them, thereby advancing towards the desired environmental sustainability goals.

7.1.5 Linking the Baseline to Monitoring and Measurement

The established baseline forms the foundation for monitoring and measuring progress towards environmental sustainability. By periodically evaluating and comparing the current status to the baseline, stakeholders can assess the effectiveness of implemented interventions and policies. This

enables informed decision-making, adjustment of strategies if necessary, and identification of emerging challenges that may require additional actions. Subchapter 7.5 expands upon the topic of monitoring and measurement, providing additional insights and guidelines for effective implementation.

7.2 Capacity Building

Effective climate change adaptation and resilience require strong leadership and informed decision-making at the regional level. The capacity building activities within the REGILIENCE project are designed to provide regional leaders with the necessary tools and knowledge to navigate the complexities of climate resilience. The key aspects of the capacity-building activities that are tailored specifically for regional leaders, empowering them to take effective action in climate resilience. These activities include:

7.2.1 Open Training Sessions

These webinar/workshop formats provide regional leaders with valuable insights into climate resilience, equipping them with the knowledge and understanding necessary to drive impactful change. The sessions showcase the tools and solutions developed and tested within the REGILIENCE project cluster, including REGILIENCE, ARSINOE, IMPETUS, and TransformAr. The series of Open Training Sessions (OTS) aims to build the capacity of regional leaders by providing valuable insights into climate resilience. Divided into two cycles, these sessions offer the opportunity to cooperate with sister projects and promote their solutions for maximum impact. The first cycle focuses on general resilience topics such as EU strategies, funding, and tools to overcome barriers, while the second cycle delves into specific technical and sector-specific issues, providing practical knowledge and inspiration for concrete climate resilience solutions. These sessions enable regional leaders to raise awareness, stay informed about relevant developments, and foster collaboration within the REGILIENCE project cluster. All recordings and presentations from the OTS are available here: https://regilience.eu/community-building/.

7.2.2 Regional Training Sessions

Designed to address the unique needs and challenges faced by the REGILIENCE focus regions, these webinar/workshop formats offer tailored support to regional leaders, enabling them to develop region-specific strategies for climate change adaptation and resilience. The RTS focuses on the unique needs of REGILIENCE focus regions, facilitating in-depth exchanges between regional actors and experts from the project cluster and beyond. These demand-driven sessions, hosted by regional partners and consortium experts, provide tailored support to regional leaders in advancing their resilience pathways. The RTS includes webinars and workshops, either online or in-person, allowing regional stakeholders to build capacities, address regional challenges, and develop climate resilience solutions. The timing of the sessions is flexible and will be determined based on the needs and requirements of the focus regions.

7.2.3 Helpdesk Support

A dedicated helpdesk is available to provide regional leaders with on-demand assistance and guidance. The helpdesk leverages the expertise and support from sister projects, including ARSINOE, IMPETUS,

and TransformAr, to address specific queries and challenges faced by regional leaders. The REGILIENCE helpdesk offers on-demand assistance to focus regions and key actors, responding to specific requests and demands. The aim is to provide practical information, technical assistance, and guidance to pave the way for developing regional resilience pathways. The helpdesk acts as a resource hub, linking stakeholders with relevant advice and support, including third-party offerings like the Innovation Packages. The service is designed to address the specific needs of focus regions and ensure timely and targeted assistance.

7.2.4 Peer-to-Peer Exchange

Facilitating collaboration and knowledge sharing, this activity enables regional leaders to learn from each other's experiences, share best practices, and explore innovative approaches to climate resilience. The peer-to-peer exchange fosters a supportive network where regional leaders can collaborate and drive collective action. The peer-to-peer exchange program within REGILIENCE offers focus regions the opportunity to be mentored by experienced professionals and innovation leaders from other regions. This voluntary and flexible activity aims to provide additional support tailored to the needs and interests of the focus regions. Through periodic exchanges with mentors, including Chief Resilience Officers and other representatives, regional leaders gain insights into challenges, solutions, lessons learned, and opportunities for replication. The mentorships foster direct and inspiring experiences, enabling focus regions to reflect, learn, and enhance their climate resilience and adaptation pathways. The program starts in the second half of 2023 and continues until the project's completion in September 2025.

7.2.5 Testing of Public-Private Partnerships

Through the demonstration of innovative solutions and co-creative approaches, regional leaders gain insights into effective public-private partnerships for implementing climate adaptation measures. This activity encourages regional leaders to explore new avenues of collaboration and leverage the potential of partnerships in advancing climate resilience. The testing of public-private partnerships offers focus regions the opportunity to engage in co-creative processes and innovative solutions for implementing climate adaptation measures. Through mentorship and guidance from peer professionals and high-level representatives, such as Chief Resilience Officers, focus regions can benefit from the experiences and expertise of other regions. This activity promotes periodic exchanges, allowing focus regions to gain knowledge and insights from inside perspectives, including challenges, solutions, lessons learned, and replication opportunities. The testing of public-private partnerships is voluntary and aims to enhance regional resilience efforts by leveraging partnerships and collaboration. The program commences in the second half of 2023 and continues until project completion in September 2025.

The monitoring process for the capacity-building activities, including impact assessment and result publication, ensures that regional leaders can track the progress and effectiveness of their efforts in driving climate resilience. Public training sessions, key takeaways, recordings, and training materials are made available on the dedicated REGILIENCE subpage, providing regional leaders with accessible resources to support their ongoing efforts (accessible at https://regilience.eu/community-building/).

By empowering regional leaders with the necessary knowledge, skills, and tools, REGILIENCE aims to enable effective climate change adaptation and resilience at the regional level. The capacity-building

activities offer regional leaders the means to make informed decisions, drive impactful actions, and lead their regions towards a more resilient and sustainable future.

7.3 Defining and Prioritising Short-Term and Long-Term Interventions

In this subchapter, we will delve into the process of defining and prioritising interventions aimed at strengthening climate resilience. With the goal of building a resilient future, it is essential to identify and allocate resources to the most impactful and urgent actions. This chapter provides a general overview of the considerations and criteria used to prioritise interventions, drawing upon the information and discussions from a variety of resources, including available platforms, funding possibilities, and the development needs of regions. provide a valuable framework for defining and prioritising interventions. The collaborative efforts and expertise gathered through tools and resources developed within REGILIENCE, taking into account the available platforms, funding possibilities, and the development needs of regions, serve as a basis for understanding the unique context and requirements of each region, enabling a tailored approach to climate resilience planning.

7.3.1 Importance of Defining and Prioritising Interventions

As regions strive to enhance their climate resilience, it is vital to have a clear roadmap that outlines the necessary interventions. Defining and prioritising interventions helps ensure effective resource allocation, maximises the potential for positive impact, and aligns efforts with the specific needs and capacities of each region. By considering various factors and criteria, stakeholders can make informed decisions on short-term and long-term interventions that address the most critical climate challenges.

Considering the development needs of regions is vital for defining and prioritising interventions. Each region has unique challenges, vulnerabilities, and opportunities that must be taken into account. This is why the REGILIENCE team has conducted a comprehensive analysis of the development needs, where the regions could identify areas where climate resilience interventions can have the most significant positive impact. This assessment helps tailor interventions to specific regional contexts, ensuring their relevance and effectiveness.

7.3.2 Available Platforms

Web-based climate change adaptation platforms in Europe play a critical role in addressing the challenges posed by climate change. These platforms, which are increasing in number, offer a range of features and tools that assist citizens, organisations, and regions in adapting to changing weather patterns, extreme weather events, and other climate-related impacts (European Environment Agency, 2015).

The utilisation of web-based climate change adaptation platforms in Europe is driven by several compelling reasons:

- Enhancing Climate Resilience: These platforms enable citizens, communities, and regions to better understand and prepare for the impacts of climate change. By providing access to climate projections, risk assessments, vulnerability analyses, and management tools, these platforms empower stakeholders to minimise the negative effects of climate change and adapt

to a changing environment. Compared to traditional resources such as books, web-based platforms offer the advantage of easy updates, ensuring the availability of the most current information.

- Fostering Collaboration: Web-based adaptation platforms facilitate collaboration among diverse stakeholders, including government agencies, businesses, communities, and citizens. By sharing information, best practices, and experiences, these platforms establish partnerships and networks that are vital for effective climate action. Collaborative efforts fostered by these platforms enhance the exchange of knowledge and expertise, enabling a collective response to climate challenges.
- Improving Decision-Making: Climate change adaptation platforms provide decision-makers with the necessary information to make informed choices regarding climate-related risks and opportunities. Through data and analytics, these platforms help identify and prioritise adaptation strategies that are both effective and cost-efficient. Decision support tools integrated within the platforms assist in avoiding maladaptation and support evidence-based decision-making processes.
- Increasing Public Awareness: Web-based adaptation platforms serve as powerful tools to raise public awareness about climate change impacts and the urgency of taking action. By delivering accessible and engaging information, these platforms educate citizens, communities, and regions about climate-related risks. They inspire individuals to contribute to climate resilience efforts by encouraging informed decision-making and behavioural changes.
- Supporting Innovation: Climate change adaptation platforms foster innovation by providing spaces to showcase, experiment, and collaborate on innovative solutions. These platforms bring together stakeholders from diverse sectors and disciplines, enabling the development of new technologies, approaches, and strategies for climate change adaptation. By encouraging cross-sectoral collaboration, these platforms accelerate the adoption of innovative practices and facilitate replication of successful initiatives.

Under the implementation of the REGILIENCE project, a comprehensive mapping and analysis of 124 web-based climate change adaptation platforms in Europe were conducted. From this analysis, 16 platforms were identified as having significant potential to support regions with practical knowledge resources and tools for implementing resilience pathways, complementing the efforts of the European Climate Adaptation Platform (Climate-ADAPT). The review process highlighted the dynamic nature of the web-based adaptation platform landscape, with each platform offering unique features and tools for addressing climate change.

The analysed platforms deliver a variety of information, including practical experiences, implemented adaptation measures, decision-support tools, scientific research results, and policy actions at different levels, such as transnational, national, and subnational. Most of these platforms are the result of funded projects and policy initiatives at international, national, and regional levels. Notably, the analysis revealed that 25% of the sampled platforms were not available in English, indicating their strong national and regional focus.

Among the platforms analysed, the most comprehensive and prominent is Climate-ADAPT. Launched in 2012 by the European Commission and the European Environment Agency (EEA), Climate-ADAPT provides an extensive database of information on climate change adaptation in Europe. It encompasses data on climate impacts, vulnerability, adaptation strategies, and measures, allowing users to integrate their own information and findings. Designed for policymakers, researchers, and practitioners working on climate change adaptation, Climate-ADAPT supports decision-making at various levels, from national to local.

While web-based climate change adaptation platforms in Europe offer a wealth of information and tools for addressing climate change, certain factors should be considered:

- Data Availability and Quality: The accuracy of climate models and projections used in adaptation platforms depends on the availability and quality of climate data. Regional variations in data availability and reliability can limit the precision of climate projections.
- Accessibility: Although efforts have been made to ensure the accessibility of web-based platforms to all users, certain individuals may face barriers, such as limited internet access, language and digital literacy constraints, or disabilities. Addressing these accessibility challenges is crucial for ensuring equitable access to climate information and tools.
- Local/Regional Context: Climate change impacts and adaptation strategies vary significantly based on local and regional contexts, including geographic, demographic, and socioeconomic factors. Web-based platforms may not always capture these nuances, potentially limiting their usefulness for local and regional decision-making processes.
- Policy Implementation: Effective implementation of climate change adaptation measures often relies on political will, resource availability, and coordination among different sectors and levels of government. Web-based platforms, while providing valuable information and tools, cannot address the complex policy and governance challenges associated with adaptation implementation.
- Funding: Climate change adaptation efforts require substantial resources, including funding opportunities, capacity building, and technical expertise. While web-based platforms can provide guidance and information, they cannot directly bridge the funding gaps and resource limitations that may hinder effective adaptation actions.

Web-based climate change adaptation platforms in Europe serve as essential tools for addressing the challenges of climate change. Their ability to enhance climate resilience, foster collaboration, improve decision-making, increase public awareness, and support innovation makes them valuable resources in the pursuit of sustainable and resilient futures. However, it is important to recognise these platforms as part of a broader suite of tools and approaches required for building climate resilience and adaptive capacity.

7.3.3 Assessment of Funding Possibilities

Funding plays a critical role in implementing climate resilience interventions. Assessing the funding possibilities helps identify potential sources of financial support, such as government budgets, grants, international funding mechanisms, or public-private partnerships. By understanding the funding landscape, regions can prioritise interventions that align with available financial resources, leverage funding opportunities, and maximise the impact of investment in climate resilience. As part of the REGILIENCE project, a Funding Opportunities repository[13] has been developed, accessible for all stages of implementation, across various sectors, and for diverse organisational types.

7.3.4 Prioritisation Criteria

To prioritise interventions effectively, stakeholders should establish clear criteria that align with the goals and objectives of climate resilience. These criteria may include factors such as the potential impact on vulnerable communities, feasibility of implementation, cost-effectiveness, alignment with regional priorities, and the urgency of addressing specific climate risks. By applying these criteria,

13 https://regilience.eu/funding-opportunities/

stakeholders can rank interventions and allocate resources to those that yield the highest overall benefit.

While short-term interventions may address immediate needs and vulnerabilities, long-term interventions contribute to sustained climate resilience. Balancing both types of interventions is crucial for comprehensive and enduring results. By considering the urgency of certain actions and the long-term vision for climate resilience, stakeholders can develop a prioritised mix of interventions that strategically combine short-term gains with lasting impact.

7.4 Develop and Implement an Improvement Plan

In order to effectively strengthen climate resilience and facilitate the implementation of adaptation measures, it is essential to develop and implement a comprehensive improvement plan. This subchapter provides a general overview of the importance of such plans for the regions, outlining the key details they should include. These details encompass a detailed timeframe for implementing suggested interventions, identification of lead actors responsible for implementation, and the involvement of relevant stakeholders. The improvement plan also clarifies the roles and responsibilities of all stakeholders, including national regulators and other relevant entities.

7.4.1 The Necessity of Improvement Plans

Improvement plans are vital for guiding the implementation of climate resilience interventions and ensuring a coordinated and structured approach. By outlining a clear roadmap, these plans enable regions to prioritise and monitor their actions effectively. Improvement plans provide a framework for decision-making, resource allocation, and accountability, facilitating efficient and transparent processes. Moreover, they serve as a communication tool to engage stakeholders and garner support for climate resilience initiatives.

7.4.2 Key Components of an Improvement Plan

A well-developed improvement plan should include the following key components:

- Detailed Timeframe: The plan should outline a specific timeline for the implementation of suggested interventions. This timeframe should consider the urgency of each action, dependencies between interventions, and realistic assessment of available resources. A well-structured timeline ensures that actions are undertaken in a timely manner, enabling progress tracking, and facilitating adjustments if necessary.
- Lead Actors and Stakeholders: The improvement plan must clearly identify the lead actors responsible for implementing each intervention. These actors can include regional authorities, relevant government agencies, community organisations, and other key stakeholders. Assigning specific responsibilities ensures accountability and facilitates effective coordination among various actors. Additionally, the plan should outline the involvement of other potentially relevant stakeholders, such as national regulators, academic institutions, private sector entities, and civil society organisations.
- Roles and Responsibilities: The improvement plan should describe in detail the roles and responsibilities of all stakeholders involved. This includes specifying the tasks, functions, and obligations of each actor throughout the implementation process. Clear delineation of roles and responsibilities enhances accountability, fosters collaboration, and minimises potential

overlaps or gaps in action. It is important to consider the capacity and expertise of each stakeholder when assigning roles, ensuring alignment with their respective strengths and resources.

- Regulatory Framework: The improvement plan should address the roles and responsibilities of national regulators in supporting climate resilience initiatives. This involves providing an overview of the regulatory framework and policy guidelines relevant to climate adaptation and resilience. Clear communication of regulatory requirements ensures that interventions comply with existing legal frameworks and can facilitate the removal of potential barriers or bottlenecks to implementation.
- Monitoring and Evaluation: An effective improvement plan incorporates mechanisms for monitoring and evaluating the progress and impact of implemented interventions. This involves establishing performance indicators, data collection protocols, and evaluation methodologies. Regular monitoring and evaluation enable timely identification of challenges, successes, and areas requiring adjustments. It allows for adaptive management and learning from experiences, ensuring continuous improvement and the optimisation of resources.

7.4.3 Iterative and Adaptive Approach

It is crucial to acknowledge that the improvement plan should be iterative and adaptive, allowing for adjustments based on new information, emerging priorities, or changing circumstances. As new knowledge and insights emerge, the plan should be flexible enough to incorporate updated data and innovative approaches. Regular review and revision of the improvement plan help ensure its relevance and effectiveness over time.

By developing and implementing a comprehensive improvement plan, regions can effectively strengthen climate resilience and navigate the complexities of adaptation. The plan provides a roadmap for action, engages stakeholders, and ensures accountability, ultimately contributing to the creation of more sustainable and resilient communities.

7.5 Monitor and Evaluate Improvements Towards Climate Resilience and Environmental Sustainability

Monitoring and evaluating the progress of implemented interventions is essential for assessing the effectiveness and impact of climate resilience measures. This subchapter provides a general overview of the key monitoring practices that regions should consider tracking improvements towards climate resilience and environmental sustainability.

7.5.1 Importance of Monitoring and Evaluation

Monitoring and evaluation serve as critical tools for understanding the outcomes and impacts of climate resilience interventions. They help regions assess whether the implemented measures are achieving their intended goals, identify areas of success, and pinpoint areas that require adjustments or further attention. Effective monitoring and evaluation enable evidence-based decision-making, facilitate adaptive management, and promote learning from experiences. They also play a crucial role in demonstrating accountability to stakeholders and funders, ensuring transparency and efficient resource allocation.

7.5.2 Key Monitoring Practices

To ensure comprehensive monitoring and evaluation, regions should consider the following key practices:

- Establishing Baseline Data: As mentioned in subchapter 7.1, before implementing climate resilience interventions, it is important to establish a new baseline or refer to an existing one that provides a clear understanding of the current state of the environment and the vulnerabilities faced. Baseline data can include climate data, ecological indicators, socioeconomic indicators, and other relevant metrics. This information serves as a reference point for measuring progress and evaluating the effectiveness of interventions over time.
- Defining Performance Indicators: Performance indicators are specific metrics or measures that allow regions to assess progress towards climate resilience and environmental sustainability goals. These indicators should be well-defined, measurable, and relevant to the objectives of the interventions. They can encompass aspects such as greenhouse gas emissions reduction, adaptation measures implemented, changes in biodiversity, or improvements in community resilience. By tracking performance indicators, regions can monitor the success of their initiatives and identify areas for improvement.
- Data Collection and Analysis: Effective data collection and analysis are crucial for monitoring and evaluating progress. Regions should establish data collection protocols, ensuring the collection of relevant data at regular intervals. This can include conducting surveys, monitoring systems, and utilising remote sensing technologies. Collected data should be analysed using appropriate analytical methods to derive meaningful insights and assess the impact of interventions on climate resilience and environmental sustainability.
- Stakeholder Engagement: Engaging stakeholders throughout the monitoring and evaluation process is essential for obtaining diverse perspectives, validating findings, and fostering ownership of the outcomes. Stakeholders can include community members, government agencies, research institutions, and NGOs. Involving stakeholders in data collection, analysis, and interpretation can enhance the quality of evaluations and contribute to building a shared understanding of progress and challenges.
- Learning and Adaptation: Monitoring and evaluation should not be viewed as static processes but rather as opportunities for learning and adaptation. Regions should actively seek to learn from the outcomes of monitoring efforts, identify lessons learned, and apply those lessons to improve future interventions. This iterative approach allows for continuous refinement of strategies and enhances the effectiveness of climate resilience initiatives.
- Reporting and Communication: Clear and concise reporting and communication of monitoring and evaluation results are crucial for transparency and accountability. Regions should prepare regular reports that highlight progress, achievements, challenges, and recommendations for improvement. These reports should be accessible to a wide range of stakeholders and communicated in a manner that facilitates understanding and engagement.

By adopting these key monitoring practices, regions can gain valuable insights into the effectiveness of their climate resilience interventions and make informed decisions to enhance environmental sustainability. Regular monitoring and evaluation contribute to evidence-based decision-making, adaptive management, and continuous improvement towards building more resilient and sustainable communities.

8 Conclusions

Climate change is one of the most pressing challenges facing European regions today. Communities across the continent are experiencing escalating climate-related risks from rising temperatures, changing precipitation patterns, extreme weather events, and slow-onset changes. These impacts disrupt economies, endanger human health and well-being, and jeopardise critical infrastructure and natural ecosystems.

To navigate the uncertainties and complexities of climate change, regions must take strategic action to assess vulnerabilities, engage stakeholders, evaluate options, target interventions, and monitor outcomes. This prioritisation strategy provides local decision-makers with knowledge, tools, and practical guidance to advance climate adaptation and build resilience.

By first highlighting key risks for resilience pathways, the strategy lays a foundation for informed planning and implementation of actions. Exploring analytical frameworks and decision-support tools equips regions with state-of-the-art techniques to quantify trade-offs, value flexibility, and identify robust strategies. Outlining structured processes for taking action, from assessing baselines to monitoring improvements, gives regions actionable steps tailored to local contexts.

Collaboration is essential, and this strategy emphasises engagements with diverse stakeholders, from citizens to national regulators, to co-develop locally owned solutions. It promotes learning from other regions through exchanges of best practices and peer-to-peer mentoring. Capacity building of regional leaders is underscored as an enabler for effective climate action.

As climate change continues to unfold in uncertain ways, flexible and iterative approaches are vital. This strategy encourages active learning, regular re-evaluation of priorities, and adaptation of plans based on emerging evidence and community needs. Above all, it aims to empower regions with the understanding, tools, and connections to create inclusive, just, and sustainable climate-resilient futures.

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Annex

Annex I: Checklist for Operationalising Climate Resilience

To transform resilience strategies into on-the-ground implementation, regions need clear guidance on practical actions. The checklists below distil key recommendations from across the prioritisation strategy into accessible "how-to" steps for different aspects of resilience planning.

Designed for direct use by regional practitioners, policymakers, and decision-makers, these checklists provide a handy reference point for applying state-of-the-art knowledge. They incorporate real-world examples and links to tools tailored specifically for European regions.

The checklists cover major activities from assessing climate risks, utilising analytical enablers, implementing actions, building capacity and monitoring progress. They include key resources from the REGILIENCE project as well as complementary tools from Climate-ADAPT, ARSINOE, IMPETUS and TransformAr.

Regions can utilise these checklists as a starting point and modify or expand them based on local contexts and needs. They allow users to easily track and monitor progress on recommended practices. By following the checklists, regions can operationalise climate resilience knowledge into on-the-ground outcomes.

The checklists empower regions to take informed steps towards assessing climate risks, making decisions under uncertainty, implementing iterative processes, and monitoring outcomes. They accelerate learning and progress towards effective, equitable and successful climate adaptation.

Table 2: Checklist for Operationalising Climate Resilience

Checklist	Clarifications and Links
Climate Risk Assessment Checklist	• Consult the **ARSINOE Data Catalogue** for climate adaptation datasets: https://catalogue.arsinoe-services.eu/geonetwork/srv/eng/catalog.search#/home
	• Use the **REGILIENCE Risk-Solution Matchmaking Dashboard** to identify regional hazards, discover tailor-made solutions, and access a list of regions with similar hazard profiles (will soon be available at: https://regilience.eu)
	• Use the **IMPETUS Hot Spot Identification and Prioritisation Service** to analyse risks spatially: https://impetus.eddy-expert.com/
	• Refer to **TransformAr's Sectoral Impact Report Cards** to understand risks: https://transformar.eulogy.eu/observatory/
	• Explore **Adaptation Pathways** used in Thames Estuary TE2100 project:

Enablers for Action Checklist	https://www.gov.uk/government/publications/thames-estuary-2100-te2100
	• Apply **Adaptive Policy Making** like German Adaptation Strategy (NAS 2020): https://www.bmu.de/en/topics/climate-energy/climate/adaptation-to-climate-change/german-strategy-for-adaptation-to-climate-change/
	• Use **Real Options Analysis** as in Port of Antwerp flood protection: https://climate-adapt.eea.europa.eu/metadata/case-studies/assessing-the-economic-feasibility-of-climate-adaptation-options-using-real-options-analysis
	• Use **MEDIATION Adaptation Pathways Generator**: https://climate-adapt.eea.europa.eu/knowledge/tools/adaptation-pathways-generator
Implementation Checklist	• Do **Rapid Vulnerability Assessments** analysis: https://climate-adapt.eea.europa.eu/en/mission/knowledge-and-data/regional-adaptation-support-tool
	• Build capacity via training programs within REGILIENCE: https://regilience.eu/community-building/
	• Prioritise interventions through funding opportunities: https://regilience.eu/funding-opportunities/
	• Develop collaborative plans with stakeholders
	• Monitor progress using Climate-ADAPT indicators: https://climate-adapt.eea.europa.eu/metadata/indicators