D4.1. Regional Resilience Maturity Model and Framework

Regions 4Climate

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Deliverable Information Sheet

Version	
Grant Agreement Number	101093873
Project Acronym	R4C
Project Title	Regions4Climate
Project Call	HORIZON-MISS-2021-CLIMA-02
Project Duration	60 months
Deliverable Number	D4.1
Deliverable Title	Regional Resilience Maturity Model and Framework
Deliverable Type	R — Document, report
Deliverable Dissemination Level	PU - Public
Work Package	WP4
Lead Partner	ICLEI Europe
Authors	Erica Manuelli, Erika Palmieri, Jole Lutzu, Alexandra Malmström, Sirkku Juhola, Johannes Klein, Sónia Bento, Joana Pinto, Susana Loureiro
Contributing Partners	DRI, ENG, RIN, SKT, SPI, TEC, UCP, UH, VTT, ZAB
Reviewers	SPI
Official Due Date	31 December 2023 (M12)
Delivery Date	

History of changes

Version	Date	Description	Author(s)
1	01/12/2023	Version for peer-review	Erica Manuelli, Erika Palmieri, Alexandra Malmström, Sirkku Juhola, Johannes Klein, Sónia Bento, Joana Pinto, Susana Loureiro
2	15/12/2023	Version for final review	Erica Manuelli, Erika Palmieri, Alexandra Malmström, Sirkku Juhola, Johannes Klein, Sónia Bento, Joana Pinto, Susana Loureiro
3	21/12/2023	Final version	Erica Manuelli, Erika Palmieri, Alexandra Malmström, Sirkku Juhola, Johannes Klein, Sónia Bento, Joana Pinto, Susana Loureiro

List of Acronyms

CRML	Climate Resilience Maturity Level
DRI	Demos Research Institute
ENG	Engineering - Ingegneria Informatica Spa
EU	European Union
EURESFO	European Urban Resilience Forum
IIED	International Institute for Environment and Development
MIP4Adapt	Mission Implementation Platform for Adaptation to Climate Change
MMSSC	Maturity Model for Smart Sustainable Communities
NUTS	Nomenclature of territorial units for statistics

P2R	Pathways2Resilience
R4C	Regions4Climate
RCRDs	Regional Climate Resilience Dashboards
RIN	RINA Consulting Spa
RRI	Responsible Research and Innovation
RRMM	Regional Resilience Maturity Model
S3	Smart Specialisation Strategies
S4+	Smart Specialisation Strategies for Sustainable and Inclusive Growth
SDGs	Sustainable Development Goals
SKT	Sihtasutus Stockholmi Keskkonnainstituudi Tallinna Keskus (SEI Tallinn)
SPI	Sociedade Portuguesa De Inovacao Consultadoria Empresarial e Fomento Da Inovacao Sa
TEC	Fundacion Tecnalia Research & Innovation
UCP	Kobenhavns Universitet
V&R	Vulnerability and Risk
VTT	Teknologian Tutkimuskeskus VTT
WP	Work Package
ZAB	Zabala Innovation Consulting, S.A.

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Keywords list

- Regional Climate Resilience Maturity
- Maturity Model

- Regional governance
- Just Transition to Climate Resilience
- Self-assessment
- Policy-linked indicators
- Digital tool

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Executive summary

This document is developed as part of the Regions4Climate (R4C) project, in fulfillment of the Grant Agreement number 101093873.

It provides the **Regional Resilience Maturity Model (RRMM)** and related **Assessment Framework**, developed within R4C's Task 4.1. The RRMM is one of the innovative tools developed within the R4C project to support 12 European regions in their efforts towards a socially just transition to climate resilience. The RRMM, composed of a set of 57 policy-linked indicators organized in 8 dimensions, is a model for a common understanding of the climate resilience-building process at a regional level, embedding climate and societal transformation within a broader climate resilience framework. The model and its assessment framework will be transposed in a web-based **self-assessment digital tool**, which will be used for periodical assessments of each region's **Climate Resilience Maturity Level (CRML)** within the course of the R4C project.

The RRMM aims to be a tool for reflection and guidance, supporting regions to self-assess their progress in their climate resilience-building process. This includes supporting them to identify their level of climate resilience maturity and potential gaps, to inform the prioritization of suitable policies to advance climate resilience and to justify for funding of specific measures.

The methodological approach adopted for the RRMM's development included a literature review on climate adaptive and resilience capacities, existing maturity models, and assessment frameworks. As illustrated in Chapter 2 of this document, a co-creation process led to this version of the model, including conceptual alignment with another EU project, Pathways2Resilience, the organization of several internal workshops with project partners and participation to dissemination events, which further strengthened the RRMM's conceptual foundation.

The RRMM development was based on the recognition that a set of regional functions, processes and characteristics can be developed to better equip a region to face evolving and multiple (climate) risks in the short- and long-term. These characteristics can be strengthened through targeted policy and action. Therefore, the RRMM and assessment framework presented in this document aim at evaluating such regional characteristics that contribute to climate resilience-building regardless of the specific sector or hazard. Moreover, the development of the RRMM was based on the acknowledgment that regions can vary significantly in terms of competences, levels of authority and scope of action for climate resilience-building. In order to assess regional climate resilience maturity, it was deemed important to better understand the specific context of the region in terms of governance characteristics, as presented in Chapter 3.

While solutions to build climate resilience often target the national and local levels, there is a lack of tools that specifically target the regional level. The tool presented in this document is an attempt to capture and clarify the role and challenges of regions in building climate resilience, in order to support regional governments in their efforts towards resilient development in a more tailored way, aligning with specific regional contexts and capacities.

The innovative character of the Regional Resilience Maturity Model and Assessment Framework requires an iterative process of adjustment, as the validity of the RRMM approach is tested and validated in the R4C

demonstration regions. While currently focused on the European regions involved in the project, future versions of the tool could include global applicability, tailoring indicators to diverse regional contexts.

1. Introduction

1.1. Regions4Climate EU project

The ambition of Regions4Climate (R4C) is to collaboratively develop and demonstrate a socially just transition to climate resilience in European regions. The project's consortium defines climate resilience as the ability to prepare for, respond to, and recover from the impacts of climate phenomena while causing minimal damage to social welfare, the economy, and the environment. Vulnerability to climate change, especially in those regions that are most affected, such as coastal areas, small islands, and deserted areas, is likely to exacerbate social vulnerability and injustices, particularly for marginalized communities, undermining efforts to achieve sustainable development.

This development of this deliverable was led by the Resilience and Climate Adaptation team at ICLEI Europe. ICLEI is a global network of local and regional governments committed to take transformative actions towards sustainable development pathways that are low-emission, nature-based, circular, resilient, equitable and people-centered. As part of its efforts for climate resilient development, ICLEI Europe is committed to supporting cities and regions in implementing the European Green Deal and achieving a just transition to climate resilience. Within R4C, ICLEI Europe is committed to engage in the development of decision-support tools that can effectively respond to regions' needs and assist them in their resilience-building process.

R4C's approach is based on the idea that, by involving all stakeholders, from governments to citizens, and combining sociocultural, technological, digital, business, governance, and environmental innovations and solutions, vulnerable regions will be able to tackle climate-related issues and create a more equitable and thriving society for all. The 12 regions involved in the project will implement specific Regional Innovation Actions (WP5) aimed at reducing their vulnerability to the impacts of climate change. These demonstration actions are supported by a set of user-centered tools and frameworks, developed by the other R4C Work Packages (WP2, WP3, WP4, WP6), which will be tested and implemented in the partner regions. The development of such tools in support of planning and implementation of a just transition to climate resilience will be based on the combination of new knowledge, detailed understanding of regional ecosystems, and innovative technologies and processes. The demonstration of such tools within the R4C partner regions will contribute to the development of a holistic framework of modular, interoperable social, environmental, economic, policy and governance innovations, including tools and methodologies underpinned by robust guidelines and models, to be applied in other regions beyond the project and support European-wide development of evidence-based climate resilience plans and adaptation pathways.

One of the innovative tools developed within R4C, as part of the project's holistic framework to support regions' socially just transition to climate resilience, is the **Regional Resilience Maturity Model** (RRMM) and Assessment Framework developed within T4.1.

1.2. Purpose and structure of this deliverable

This document presents the **Regional Resilience Maturity Model (RRMM)** and related **Assessment Framework**, developed within R4C's Task 4.1. The RRMM is a model for a common understanding of the climate resilience-building process, embedding climate and societal transformation within a broader climate resilience framework.

The RRMM and its assessment approach were developed in collaboration with project partners and regional representatives, through a series of co-creation steps, as illustrated in Chapter 2 (Methodology). Following the methodology section, Chapter 3 provides background on the relevance to assess climate resilience at regional level and demonstrates the approach developed within R4C, including the way that the model and assessment framework have been linked to other R4C activities.

The Regional Resilience Maturity Model (RRMM) is composed of a set of policy-linked indicators aimed at assessing regional functions and characteristics contributing to its climate resilience maturity, organized in 8 dimensions, presented in detail in Chapter 4. In order to assess regions' climate resilience maturity, an assessment approach was developed, as illustrated in Sub-Chapter 4.2. This includes a scoring system designed for each indicator, and the design of a "governance context" assessment to enable the better understanding of each regional context.

As a next step, the RRMM and related assessment framework will be transposed in a web-based **self-assessment digital tool**, also developed by T4.1, as presented in Chapter 5.

The RRMM model, assessment approach and digital tool will be used for periodical assessments of each region's **Climate Resilience Maturity Level (CRML)** within the course of the R4C project (T4.3). Regions will be supported by T4.3 in the conduction of these assessments, including via an annual workshop conducted as part of R4C consortium meetings.

As per the project's Grant Agreement, results of the regional CRML assessments will be shared as a "synthesis view" on the online Regional Climate Resilience Dashboards (RCRDs), featured in the project's Climate Resilience Portal digital platform (T3.5) (more information in Sub-Chapter 5.3).

The assessment results will support regions in the identification of suitable policies to implement to develop climate resilience. In combination with other tools and assessments conducted within R4C (including T2.1 Socio-economic vulnerabilities analysis, T3.1 Vulnerability and Risk Assessments, T3.2 Monitoring and Evaluation plans, T4.2 Governance assessments, T4.4 Policy needs analysis) it aims at supporting regions in the prioritisation of climate resilience policy implementation, including the justification of expenditures on specific measures. Interlinkages between T4.1 and other R4C tasks are further explored in section 3.3.

2. Methodology

This Chapter illustrates the methodological approach adopted in the development of the RRMM and related assessment framework. Methodological choices were informed by the intention to develop a tool that considers the unique challenges and context-specificity of the regional scale, for it to be suitable to assist regions in climate resilience-building, as further explored in Chapter 3.

First, Section 2.1 presents an overview of the steps taken in the conceptual development of the model. Then, Section 2.2 documents the extensive process of content creation conducted with project partners. The Chapter closes with a section on limitations.

2.1. RRMM conceptual development

A review of literature on climate adaptive and resilience capacities, other existing maturity models and assessment frameworks for climate adaptation and resilience (often at community/local level) was conducted. A detailed review of the consulted resources is provided in Chapter 3. Following the review, a robust list of indicators for assessing climate resilience was compiled, mainly drawing from:

- *Smart Mature Resilience Maturity Model*
- *Operational framework for Tracking Adaptation and Measuring Development (TAMD)*
- *UNDRR Disaster Resilience Scorecards for Cities*
- *Maturity model for smart sustainable Communities (MMSSC) applying ISO 37153 methodology, developed within ISO TC 268 Sustainable Cities and Communities*
- *A number of other publications including climate resilience assessment frameworks (e.g. Disaster Resilience Integrated Framework for Transformation (DRIFT), by Manyena et al., 2019)*

As further explained in the Sub-Chapter 3.2.1, an existing climate resilience maturity model was studied as reference for the development of the RRMM: the Resilience Maturity Model lor cities developed as part of H2020 project SMR (GA no. 653569).

In general, the main purpose of maturity models is to describe stage and maturation paths, explaining the characteristics of each stage and the logical relationship between them (Kuznets, 1965; Poeppelbuss & Roeglinger, 2011). Maturity models aim at assessing current maturity levels and identifying gaps and improvement measures in order to reach desirable climate resilience goals.

In particular, the RRMM has the following functions:

- *Enable regions to identify their current level of climate resilience maturity, through the assessment of their capabilities against a set of indicators (descriptive function of the maturity model as per Poeppelbuss & Roeglinger, 2011).*

- *Thanks to policy-linked indicators, support the region in the identification of desirable maturity levels and provide guidelines on improvement measures (prescriptive function of the maturity model as per Poeppelbuss & Roeglinger, 2011)*

The design of the RRMM was informed by some principles:

- ***User-focused**: should be developed in collaboration with regional partners, to ensure the model meets their needs in a user-friendly way. Regional practitioners (incl. political and technical staff) are considered as target users for the conduction of the assessment based on the RRMM.*
- ***Simple to use**: should not be overly complex and should be intuitively easy to use. Its use should not require data collection more costly or extensive than what foreseen within the project;*
- ***Comprehensive**: should cover the key elements contributing to climate resilience-building at regional level*
- ***Flexible**: should be applicable to very different sizes and types of regions.*

2.2. Content creation with project partners

2.2.1. Cooperation with P2R on general conceptual framework

Since the early stages of the project, a strong conceptual alignment was identified between R4C and the Pathways2Resilience (P2R) project. This emerged at the very early stages of the Mission Adaptation activities, under which both projects are funded, in particular during the launch of the Mission Adaptation Community of Practice, which took place in Brussels in January 2023.

Both projects in fact entail the development of a Regional Resilience Maturity Assessment: R4C's T4.1 developing the RRMM presented in this document, and P2R delivering the Resilience Maturity Curve Framework (D1.1). A collaboration between the respective task leaders, ICLEI Europe and the International Institute for Environment and Development (IIED), took place with the aim of developing a common conceptual framework for assessing regional climate resilience maturity, intended to inform the development of two distinct but compatible tools for each project (RRMM in R4C and the Resilience Maturity Curve in P2R).

The collaboration, which took place mainly in Spring 2023, addressed the usefulness of conceptualising regional resilience maturity as a set of climate resilience capacities (see Sub-Chapter 3.1.3), in order to try to elaborate a common approach to assessing Regional Resilience Maturity. The two projects then built on this conceptual work independently, developing two separate tools. However, the continuation of a collaboration between R4C and P2R is deemed highly desirable by both ICLEI Europe and IIED, especially for the purpose of developing a harmonised approach to assessing Regional Resilience Maturity under the EU Mission Adaptation. The phase of validation and adjustment of the RRMM and assessment approach (including the development of the RRMM digital tool) which will follow this deliverable could provide an opportunity for alignment between the two projects' tools and approaches.

2.2.2. Internal workshop series

A series of internal workshops were arranged between July and September 2023 involving key R4C partners involved in T4.1 activities (DRI, ENG, ICL, RIN, SKT, TEC, UH, UCP, VTT, ZAB). The workshops aimed at

validating the RRMM while ensuring alignment with other project activities (e.g. tools and frameworks developed in WP2, WP3, WP6). Regional representatives were not involved directly in this series of workshops, but alignment with regional needs was ensured thanks to the participation of technical partners involved in T4.1 and in the regional clusters, who were able to provide valuable knowledge of regional contexts to contribute to the framework development. Through interactive exercises, the workshops focused on the validation of the dimensions and policy areas considered as key for regional climate resilience-building and therefore included in the RRMM, as well as on the assessment framework and approach. An overview of the workshops and their key outcomes are summarized in Table 1 below.

Following up from the workshops' results, drafts of the model were circulated regularly among WP4 partners and partners from other WPs to gather feedback. In particular, it was shared with WP4 partners (mainly ZAB, UH, SKT, VTT, RIN), to align the RRMM with the other WP tasks' requirements; WP2 partners (DRI, UCP) to cross-check with Just Transition principles and enabling conditions, following the rationale that justice elements should be cross-cutting across the RRMM; WP3 partners (TEC) in order to align with the envisioned approach for risk and vulnerability assessments (D3.1 Vulnerability and risk assessment framework) and to clarify alignment with the approach developed within T3.2 for the regional monitoring and evaluation plans; WP6 partners (SPI) in order to align with the Common Innovation Framework.

Table 1 - Overview of the internal workshops and their key outcomes

Workshop	Key questions addressed	Key outcomes
Workshop #1 *(17.07.2023)*	Do you find any gaps/missing elements? Do you see any redundancy, potential overlapping? What kind of operational challenges can be foreseen?	General considerations / aspects to address: - ***Maturity level assessment should be relative*** *(specific to region's actual capacity for transformation) and not absolute.* - *(Regional Climate)* ***Governance*** *= a multitude of actors at various levels contributing to delivering climate actions with a variety of instruments + the interrelations among those actors + the structural conditions in which they operate* Gaps: - *Ideally, the* ***model should capture informal processes and instruments*** *(e.g., private sector initiatives, community-led initiatives) in addition to govt-led formal instruments like plans and regulations.* - *Need to understand* ***integration and coordination between administrative levels*** *in terms of planning and governance.* - *Ideally, the model should aim to* ***capture structural conditions*** *incl. social characteristics/societal capacity to absorb shocks.* - *The model should* ***address issues of directionality and vision*** *including emerging trade-offs, existing and forthcoming regional development priorities etc.* - *Need to assess the "quality" of plans/strategies/assessments, and not only assess whether they have been adopted or not (incl. process-oriented criteria).* - ***Need to include the role of innovation*** *for climate resilience-building. For example, including the assessment of innovation potential of the region, based on Common Innovation Framework developed by T6.1.* Operational challenges for assessment: - *Difficulty to assess informal processes and instruments for climate resilience-building.* - *Regional governments (leaders, practitioners) as target users of the RRMM digital tool: how can data regarding private sector etc be gathered? Is a multi-stakeholder assessment process feasible? Considering that RRMM should be a self-assessment*
Workshop #2 *(08.08.2023)*	Does the model capture all important elements to adequately assess regional climate resilience maturity? What connections between regional competences/characteristics and the	Completeness of the model / approach: - *No major gaps identified.* - *How / where is physical climate resilience of the region addressed (e.g., how well people are protected from floods etc.)? Challenge in linking with T3.1 vulnerability and risk assessment.* - *Challenge: comprehensiveness VS usability (avoid too many indicators)* - *Challenge: bias in self-assessment. Make sure to be specific to avoid risk of misunderstanding.* → ***Define in detail what each score means for each indicator.*** Connections between **regional competences** and other elements of the model: - *"Maturity" looks different for different regions.* - *Need to understand what the actual scope of action/transformation of each region is.* **Key interlinkages** and need for alignment identified:

	other elements are relevant for assessing climate resilience maturity? Where do regional competences have an influence? What are connections between the RRMM model and other R4C Tasks and Deliverables?	- *with Just Transition Framework and Roadmaps → assessment of regional competences would be useful for JT roadmaps as well, as these are meant to address actions that are feasible for the regions.* - *with T4.2 governance framework → regional competences shall be part of the framework* - *with T3.1 vulnerability and risk assessments* Discussed in the workshop → proposed approach to assess climate resilience maturity in a relative way: - *Exploiting alignment with Just Transition Roadmap process.* - *Based on first evaluation of climate resilience maturity and assessment of the region's competences/capacities for transformation and climate resilience-building, each region should ideally develop of vision for an "ideal climate resilience maturity" that is feasible for its context (vision of transformation).* - *This would include the identification of specific actions that the region could take in order to increase its maturity level in the various RRMM elements (a resilience maturity "journey" for each region). Alignment with P2R approach.* - ***Goal** of RRMM: through periodic CRML evaluations, assess whether the region is progressing in its own climate resilience maturity journey and understand how close it is getting to its vision.* - *Challenges: beyond project's scope? Is it feasible? Mining robustness of the assessment? Still unclear*
Workshop #3 *(18.09.2023)*	For each RRMM indicator: Where can these data be found (e.g., if already assessed in another R4C task)? For which other task/activity will this information be relevant? What key aspect would you like to see included in this section?	Information answering the questions on the left was collected through interactive exercise. Main findings with regards to alignments and overlaps: - *There is a set of topics needed for the regional S4+, to be integrated in RRMM so that T4.5 can build on the results of CRML assessments.* - *Alignment needed with T3.2 M&E.* - *D2.1 indicators (e.g., vulnerable groups, education) might not be directly integrated in RRMM, but can be useful as background info.* - *Potential alignment with System Dynamic Modelling and JT indicators to be clarified.* - *T4.2 Just Transition Roadmaps will need monitoring process: there could be a link to periodical CRML assessments, through the inclusion in RRMM of indicators relevant for JT roadmaps. However, different timelines will be an obstacle: regional actions will be defined by JT roadmaps once RRMM is already developed. Find a way to include them as region-specific "steps" for climate resilience maturity journey?*

2.2.3. Presentation at Adaptation Futures 2023

On October 6th, 2023, the model and related assessment framework were presented by ICLEI during the Adaptation Futures 23 Conference in Montreal, Canada, as part of a session chaired by Infrastructure Canada. Alongside the RRMM and its related assessment framework, other decision-support tools for climate resilience-building were presented.

The presentation and subsequent discussion allowed to gather valuable feedback from international experts, both from practice and academia, on the envisioned approach to assessing regional climate resilience maturity at regional level. Among the points raised and discussed, the need for decision-support tools that clarify the role of regional governments in climate resilience-building, with respect to and in relation to other levels of governments, was particularly highlighted.

2.2.4. Workshop and Closed-Door session at EURESFO23

An ad-hoc workshop was organised as part of the European Urban Resilience Forum 2023 (EURESFO) to present the RRMM model to R4C regional partners and the external regions attending the Forum and gather feedback. Since 2013, EURESFO has offered a unique space for knowledge exchange, becoming the European platform for city and region representatives and stakeholders to meet, discuss, and learn about new strategies and actions for adapting to climate change and building urban resilience (Figure 1). Therefore, the forum was deemed a suitable venue to present the RRMM and contribute to its validation, through an ad-hoc workshop.

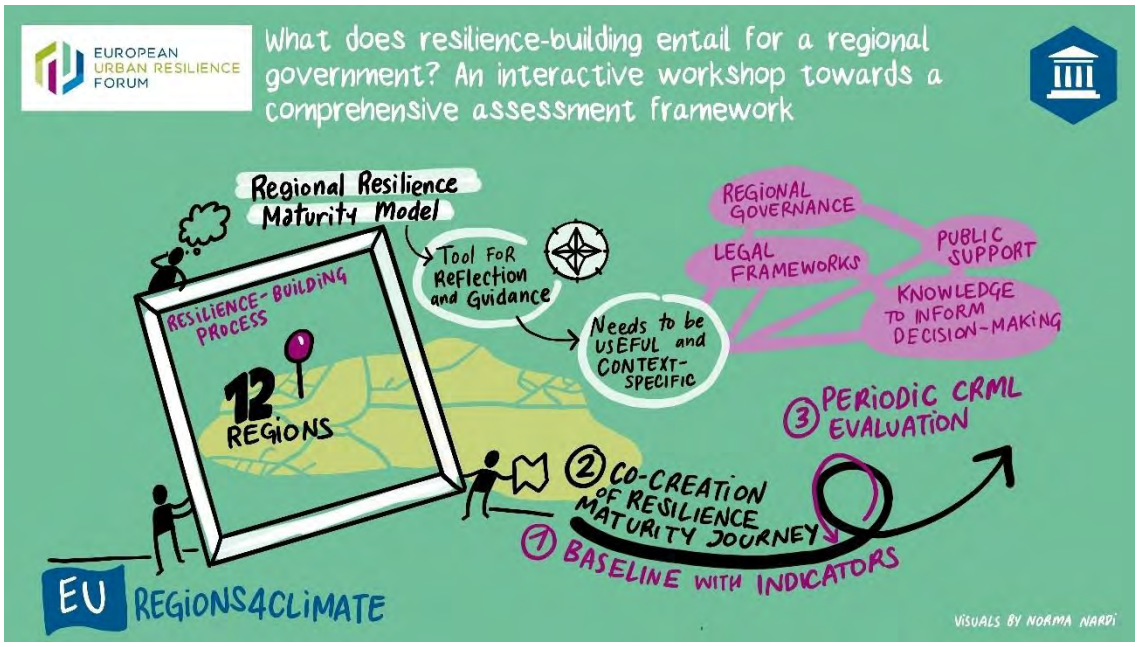


Figure 1 - Graphic developed during EURESFO for R4C workshop by Norma Nardi

The **interactive workshop** was titled "*What does resilience-building entail for a regional government? An interactive workshop towards a comprehensive assessment framework*" and aimed at presenting, discussing, and validating the RRMM framework with the help of representatives, experts and stakeholders from local and regional institutions across Europe. Several R4C regional partners, including from Azores, Køge Bay, Pärnumaa, Sitia, Helsinki-Uusima, along with technical partners from the Basque Country and Tuscany region, actively participated. Additionally, representatives from external regions and cities, such as South Africa, North West Croatia and The Hague took part in the session and expressed keen interest in engaging with Regions4Climate initiatives.

The workshop was based on an interactive format to facilitate discussions on how regions can best be supported in assessing and advancing their climate resilience-building process. It was divided in 2 thematic blocks of 30 minutes, addressing the key questions below.

- **First block: The value of assessing Regional Resilience Maturity.** Following up from the presentation done at the beginning of the session, participants were asked to discuss the value of the proposed assessment. They were provided with a printout of the model in order to be able to discuss its dimensions and make comments and suggestions with regards to the proposed model and approach. Questions addressed included: is anything missing? Do you see challenges emerging from your specific regional context that we should consider? For example, in terms of how legislative competences and administrative structures affect climate resilience-building in your region?

- **Second block: Definition of a "user friendly" assessment process.** Participants were asked to answer questions including: who should coordinate the data collection and assessment process? Which stakeholders would be needed in each region? What would be an ideal periodicity of the assessment process? What would be preferred tools and formats? Is climate resilience maturity already assessed in your region and, if yes, how?

In addition, a **closed-door session** was organized within the Forum, open to R4C partners only. The session aimed at gathering input from the regions with regards to their needs and wishes when it comes to data collection and assessment processes. It also aimed at collecting feedback concerning the usefulness of project results generated so far and upcoming tasks, including how learnings from deliverables can be used to inform regional climate resilience efforts.

The main outcomes of the workshop and closed-door session are summarized in Table 2 below. These have been incorporated as much as possible in the current version of the RRMM and related assessment framework.

Table 2 - Outcomes of the workshop and close-door session at EURESFO23

Topic	Gathered feedback
What is unclear or missing?	Need to better specify what kind of resilience is being assessed. Resilience in terms of citizens' capacity or geographical scope? The model should address the motivation for actors to get involved in the assessment. Need to specify to what extent the RRMM is a process- or outcome-based assessment. Need to specify what sectors are most relevant for each region (beyond R4C-related areas of intervention?) Need to recognise the need for flexibility, adaptability, agility. It should capture the ability of a regional system to re-prioritise, for example redirecting funding in order to be agile. Overlap of indicators – risk of double-counting and misinterpretation. RRMM and related assessments could be an opportunity for knowledge sharing (best practices, experiences, barriers) among R4C regions, not only within clusters.

The "Regional" in the RRMM	From the RRMM should be clear that we are assessing climate resilience in regions, not in other governance levels. It should not be simply a slight adaptation of existing frameworks for the urban level: we need to make the model really region-focused. Need to better specify the "region": - *Provinces vs regions – what is the role of the regional government participating in the assessment? What is its scope of responsibilities?* Need to account for different competences at regional level between different EU countries and dominance of sectors at regional level in different EU countries. Specific points being raised: - *Regions' influence on education is limited* - *Levels of governance may not match, e.g., citizen engagement will be done at local level*
Designing a friendly assessment process	If information needs to be collected from various sources or stakeholders, collaboration is key for the success of the assessment, including internal communication between teams (regional administration). Who has the ownership over the assessment process?
Role and capacity of regions in the project	Consider minimizing the involvement of regions in the conceptualization process. Instead, provide them with precise instructions pertaining to the desired goals and results. Their primary role should focus on commenting and offering advice on specific proposals. Regions lack the resources necessary to address all incoming requests. Internal organisation will be needed to provide the assessments.

2.2.5. Feedback sessions with partner regions

In addition to the sessions organized within EURESFO23, feedback was gathered from R4C regional partners through a workshop organised by WP5 on December 12th, 2023. The workshop, titled "Workshop on R4C collaboration and peer learning" was organized as a T5.1 thematic workshop to promote collaboration and peer learning. It represented an opportunity to present to R4C regional partners the updated version of the RRMM and related assessment framework, after having incorporated the feedback collected at EURESFO23.

In early 2024, sessions will be organized with R4C regional partners involved in T4.3 to go more in-depth and prepare regional partners for the assessment process. These sessions will also serve to gather valuable feedback from the regions and validate the model presented within this deliverable. This feedback will be integrated in the digital tool which will be finalized by June 2024. More details in Chapter 6 (Ways Forward).

2.3. Limitations and reflections

This chapter delves into the limitations of the methodological approach adopted for the RRMM's development and acknowledges the encountered challenges.

Extending applicability beyond the 12 demo Regions

Although the primary focus of the R4C remains on the engagement of the 12 European regions part of the project, the efforts are directed towards the applicability of tools and frameworks to the European regions overall, with a particular emphasis on those actively participating in the Mission Adaptation through other projects and initiatives, such as P2R and MIP4Adapt. Therefore, it is crucial to acknowledge as a limitation and challenge that the insights gained from the 12 R4C regions may not capture the whole European context and, most significantly, may fall short in addressing the global level. Nevertheless, these insights, inclusive of challenges, experiences, and opportunities, merit acknowledgment as valuable benchmarks for addressing the overarching Regions' challenges. This not only

pertains to our collaboration within the ICLEI network but also extends to our collaborative efforts with diverse regions and partners actively engaged in European resilience activities.

Accounting for regional differences

The geographical and administrative diversity among the 12 R4C demonstration regions, and in general of (European) regions, introduced complexities in crafting a model that resonates with varied regional contexts. The challenge lies in striking a balance between a standardised framework and the adaptability required to accommodate diverse regional characteristics to build climate resilience. This prompts critical reflections on how to reconcile attributes of each region within a cohesive model that maintains its efficacy across the diverse territory units identified by the Nomenclature of territorial units for statistics (NUTS) levels. Considerable efforts were dedicated to design an assessment approach that takes these differences into account and tries to address the identified operational challenges. In fact, considering their diverse contexts and characteristics, it is possible that some regions will not be able to answer some of the indicators, or not fully. For example, in the case the indicator's description does not fit the specific context, including the regional competences. Information in this regard will be collected as part of the assessment (see Sub-Chapter 4.2). This will inform the adjustment of the RRMM and assessment approach during the following phase of the project.

Co-creation process

The development of the RRMM was done through involvement of R4C technical partners with knowledge and expertise about the project regions, rather than direct engagement of regional representatives. This approach served to prioritize establishing a robust foundation before seeking contributions from regional representatives. From October, a process was initiated to gather regions' contributions through interactive workshops designed to align the RRMM with regional needs and to incorporate diverse perspectives on the definition of regional resilience maturity (namely EURESFO23 and the workshop organised by WP5). It became evident that the insights and perspectives of the regions are invaluable for the tool's validation. This led to the design of a validation phase, in the coming months, that would enhance the involvement of regional stakeholders. However, it is essential to recognize existing limitations within the project, particularly regarding the extent of feasible stakeholder engagement.

Harmonised conceptual approach under the Mission Adaptation

Since the first phases of RRMM development, alignment with other Mission Adaptation projects (P2R for example) was identified as desirable, in order to avoid redundancy of tools and to operate under a compatible conceptual approach when it comes to resilience-building at regional level. This alignment has proven to be challenging, due to different timelines and requirements of different projects. Nevertheless, this should not prevent partners from engaging in efforts aiming at finding alignment with other projects (not only P2R), for example in the upcoming phase of adjustment of this model, to clarify how the RRMM could be complementary to other assessment tools.

Selection of indicators

The formulation and selection of RRMM indicators were the result of a collaborative effort that engaged several partners within and beyond the R4C Consortium. Further information on the decisions underpinning the current model can be found in Chapter 4.1. However, it is important to recognize certain limitations in the indicators' selection process. The necessity of keeping a balance between comprehensiveness and usability meant that decisions had to be made to limit the scope of the model and not all contributions could be included. The validity of the current model will be tested in the coming months and adapted accordingly.

3. The Regions4Climate's Regional Resilience Maturity Model approach and conceptual development

3.1. Context and conceptual background

3.1.1. The relevance of climate resilience-building at regional level

The operational planning and implementation of climate adaptation and resilience building efforts is usually carried out at local levels (e.g., municipal), as these efforts need to be tailored to the local administrative and socio-economic context to ensure their effectiveness and successfulness, as well as acceptance by the stakeholders. However, it has been brought to the attention that local administrations do not always have the capacity and resources to implement climate adaptation and resilience measures, nor can they always mobilise required resources (Gallaraga et al. 2011; Olazabal & de Gopegui; 2021). In recent years, there has been a growing interest in the regional scale for climate adaptation and resilience building. Regional governments, as subnational level of governance between state and local political and administrative scales, are considered a promising scale to "facilitate boundary work and create significant leverage through regional coordination and two-way mediation between local knowledge and expert adaptation knowledge (including the mediation between science and policy)" (Granberg et al., 2019, p. 2). Being often responsible for infrastructure and populations across vast and often vulnerable geographic areas and having policy authority in several areas having an impact on economic development, regions are considered suitable for strategic planning for local-scale climate resilience and adaptation (OECD, 2020). Moreover, it has been suggested that regional level of governing can mobilise larger pool of resources than local government, while carrying out decision making closer to stakeholders than the national level would (Gallaraga et al., 2011). According to the OECD (2020, p. 3), regions "have gained much traction in facilitating vertical coordination among national and local levels, as well as horizontal cooperation across local authorities within their territories (e.g., subnational climate action plans or policies to promote urban-rural linkages)".

This is recognised also by the EU Mission on Adaptation to Climate Change's focus on the regional scale. In fact, the Mission emphasises the importance of regions as key agents of change, to design pathways of transformation addressing regional and local needs in the face of increasing challenges, including climate change. Its objective is to accompany by 2030 at least 150 European regions and communities towards climate resilience.

However, there appears to be a lack of knowledge on what climate adaptation and resilience really mean at regional level, and therefore a lack of guidance for climate resilience-building that is context- and scale-specific.

In fact, policy direction from higher levels of government seldom distinguishes between the role of municipalities (i.e., cities) and regional governments (a type of local or sub-national government that operates just above municipalities) in climate action (Birchall et al., 2023). But what a region is can mean many different things depending on the country. Regional government structure can vary drastically in terms of jurisdictions and

authoritative powers and research shows how governance structures have an impact on the local capacity for resilience (Birchall et al., 2023). For example, according to Granberg et al. (2019), the role of regional governments depends on the strength of the municipalities on its territory as well.

In the development of the work presented in this deliverable, the diversity of regional administrative structures among the project demonstrations and partners was acknowledged. This led to approaching the "region" as an administrative level between "national" and "local". In different countries and contexts, this may pertain to autonomous status, regions, coalition of municipalities, metropolitan areas etc.

When it comes to R4C partner regions, some of their differences are summarized in Table 2 below, which was developed based on Table 1 from R4C's deliverable D6.1 and Table 2.1 from R4C's deliverable D2.1. One element of interested pointed out in D2.1, for example, is that The Nordic Archipelago, one of the R4C partner regions, covers a large cross-border region from Östergötland and Stockholm in Sweden to the Åland Islands and the Finnish south coast, including Helsinki-Uusimaa, which is a case region for itself in R4C.

Table 3 - Overview of R4C Partner regions (adapted from R4C D2.1 and D6.1)

R4C Region	**Geographical definition**	**Administrative units**[1]		
		NUTS 2	NUTS 3	LAU 1
Basque Country (ES)	Basque Country	●		
South Aquitaine (FR)	Communauté d'agglomération du Pays Basque (158 communes)			●
Tuscany (IT)	Tuscany Region			●
Azores (PT)	Azores islands		●	
Køge Bay (DK)	11 municipalities			●
Burgas (BG)	Burgas municipality			●
Helsinki-Uusimaa (FIN)	Uusimaa		●	
Parnumaa (EE)	Pärnu County (7 municipalities)			●
Sitia, Crete (EL)	Sitia municipality, Lasithi prefectural unit			●
Castilla y León (ES)	Autonomous community Castilla y León	●		

[1] The NUTS classification subdivides the economic territory of the Member States, as defined in Decision 91/450/EEC, into territorial units. The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU and the UK. LAU (Local Administrative Units) comprise the municipalities and communes of the EU (in Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS) – (the information from this footnote is taken directly from R4C D6.1)

The Nordic Archipelago(AX/SUE/FIN)	Large cross-border region	●	
Troodos (CY)	Several rural municipalities		●

Legend

●	Location – geographical coverage of the Innovation Actions
	Administrative authorities (regional/local authorities) are part of the Consortium

3.1.2. Review of Smart Mature Resilience's Resilience Maturity Model for Cities

For the development of the RRMM, the Resilience Maturity Model for cities developed as part of H2020 project Smart Mature Resilience (SMR) (GA no. 653569) was studied as reference. In fact, as per Grant Agreement, the RRMM was meant to be developed adapting SMR's model.

The Smart Mature Resilience Maturity Modelis a model developed explicitly for the city level. The model is based on a conceptualization of resilience along four dimensions, with a number of sub-dimensions, assessed based on five levels of maturity: *Starting, Moderate, Advanced, Robust, VerTebrate*.[2]

Table 4 - SMR Resilience Maturity Model for Cities

Dimensions	Sub-dimensions
Leadership & Governance	Municipality, cross-sectorial and multi-governance collaboration
	Legislation development and refinement
	Learning culture (learning and dissemination)
	Resilience action plan development
Infrastructure and resources	Reliability of City infrastructures and their interdependences
	Resources to build up resilience and to response
Preparedness	Diagnosis and Assessment
	Education and Training
Cooperation	Development of partnerships with city stakeholders
	Involvement in resilience networks of cities

[2] For more details and detailed explanations of the maturity levels, please refer to the Smart Mature Resilience website (https://smr-project.eu/home/) and the project deliverable D3.1 "Revised Resilience Maturity Model".

An evaluation of the SMR Resilience Maturity Model brought to a series of conclusions:

- *The model cannot be directly applied to the regional scale, due to significant differences between municipalities and regions. This highlighted the need to consider regional differences in terms of administrative structures and boundaries, legal competences etc. in the development of the RRMM.*
- *The model does not make explicit reference to justice dimensions, which are a pillar of R4C and should be included in the RRMM. Citizen participation is also not adequately addressed.*
- *The indicators used in the model are not specific enough to provide a guideline for regions to improve their maturity level. More specific, policy-linked indicators shall be included in the RRMM.*

These considerations brought to the decision of distancing the RRMM from the SMR model and developing a separate approach that more explicitly deals with the regional scale.

Another maturity model that was analysed is the **Maturity Model for Smart Sustainable Communities** (MMSSC), which applies the ISO 37153 methodology. In the MMSSC, Maturity is evaluated across four dimensions, each comprising sub-dimensions. The first three dimensions, namely Strategy Management, Citizen-centric Service Management, and Physical and Digital Resource Management, encompass 26 'smart enablers' organised within these three domains. These domains focus on governance, planning, decision-making at a city-wide level, enhancing the delivery of city services, and optimizing the management of physical, technological, and information resources to facilitate efficient and cost-effective city-wide transformations. The fourth dimension assesses city's maturity based on its accomplishment of six purposes outlined in ISO 37101, emphasizing well-being, attractiveness, environmental preservation and improvement, social cohesion, responsible resource use, and resilience. It is important to notice that the focus of the MMSSC on the urban level, as is the case for the SMR model, does not allow direct transfer to the regional scale. However, the focus on governance, planning and decision-making as fundamental aspects for the delivery of services and transformations was considered in the development of the RRMM, as well as a more pronounced focus on citizen engagement, compatible with the R4C commitment to a socially just transition to climate resilience (see RRMM Dimension 4: “Participatory governance and stakeholder engagement”).

3.1.3. Review of existing frameworks to assess regional climate resilience

Several publications and frameworks for the assessment of climate resilience were analysed to inform the development of the RRMM (Bahadur et al., 2015; Béné et al., 2012; Béné et al., 2015; IPCC, 2022; Manyena et al., 2019; ODI, 2016; Vaughan, 2018; Watkiss & Cimato, 2020; Ziervogel et al., 2016). An important finding of the literature review was the identification of a shortage of frameworks assessing climate resilience (maturity) at an explicitly regional scale. Most publications and frameworks focused in fact on either a city or community scale.

Some authors refer to resilience as a means to an end, the end being an improvement in wellbeing (Béné er al., 2015). Based on that, resilience is often conceptualized as a property, rather than as an outcome to be measured (Béné et al. 2012; 2015). According to much of the reviewed literature, the resilience “property” combines different dimensions, or resilience capacities (Bahadur et al., 2015; Béné et al. 2012; 2015; Manyena et al., 2019; ODI, 2016; Vaughan, 2018). In the reviewed literature, resilience capacities were defined and categorized in different ways.

Below is a concise summary of the climate resilience capacities most often found in the reviewed literature and their common definitions (based on and adapted from a review of Bahadur et al., 2015; Béné et al., 2012; Béné et al., 2015; IPCC, 2022; Manyena et al., 2019; ODI, 2016; Vaughan, 2018; Watkiss & Cimato, 2020; Ziervogel et al., 2016). However, it must be noted that this is only one of the possible definitions. For example, Manyena et al. (2019) include "preventive and mitigation capacity" as a fifth capacity. Moreover, the definition of transformative capacity is much discussed in the literature (Vaughan, 2018; Watkiss & Cimato, 2020; Ziervogel et al., 2016).

- *Anticipatory capacity: capacity to anticipate and prepare for disturbances through preparedness and planning.*
- *Absorptive capacity: capacity to absorb and cope with known impacts of climate variability - maintaining or rapidly returning to desired functions in the face of a disturbance.*
- *Adaptive capacity: capacity to adapt to changes, including ability to take deliberate and planned decisions to achieve a desired state even when conditions have changed or are about to change*
- *Transformative capacity: capacity to change the fundamental attributes of a system in response to climate and its effects*

Several caveats were identified in the use of this capacity approach to structure the RRMM: above all, the fact that the capacities are hardly mutually exclusive and not enough intuitive for the RRMM, meant to be a user-friendly and easy-to-use self-assessment tool. Therefore, the climate resilience capacities were used as theoretical heuristic to guide the exploration and selection of climate resilience-building dimensions and indicators but were not included explicitly in the model. The exploration of resilience capacities as the theoretical backbone for assessing resilience maturity was a joint endeavor part of the collaboration with the P2R project: this is reflected in the fact that resilience capacities are used as theoretical framework in P2R's work as well.

3.2. The RRMM approach within R4C

3.2.1. Understanding Regional Climate Resilience Maturity

R4C's definition of climate resilience has been further specified in order to guide the development of the RRMM, referring to the ability of a region (and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales):

- *To anticipate and prepare for disturbances and impacts of climate phenomena (e.g., through availability and use of climate information, deployment of emergency response mechanisms…)*
- *To absorb, respond and cope with disturbances, maintaining or rapidly returning to desired functions in the face of a disturbance (e.g., causing minimal damage to social welfare, the economy and the environment)*
- *To adapt to change (e.g., devising flexible and adaptive institutions)*
- *To quickly transform systems that limit current or future adaptive capacity (e.g., engaging in tackling the root causes of vulnerability)*

(adapted from Foster, 2007; Manyena et al., 2019; Meerow et al., 2016)

The Regional Climate Resilience Maturity Model (RRMM) is based on the recognition that a set of regional functions, processes and characteristics can be developed to better equip a region to face evolving and multiple

(climate) risks in the short- and long-term, as articulated above. These characteristics can be strengthened through targeted policy and action. Therefore, the present RRMM and assessment framework aims at evaluating such regional characteristics that contribute to climate resilience-building regardless of the specific sector or hazard. Outcome-oriented assessments will then be conducted as part of R4C through other WPs and Tasks, for example T3.1 vulnerability and risk assessment. A combination of these assessments will provide the basis for the elaboration of more comprehensive policy recommendation, as previously outlined in Chapter 1.

As illustrated in the introduction to this document, R4C aims at developing a holistic framework of modular, interoperable innovations including tools and methodologies, to support regional climate resilience-building and the development of evidence-based climate resilience plans and adaptation pathways. This set of tools constitutes what could be viewed as a "R4C-approach" to support a socially just transition to climate resilience in European regions, which will be demonstrated across the project in the partner regions. Based on this understanding, the tools, innovations, activities, methodologies developed within the different work packages can potentially contribute to regional climate resilience maturity. Therefore, R4C partner regions are expected to increase their resilience maturity level through their engagement in the project activities, including the implementation of regional innovation actions (WP5). This idea informed the decision to pursue a close alignment of the RRMM with other R4C tools and frameworks, especially considering the fact that the RRMM, as per Grant Agreement, is meant to provide a common understanding of the climate resilience building process, embedding climate and societal transformation within a broader resilience framework.

3.3. The RRMM within R4C: interlinkages with other tasks and work packages

The RRMM was developed thanks to the contribution of several other R4C Tasks, to ensure conceptual alignment and effective integration of the tools and frameworks developed within the project, towards the development of a holistic R4C approach to support regions in their just transition to climate resilience.

Figure 1 below offers a synthesis of some key interlinkages of the RRMM and related CRML assessments with other project tasks and work packages.

Some of the main contributions and interlinkages take place within WP4. For example, T4.2 Governance framework was aligned with the RRMM, also with the intention of aligning T4.2 baseline assessments of regional governance structures and processes with CRML assessments conducted within T4.3. This will allow gathering information about regional governance characteristics, needed for the conduction of CRML assessments in a region-tailored way. Furthermore, CRML assessments will contribute to the development of policy recommendations within T4.4. In fact, evaluation of the changes in regional CRMLs will be combined with analysis of barriers and opportunities in each region to develop recommendations regarding future policy needs to advance climate resilience maturity. These recommendations will serve as strategic input for the collaborative exploration of (macro-)regional Smart Specialisation Strategies for Sustainable and Inclusive Growth (S4+) in T4.5, in alignment with Just Transition Roadmaps (T2.4) and Regional Innovation Roadmaps (T6.1), developed based on the Common Innovation Framework (D6.1).

Some key interlinkages were identified and pursued with WP2, as well. T2.1 baseline assessments of social and economic vulnerabilities in partner regions were considered in the development of RRMM and its policy-linked

indicators. T2.2 Just Transition Framework was used as reference for the embeddedness of just transition elements in the RRMM. Moreover, the CRML assessments can be used in the scope and context building of the just transition roadmap process and serve as a baseline: therefore, alignment between T2.4 Just Transition Roadmaps and T4.3 CRML assessments will be further explored. For example, successful implementation of the actions in the Just Transition Roadmaps can improve some of the indicator values in the CRML assessments.

Through the inclusion of one dimension specific on Innovation, we aimed at aligning the model with the Common Innovation Framework (CIF) developed by T6.1, acknowledging the important role played by innovations for transformative change. In this way, the CRML assessments can contribute to assessing key aspects for regional innovation, as was foreseen in D6.1.

On the interlinkages with WP3, the T3.1 Vulnerability and Risk Assessment Framework is being developed in parallel to RRMM and CRML assessments. Alignment has been sought from the early phases of the project, as explained in the Sub-chapter 4.3.7 on the RRMM Dimension 7 “Vulnerability and Risk Assessment”. Potential feedback loops and other interlinkages between the assessments need to be further explored as the project progresses.

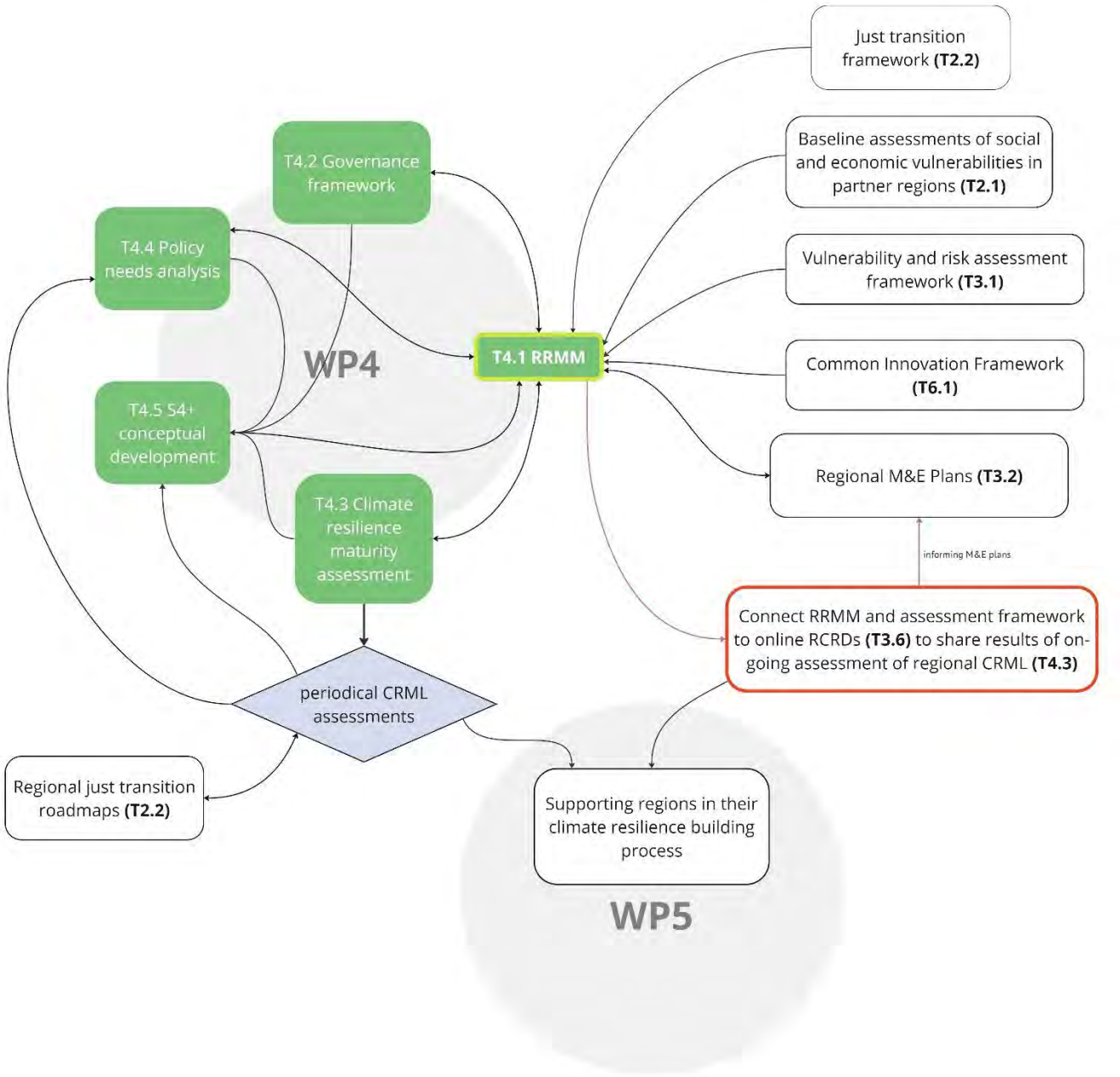
T3.2 aims at developing tailored Monitoring and Evaluation (M&E) plans for each region, in order to monitor the innovations carried out in demonstration regions (WP5). Alignment between the indicators used in the T3.2 M&E plans (still under development) and the policy-linked indicators constituting the RRMM was sought. In fact, the regional partners’ innovation actions developed and implemented within R4C will demonstrate scalable solutions that aim to be replicated across the entire region, contributing to increased regional climate resilience. Together with M&E, periodic CRML assessments of regional CRMLs will contribute to the evaluation of the impact of innovation actions implemented in each partner region as well as the development of replication and scaling strategies for exploitation.

In general, the ultimate **purpose** of conducting periodic CRML assessments based on the RRMM is to **support partner regions in their climate resilience-building efforts**.

In fact, the execution of the assessments shall support the regions to:

- *Gain a better understanding of the resilience-building process (tool for reflection);*
- *Identify their level of climate resilience maturity and potential gaps;*
- *Inform the prioritization of suitable policies to advance climate resilience. The assessment results, in combination with other tools and assessments conducted within R4C (including T2.1 Socio-economic vulnerabilities analysis, T3.1 Vulnerability and Risk Assessments, T3.2 Monitoring and Evaluation plans, T4.2 Governance assessments, T4.4 Policy needs analysis) will support regions in the identification and prioritisation of policy implementation, including the justification of expenditures on specific measures.*

Figure 2 – Simplified diagram of interlinkages with other tasks and work packages



3.4. Approach to embed other R4C tools and frameworks

3.4.1. Embedding justice and equity principles in the model (T2.1-T2.2-T2.4)

Author: Johannes Klein (DEMOS)

Currently the impacts and burdens of climate change are unevenly distributed. This is caused by the differential vulnerabilities and exposure across society to climate change and climate hazards. Therefore, climate resilience has to include elements of recognitional, procedural, distributional and restorative justice. The journey to build climate resilience can entail fundamental changes to the ways how we live, work, and govern our society. “All societal groups should have the possibility to participate actively and shape this transformative process. Also, the benefits, costs, rights, and responsibilities in this process should be distributed in a fair way, and nobody should be more vulnerable or marginalized because of the transition to climate resilience." (R4C Deliverable 2.2 Just Transition Framework)

Elements of procedural justice are well recognized in the *Participatory governance and stakeholder engagement dimension* of the RRMM. Recognitional justice has to be reflected in the skills of people working with climate resilience, because they have to be able to recognize and acknowledge the specific needs of those most vulnerable and marginalized groups that are often overlooked. The basis for recognitional and procedural justice can be also prepared in *Regional Governance and Institutional capacity* and *Planning, regulatory and policy instruments* enabling transparency in the process and meaningful participation. Elements of distributional and restorative justice become mostly visible in the implementation of climate resilience building activities ensuring a fair distribution of burdens, costs and benefits, right and responsibilities and by acknowledging and compensating for already incurred or unavoidable harm.

The baseline assessment in the RRMM can inform the scoping and context building for a just transition to climate resilience because it can provide insights on potential weak spots in climate resilience and specific development needs. In addition, RRMM can support building a vision for a just transition to climate resilience when defining target values for the indicators depicting and ideal situation for regional climate resilience. Furthermore, some of the RRMM indicators can also be used to monitor the successful implementation of actions promoting the just transition to climate resilience, e.g., when participatory processes are established or vision and goals of just climate resilience are mainstreamed into regional sectoral plans or strategies.

Example of RRMM indicators that can contribute to monitor Just Transition actions implementation:
1.1 – *Political support for a just transition to climate resilience*
2.6 – *Alignment of existing policy instruments with regional ambitions for a socially just transition to climate resilience*
4.4 – *Identification of stakeholders most affected by climate change*
4.6 – *Participatory governance to enhance coordination and agenda-setting.*

3.4.2. Embedding Innovation in the model (T6.1)

Authors: Sónia Bento, Joana Pinto, Susana Loureiro (SPI)

Under the scope of the innovation management (T6.1), the Common Innovation Framework (CIF) guides regions in their innovative processes, particularly in the R4C innovation packages development, but also in similar missions to encourage and disseminate a clear vision, set a direction, and stimulate innovative actions. Outlined in detail in D6.1, this model considers monitoring an essential part of the innovation process as it helps track progress and ensures that activities are on the correct path to achieve the established goals. This is the baseline model to develop the Innovation Roadmaps (D6.2) transposing the CIF into each regional context to achieve specific climate resilience innovation goals ensuring post-project sustainability and alignment with SDG.

Innovation indicators can play a central role in the design and implementation of public policies including climate change mitigation/adaptation, and most importantly, in assessing them. As a regional-based innovation process, R4C innovation assessment must not only focus on the process (assessed through WP3/WP5) but also the impact of the project in transforming the context (assessed through WP4/T4.1 in RRMM). These two dimensions - process and context monitoring - stand as core pillars, providing essential insights to inform decision-making processes.

According to the CIF, impact assessment must cover the 5 systems among Quintuple Helix, for full alignment to sustainable development - Political system, Economic system, Education system, Media-based and culture-based public and Natural environment (Carayannis et al., 2012). The proposed CIF developed under T6.1 was transposed into the RRMM **Dimension 8 "Innovation Potential Assessment"** (based on the indicators from the European innovation scoreboard), nevertheless this is only part of the innovation assessment as, conceptually, innovation is connected to all dimensions covered by the RRMM, therefore, the regional innovation performance cannot be assessed through this dimension only. Also, as a holistic model, CIF is intrinsically connected with the UN SDGs by implementing innovation indicators regarding impact assessment to reconcile local needs with global challenges, address societal challenges, and build knowledge streams at the global level, within exploitation activities.

Following European Commission guidelines in this regard (EC, Research and innovation strategy 2020-2024), the approach "Innovation Potential Assessment" is based on the collection of data that may assess the regional innovation performance and compare it with the innovation in climate-related topics, to **acknowledge how the regional ecosystems enable innovation towards climate resilience**.

3.4.3. Embedding the regional adaptation governance framework (T4.2)

Author: Alexandra Malmström, Sirkku Juhola (UH)

As introduced in the previous chapters, regions can vary significantly in terms of competences, levels of authority and scope of action for climate resilience-building. In order to assess regional climate resilience maturity, it is deemed important to better understand the specific context of the region in terms of governance characteristics.

T4.2 within R4C aims at developing a general governance framework for just, evidence-based regional climate resilience transitions. Based on the baseline assessment of regional governance structures and processes, T4.2 will deliver a series of recommendations for R4C partner regions in support of collaboration on climate-related issues (D4.3 Governance Recommendations).

The RRMM and related assessment approach has been aligned with T4.2 in various ways. A common definition of regional governance has been adopted. A codebook for the assessment of the regional governance context is under development within T4.2, with the support of other WP4 partners and tasks (namely T4.1, T4.3, T4.4, T4.5).

This codebook is based on the regional adaptation governance framework developed within T4.2 (see below) and it will be used to collect information regarding a series of regional governance characteristics, aiming at developing a detailed governance context "profile" for each R4C region. This will build on work already done at proposal phase and as part of other R4C tasks (namely T6.1 and T2.1).

Assessing the governance context of each region will provide background information necessary for the CRML assessments, as further explained in Sub-Chapter 4.2.1. It will also provide information that will be used for the baseline assessment of regional governance structures and processes that will be conducted as part of T4.2.

This close alignment among WP4 tasks around a common approach to assessing regional governance rests upon the assumption, based on current literature, that different regional governance characteristics have an influence on the region's capacity for climate resilience-building (See Subchapter 3.1 and 3.2). Therefore, it was deemed important that CRML assessments are as region-specific as possible, shedding light on the regions' competences and scope of action for climate resilience-building.

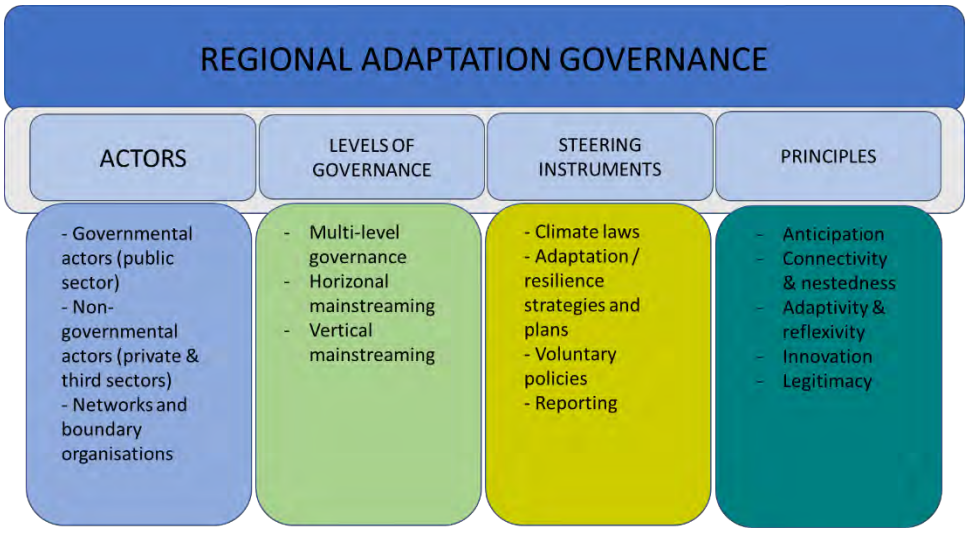
3.4.3.1. T4.2 regional adaptation governance framework

The purpose of the regional adaptation governance framework is to provide an explanation of the main elements and their interaction in the regional governance of adaptation. Drawing on the scientific literature on adaptation and regional governance, T4.2 builds a framework of adaptation governance with a regional level as an entry point, while acknowledging that adaptation governance by nature is multi-level and muti-actor.

T4.2 builds on the definition of governance as societal decision-making, which takes place across the local, to the international levels. More specifically, governance is considered to mean a set of institutions and actors that are drawn from but also beyond government with a blurring of responsibilities for tackling the climate issue, emerging in networks with varying degrees of power and steering instruments (Stoker, 1998). To further explore the governance of climate resilience at the regional level, T4.2 proposes a regional adaptation governance framework that builds on four core categories:

- *Actors in regional adaptation governance*
- *Levels of governance*
- *Steering instruments*
- *Principles of effective governance*

Figure 3 - Elements and attributes of regional adaptation governance (Figure developed by UH)



Actors

Adaptation governance is multi-actor (deWulf et al., 2015) and can be conceptualised as a polycentric network with many nodes of different types of societal actors. Polycentricity refers to the notion that governance of commons takes place in multiple centers of decision-making, each of which has some degree of autonomy (Ostrom, 2010).

For adaptation, this means that a number of actors should be involved in governance, including governmental and non-governmental. Governmental actors at different levels refer to the public sector and include relevant ministries, regional and local authorities in different sectors, which have the legal mandate to make decisions. Sometimes an authority responsible for leading and coordinating adaptation is created or the function is integrated into the mandates of existing formal institutions. Non-governmental actors include private and third sectors, the former being businesses and enterprises and the latter non-governmental organisations or non-profit interest groups. Private sector plays an important role in adaptation governance, being the actor mainly in the implementation phase (Klein et al., 2018; Petzold et al., 2023). This is especially significant in cases where the role of the public sector is limited in allocating responsibilities and is not able to create legal frameworks for operations and provide information for the private sector to act upon.

Additionally, boundary organisations and networks are actors in adaptation governance. Boundary organisations, while varying in institutional design, are organisations in the science-policy interface, the main function of which is to facilitate, manage and promote science and policy interactions (Gustafsson & Lindskog, 2018). Networks refer to organisations that bring together local governments and other actors to support the development of climate, both mitigation and adaptation, action at the municipal or regional level and can include networks of municipalities or regions, climate networks, which may advance the implementation of adaptation (e.g., ICLEI, C40 Cities Climate Leadership Group, the Global Covenant of Mayors, among others) (Heikkinen et al., 2020).

Levels of governance

Adaptation governance is multi-level (DeWulf et al., 2015; Hanssen et al., 2013). Even though this framework takes a regional perspective, it is important to place regional governance in the multi-level context, i.e., including also

national and local levels, as there are implications of mandates and capacities that are located at levels other than regional, and there is a need to align regional adaptation governance with national and local planning and financial processes (Termeer et al. 2011).

The recognition of adaptation as a multi-level effort includes the notion that adaptation needs to be horizontally and vertically mainstreamed, i.e., aligned and integrated into processes and arrangements across sectors (horizontal) and across levels (vertical) (van den Ende et al., 2022).

Steering instruments

Steering instruments here are considered to be both the traditional steering instruments, such as legal frameworks and policy instruments, but also the non-hierarchical soft modes of steering which refer to instruments such as collaborative working, co-operation and voluntary action (Treib et al., 2007). These instruments are deployed depending on the mode of governance, i.e., is the focus on state-centered system as opposed to the market mode of governance where the focus is on as little intervention from the state as possible. There are several possible instruments for adaptation, including economic and financial instruments (taxes, incentives, subsidies); various market-based instruments (payments for ecosystem services, commodity/resource markets); standards, licenses and permits; and legal frameworks (Bräuninger et al. 2011).

Here, the focus is specifically on the legal frameworks. Legal frameworks refer to the laws, strategies, plans and other policies that set the framework for governance processes at different levels. These processes include negotiation, defining goals, coordinating responsibilities, allocating resources, establishing structures and processes for climate resilience and adaptation planning, implementation, coordination, monitoring and revision.

Principles

By principles, reference is made to the features of the governance system itself, which are considered to favour and support climate resilience. Based on existing literature, five features are identified: anticipation, connectedness, reflexivity, innovation and legitimacy.

- *Anticipation*

Anticipatory governance provides principles for governing in high uncertainty and complexity. Anticipation refers to foresight in governance, i.e., governing with long-term horizons using not only the most probable scenario, but rather a range of plausible scenarios (Quay, 2010). Anticipatory governance presupposes regular evaluation and monitoring to allow for timely adjustments.

- *Connectivity and nestedness*

Connectivity refers to the strong link among actors, frameworks, policies and actions horizontally across sectors and vertically across different levels of governance (Termeer et al., 2011). Bridging and boundary organisations contribute to connectivity across levels and sectors. Connectivity is critical to avoid conflicts in agendas, responsibilities, resources and mandates (Bennet & Satterfield, 2018). Nestedness is closely linked to the connectivity and means that the tasks are assigned to the appropriate level, decision-making responsibility and authority are conferred to the lowest possible level, and self-organisation is encouraged (Bennet & Satterfield, 2018).

- *Reflexivity & adaptivity*

Reflexivity and adaptivity are closely linked with anticipation and provide ground for monitoring, evaluation, documentation, learning and implementation of knowledge to policy adjustment. In addition to the implementation of acquired knowledge on the progress in adaptation implementation, adaptivity refers to the monitoring and adjustment of changes in social-ecological systems and adjustment of policies accordingly. It is important that processes allowing for reflection, deliberation and adjustment are institutionalized (Bennett & Satterfield 2018).

- *Innovation*

Governance support for innovations and experimentation is important in regional adaptation, and monitoring of success and failures allows for knowledge-sharing and development (Bennett & Satterfield 2018). Support for innovation and institutional entrepreneurship is especially important in "institutional void", i.e., in the absence of strong regulatory frameworks (van den Ende et al. 2022).

- *Legitimacy*

Legitimacy refers to the shared vision that guides actors, actions and policies across scales. Legitimacy is an important enabler in adaptation as it ensures support top-down from the institutions and bottom-up from the constituents (Bennett & Satterfield 2018).

3.4.4. Alignment with Responsible Research and Innovation

In adherence to the ethical standards integral to Regions4Climate, the actions undertaken under the WP4 acknowledge and incorporate the project's general ethical principles, norms and Responsible Research and Innovation (RRI) approach. In the following table the specific actions undertaken to ensure full compliance with RRI are outlined.

Table 5 - Overview of actions undertaken by WP4 to comply with RRI

Ethics Categories	WP4 Compliance
RRI Aspects in the RRMM Framework	RRI aspects have been included in the building of the RRMM framework. An attempt was made to include the project's ethical principles and the Just Transition framework principles (T2.2) as cross-cutting elements, so that the RRMM indicators can support the assessment of the ethics of climate resilience-building actions and processes developed by Regions, as part of their maturity. For example, the indicators are explicit about the importance of considering potential unexpected consequences of actions (e.g., maladaptation, trade-offs).
Management of expectations	In crafting D4.1, a transparent and realistic tone has been maintained, ensuring the avoidance of unrealistic expectations. Therefore, the communication has focused on the achievable scope and outcomes of the Regional Resilience Maturity Model (RRMM) and Climate Resilience Maturity Level (CRML) assessments. This included clearly delineating the objectives and anticipated outcomes within D4.1 (and T4.1), elucidating in a simple and understandable way the significance of employing the model for regional assessments and why regions should engage with the model and the specific advantages it offers. This approach is meant to foster a clear understanding of the model's utility, guiding regions in making informed decisions about its adoption.

Research ethics and integrity	**Impartiality:** D4.1 provides explanation of the reasons behind the decisions that have informed the development of the RRMM (see Chapter on Methodology) **Reliability:** The RRMM was designed in a way that considers the different regional contexts and characteristics of the R4C regions, to ensure wider representation and to capture the nuances of regional climate resilience-building. **Integrity:** Existing and validated frameworks served as resources for the development of the RRMM model and its indicators. **Responsibility:** Using an approach that strives for explicit acknowledgement about regional differences, the aim is to comply with responsibility commitments, recognising different values and principles between regional partners and their contexts. As designers of the methodology, full responsibility for the presented work will be assumed. **Honesty:** All references used can be found in this document and transparent communication with partners and regions was ensured throughout the process, ensuring transparent review of the work. The limitations of the approach are openly acknowledged (see Sub-chapter 2.3). **Respect**. Respect has been a fundamental guiding principle in all meetings, actions, and communication during the project. Respecting the research community, partners, and various stakeholders included in this work, other RRI principles were and will be taken seriously and that work is designed and delivered according to those. All contributions will be acknowledged in a proper way when disseminating this work.
Inclusive Stakeholder Engagement: Co-Creating Processes for Comprehensive Perspectives	In T4.1, the focus was on transparently detailing the involvement of all regions in shaping the Regional Resilience Maturity Model (RRMM). Initial engagement took place with online workshops with project partners and the organisation of two sessions with some of the R4C regional partners at EURESFO23. Our commitment to inclusivity will now be strengthened thanks to the launch of a phase of closer consultation with regional partners, starting with a workshop initiated by WP5 on December 12th, 2023. This collaborative spirit extends beyond December, with ongoing engagement in the weeks and months ahead. Our dedication to involving all regions is not only reflected in T4.1 but also permeates the formulation of the RRMM and its indicators, with the intention to design a tool and an assessment process that truly reflect regional needs and contexts. Diversity of the stakeholders will be taken into account in the process to ensure that all relevant aspects are considered.

4. The Regional Resilience Maturity Model and Assessment Framework

This chapter starts by providing an overview of the structure of the Regional Resilience Maturity Model, delineating the method through which a region can assess its maturity via 57 indicators distributed across 8 dimensions. A second part focuses on how the governance assessment will be undertaken and which questions will delve into the diverse contexts of each Region. Following, the scoring system of Regional Resilience Maturity Model's indicators is presented, alongside an explanation of how the results for each of the 8 dimensions will be showcased. Consequently, a part is dedicated to the approach on how the assessment of the RRMM will be conducted. A concluding section describes in detail all the 8 dimensions and their related indicators, including explanations for each indicator and its related scoring system.

4.1. Overview of RRMM structure and indicators

The regional characteristics constituting the RRMM are organised in 8 dimensions:

1. *Regional governance and institutional capacity*
2. *Plans and policy instruments*
3. *Human resources and technical skills*
4. *Participatory governance and stakeholder engagement*
5. *Public support, awareness and climate change communication*
6. *Financial capabilities*
7. *Vulnerability and risk assessment*
8. *Innovation potential assessment*

Each dimension is composed of a number of indicators. Each indicator is assessed based on a scoring system assigning a score from 0 to 4. The scoring system is further explained in Section 4.2.2.

Following the methodological approach illustrated in Chapter 2, including the literature review and the process of content creation with partners, a large set of indicators to measure different aspects of regional climate resilience-building was developed. The workshops and feedback sessions informed the selection of the most relevant indicators and their organisation in different dimensions, leading to the final 8 dimensions constituting the current version of the RRMM. The decisions underpinning the current version of the model were informed by several considerations, emerged in collaboration with project partners and external participants to the above-mentioned workshops and sessions.

The first was the need of designing a user-friendly self-assessment tool. This led to the selection of mostly qualitative indicators, to allow regional practitioners to be able to answer them within a reasonable effort in terms of time and data needed. Most indicators require the respondent to retrieve information from other regional departments or existing databases, fostering or strengthening coordination mechanisms internal to the regional administration or with key stakeholders.

The choice of dimensions and indicators that are not sector-specific or hazard-specific was motivated by the approach taken in understanding regional climate resilience maturity, as explained in Sections 3.1 and 3.2: the model aims at assessing the region's performance with regard to a set of functions, processes and characteristics that can be developed to better equip a region to face evolving and multiple (climate) risks in the short- and long-term and across sectors. These characteristics can be strengthened through targeted policy and action: therefore, indicators have been developed in a detailed way, in order to provide inspiration for policy development. A potential future improvement of the RRMM and its assessment approach could entail tailoring the indicators based on the specific climate hazards, risks and vulnerability of the region, in addition to its specific governance context.

Moreover, it was deemed appropriate to focus on mostly process- rather than impact-related indicators, to provide a tool for reflection for regions to better orient themselves in their own climate resilience-building process, and to take into account the fact that other R4C tasks are specifically in charge of developing impact assessments (T3.1 vulnerability and risk assessment; T3.2 monitoring and evaluation plans).

Ideally, the model will be complemented with additional resources including collection of best practices from other regions, in order to further support regions in policy development for climate resilience-building.

Table 6 - List of indicators of RRMM

	Dimensions			Indicators
1	**Regional Governance and Institutional capacity**	1	1.1	Political support for a just transition to climate resilience
		2	1.2	Regional governance structures for cross-sectoral coordination
		3	1.3	Governance structures for multi-level (vertical) coordination
		4	1.4	Governance structures for cross-border cooperation (across administrative boundaries)
		5	1.5	Engagement in networks
		6	1.6	Anticipatory governance
		7	1.7	Region's monitoring and evaluation system
2	**Plans and policy instruments**	8	2.1	Regional plan or strategy for climate resilience
		9	2.2	Integration of planning and regulatory framework for climate resilience
		10	2.3	Policy instruments supporting regional resilience-building
		11	2.4	Mainstreaming of climate resilience into other regional sectoral plans and strategies
		12	2.5	Regional plan or strategy for emergency response
		13	2.6	Alignment of existing policy instruments with regional ambitions for a socially just transition to climate resilience
		14	2.7	Assessment of region's progress towards relevant SDGs
		15	2.8	Identification of local/regional targets that align with macro-regional S3/S4+ strategies
3	**Human resources and technical skills**	16	3.1	Staff assigned to the planning and implementation of climate change resilience actions
		17	3.2	Flexibility in staff contracting and allocation

	18	3.3	Staff's competencies, knowledge and skills to understand and use climate change data and information
	19	3.4	Staff's competencies, knowledge and skills to design and conduct effective participatory and stakeholder engagement processes
	20	3.5	Staff's competencies, knowledge and skills to successfully implement the planned climate resilience and adaptation strategies and measures
	21	3.6	Staff's competencies, knowledge and skills to successfully engage in climate change mainstreaming
	22	3.7	Staff's capacity building
	23	3.8	Staff's competencies, knowledge and skills to make use of multiple financing opportunities
4 Participatory governance and stakeholder engagement	24	4.1	Identification of purpose and clear objectives for stakeholder engagement
	25	4.2	Identification of opportunities and challenges for stakeholder engagement
	26	4.3	Mapping of stakeholders
	27	4.4	Identification of stakeholders most affected by climate change
	28	4.5	Development of a stakeholder engagement plan
	29	4.6	Participatory governance to enhance coordination and agenda-setting
	30	4.7	Engagement with the private sector
	31	4.8	Engagement with citizens
	32	4.9	Engagement with organised civil society
	33	4.10	Engagement with academia and research community
5 Public support, awareness and climate change communication	34	5.1	Climate risk communication strategies
	35	5.2	Dissemination of scientific information and good adaptation practices
	36	5.3	Alignment of regional communication and marketing strategies with climate resilience priorities
	37	5.4	Analysis of public perception of climate change
	38	5.5	Analysis of public perception and acceptance of policies
6 Financial capabilities	39	6.1	Financial resources availability
	40	6.2	Budget allocation and distribution at local level
	41	6.3	Budget allocation for planning
	42	6.4	Budget allocation for implementation
	43	6.5	Incentives for private sector
7 Vulnerability and Risk Assessment	44	7.1	Ability to conduct risk and vulnerability assessments
	45	7.2	Risk assessments
	46	7.3	Integrated vulnerability and risk assessments
	47	7.4	Alignment of vulnerability and risk assessments with justice and equity principles
	48	7.5	Comprehensiveness of indicators

		49	7.6 Use of vulnerability and risk assessments' results
8	**Innovation Potential Assessment**	50	8.1 Framework conditions - Education & Lifelong learning
		51	8.2 Framework conditions - Research System
		52	8.3 Framework conditions - Digitalisation
		53	8.4 Public investments in innovation
		54	8.5 Innovation activities in SME
		55	8.6 Collaboration
		56	8.7 Economic impact of innovation
		57	8.8 Environmental sustainability

4.2. Approach for CRML assessments based on the RRMM

4.2.1. Governance Context Assessment

As introduced in Sub-Chapter 3.4.3, the assessments will be informed by the analysis of each region's governance context, in alignment with T4.2.

The assessment of regional governance context will be based on a codebook under development within T4.2, with the support of other WP4 partners (namely T4.1, T4.3, T4.4, T4.5).

Most of the information for this assessment is expected to be collected through desk research, also making use of information already collected through other R4C activities, including information provided by regional partners during the proposal phase, information collected through T6.1 and T2.1. This information will be complemented through a follow-up survey that will be circulated among regions in February-March 2024 (exact timeline to be defined by T4.2 partners).

The governance context assessment will cover the following aspects, that have been defined throughout the process of collaborative content creation that has taken place all along the first year of the project. Each category will be better defined in the aforementioned codebook developed by T4.2.

Table 7 - Overview of questions of governance context assessment

Category	Description
What kind of region are we talking about?	Questions aiming at better understanding the precise role of the regional level in the respective national territorial government system. Example: - *Is the region an administrative unit?* - *What is the region's degree of autonomy?*
What is the regional scope of action for resilience-building?	Questions aiming at better understanding the region's scope of action, both for planning and implementation of climate resilience-building actions. This includes understanding how the regional competences are embedded in a multi-level governance system. Example: - *Does the region have legislative competences to develop a CC adaptation or resilience strategy/plan/law?* - *Does the region have legislative competences over key sectors affected by climate change?* - *Does the region have ownership /management competences over key sectors affected by climate change? (competences to implement)* - *If the region does not have competences above, who has competences (what levels of governance)?*
What are the main existing planning and regulatory instruments relevant for climate resilience?	Questions aiming at mapping existing legal frameworks and policies relevant for climate resilience at multiple levels. Example: - *Is there a national framework for CC? Does it give mandate to regional level to deliver CC plan/law/strategy?* - *What regulatory and planning instruments relevant for climate resilience can the region adopt?* - *What regulatory and planning instruments relevant for climate resilience can the other levels of government adopt?* - *How are planning and regulatory instruments across different levels coordinated and interlinked?*
What are the main existing policy instruments relevant for climate resilience?	Questions aiming at mapping existing regional policy instruments (including beyond plans etc. assessed in the previous category) relevant for climate resilience. Policy instruments considered include (list adapted from Gram-Hanssen et al., 2023): - Policy frameworks/strategies/plans, - Systems in place for monitoring, reporting and evaluation (MRE), - Economic measures to incentivise adaptation efforts (insurance and risk transfer mechanisms, adaptation funding mechanisms, research and innovation programmes, taxes)
What are the regional priorities?	Questions aiming at better understanding the region's existing vision and directionality in terms of development priorities. Example: - *Who are the actors involved in the process of setting priorities?* - *Have the regional domains of competitive advantage and specialisation been identified? (e.g. through S3 strategies)* - *To what extend is climate change prioritised in regional development?*

4.2.2. Scoring system

Each indicator is assessed based on a scoring system assigning a score from 0 (lowest maturity level) to 4 (highest maturity level).

In the project's proposal phase, pre-assessments of the regions' Climate Resilience Maturity Levels (CRMLs) were conducted. As shown in Annex 1 these assessments considered 9 possible levels of maturity, applied to different sectors of climate resilience solutions. For the development of the RRMM, it was deemed appropriate to reduce to number of maturity levels, to make the self-assessment more intuitive for respondents. Furthermore, it was deemed that the generic description of what each maturity level entails, as provided in the pre-assessments, could not be applied to each RRMM indicator, as these are significantly more specific than the general "sectors" considered in the pre-assessments. Therefore, it was decided to specify 5 levels of maturity (scores from 0 to 4) for each indicator, in a way that is more precise, tailored to the indicator itself and linked to potential policy recommendations. This approach was inspired by the UNDRR Disaster Resilience Scorecards for Cities, which adopted a similar scoring on 5 levels, and by the Smart Mature Resilience Maturity Model for Cities, which also considers 5 levels of maturity.

Below the indicator "*Staff assigned to the planning and implementation of climate change resilience actions*" is provided as an example.

Table 8 - Indicator provided as an example to explain the scoring system

Indicator	Description	Scoring system
3.1 Staff assigned to the planning and implementation of climate change resilience actions	This indicator aims to assess whether sufficient staff is specifically assigned to the planning and implementation of climate change resilience measures and interventions within the regional administration.	4 - Sufficient staff is assigned, and functions, roles and responsibilities among staff are clear. 3 - Sufficient staff is assigned, but functions, roles and responsibilities among staff are unclear, impeding effectiveness of planning and implementation. 2 - Some staff is assigned to both planning and implementation of climate resilience actions, but it is deemed insufficient 1 - Some staff is assigned, but only to planning of climate resilience actions, and it is deemed insufficient 0 - No staff is assigned

When assessing this indicator, in addition to selecting one answer from 0 to 4, which will give a score for that indicator, the region will be asked to **provide additional information**:

- *If you are selected a score lower than 4, what barriers does your region encounter in achieving a higher score for this indicator?*
- *Should this indicator not correctly apply to your regional context (e.g. the region has no competence to act in this realm), please provide an explanation and a suggestion for how it could be better phrased to reflect the characteristics of your region.*

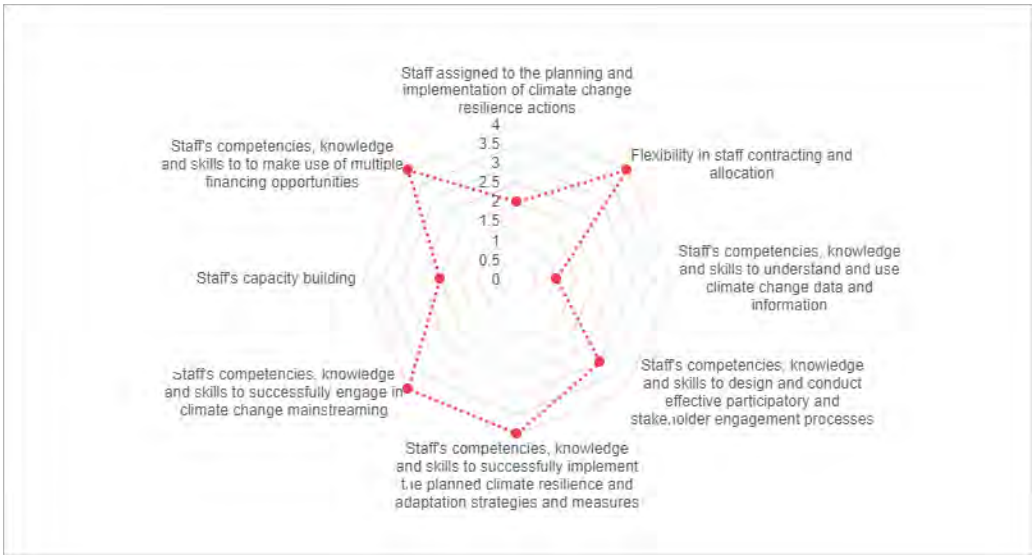
This additional information will allow us to gain a better understanding of the regional context that will be used to formulate more adequate policy recommendations and will form a basis for other tasks and work packages.

This is one of the 8 indicators forming Dimension 3 "*Human resources and technical skills*". Ideally, when each of the indicators of Dimension 3 are assessed (see Table 9), results for Dimension 3 can be visualised through a radar chart (see Figure 4).

Table 9 - Example of hypothetical scoring for each indicator of Dimension 3

Indicators of Dimension 3 "Human resources and technical skills"	**Result**
Staff assigned to the planning and implementation of climate change resilience actions	2
Staff's competencies, knowledge, and skills to understand and use climate change data and information	4
Staff's competencies, knowledge, and skills to design and conduct effective participatory and stakeholder engagement processes	1
Staff's competencies, knowledge, and skills to successfully implement the planned climate resilience and adaptation strategies and measures	3
Staff's competencies, knowledge, and skills to successfully engage in climate change mainstreaming	4
Staff's competencies, knowledge, and skills to make use of multiple financing opportunities	4
Staff's capacity building	2
Staff's competencies, knowledge, and skills to make use of multiple financing opportunities	4

Figure 4 - Example of CRML results for Dimension 3, visualized through a radar chart, based on Table 8



A CRML score will be hence provided for each of the 8 dimensions. The overall CRML score for the region will be a sum of the 8 dimensions' CRML scores.

The radar chart was chosen as proposed mode of visualisation to be embedded in the RCRDs as it offers an intuitive and easy-to-read picture of the maturity levels for each indicator and the potential areas of improvement, in order to inform prioritization of policy interventions from the part of the regions assessed.

4.2.3. Execution of the assessments

The assessment approach will be defined in detail by T4.3: the information included in this section will be subject to changes and should serve as a guideline.

The approach under development would entail a more intensive exercise for the first round of assessment, to be conducted over 4 months from January until April 2024. The first assessment round will require more effort than the subsequent rounds because it will require regional partners to become familiar with the model and approach before conducting the assessment. It will also include the collection of "governance context" information (see Sub-Chapter 4.2.1), in alignment with other R4C tasks (T4.2-T4.4-T4.5). The first assessment will also be used to gather feedback on the model from R4C regions.

4.3. The RRMM

4.3.1. Dimension 1: Regional governance and institutional capacity

This dimension aims to assess the level of maturity of the region in terms of governance and institutional capacity. The indicators are informed by the Governance Framework developed by T4.2, looking at four main elements of governance, as introduced in Sub-Chapter 3.4.3: 1) actors in regional adaptation governance; 2) levels of governance; 3) steering instruments; 4) principles of effective governance. Steering instruments are further addressed under Dimension 2 "Plans and policy instruments".

Table 10 - List of indicators of Dimension 1 - Regional governance and institutional capacity

	Indicator	Description	Scoring system	Source
1.1	**Political support for a just transition to climate resilience**	High-level political support for climate resilience is a prerequisite for successful implementation of climate resilience actions. High-level political support can be brought by top-down recommendations and legal requirements from supra-regional and supra-national levels (e.g., national strategies, EU Strategies). In particular, the new EU Adaptation Strategy aims at achieving climate resilience in a just and fair way. This indicator assessed the level of political support at regional level for a just transition to climate resilience. Just transition can be defined as "the active transformation of the ways how we live, work, and govern our society to make it more capable to cope with and adapt to a changing climate and extreme climate events. [...] All societal groups should have the possibility to participate actively and shape this transformative process. Also, the benefits, costs, rights, and responsibilities in this process should be distributed in a fair way, and nobody should be more vulnerable or marginalized because of the transition to climate resilience." (WP2)	4 – A high-level political commitment to a just transition to climate resilience is agreed by regional authorities and fully translated into both planning and implementation 3 – Political commitment to a just transition to climate resilience is shared among regional practitioners and authorities and addressed in at least one key policy instrument 2 – The commitment to a just transition to climate resilience is explicitly endorsed by some regional practitioners and internal discussions across departments are in place to understand how this can be translated into planning and implementation 1 – Some regional practitioners are familiar with the concept of just transition to climate resilience and recognize its values, but this has not been translated in any political commitment nor policy documents. 0 – Regional practitioners are not familiar with the concept of just transition to climate resilience	Content creation with project partners (WP2) Regional Adaptation Support Tool, 2023
1.2	**Regional governance structures for cross-sectoral coordination**	Climate change impacts need cross-sectoral coordination mechanisms to ensure effective implementation, with clear demarcation of roles/powers and corresponding accountability. This indicator assesses the maturity of regional governance structures enabling the coordination efforts needed for climate resilience-building and implementation.	4 - Coordination structures and processes are fully operational. Gaps and challenges are continuously monitored and addressed. Funding is allocated to establish and sustain the coordination structures and processes. 3- The coordinating body has authority and a clear mandate to enforce coordination efforts across sectors, for example thanks to its strategic	Content creation with project partners

		The assessment of this indicator should take into account the specific regional context. For example, the specific characteristics of the regional authority and administration under examination. Effective inter-departmental coordination can be achieved thanks to, for example: - tools to overcome siloes issues and strengthen collaborative modes of working within regional administration - definition of roles and responsibilities for coordination efforts across regional administration sectors - continuous integration of new competencies into departments tasked with implementation of climate actions	positioning within the regional administration. Roles of all actors involved in coordination efforts are clearly defined and accountability mechanisms are in place. 2 - (New) management and governance structures and processes are established to ensure flow of regular communication among regional departments and agencies and support coordination efforts. This includes the establishment of a designated authority/body/board responsible for coordinating plans and actions to address climate change resilience across sectors. 1 - Some coordination mechanisms exist, but definition of roles and responsibilities for coordination is insufficient and structures for accountability are lacking. 0 - There are no coordination mechanisms and no plans for them to be established.	
1.3	**Governance structures for multi-level (vertical) coordination**	Institutionalization of multi-level governance systems is crucial for successful climate resilience-building and implementation of climate resilience actions. Relevant levels of governance include sub-regional (e.g. municipalities, provinces), national, supra-national. This indicator aims to assess the maturity of governance structures supporting multi-level coordination. This includes the strategic orchestration of policy planning and implementation across tiers of government (e.g., alignment between municipal and regional level). Multi-level governance coordination should be based on transparent responsibility and accountability mechanisms. This includes the clear delineation of roles and responsibilities for coordination, regular meetings across levels, sharing of responsibilities for implementation. Mechanisms to ensure conformity with national and international standards include for example certification processes. Regional governments often have the ability to act as coordination bodies, with respect to lower tiers of government. Actions in this sense include the provision of financial and technological assistance (e.g., funding programs) for the implementation of climate change resilience measures at local level (e.g. sub-regional, municipal, provincial).	4 - The established multi-level coordination structures and processes are perceived as effective. 3 - The regional government has established structures and processes for multi-level coordination on key (climate-related) sectors, with clear delineation of roles and responsibilities. 2 - Policy issues/sectors/measures that require multi-level cooperation and integration are clearly identified and plans to address existing gaps are developed. 1 - Multi-level coordination occurs occasionally and informally, with no clear delineation of roles and responsibilities. Gaps in multi-level coordination are not clearly identified. 0 - No processes or structures have been put in place to ensure multi-level coordination	Content creation with project partners
1.4	**Governance structures for cross-border cooperation (across administrative boundaries)**	Climate change issues often transcend administrative boundaries and require cross-border cooperation in order to be addressed. For example, coordination between bordering regions could be necessary to manage public transport systems. Transboundary water management could require the establishment of a management authority at river basin level, involving administrations from different countries. This indicator aims to assess the maturity of governance structures supporting cross-border coordination. Governance structures and processes for cross-border cooperation include for example standardised processes and workflows to ensure communication and collaborative actions across administrative boundaries.	4 - Governance structures and processes for cross-border cooperation are in place and ensure collaborative actions across administrative boundaries. The transboundary nature of (climate-related) policy issues is recognised and adequately addressed in all policy instruments. 3 - Governance structures and processes for cross-border cooperation are being developed in order to involve key entities, stakeholders and organisations working at a scale relevant for cross-border issues. 2 - Cross-border cooperation occurs informally and/or on an ad-hoc basis. Policy issues/sectors/measures that require cooperation across administrative boundaries are clearly identified. 1 - Cross-border cooperation occurs informally and on ad-hoc basis. 0 - No processes or structures have been put in place to ensure a cross-border cooperation	Content creation with project partners
1.5	**Engagement in networks**	The region, participating proactively in regional, national and international networks, promotes initiatives, exchanges experiences and learns. Partnerships and alliances with regions facing similar (climate) risks provides opportunities for knowledge-sharing, joint planning, creation of partnerships for funding etc. This indicator assesses how the regional government	4 - Internal structures and processes within the regional government are established (for example creation of ad-hoc positions) to coordinate and manage the region's engagement in networks 3 - The region participates proactively in regional, national and international networks 2 - The region participated occasionally in networks	Content creation with project partners

		engage and coordinate with networks, in order to increase opportunities of exchange. Ideally, internal structures and processes within the regional government are established (for example creation of ad-hoc positions) to coordinate and manage the region's engagement in networks. This include coordinating the involvement of a variety of stakeholders (academia, private sector, civil society) to promote and make use of knowledge transfer and sharing through networks and related projects. The region could participate in global alliances, projects, initiatives that promote climate resilience-building and vulnerability reduction not only within its own territory but on a global scale, in line with global climate justice principles.	1 - The region showed interest in participating in networks 0 - The region doesn't engage in networks	
1.6	**Anticipatory governance**	Anticipation and flexibility go hand in hand in conditions of governing under complexity and deep uncertainty. Anticipation builds on the use of long-term horizons in decision-making, a range of possible and plausible scenarios, assessments of risks, opportunities and alternatives, and includes monitoring and evaluation of both risks and adaptation to them allowing for timely adjustments (Quay 2010; Bennet & Satterfield, 2018; Jurgilevich 2021)" From P2R: The inherently complex and uncertain nature of climate risks necessitates the ability of institutions to anticipate, adapt, and respond to varied climate eventualities, while still maintaining functionality persistence. Typically, this requires adaptive capacities manifest in conditions enabling institutional processes to be flexible, proactive, and with scope for continuous learning. They are also reflected in the ability of regional institutions to prepare and plan for multiple, future long-term, reactive, and future climate-related risks. In addition, regions require transformative capacities that go beyond repair and maintenance and refer to the ability of the region to change the fundamental attributes of the system. It is geared towards systemic strategies with an emphasis on phasing out unsustainable practices, behaviours, and path dependencies and maladaptation contributing to the current predicament. The fundamental tenets here are systemic approach/ systems thinking instead of single issues or sectors.	4 – Climate resilience strategy is long-term, considers several scenarios, includes obligation of monitoring and evaluation of both progress on adaptation as well as of outcomes of implementation 3 – Climate resilience / adaptation strategy or plan consider one most plausible scenario. Monitoring and evaluation mechanisms are in place and adjustments to adaptation are institutionalized. 2 – Climate resilience / adaptation strategy or plan consider one most plausible scenario. Monitoring and evaluation mechanisms are in place. Adjustments to the resilience & adaptation are not institutionalized. 1 – Climate resilience / adaptation strategy or plan are based on the most probable climate scenario. Learning, monitoring and evaluation mechanisms are not in place. 0 - Future climatic or socio-economic developments are not taken into account Climate resilience / adaptation are based on past climate impacts and are rather reactive than proactive in nature. Learning mechanisms are not established. Climate resilience / adaptation actions' implementation is not monitored, nor their outcomes are assessed in the planning phase.	Content creation with project partners
1.7	**Region's monitoring and evaluation system**	The region needs to have a monitoring and evaluation system in place, in order to track its progress in the achievement of its climate adaptation, resilience and broader sustainability targets. This indicator aims to assess the level of maturity of the region's monitoring and evaluation system (MRE). The levels are defined as follows: - Absence of MRE = No established monitoring and evaluation system in place to assess and track progress towards climate resilient policy targets. Characteristics: Lack of data collection mechanisms, no regular assessment of policy implementation, Absence of metrics or indicators. - Initial Development of MRE = Initial steps have been taken to develop a monitoring and evaluation system, but it is not fully functional or comprehensive. Characteristics: Limited data collection initiatives; basic metrics/indicators are identified; limited capacity for regular assessment. - Basic MRE = A basic monitoring and evaluation system is in place, allowing for some assessment of progress towards climate resilient policy targets. Characteristics: Regular data collection, but not exhaustive, basic metrics or indicators are measured/ assessed, limited capacity for in-depth analysis. - Intermediate MRE = MRE system is in place, providing a more comprehensive assessment of progress towards climate resilient policy targets. Characteristics: Continuous and comprehensive data collection; robust metrics or indicators; **some capacity for in-depth analysis and evaluation.** - Advanced MRE = Description: An advanced and well-	4 - Advanced MRE 3 - Intermediate MRE 2 - Basic MRE 1 - Initial development of MRE 0 - Absence of MRE	Content creation with project partners

established monitoring and evaluation system is in place, offering a thorough and sophisticated assessment of progress towards climate resilient policy targets. Monitoring should be conducted in a participatory way (co-monitoring communities, linking local, scientific, and interdisciplinary knowledge). Characteristics: Continuous and comprehensive data collection; robust metrics or indicators, **high level of capacities for evaluation, and adaptation of policies based on findings.**

4.3.2. Dimension 2: Plans and policy instruments

This dimension is based on the idea that the region's climate resilience-building process can be supported by having an appropriate set of planning, regulatory and policy instruments. The identification of clear policy targets and systems to regularly assess the region's progress against them is also considered as a key contributor to climate resilience maturity. Regional policy instruments and targets should be aligned with climate resilience objectives, including principles and objectives to achieve a socially just transition to climate resilience, as well as to SDGs and macro-regional strategies. The indicators in this Dimension were developed in close collaboration with R4C partners from T4.4, T4.5 and T2.2.

Table 11 - List of indicators of Dimension 2 - Plans and policy instruments

	Indicator	Description	Scoring system	Source
2.1	**Regional plan or strategy for climate resilience**	This indicator assesses whether regional planning adequately contributes to climate resilience-building. The assessment of this indicator should be based on the specific regional context and the existing plans and strategies. Depending on the specific context, the region might have a binding climate resilience or adaptation plan, a voluntary resilience strategy, or might address its climate resilience objectives through sectoral regional planning instruments. Additional resources for the assessment of adaptation plans: - Assessment of credibility of adaptation plan by Olazabal et al., 2019 - Adaptation justice index by Juhola et al., 2019	4 - Levels below + the strategy/plan includes multiple policy instruments (portfolio approach, combining diverse interventions designed to operate in an integrated and coherent manner). 3 - An up-to-date plan/strategy for climate adaptation and resilience exists at regional level, explicitly addressing climate risks, uncertainties and risks associated with unintended consequences of climate responses (i.e., maladaptation and green gentrification) and potential trade-offs (e.g., with mitigation objectives and measures) 2 - An up-to-date plan/strategy for climate adaptation and resilience exists at regional level, explicitly addressing climate risks and uncertainties 1 - An up-to-date plan/strategy for climate adaptation and resilience exists at regional level 0 - No plans or strategies exist at regional level that explicitly address climate adaptation and resilience.	Content creation with project partners Olazabal et al., 2019 Juhola et al., 2019
2.2	**Integration of planning and regulatory framework for climate resilience**	Integration of planning and regulatory instruments across sectors and levels is considered an important prerequisite for successful climate action. The regional level can play a pivotal role in harmonising plans, both vertically (e.g. ensuring that lower-level plans, such as municipal plans, are aligned with plans at regional level) and horizontally (e.g. ensuring that plans are aligned across sectors), in order to ensure local and regional ownership and support of the climate resilience-building process. The relevance of planning and regulatory instruments for climate resilience shall be defined based on the regional context. Criteria for relevance could include: - instruments explicitly labeled as climate adaptation / resilience- relevant; - instruments within sectors (buildings, energy, agriculture, forestry, transport...) that are considered relevant for climate resilience-building in the region (e.g., based on specific regional climate risks)	4 - Structures, processes and precise timelines are in place to ensure better integration and alignment between planning and regulatory instruments across different levels and sectors. 3 - Needs for better integration and alignment between planning and regulatory instruments across different levels and sectors are identified. 2 - Integration and interlinkages between planning and regulatory instruments across different levels and sectors are assessed to identify gaps. 1 - All planning and regulatory instruments relevant for climate resilience across levels (local/municipal, regional/sub-national, national) and sectors are mapped 0 - An overview of planning and regulatory instruments relevant for climate resilience across levels (local/municipal, regional/sub-national, national) and sectors is lacking or not exhaustive.	Content creation with project partners
2.3	**Policy instruments supporting climate regional resilience-building**	This indicator aims to assess what policy instruments are in place to support climate resilience-building at regional level. The policy instruments considered for the assessment of this indicator can vary depending on the region. Types of policy instruments include (adapted list based on Gram-Hanssen et al., 2023): 1. policy frameworks/strategies/plans, 2. systems in place for Monitoring, reporting and evaluation (MRE),	4 - All three types of policy instruments are utilised to support climate resilience-building and alignment of policy instruments is continually assessed. 3 - Two types of policy instruments are in place to support climate resilience-building. Other types of existing policy instruments have been identified where alignment needs to be improved. Processes for alignment of identified policy instruments are in place. 2 - One type of policy instruments is in place to support climate resilience-building. Other types of existing policy instruments have been identified where alignment needs to be improved.	Content creation with project partners Gram-Hanssen et al., 2023

		3. economic measures to incentivize adaptation efforts (insurance and risk transfer mechanisms, adaptation funding mechanisms, research and innovation programs, taxes) Policy instruments are considered as "supporting" climate resilience-building if they are explicitly aligned with climate resilience ambitions and targets.	1 - One type of policy instrument mainly is in place to support climate resilience-building. 0 - No policy instruments are in place to support climate resilience-building.	
2.4	**Mainstreaming of climate resilience into other regional sectoral plans and strategies**	This indicator aims to assess the depth of mainstreaming of climate resilience into regional sectoral plans and strategies. Mainstreaming includes the integration of climate resilience goals within sectoral plans and programs, in order to reorient their objectives and specific measures in alignment with climate resilience ambitions. Mainstreaming actions can be effectively organized by experts accompanying regional stakeholders, like professionals with proven experience from both academia and research (Master Adapt Project). Mainstreaming across policy domains is needed in order to address administration siloes and ensure effectiveness of climate resilience action. What is referred to with "sectoral policies" depends on the regional context. "Sectoral policies" could be regional planning instruments or strategies regulating climate resilience-relevant sectors such as mobility, energy, water management etc. If the region under examination does not have regional sectoral policies, other plans or strategies can be considered relevant for the assessment of this indicator. "Climate resilience objectives and measures" are those contained in a regional climate resilience strategy, as described in Indicator 2.2. Alignment of sectoral policies with climate resilience objectives and measures entails harmonisation/alignment with the relevant regional climate resilience strategy.	4 - All sectoral policies mainstream climate resilience and reflect, as relevant, alignment with climate resilience objectives and measures 3 - 3 or more sectoral policies mainstream climate resilience in more detail, including alignment of climate resilience objectives and measures 2 - 1-2 key sectoral policies mainstream climate resilience in more detail, including alignment of climate resilience objectives and measures 1 - Sectoral policies mention climate resilience 0 - No sectoral policies mention climate resilience OR there are no regional climate resilience policy instruments/objectives/measures	Content creation with project partners Master Adapt, 2019
2.5	**Regional plan or strategy for emergency response**	Planning for effective Disaster Risk Reduction (DRR) and Disaster Risk Management (DRM) is considered key for regional climate resilience-building. This indicator aims to assess whether the region disposes of an adequate emergency response plan. The type of plan/strategy being assessed depends on the regional context and the distribution of DRR and DRM-related competences. If emergency response is not a regional competence (e.g., emergency response is coordinated at national level), this indicator shall assess the relevant emergency response plan/strategy in its aspect relating to the regional territory, if applicable. For example, if aspects of the implementation of a national emergency response plan are delegated to regional authorities such as regional civil protection bodies.	4 - The regional emergency response plan is regularly updated, and it leverages professional responders and community organisations to ensure effective DRR and DRM. It includes cooperation agreements with critical infrastructure providers. 3 - The regional emergency response includes an assessment of critical infrastructure (e.g., monitoring its functionality) and of services related to critical infrastructure. 2 - The regional emergency plan is aligned with regional risk and vulnerability assessments: it includes the consideration of changes in the frequency, magnitude, or impact of relevant hazards, as well as projected future hazards. 1 - The region has prepared an emergency response plan based on climate hazards most relevant to them and based on historical experience. 0 - The region has no response plan to deal with emergencies.	Content creation with project partners UNDRR, 2017 SMR Resilience Maturity Model, 2016
2.6	**Alignment of existing policy instruments with regional ambitions for a socially just transition to climate resilience**	This indicator aims to assess what policy instruments are in place to support a socially just transition to climate resilience at regional level, for example as defined in the R4C Just Transition Framework (T2.2). The policy instruments considered for the assessment of this indicator can vary depending on the region. Types of policy instruments include (adapted list based on Gram-Hanssen et al., 2023): 1. policy frameworks/strategies/plans, 2. systems in place for Monitoring, reporting and evaluation (MRE), 3. economic measures to incentivise adaptation efforts (insurance and risk transfer mechanisms, adaptation funding mechanisms, research and innovation programs, taxes) Policy instruments are considered as "supporting" a socially just transition to climate resilience if they are	4 - All three types of policy instruments are utilised to support a socially just transition to climate resilience and alignment of policy instruments is continually assessed. Measures are in place to tackle any identified misalignment between regional policy instruments and regional Just Transition Roadmap. 3 - Two types of policy instruments are in place to support a socially just transition to climate resilience. Other types of existing policy instruments have been identified where alignment needs to be improved. Processes for alignment of identified policy instruments are in place. 2 - One type of policy instruments is in place to support a socially just transition to climate resilience. Other types of existing policy instruments have been identified where alignment needs to be improved. 1 - One type of policy instrument mainly is in place to support a socially just transition to climate resilience	Content creation with project partners

		explicitly aligned with at least one of the four justice dimensions, as defined in R4C D2.2: 1. Recognitional justice: acknowledgement of existing social structures or norms that may create unequal conditions for different groups of people and hence differing vulnerabilities to climate risks. 2. Distributive justice: concerns the distribution of climate impacts and adaptation impacts across society. 3: Procedural justice: refers to equitable participation of stakeholders or actors in the process. 4. Restorative justice: refers to how harm and injustice need to be acknowledged and attributed, and possible measures for compensation need to be developed.	0 - No policy instruments are aligned with justice dimensions for a socially just transition to climate resilience	
2.7	**Assessment of region's progress towards relevant SDGs**	This indicator aims at assessing whether regional targets align with Sustainable Development Goals (SDGs), to what extent these are operationalised and explicitly linked to regional planning and policy instruments, and whether the region is progressing with regards to relevant SDGs. T4.4 will introduce and assist the regions in applying an approach to assessing their progress against relevant SDGs.	4 - Measures are in place to tackle any identified gaps, including potential misalignment between regional policy instruments and relevant SDGs 3 - A system is in place to assess the region's progress against relevant SDGs 2 - Relevant SDGs have been operationalized (e.g. regional policy targets identified) and explicitly linked to regional planning and policy instruments 1 - Relevant SDGs have been identified and initially used as a lens for framing the region's work 0 - The region has never engaged with SGDs in any of its regional planning and policy instruments.	Content creation with project partners
2.8	**Alignment of regional strategies with macro-regional S3/S4+ strategies**	Regional priorities and strategies should be aligned with macro-regional priorities for sustainable and inclusive development, also in order to strengthen cross-border cooperation. This indicator aims at assessing whether regional targets align with macro-regional strategies (S3 or S4+ strategies, depending on what is the most updated strategy available) and to what extent these are operationalised and explicitly linked to regional planning and policy instruments. S3 = smart specialisation strategies S4+ = smart specialisation strategies for sustainable and inclusive growth	4 - Macro-regional strategies have been aligned and explicitly linked to regional policy targets and measures are in place to tackle any misalignment 3 - Gaps and misalignments between regional policy targets and macro-regional strategies are clearly identified 2 - Regional policy targets aligned with macro-regional strategies have been identified and operationalised and are being monitored. 1 - A system is in place to assess the alignment of regional policy targets with macro-regional strategies 0 - No regional policy target is aligned with macro-regional strategy	Content creation with project partners

4.3.3. Dimension 3: Human resources and technical skills

This dimension aims at assessing skills and competencies available within the regional administration, defined based on the specific regional context. The goal is to support the region in mapping the available competencies and skills and identify gaps and needs in order to develop appropriate policies to increase maturity with regard to this dimension. For this, these indicators also aim to assess whether the region under examination has the possibility (in terms of mandates, resources etc.) to fill identified gaps, for example complementing in-house competencies with externally contracted technical staff if needed, or through training and hiring of new staff.

Table 12 - List of indicators of Dimension 3 - Human resources and technical skills

	Indicator	Description	Scoring system	Source
3.1	**Staff assigned to the planning and implementation of climate change resilience actions**	This indicator aims to assess whether sufficient staff is specifically assigned to the planning and implementation of climate change resilience measures and interventions within the regional administration.	4 - Sufficient staff is assigned, and functions, roles and responsibilities among staff are clear. 3 - Sufficient staff is assigned, but functions, roles and responsibilities among staff are unclear, impeding effectiveness of planning and implementation. 2 - Some staff is assigned to both planning and implementation of climate resilience actions, but it is deemed insufficient 1 - Some staff is assigned, but only to planning of climate resilience actions, and it is deemed insufficient 0 - No staff is assigned	Content creation with project partners
3.2	**Flexibility in staff contracting and allocation**	This indicator aims to assess whether regional structures and processes are flexible enough to (re-) allocate, hire and/or contract skilled staff (for example, technical staff from sectoral agencies) in order to successfully carry out climate resilience actions and adapt to changing circumstances.	4 - Whenever staff or specific competencies and skills are deemed lacking, flexible and quick processes and structures are in place to contract external collaborators, in addition to possibilities to redirect functions of staff and to increase technical staff 3 - If deemed necessary, flexible processes and structures exist to redirect functions of staff and to increase technical staff number to carry out climate change strategies and actions 2 - If deemed necessary, possibilities exist to redirect functions of existing staff, but resources are lacking to hire new staff 1 - Processes and structures to redirect functions of existing staff or hire new staff are overly burdensome and inefficient 0 - No possibilities exist to redirect functions of existing staff, nor to hire or contract additional (external) staff	Content creation with project partners
3.3	**Staff's competencies, knowledge and skills to understand and use climate change data and information**	This indicator evaluates the proficiency of staff in handling climate change data and information within the context of regional programming.	4 - Staff already possess significant expertise, actively managing climate change data and information as an integral part of the Regional programming. 3- Staff demonstrate competence in managing climate change data and information, albeit outside the Regional programming. 2 - Staff have received specific education on climate change data and information but have not applied this knowledge within a regional perspective. 1 - Staff possess specific education on climate change data and information but have not yet applied this knowledge. 0 - No staff members have relevant experience or knowledge in managing climate change data and information	Content creation with project partners
3.4	**Staff's competencies, knowledge and skills to design and conduct effective participatory and stakeholder engagement processes**	This indicator assesses the proficiency of staff in designing and conducting participatory and stakeholder engagement processes, within the framework of regional programming. This indicator provides insights into the staff's capability to lead effective participatory processes and stakeholder engagement, considering both practical experience and educational background, with a focus on the regional scale and governance.	4 - Staff demonstrate advanced competence, having designed and successfully conducted participatory and stakeholder engagement processes as an integral part of the Regional programming. 3- Staff exhibit proficiency in designing and conducting participatory and stakeholder engagement processes, although their experience lies outside the Regional programming. 2 - Staff possess specific education on participatory and stakeholder engagement processes but have not yet applied this knowledge at the regional level. 1 - Staff have received specific education on participatory and stakeholder engagement processes but have not designed or conducted them. 0 - No staff members have relevant experience or knowledge in designing and conducting participatory and stakeholder engagement processes.	Content creation with project partners

3.5	**Staff's competencies, knowledge, and skills to successfully implement the planned climate resilience and adaptation strategies and measures**	This indicator assesses the proficiency of staff in implementing climate resilience and adaptation strategies, particularly within the context of regional programming. This indicator provides insights into the staff's capability to translate knowledge into action by effectively implementing climate resilience and adaptation strategies, considering both practical experience and educational background, with a focus on the regional scale and governance.	4 - Staff demonstrate advanced competence, having successfully implemented climate resilience and adaptation strategies as an integral part of the regional programming. 3- Staff exhibit proficiency in implementing climate resilience and adaptation strategies, although their experience lies outside the Regional programming. 2 - Staff possess specific education on climate resilience and adaptation strategies but have not yet applied this knowledge at the regional level. 1 - Staff have received specific education on climate resilience and adaptation strategies but have not implemented them. 0 - No staff members have relevant experience or knowledge in implementing climate resilience and adaptation strategies.	Content creation with project partners
3.6	**Staff's competencies, knowledge, and skills to successfully engage in climate change mainstreaming**	This indicator assesses the proficiency of staff in engaging in climate change mainstreaming, particularly within the context of regional programming. This indicator provides insights into the staff's capability to integrate climate change considerations into various aspects of regional programming, considering both practical experience and educational background.	4 - Staff already engaged in climate change mainstreaming inside the regional programming 3- Staff already engaged in climate change mainstreaming outside the regional programming 2 - Staff have specific education on climate change mainstreaming but never implemented inside a regional perspective 1 - Staff have specific education on climate change mainstreaming but never implemented them 0 - No staff have experience or knowledge	Content creation with project partners
3.7	**Staff's capacity building**	This indicator evaluates the existence and effectiveness of a continuous training plan for staff, implemented by the regional government, with a specific focus on climate adaptation, resilience, and mitigation. It also assesses if: - training guidelines and manuals are readily available to staff - training and capacity building in climate adaptation/resilience and mitigation is provided across departments, also targeting staff not working directly on climate-related topics.	4 - Full training curriculum in climate adaptation/resilience and mitigation is provided across departments, also targeting staff not working directly on climate-related topics. 3- Full training curriculum in climate resilience is provided only in departments working specifically on climate related issues 2 - Training and manuals are available but are not fully deployed for staff 1 - Training are under development 0 - No training	Content creation with project partners
3.8	**Staff's competencies, knowledge and skills to make use of multiple financing opportunities**	This indicator provides insights into the staff's capability to navigate and leverage financing opportunities for climate change projects, considering both practical experience and educational background, with a focus on regional scale. Financial opportunities could constitute: - EU funds - National funds - Private sector funding	4 - Staff already managed climate change related financing opportunities inside the Regional programming 3- Staff managed climate change related financing opportunities outside the Regional programming 2 - Staff have specific education on financing opportunities for climate change projects but never managed them inside a regional perspective 1 - Staff have specific education on financing opportunities for climate change projects but never managed them 0 - No staff have experience or knowledge	Content creation with project partners

4.3.4. Dimension 4: Participatory governance and stakeholder engagement

The indicators included in this Dimension are based on the idea that the region should develop a stakeholder engagement plan for its climate resilience governance. The definition of climate resilience governance used for the purpose of this model and its relative assessment is the one adopted by R4C's T4.2 (see Sub-chapter 3.4.3). In general, governance is multi-actor, and a variety of stakeholders should be involved in both climate resilience planning and implementation. What constitutes in practice climate resilience governance depends on the specific regional context (i.e., what actors, what planning and regulatory instruments etc.). The stakeholder engagement plan can take many forms depending on the specific regional context and the regional competences (see description of 4.5 indicator).

Table 13 - List of indicators of Dimension 4 - Participatory governance and stakeholder engagement

	Indicator	Description	Scoring system	Source
4.1	**Identification of purpose and clear objectives for stakeholder engagement**	This indicator aims to measure if the purpose of the stakeholder engagement is clearly identified and shared among all stakeholders. If the purpose is clear, it will be possible to assess the interest of the potential stakeholders to engage. The definition of the engagement purpose should be societally relevant. To guide this definition, it could be aligned with envisioned impacts on society that the co-creation process is expected to contribute to. Societal impacts comprise five dimensions: social, environmental, health, political and economic (Petruzziello et al., 2023). The way in which the challenge is shaped is key for the success of the process: be sure that the discussion revolves around challenges and not around solutions and frame it in a way that it is inclusive for all groups of stakeholders. People are more likely to commit if they can relate to the local problem addressed. (Mosaic co-creation methodology toolkit)	4 – Purpose and clear objectives are identified, and the engagement plan is shared with the identified stakeholders' groups, with a simple language 3 – Purpose and clear objectives are identified and shared with the stakeholders' groups 2 – Purpose and clear objectives for engagement are identified 1 – Purpose for engagement definition is under development 0 – Purpose for engagement is still not clear	Petruzziello et al., 2023
4.2	**Identification of opportunities and challenges for stakeholder engagement**	This indicator evaluates whether and how opportunities and challenges are identified for stakeholder engagement and participation within the specific context of the region, in order to formulate a robust stakeholder engagement plan tailored to climate resilience-building efforts. These can include: - the existence of laws regulating participation at regional level, which can represent both an enabler and an obstacle. For example, if participatory governance is formalised in institutions this can contribute to ensure influence on decision making and transparency. - the availability of financial, human, knowledge resources and their allocation to the design and implementation of participatory processes for the engagement of different types of stakeholders. - trade-offs and potential negative consequences of participation and stakeholder engagement	4 – Opportunities and challenges are addressed in the stakeholder engagement plan 3 – A plan to address opportunities and challenges is defined 2 – Opportunities and challenges are identified 1 – Opportunities and challenges are in course of assessment 0 – Opportunities and challenges are not assessed	Content creation with project partners
4.3	**Mapping of stakeholders**	This indicator assesses the effectiveness of the stakeholder engagement process by evaluating the stakeholder mapping procedure. The identification of stakeholders is recognized as a pivotal step in developing a robust plan for engagement, encompassing the discernment of key actors, understanding their organizational structures, and	4 – Participation and stakeholder engagement practices are adapted to mapped stakeholders (levels 2 and 3) and particular attention is given to possible excluded groups 3 – A detailed mapping of internal and external stakeholders is available (level 2), together with the identification of their motivations to	Uittenbroek et al., 2019 Ferguson et al., 2017

		assessing their levels of involvement in climate-related matters. The mapping process aims to capture a nuanced understanding of diverse stakeholders, including their interests, motivations, capacities, and institutional constraints. Internal stakeholders are meant to be the ones working in the administrative structure of the regional government. External stakeholders are those not strictly involved in the regional administration procedures (private sector, community organizations, citizens, NGOs, academia, etc). The indicator emphasizes an ideal sequence starting with a preliminary stakeholder mapping exercise, followed by discussions with identified stakeholders to foster collaborative relationships. A detailed mapping exercise then ensues, delving into the spectrum of stakeholder interests, motivations, capacities, and potential conflicts. This comprehensive approach seeks to inform the development of stakeholder interactions that address and achieve their objectives. The mapping process extends to evaluating stakeholders' interest in participating in the engagement process. By analysing their motivations, the region gains insights that can guide the prioritization of challenges faced by the population. Understanding participant motivations and expectations contributes to the design of effective stakeholder interactions and fosters trust. It is crucial to recognize and address situations where stakeholders may be unwilling or uninterested in participating. It should be noted that unwilling stakeholders might require different participation, practices as the reason for their unwillingness might come from unawareness that the problem at hand is also their problem. The indicator also underscores the importance of recognizing and reconciling differences in perspectives on valid interests. It acknowledges potential disparities between regional or local government perceptions of stakeholders' interests and citizens' self-perceived interests, emphasizing the need for inclusive practices to avoid exclusion.	participate and expectations. 2 – A detailed mapping of internal and external stakeholders is available, including identification of their structures, capacities, institutional constraints and potential conflicts. 1 – Key internal and external stakeholders are identified 0 – Stakeholders groups are not identified	Content creation with project partners (including referring to R4C WP5 Innovation Packages)
4.4	**Identification of stakeholders most affected by climate change**	This indicator evaluates the extent to which climate resilience planning addresses and involves the most vulnerable groups in the population. The assessment considers evidence of targeted planning with or for these relevant groups, ensuring coverage across the spectrum of the vulnerable population. The indicator further emphasizes the importance of obtaining confirmation from these groups regarding the effectiveness of their engagement in the planning process. Vulnerable groups of the population might include, as examples: Those in areas of high poverty; Transient or nomadic communities; The elderly; Physically or mentally sick or disabled; Children; Non-native language speakers. Engagement strategies may involve collaboration through neighbourhood organizations, specialist government agencies, charities, NGOs, and other grassroots organizations.	4 - All vulnerable groups are identified and regularly engaged on climate resilience issues and they or their representatives confirm as such 3 - All vulnerable groups are identified and regularly engaged on climate resilience issue 2 - All major groups are engaged - some minor gaps 1 - Gaps in coverage of effective engagement are found 0 - No vulnerable groups specifically identified	UNDRR, 2017

4.5	**Development of a stakeholder engagement plan**	The development of a stakeholder engagement strategy/plan aims to identify and promote a participatory and local stakeholder engagement process to integrate adaptation and mitigation into all regional sectoral policies. A strategy to engage identified stakeholders in the elaboration and implementation of (climate resilience) policies and measures is designed, which takes into account the needs and characteristics of various groups. For stakeholder engagement plan is meant a collaborative effort involving various stakeholders to address complex societal challenges to foster concrete innovative solutions. This indicator evaluates if and how a stakeholder engagement plan has been developed by the regional government. The plan should take into consideration all perspective and phases described in the previous indicators of this section. The stakeholder engagement strategy includes the delineation of balanced management roles and responsibilities for implementation, including the establishment of a core team / task force for coordination, composed of representatives of all stakeholder groups (including key ministries and government agencies, public research organizations and universities, private sector, civil society). The implementation of stakeholder engagement processes is supported by adequate coordination meetings involving all interested parties and adequate structures and processes for monitoring and learning/adjustments. The region engages closely with local level governments (e.g., Municipalities) and local civil society groups and initiatives in order to design and carry out stakeholder engagement processes that are based on strong knowledge of the relevant local communities.	4 - A clear stakeholder engagement strategy is in use and updated on a need basis, a core team / task force is established for coordination, composed of representatives of all stakeholder groups. 3 - A stakeholder engagement strategy/plan is designed; it takes into account the needs and characteristics of various and diverse groups. 2 - A stakeholder engagement strategy/plan is designed 1 - A stakeholder engagement strategy is under development 0 - Absence of a stakeholder engagement plan	Stead and Meijers, 2009 IPCC, 2014 Wamsler, 2014 Uittenbroek, 2016 Clever Cities, 2018
4.6	**Participatory governance to enhance coordination and agenda-setting**	This indicator aims to assess the maturity of existing structures and processes for participatory governance, including stakeholder engagement and co-creation activities, aiming at enhancing the coordination among actors for climate resilience-building, for joint agenda-setting and implementation. Ideally, participatory governance structures and processes should be informed by a stakeholder engagement plan, the detailed mapping of relevant stakeholders, and knowledge about the climate change risks of the region and the impacts on different sectors of the population. Cooperation with relevant stakeholders, including sectoral authorities, interest groups, NGOs or representatives from the private sector can be set up with different levels of involvement - from informing to consultation or participatory involvement throughout the whole process. The level of involvement can also change over the course of the adaptation process (e.g., high level when defining objectives vs. low level when working on an evaluation scheme). But when starting the process, the objectives as well as the role of stakeholders need to be clear and communicated to manage expectations. Stakeholder engagement and co-creation activities can vary depending on the region. For example, these could include: - Establishment of a wide collaborative platform / network with stakeholders to reflect on and make decisions about the climate resilience building process, including all actors from the beginning. This could be, for example, a Management Board including a variety of stakeholders e.g. local businesses, citizens, local authorities, governmental departments, NGOs.	4 - Exemplary Engagement: comprehensive stakeholder engagement and co-creation activities, robust collaborative platform/network that includes all relevant stakeholders, highly effective coordination mechanisms fostering regular and structured interaction, regular and strategic meetings contributing to consensus-building, policy recommendations, and joint agendas. 3 - Advanced Engagement: Extensive stakeholder engagement involving a diverse range of actors, Well-established collaborative platforms and networks, Effective coordination mechanisms facilitating regular interaction, regular meetings with periodic assessments and policy discussions. 2 - Intermediate Engagement: Moderate stakeholder engagement with relevant actors, established platforms or networks for periodic interaction, some coordination mechanisms in place, and regular but possibly less frequent meetings. 1 - Basic engagement is in place: limited stakeholder involvement, ad hoc engagement with a few key actors, minimal coordination mechanisms in place and infrequent or irregular meetings 0 - No activities are in place to engage stakeholders	Petruzziello et al., 2023

		- Regular meetings of the board/working groups, to provide periodical assessments and policy recommendations, acting as an arena for debating alternative policy proposals and creating consensus about priorities, and joint agendas (through formal mechanisms) between industry and public knowledge institutions - Co-creation processes: Mosaic as a source describing an "ideal" co-creation process		
4.7	**Engagement with the private sector**	This indicator aims to assess the region's engagement with the private sector. The definition of which actors constitute the relevant "private sector" depends on the region: it could include private companies, businesses, industrial associations, sectoral associations etc. Involvement of the private sector is considered key for climate resilience implementation for several reasons. However, it is important that a balance between public and private interests is guaranteed. Forms of engagement with the private sector include: - encourage the private sector to channel resources towards the implementation of climate resilience actions - establishment of private-public partnerships when needed to ensure implementation and continuity of climate resilience actions A preliminary step for the assessment of this indicator is the identification of past and current initiatives in the area of climate change resilience in the region that involve the private sector.	4 - The region regulates its relations with the private sector (e.g., Public-private partnerships) explicitly addressing issues of equity and just transition and maintaining a balance between public and private interests. These are explicitly considered for example in the decision of which private partners it supports and engages with. 3 - The region has regulations, programmes, policies, initiatives in place to establish, formalise and monitor forms of engagement with the private sector for the implementation of its climate resilience ambitions and policies 2 - The region has regular engagements with the private sector, however they are not formally regulated 1 - The region has sporadic collaboration with private sector. 0 - The region has no collaboration with private sector	Content creation with project partners
4.8	**Engagement with citizens**	This indicator evaluates the degree of engagement with citizens in shaping regional climate change and resilience policies. The focus is on enhancing community involvement in policy definition through various means, such as workshops for launching and testing applications, regional events, informative articles, and other engagement initiatives. The assessment considers the effectiveness and inclusivity of these engagement efforts in gathering input from diverse segments of the community. The indicator aims to measure the region's commitment to fostering a participatory approach, ensuring that citizens play an active role in shaping policies that address climate change and enhance resilience.	4 - The region consistently involves citizens in participatory processes, systematically mapping the interests of all relevant groups and taking into account gender and diversity of citizens to be involved 3 - The region actively engages citizens in participatory processes on a regular basis. 2 - While there is no direct engagement with citizens, the region achieves effective coordination at the local level 1 - The region lacks direct engagement with citizens, and there is minimal effort in coordinating with local levels or mapping the interests of various groups within participatory processes. 0 - The region has no direct engagement with citizens	Content creation with project partners
4.9	**Engagement with organised civil society**	This indicator assesses the extent to which the region actively collaborates with organized civil society groups in the development of climate resilience planning. The evaluation takes into account the coordination efforts with the local level to ensure a just and fair approach to climate resilience planning. Organized civil society encompasses various entities such as activist groups, community-led and self-organized initiatives, associations, environmental groups, and more. The indicator aims to gauge the depth of involvement and collaboration with these diverse stakeholders, recognizing their valuable contributions to fostering inclusive and equitable climate resilience initiatives.	4 - The region institutionalised partnership with civil society groups and provides regularly financial and technological support to civil society groups and community initiatives to contribute to climate resilience-building. 3 - The regional government, in partnership with local/municipal governments, provides financial and technological support to civil society groups and community initiatives to contribute to climate resilience-building. 2 - Networks, platforms and/or physical spaces are provided and/or promoted by the regional government that allow civil society and community organisations to coordinate, receive support and contribute to climate resilience-building processes. 1 - Existing community initiatives are mapped, also thanks to the involvement of local/municipal governments and existing networks. 0 - The region has no engagement with organised civil society groups	Content creation with project partners

4.10	**Engagement with academia and research community**	This indicator aims to measure the establishment of formal partnerships and collaboration processes between the region and local academic/scientific entities. Regular involvement of universities and research institutions in climate resilience and adaptation planning is considered, encompassing consultation on specific topics/projects, participation in thematic working groups, and support in agenda-setting. Additionally, this Indicator assesses the ongoing engagement of universities and research institutions in the implementation of climate resilience actions, which includes their participation in specific projects and interventions. Furthermore, it recommends the formation of a technical-scientific committee comprising representatives from academia and research. This committee should be designed to assist the regional government in monitoring the climate resilience implementation process, ensuring necessary adjustments to planned climate resilience actions and interventions.	4 - Formal partnerships and formalised collaboration processes are established between the region and academic/scientific entities and a technical-scientific committee is established to support the regional government in monitoring the climate resilience implementation process 3 - Formal partnerships and formalised collaboration processes are established between the region and academic/scientific entities 2 - Universities and research institutions are involved on a regular basis in climate resilience and adaptation planning and implementation 1 - Universities and research institutions are involved ad-hoc in climate resilience and adaptation planning 0 - The region has no engagement with academia and/or research institutions	Content creation with project partners

4.3.5. Dimension 5: Public support, awareness and climate change communication

This Dimension includes indicators assessing the region's maturity in terms of public support and awareness. This includes assessing the region's strategies for communicating climate information to stakeholders involved in climate resilience-building and to the general public, fostering public awareness and preparedness. Indicators assessing the region's capacity to analyse public perception of climate change and acceptance of policies are also included, as these are considered important factors affecting climate resilience maturity in the regional system.

Table 14 - List of indicators of Dimension 5 - Public support, awareness, and climate change communication

	Indicator	Description	Scoring system	Source
5.1	**Climate risk communication strategies**	This indicator aims to assess the region's efforts to disseminate comprehensive information about climate risk and readiness within its territory. This indicator evaluates the region's commitment to transparently and effectively disseminating critical climate risk information to other organisations and stakeholders involved in regional climate resilience, fostering public awareness, understanding, and preparedness. The completeness and accessibility of the information play a pivotal role in enhancing the region's climate resilience and promoting community engagement in climate risk mitigation and adaptation efforts. Climate risk and readiness communication may include: - A clear summary of the region's readiness to address climate risks - Clear information on the hazards the region is anticipated to face, along with associated probabilities. - A hazard-map based summary highlighting areas at risk within the region. - Clear descriptions of building codes, specifying what they protect against and indicating areas where these codes have been implemented. - Information about key roles and accountabilities within the region concerning climate resilience and emergency response. - Transparency regarding planned investments that will impact the region's climate resilience to climate risks.	4 - Information on climate risk and readiness is fully available and shared with stakeholders in a way that it is easily accessible and understandable. The region has established coordination mechanisms with local entities responsible for risk communication, all across the regional territory, to ensure extensive dissemination of the information. The region's climate risk communication strategy is comprehensive and fully operational. 3 - Some minor gaps persist in information dissemination, or the information is in more than one place, but it is shared. The regional government has established some coordination mechanisms with local entities responsible for risk communication. 2 - Some gaps persist in information dissemination, but they have been identified and the region developed a climate risk communication strategy in order to address them. 1 - Information on climate risk and readiness is only partially shared and not to all relevant organisations and stakeholders. Some significant information on climate risk and readiness is withheld from other organisations and stakeholders, is missing or is highly fragmented. The region is developing a climate risk communication strategy. 0 - Information sharing and communication on climate risk and readiness is absent or rudimentary at best. The region does not have a climate risk communication strategy.	Content creation with project partners UNDRR, 2017 (Adapted from Detailed Assessment, Indicator 1.4.1)
5.2	**Dissemination of scientific information and good adaptation practices**	This indicator assesses the effectiveness of regional strategies for disseminating scientific information and good adaptation practices to the general public, in order to strengthen citizens' preparedness to cope with climate impacts. This indicator provides insights into the region's commitment to sharing valuable adaptation practices with the public, considering collaboration, language accessibility, and the acknowledgment of potential barriers to dissemination. It emphasizes the importance of collaborating with local universities, research centers, practitioners, and community groups. In particular, it considers the need to disseminate: - Publicly accessible information detailing what citizens should expect in terms of disaster impacts, the anticipated response from the region and cities, and the potential implications for daily life.	4 - Scientific information and good adaptation practices are fully disseminated to the general public, based on a strategy developed in collaboration with local universities, research centers, practitioners and citizens, which uses a simple language and addresses accessibility barriers and specific socio-cultural contexts. 3 - Some minor gaps persist in the dissemination, but they are identified and addressed in a strategy developed in collaboration with local universities, research centers, practitioners, and citizens. Barriers persist, such as language barriers or lack of consideration of specific socio-cultural contexts. 2 - Some gaps persist in the dissemination, but information reaches a diversity of groups in society and a strategy is being developed to address gaps.	Content creation with project partners UNDRR, 2017 (Adapted from Detailed Assessment, Indicator 1.4.1)

		- A description of what citizens should do for themselves and their families in preparation for climate-related events. - Provision of further resources and contact details for citizens seeking more information or assistance.	1 - Scientific information and good adaptation practices are only partially shared and do not reach all affected groups in society. 0 - Scientific information and good adaptation practices are not disseminated to the general public	
5.3	**Alignment of regional communication and marketing strategies with climate resilience priorities**	This indicator evaluates the region's incorporation of climate-related risks and vulnerability into its communication strategies, specifically in the context of promoting local tourism and territorial marketing. The scoring system considers the depth of integration and coverage across the regional territory.	4 - The region integrates the consideration of climate-related risks and vulnerability in its communication strategies, including for the promotion of local tourism and territorial marketing, across the regional territory 3 - The region integrates the consideration of climate-related risks and vulnerability in its communication strategies, including for the promotion of local tourism and territorial marketing, just in the most touristic places 2 - The region integrates the consideration of climate-related risks and vulnerability in its communication strategies, but they are not integrated in the local tourism promotion yet 1 - An alignment plan between regional communication and climate resilience priorities is under development 0 - No alignment exists between regional communication and climate resilience priorities	Content creation with project partners
5.4	**Analysis of public perception of climate change**	This indicator evaluates the general public's awareness and knowledge of climate change and its impacts on the regional territory. The assessment considers various social and cultural norms, as well as personal experiences of climate change impacts. The analysis encompasses the following dimensions: - General public awareness regarding climate change and its specific impacts on the regional territory. - Public concern and urgency to act in response to climate change. This analysis helps understand the perceived immediacy of climate-related challenges among the population. - Evaluate the population's knowledge of the causes of climate change and their awareness of possible solutions. - Response behaviors to address climate change. This includes an examination of different social and cultural norms that may influence individual and collective actions in response to climate-related challenges.	4 - In-depth analysis is conducted to assess citizens' awareness of climate change impacts, urgency to act, causes knowledge and response behaviours. 3 - An analysis is performed to evaluate citizens' awareness of climate change impacts, urgency to act, causes knowledge and response behaviours. 2 - An analysis is initiated to evaluate citizens' awareness of climate change impacts, urgency to act, knowledge of causes, and response behaviors 1 - The analysis includes a limited assessment of citizens' perceptions 0 - No analysis of public perception of climate change is conducted	Content creation with project partners Ford and King 2015, Olazabal et al., 2019 Averchenkova and Bassi 2016, Van der Linden, 2015 Swim et al., 2011 Farrokhi et al 2020
5.5	**Analysis of public perception and acceptance of policies**	This indicator evaluates citizens' awareness, perceptions, and acceptance of existing policy instruments and solutions for climate adaptation/resilience. The overarching goal is to understand not only citizens' perception of policies but also their awareness and views on the policy instruments driving climate adaptation/resilience efforts. This holistic analysis provides valuable insights into the public's engagement, understanding, and acceptance of the mechanisms employed to address climate challenges within the region. The assessment takes into consideration these dimensions: - Awareness Analysis: Examines the extent to which citizens are informed about existing policy instruments and solutions for climate adaptation/resilience. - Cost-Benefit Perception Analysis: Assesses citizens' perception of the distribution of benefits and costs associated with existing climate adaptation/resilience policies. - Fairness Perception Analysis: Evaluates whether	4 - In-depth analysis is conducted to assess citizens' awareness of existing policy instruments and solutions for climate adaptation/resilience, the policy fairness and adequacy. 3 - An analysis is performed to evaluate citizens' awareness of existing policy instruments and solutions for climate adaptation/resilience, lacking depth on policy fairness and adequacy. 2 - An analysis is performed to evaluate citizens' awareness of existing policy instruments and solutions for climate adaptation/resilience, lacking depth on policy fairness and adequacy. Limited number of citizens is considered. 1 - The analysis includes a limited assessment of citizens' perceptions, fairness of existing policy instruments and solutions for climate adaptation/resilience.	Content creation with project partners Smith and Mayer, 2018 Cologna and Siegrist, 2020

		citizens perceive existing policy instruments and solutions for climate adaptation/resilience as fair, considering social equity and justice. - Effectiveness/Adequacy Perception Analysis: Gauges citizens' perception of the effectiveness and adequacy of existing policy instruments and solutions for climate adaptation/resilience.	0 - No analysis of public perception and acceptance of policies is conducted	

4.3.6. Dimension 6: Financial capabilities

This dimension aims to assess the region's maturity in terms of its capacity to identify regional investment needs for climate resilience innovations, access necessary funding, and develop a robust and strategic approach for the allocation and use of its financial resources.

Table 15 - List of indicators of Dimension 6 - Financial capabilities

	Indicator	Description	Scoring system	Source
6.1	**Financial resources availability**	This indicator maps whether the region has available financial resources and how they are managed. In additions, it aims to measure if funding and investment needs are defined in order to foster climate resilience planning and implementation.	4 - All the points below + Distributional impacts of investments, potential risks of maladaptation, and mitigation/adaptation trade-offs are explicitly considered in administering financial resources. 3 - A financial plan for the region is developed using scenario-based approaches. The plan is protected from political change and coherently covered all identified needs, compatibly with climate resilience and adaptation objectives. 2 - All possible financing and funding sources, methods and instruments are mapped (+ Alternative for catalytic financing must be explored). 1 - Regional investment needs (adaptation finance gap) are quantified, mapping financial challenges across sectors and stakeholders. 0 - Financial needs are not mapped for climate resilience investments	Content creation with project partners
6.2	**Budget allocation and distribution at local level**	Regions play a pivotal role in distributing and allocating funding from national and European level to lower levels of government in order to start processes of climate resilience. The regions need to take into consideration: - Regional distributive capacity - Vulnerability of municipalities - Equitable distribution among the municipalities - Transparency of public government budget distribution	4 - The region funding distribution at local level is continuous, equitable and secured; vulnerability of municipality and transparency are considered. 3 - The region has capacity to allocate and distribute budget evenly in its territory, and take into consideration most vulnerable local municipalities to climate risks. 2 - The region has capacity to allocate and distribute budget in its territory 1 - The region allocates and distribute budget unevenly and ad-hoc when a disaster occurs 0 - Region has no capacity in distributing funding at local level	Content creation with project partners

6.3	**Budget allocation for planning**	A dedicated budget for planning is needed. Including funding to support the mainstreaming/integration of climate change adaptation plans into regional policies and interventions. Targeted funding for research, development and demonstration projects and infrastructures are also needed. A dedicated budget needs to be allocated to support the population affected by extreme events or disasters such as those related to climate change (ref: P2R).	4 - Financial resources are allocated in a transparent and equitable way for climate resilience planning, explicitly considering funding to support the mainstreaming/integration of climate change adaptation plans into regional policies, funding for research and to support population affected by climate-related disasters 3 - Appropriate budget is allocated to climate resilience planning, explicitly considering funding to support the mainstreaming/integration of climate change adaptation plans into regional policies 2 - Appropriate budget is allocated to climate resilience planning for people and territories affected by climate-related disasters 1 - Project-based funding are allocated to climate resilience planning 0 - No funding is allocated to climate resilience planning.	Content creation with project partners
6.4	**Budget allocation for implementation**	A dedicated budget to cover the costs of implementation is needed. In order to allocate budget for implementation climate change adaptation and mitigation measures needs to be first identified. Depending on the regional context, implementation may include: - On-the-ground realisation of climate resilience-enhancing interventions included in regional plans and strategies - Realisation of climate resilience innovation and demonstration projects - Realisation of disaster risk reduction and prevention projects	4 - Financial resources are allocated in a transparent and equitable way for climate resilience implementation, explicitly considering planned climate resilience enhancing interventions and most vulnerable territories 3 - Appropriate budget is allocated to climate resilience implementation, and climate adaptation and mitigation measures are identified as a first action 2 - Appropriate budget is allocated to climate resilience implementation for people and territories affected by climate-related disasters 1 - Project-based funding are allocated to climate resilience implementation 0 - No funding is allocated to climate resilience implementation	Content creation with project partners
6.5	**Incentives for private sector**	This indicator aims to measure the effectiveness of frameworks and mechanisms designed to stimulate private sector involvement in climate adaptation efforts at a regional level. Regulations, programs/policies, or initiatives should be in place to encourage the private sector to channel resources toward climate adaptation plans. The indicator evaluates also the robustness of institutional arrangements, including both policy and financial de-risking instruments, to bolster private sector engagement in climate adaptation initiatives. Additionally, it assesses the presence of incentives targeting diverse sectors and segments of both the business and societal realms.	4 - Funding are allocated in a transparent way and regulated by programs/policies to encourage diverse private sectors to channel resources toward climate resilience plans; also de-risking instruments are in place to protect the private sector 3 - Funding are allocated in a transparent way and regulated by programs/policies to encourage diverse private sectors to channel resources toward climate resilience plans 2 - Appropriate funding is allocated regularly to boost private sector engagement, but it is not regulated 1 - Funding are allocated to the private sector ad-hoc, based on projects opportunities 0 - No incentives are allocated to the private sector to encourage climate resilient private investment	Content creation with project partners

4.3.7. Dimension 7: Vulnerability and risk assessment

This dimension aims at assessing the region's maturity in terms of its ability to monitor hazards, risks and vulnerability, the quality and comprehensiveness of the assessments conducted and their use and dissemination. The indicators in this dimension have been developed in close collaboration with R4C T3.1 partners (TECNALIA). This alignment was based on a shared approach based on which the availability of robust data on hazards, risks and vulnerability informing decision-making contributes to regional climate resilience maturity.

Table 16 - List of indicators of Dimension 7 - Vulnerability and risk assessment

	Indicator	Description	Scoring system	Source
7.1	**Ability to conduct risk and vulnerability assessments**	This indicator aims to assess the region's capacity to monitor hazards, risks and vulnerability and conduct relevant assessments. Data availability is considered as the basic requirement for building capacity to conduct robust vulnerability and risk assessments. The level of maturity increases as the region improves its ability to assess and track risks and vulnerability on its own territory, making use of innovative tools and robust partnerships.	4 - Partnership with universities, research centers and other relevant private organisations are actively used in order to ensure the highest possible quality and comprehensiveness of the assessments. 3 - Adequate tools for monitoring and forecasting extreme events and for modelling long-term changes at regional scale are in place and operational, including innovative evidence-based digital tools used to assess and track hazards, risks and vulnerability. Data from heterogenous sources are complemented. 2 - Some monitoring tools/systems exist in the region, providing partial data on regional climate hazards, risks, vulnerability. 1 - Data on regional climate hazards, risks, vulnerability are partially available from other sources (e.g., at scale different than regional scale), but no monitoring tools/systems exist in the region. 0 - No data on regional climate hazards, risks, vulnerability exists	Content creation with project partners
7.2	**Hazard assessments**	This indicator assesses the existence of recent, expert-reviewed hazard assessments. Hazard assessments provide knowledge of hazards that the region faces and their likelihood/probability. Regions need to have a view of the hazards they face (e.g., flood, fire, hurricane etc.) and how severe they might be. Comprehensive risk assessments entail: - For each hazard, identification, as a minimum, of a "most probable" incident and a "most severe" incident (UNDRR). - Inclusion of future hazard projections for different climate change scenarios. - Inclusion of information about downscaling resolution of hazards. Hazard estimates need to be updated regularly, as hazards may change over time as a consequence of land use changes, climate change or better knowledge (UNDRR).	4 - Comprehensive risk assessments exist, were updated in last 3 years and reviewed by a 3rd party. "Most severe" and "most probable" hazards are generally accepted as such 3 - Risk assessments exist but have shortcomings in terms of when updated and level of review or acceptance 2 - Some risk assessments exist but are not comprehensive; or are comprehensive but more than 3 years old; or are not reviewed by a 3rd party 1 - Only a generalized notion of hazards, with no attempt systematically to identify probability 0 - No estimates	UNDRR, 2017 (Adapted from Detailed Assessment, Indicator 2.2.1)

7.3	**Integrated vulnerability and risk assessments**	This indicator assesses whether the region disposes of comprehensive scenarios that assess its exposure and vulnerability to identified hazards. Exposures and vulnerabilities may be assessed from sources such as regional flood maps or earthquake hazard maps, or from expert estimation. Hazards, exposures and vulnerabilities need to be assembled into “scenarios”. Comprehensive scenarios for the “most probable” and “most severe” incidence of each hazard should be available. Scenarios are comprehensive pictures of the total impact of the hazard (if any) across the region. Comprehensiveness of the scenarios entails the inclusion of: - Exposure and vulnerability of economic zones; - Exposure and vulnerability of critical infrastructure items; - Benefit from, and status of ecosystem services, where applicable; - Estimates of recovery time, given estimated benefit of mitigation measures, if any; - Quantification in terms of economic impacts, number of people affected, etc.; - Future exposure and vulnerability scenarios; - Explicit consideration of interdependencies between risks: risk systematicity should be considered in assessment and prioritisation of risk scenarios and their implications. This includes the assessment of complex, compounding and cascading risks. - Consideration of scale: the assessment should be conducted at the appropriate scale / spatial level. This includes taking into account trans-boundary issues and scaling and integration of knowledge, data and information available at the city level that is relevant for regional level. Scenarios will ideally have been for reviewed for thoroughness and plausibility by a 3rd party and updated in last 18 months. This is more frequently than the reviews of hazards, as land use and development that may affect exposure and vulnerability happens on a faster timescale.	4 - Comprehensive scenario exist, updated in the last 18 months and reviewed by a 3rd party 3 - Scenarios have shortcomings in terms of coverage, when updated, level of thoroughness of review 2 - Partial scenarios exist but are not comprehensive or complete; and/or are more than 18 months old; and/or are not reviewed by a 3rd party 1 - Only a generalized notion of exposure and vulnerability, with no attempt systematically to identify impacts 0 - No risk assessment	UNDRR, 2017 (Adapted from Detailed Assessment, Indicator 2.2.1)
7.4	**Alignment of vulnerability and risk assessments with justice and equity principles**	This indicator assesses the alignment of the vulnerability and risk assessments with four justice dimensions, as defined in R4C D2.2: 1. Recognitional justice: acknowledgement of existing social structures or norms that may create unequal conditions for different groups of people and hence differing vulnerabilities to climate risks. For example, the assessment should explicitly identify groups and communities most vulnerable to the impacts of climate change. 2. Distributive justice: concerns the distribution of climate impacts and adaptation impacts across society. For example, the assessment should explicitly assess unequal distribution of risks in society. 3: Procedural justice: refers to equitable participation of stakeholders or actors in the process. For example, mechanisms should be in place to ensure that all groups can contribute to information collection and use. This includes the use of citizen science methods for risk mapping, and the inclusion of tacit, local, indigenous knowledge. 4. Restorative justice: refers to how harm and injustice need to be acknowledged and attributed, and possible measures for compensation need to be developed. For example, the assessment should explicitly recognise the unfair distribution of climate impacts as well as the unfair distribution of negative outcomes of adaptation, i.e., maladaptation, and how they impact vulnerability.	4 - The assessment is aligned with all justice dimensions in a comprehensive way 3 - The assessment explicitly considers at least 3 of the justice dimensions 2 - The assessment explicitly considers one or two justice dimensions 1 - The assessment makes reference to justice aspects in a generic way 0 - The assessment does not consider any justice dimension	Content creation with project partners R4C D2.2
7.5	**Comprehensiveness of indicators**	The indicators used in the climate change vulnerability and risk assessment can vary considerably depending on the region. Indicators to be considered include these categories: 1. Indicators regarding sensitivity, or the extent to which the region will be affected by, or responsive to, a climate hazard 2. Indicators regarding adaptive capacity, or the ability to prepare for or cope with a climate hazard. This includes indicators assessing readiness of the regional system to reduce vulnerability to climate hazards. For example, measuring economic conditions, governance capacities, societal readiness.	4 - The assessment includes a comprehensive set of indicators, covering all 5 categories. Any knowledge gaps and uncertainties are summarized and made explicit. 3 - The assessment includes a satisfactory set of indicators covering all 5 categories. 2 - The assessment includes a set of indicators covering at least 3 categories.	Content creation with project partners UNDRR, 2017 ND-GAIN, 2019

		3. Indicators regarding exposure (e.g., the percent of population experiencing a climate hazard) 4. Indicators assessing all sectors of interest in terms of risk, damage, and loss. For example, business output and employment at risk, populations at risk of displacement, housing at risk, agricultural land and ecosystems at risk, cultural heritage at risk, lives, and livelihoods at risk etc., assessed for key identified scenarios. This should be in alignment with the "Do Not Significant Harm" principle, as described in R4C D1.2 5. Indicators assessing interactions between risks, transboundary effects, cascading impacts. This includes assessing the interdependencies of critical assets (UNDRR Scorecards): critical assets should be identified and relationships between them systematically identified in the form of "failure chains", in order to frame disaster plans and retrofits and upgrades to improve the capability of the infrastructure to withstand disasters.	1 - The assessment only includes one or two categories of indicators. 0 - Indicators appear not adequate and not up-to-date	
7.6	**Use of vulnerability and risk assessments' results**	This indicator assesses the use of the results of vulnerability and risk assessments to inform decision-making. Risk assessments' data and results can be used to support decision-making at regional level in various ways. For example, hazard maps for current regional development and future growth should be developed based on available risk-assessments. Data and results of risk assessments should be considered in regional planning across sectors.	4 - Levels below + Data of risk assessments are publicly available as open data to be used via standard protocols 3 - The vulnerability and risk assessment is thoroughly integrated in existing policies and regional planning instruments 2 - Risk assessments' data and results are regularly used to support decision-making 1 - Risk assessments' data and results are sporadically used to support decision-making 0 - Results of vulnerability and risk assessments are not available to regional authorities and other key actors	Content creation with project partners

4.3.8. Dimension 8: Innovation potential assessment

This dimension aims at assessing the region's level of maturity in enabling innovation for climate resilience, following the approach developed by T6.1 in the Common Innovation Framework (see Sub-Chapter 3.4.2). The indicators, part of this dimension, have been developed by T6.1 (SPI).

The dimension 8 will provide the impact of R4C Innovation Packages in each regional context, concerning the research and innovation performance, particularly, in the following domains: (i) framework conditions, (ii) investments in innovation, (iii) innovation activities, and (iv) impacts.

The data is retrievable from existing datasets: (a) data from the European Innovation Scoreboard and Regional Innovation Scoreboard that provides a comparative assessment of the research and innovation performance of EU Member States; and (b) data from national statistics institutions or other official data that may acknowledge innovation in climate-related topics.

The **scoring system** is based on the methodology of EC that defines the performance sub-groups – Innovation Leaders, strong innovators, moderate innovators and emerging innovators – in the European/Regional Innovation Scoreboard (Methodology Report)[3]

Based on the literature, for each indicator, 5 levels indicate the performance range comparing it to the EU average, as indicated in the Table 17 below.

Table 17 - Performance range for indicators of Dimension 8

Level 0	**Below 36.0% of EU average**
Level 1	**Between 36.0% and 70% of EU average**
Level 2	**Between 70% and 100% of EU average**
Level 3	**Between 100% and 125% of EU average**
Level 4	**Above 125% of EU average**

[3] Adapted from Table 2, page 27

Table 18 - List of indicators of Dimension 8 - Innovation potential assessment

	Indicator	Description	Scoring system	Source
8.1	**Framework conditions - Education & Lifelong learning**	This indicator maps whether the region invests in education for climate resilience through highly skilled human resources that may have competencies to address climate challenges. Additionally, the region should allocate resources and invest in lifelong learning initiatives to raise social awareness of climate change and sustainability. Goal: The region has skilled human resources that may enable innovation in climate change topics.	0 - Below 36.0% of EU average - Percentage of population aged 25-34 having completed tertiary education, in climate change fields of expertise 1 - Between 36.0% and 70% of EU average - Percentage of population aged 25-34 having completed tertiary education, in climate change fields of expertise 2 - Between 70% and 100% of EU average - Percentage of population aged 25-34 having completed tertiary education, in climate change fields of expertise 3 - Between 100% and 125% of EU average - Percentage of population aged 25-34 having completed tertiary education, in climate change fields of expertise 4 - Above 125% of EU average - Percentage of population aged 25-34 having completed tertiary education, in climate change fields of expertise	European Commission, 2023a; 2023b
8.2	**Framework conditions - Research System**	This indicator aims to recognise whether there are regional structures to support innovation and research, along with efforts to promote R&D that may enable innovations in this regard. Goal: The region has an attractive research system and regional structures to support innovation, that may enable climate resilience.	0 - Below 36.0% of EU average – International scientific co-publications regarding climate change and climate adaptation and/or mitigation, per million population 1 - Between 36.0% and 70% of EU average - International scientific co-publications regarding climate change and climate adaptation and/or mitigation, per million population 2 - Between 70% and 100% of EU average - International scientific co-publications regarding climate change and climate adaptation and/or mitigation, per million population 3 - Between 100% and 125% of EU average - International scientific co-publications regarding climate change and climate adaptation and/or mitigation, per million population 4 - Above 125% of EU average - International scientific co-publications regarding climate change and climate adaptation and/or mitigation, per million population	European Commission, 2023a; 2023b
8.3	**Framework conditions - Digitalisation**	This metric is designed to evaluate the degree of digital technology adoption within different regions, serving as a fundamental basis for fostering innovation. Goal: The region is conducive to digitalization due to its high broadband penetration, which encourages the development of digital skills and innovation for climate resilience.	0 - Below 36.0% of EU average –individuals who have above basic overall digital skills (EIS)/Own estimates using Households with broadband access (RIS) 1 - Between 36.0% and 70% of EU average – individuals who have above basic overall digital skills (EIS)/Own estimates using Households with broadband access (RIS) 2 - Between 70% and 100% of EU average - individuals who have above basic overall digital skills (EIS)/Own estimates using Households with broadband access (RIS) 3 - Between 100% and 125% of EU average - individuals who have above basic overall digital skills (EIS)/Own estimates using Households with broadband access (RIS) 4 - Above 125% of EU average - individuals who have above basic overall digital skills (EIS)/Own estimates using Households with broadband access (RIS)	European Commission, 2023a; 2023b
8.4	**Public investments in innovation**	The objective of this particular indicator is to evaluate whether the funding provided by the public sector facilitates research and development activities along the entire innovation chain, leading to a positive impact in terms of climate resilience. Goal: The public authorities support R&D expenditure for climate action.	0 - Below 36.0% of EU average – R&D expenditure in the public sector for climate action as percentage of GDP 1 - Between 36.0% and 70% of EU average - R&D expenditure in the public sector for climate action as percentage of GDP 2 - Between 70% and 100% of EU average - R&D expenditure in the public sector for climate action as percentage of GDP 3 - Between 100% and 125% of EU average - R&D expenditure in the public sector for climate action as percentage of GDP 4 - Above 125% of EU average - R&D expenditure in the public sector for climate action as percentage of GDP	European Commission, 2023a; 2023b

8.5	**Innovation activities in SME**	This indicator aims to assess if the private sector can scale up R&D investment in climate change mitigation/adaptation. It could play an essential role as these private investment projects may have important public benefits. Goal: The region has important intellectual assets and climate-oriented businesses that have introduced innovations on the market or within their organisations.	0 - Below 36.0% of EU average – SMEs introducing product innovations with an impact on climate adaptation and/or mitigation. 1 - Between 36.0% and 70% of EU average - SMEs introducing product innovations with an impact on climate adaptation and/or mitigation. 2 - Between 70% and 100% of EU average - SMEs introducing product innovations with an impact on climate adaptation and/or mitigation. 3 - Between 100% and 125% of EU average – SMEs introducing product innovations with an impact on climate adaptation and/or mitigation. 4 - Above 125% of EU average - SMEs introducing product innovations with an impact on climate adaptation and/or mitigation.	European Commission, 2023a; 2023b
8.6	**Collaboration**	This indicator aims to assess the collaborative governance between the public and private sector and within the industry, to address climate issues to foster environmental performance. These partnerships will create new models for sustainable growth and serve as a benchmark for innovative practices in the public and private sectors. Goal: The region relies on strong collaboration between the public and private sectors, regarding innovation to face climate change.	0 - Below 36.0% of EU average – Innovative SMEs collaborating with other SMEs, on climate change topics 1 - Between 36.0% and 70% of EU average - Innovative SMEs collaborating with other SMEs, on climate change topics 2 - Between 70% and 100% of EU average - Innovative SMEs collaborating with other SMEs, on climate change topics 3 - Between 100% and 125% of EU average - Innovative SMEs collaborating with other SMEs, on climate change topics 4 - Above 125% of EU average - Innovative SMEs collaborating with other SMEs, on climate change topics	European Commission, 2023a; 2023b
8.7	**Economic impact of innovation**	This indicator aims to measure the sales of climate-related product, with an impact on employment, through just transition. This can help ensure that private-sector adaptation investments generate the intended climate impact. Goal: Strong economic impact of climate-related innovations in the regional context	0 - Below 36.0% of EU average – Sales of new-to-market and new-to-enterprise innovations regarding climate change, as percentage of total turnover 1 - Between 36.0% and 70% of EU average - Sales of new-to-market and new-to-enterprise innovations regarding climate change, as percentage of total turnover 2 - Between 70% and 100% of EU average - Sales of new-to-market and new-to-enterprise innovations regarding climate change, as percentage of total turnover 3 - Between 100% and 125% of EU average - Sales of new-to-market and new-to-enterprise innovations regarding climate change, as percentage of total turnover 4 - Above 125% of EU average - Sales of new-to-market and new-to-enterprise innovations regarding climate change, as percentage of total turnover	European Commission, 2023a; 2023b
8.8	**Environmental sustainability**	This indicator captures improvements to reduce the negative impact on the environment. A resilient EU growth model is grounded in sustainable competitiveness, with innovation serving as a cornerstone to build climate resilience. Goal: The industry is making improvements to reduce the negative impact of human activity on the environment.	0 - Below 36.0% of EU average – Air emissions in fine particulates (PM2.5) in Industry 1 - Between 36.0% and 70% of EU average - Air emissions in fine particulates (PM2.5) in Industry 2 - Between 70% and 100% of EU average - Air emissions in fine particulates (PM2.5) in Industry 3 - Between 100% and 125% of EU average - Air emissions in fine particulates (PM2.5) in Industry 4 - Above 125% of EU average - Air emissions in fine particulates (PM2.5) in Industry	European Commission, 2023a; 2023b

5. Regional Resilience Maturity Model and Assessment Digital Tool

5.1. Primary purpose of the digital tool

The Regional Resilience Maturity Model and Assessment digital tool will be developed by the end of T4.1 (M16), to be online and ready to be used and tested by R4C partner regions during the project's Consortium Agreement taking place in April 2024.

The Regional Resilience Maturity Model and Assessment digital tool aims to provide a point of reference for self-assessing regions' progress in their climate resilience-building process. It aims to be a tool for reflection and guidance, supporting regions to:

- *identify their level of climate resilience maturity and potential gaps.*
- *inform the prioritization of suitable policies to develop climate resilience.*
- *justify for funding of specific measures.*

Using the assessment approach illustrated in the previous chapters of this deliverable, the combination of governance context assessment and CRML assessments shall help regions to understand their scope of action for climate resilience-building based on their specific regional (governance) characteristics. Based on that, CRML assessments shall provide reference information to help regions develop a strategic approach to improve climate resilience maturity, including the identification of suitable policies. The model and related assessments may also be used as reference for the development of regional resilience strategies or action plans.

5.2. Who should use the digital tool

The RRMM and the deriving digital tool is aimed at regional authorities, authoritative bodies or practitioners operating at regional level. However, the RRMM approach recognizes the regional system as comprising socio-ecological and socio-technical networks across temporal and spatial scales. The term "region" is purposefully not defined strictly in the model, for the assessment to be used by various types of regions and tailored to their specific context. As introduced in Sub-Chapter 3.1, the "region" is understood as an administrative level between "national" and "local". In different countries and contexts, this may pertain to autonomous status, regions, coalition of municipalities, etc.

The CRML assessment is targeted at regional leaders and practitioners, as the actors who should take the lead in conducting the assessment, but it aims at capturing and assessing the capacities and features of the regional system as a polycentric system, with different types of actors steering the climate resilience-building process at various levels and scales. In fact, climate resilience-building needs to be cross-sectoral and requires collaboration across different systems. Within R4C, the assessment should be conducted by project regional partners with the support of colleagues from other regional departments or agencies if needed. R4C regional partners partners will be supported in the conduction of CRML assessments by T4.3 partners, in particular Zabala.

5.3. Characteristics of the digital tool

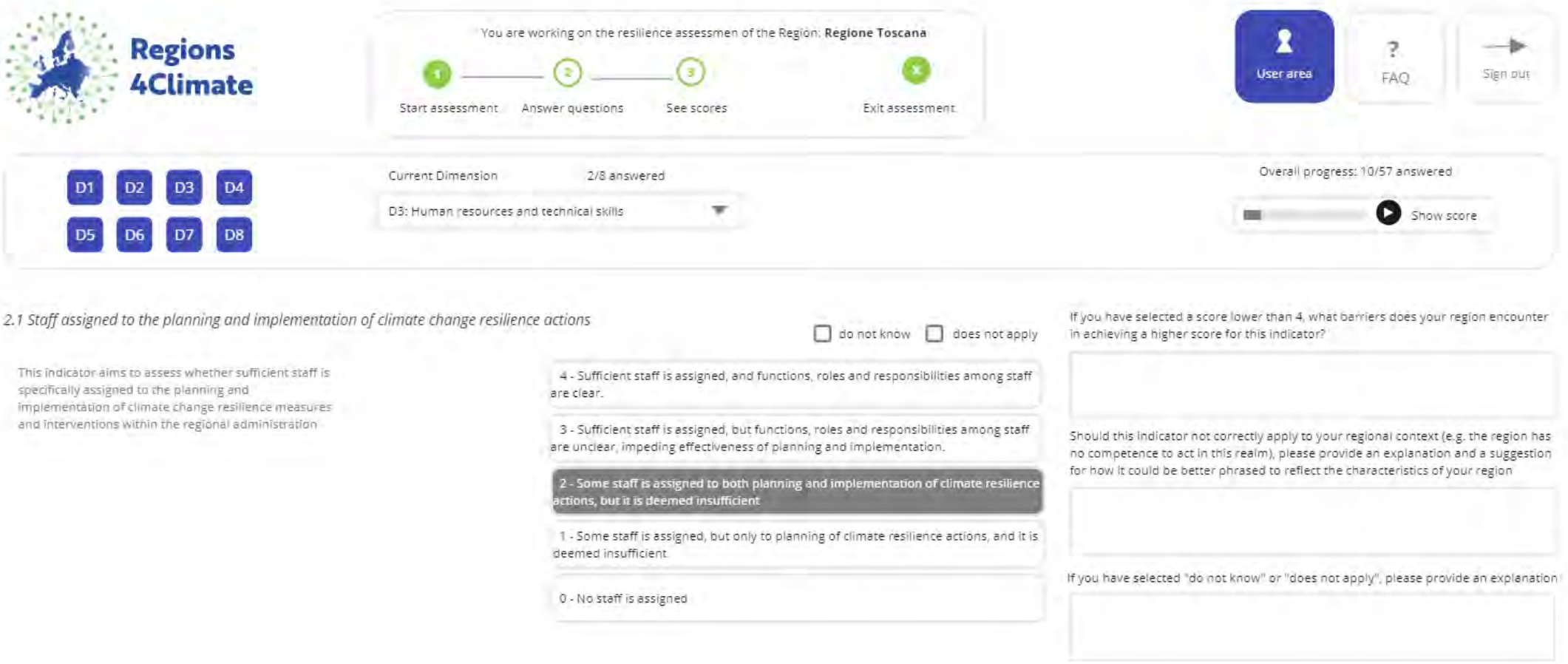
The Regional Resilience Maturity Model and Assessment digital tool will be a web-based self-assessment platform. Operating on a questionnaire-based format, it accommodates flexibility for users to save and edit their responses, recognizing that the assessment may span multiple sessions. All collected data and responses will be securely stored within the tool itself during the assessment process. Upon the completion of the assessment, the comprehensive set of results will be archived in the ICT Infrastructure Database layer. This database, developed by the partner Engineering, serves as a repository for organized data management.

Access to the Regional Resilience Maturity Assessment tool will be facilitated through the R4C log-in function, provided by the partner Engineering, embedded within the R4C Climate Resilience Portal. This integration will ensure data from the assessments will be saved in the account of the Region. Upon logging in, the Region will have the ability to evaluate its Resilience Maturity across the eight dimensions and 57 indicators, as summarised in Table 6.

Furthermore, the outcome of the assessments will not only be stored but also visualized through the Climate Resilience Dashboards (in collaboration with the partner Revolve). This feature enhances the utility of the tool by providing clear and comprehensive visual representations of the results, fostering a better understanding of regional climate resilience maturity levels.

Figure 5 shows an example of how the online tool interface could look like, after the user's login. This exemplary interface was based on the *ARCH Resilience Assessment Dashboard RAD*, developed as part of the EU research project "ARCH – Advancing resilience of historic areas against climate-related and other hazards". The tool will also include an introductory page with explanations of the tool's logic and purpose.

Figure 5 - Overview of the digital tool Regional Resilience Maturity Model and Assessment



6. Ways forward

The innovative character of the Regional Resilience Maturity Model and Assessment Framework requires an iterative process of adjustment, as the validity of the RRMM approach is tested and validated in the R4C demonstration regions. By June 2024 (M18), a digital tool will be developed incorporating inputs from R4C regions. The tool will be used for periodic regional assessments throughout the project, which will enable its validation. The periodic assessments will be an occasion to collect information and feedback on the tool, which will be used to make adjustments towards the development of future improved versions of the tool for widespread dissemination beyond R4C. After completion of T4.1, the continuation of the tool's improvement will be enabled by ICLEI's involvement in T4.3.

The tool currently focuses on European regions and is based on a European governance context. Ideally, a more robust version of the tool will include a level of flexibility for it to be tailored to a variety of regional contexts, including extra-European. With this intention in mind, the model is based on a definition of "region" that can reflect a variety of regional contexts.

In this sense, the RRMM indicators could be improved through more detailed specification but also through the inclusion of additional indicators, incorporating some of the suggestions received from project partners which could not be included at this stage. For example, additional indicators could address the existence of backup systems, or the existence of available material to offset the loss caused by climate hazards. As already highlighted, a potential future improvement of the RRMM and its assessment approach could entail tailoring the indicators based on the specific climate hazards, risks, and vulnerability of the region, in addition to its specific governance context. The inclusion of more sector-specific indicators could also be considered, based on the specific regional context. For example, indicators assessing the resilience maturity of built infrastructure, including cultural heritage.

Following feedback gathered from R4C partner regions during EURESFO, additional features could be added in the digital tool. Among these, the RRMM could be linked to best practices and case studies hosted on the Mission Implementation Platform (from R4C regions and beyond) as sources of inspiration for the design of policy interventions aimed at improving resilience maturity levels based on CRML assessments.

Throughout the course of the project, data will be gathered that will serve to improve the model and related assessment framework, better clarifying the relation between regional governance characteristics and capacities for climate resilience-building. The close alignment among WP4 tasks around a common approach to assessing regional governance could lead to the collection of enough information to build a typology of regional governance characteristics that covers the 12 R4C regions. An outcome of this could be the clarification of the role of regional governments in climate resilience-building, supporting the development of a tool that can be tailored to the specific regional context.

7. References

ARCH Resilience Assessment Dashboard RAD. Available at: https://arch.iais.fraunhofer.de/ (Accessed on 01/12/2023)

Averchenkova, A., & Bassi, S. (2016). Beyond the targets: assessing the political credibility of pledges for the Paris Agreement.

Bahadur, A.; Peters, K.; Wilkinson, E.; Pichon, P.; Gray, K.; Tanner, T. (2015). The 3As: Tracking resilience across BRACED. ODI, London, UK, 57 pp.

Béné, C., Godfrey Wood, R., Newsham, A., Davies, M. (2012). Resilience: new utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. Brighton: Institute of Development Studies. https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.2040-0209.2012.00405.x

Béné, C., Frankenberger, T., & Nelson, S. (2015). Design, Monitoring and Evaluation of Resilience Interventions: Conceptual and Empirical Considerations. Institute of Development Studies. Available at: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/6556/Wp459.pdf?sequence=1&isAllowed=y

Bennett, N. J., & Satterfield, T. (2018). Environmental governance: A practical framework to guide design, evaluation, and analysis. *Conservation Letters*, *11*(6), e12600.

Bräuninger, M., S. Butzengeiger-Geyer, A. Dlugolecki, S. Hochrainer, M. Köhler, J. Linnerooth-Bayer, R. Mechler, A. Michaelowa, and S. Schulze (2011), Application of economic instruments for adaptation to climate change Final report, Perspectives GmbH, 17 Dec. [Available at http://ec.europa.eu/clima/policies/adaptation/what/docs/economicinstrumentsen.pdf.] CLIMA.C.3./ETU/2010/0011

Carayannis, Elias G., Barth, Thorsten D. and & Campbell, David F. J. Campbell (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. Journal of Innovation and Entrepreneurship volume 1, Article number: 2. https://doi.org/10.1186/2192-5372-1-2

Chmutina, K., Lizarralde, G., Von Meding, J., & Bosher, L. (2023). Standardised indicators for “resilient cities”: the folly of devising a technical solution to a political problem. International Journal of Disaster Resilience in the Built Environment. https://doi.org/10.1108/IJDRBE-10-2022-0099

Clever Cities. (2018). Available at: https://clevercities.eu/ (Accessed on 14/12/2023)

Cologna, V., & Siegrist, M. (2020). The role of trust for climate change mitigation and adaptation behaviour: A meta-analysis. *Journal of Environmental Psychology*, *69*, 101428.

Dewulf, A., Meijerink, S., & Runhaar, H. (2015). The governance of adaptation to climate change as a multi-level, multi-sector and multi-actor challenge: a European comparative perspective. Journal of Water and Climate Change, 6(1), 1-8 https://iwaponline.com/jwcc/article/6/1/1/320/Editorial-The-governance-of-adaptation-to-climate

European Commission (2020). Directorate-General for Research and Innovation. Research and innovation strategy 2020-2024. Ref. Ares(2020)5352987 – 08/10/2020

European Commission (2023a). European innovation scoreboard. Available at: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en (Accessed on 13/12/2023)

European Commission (2023b). Regional innovation scoreboard. Available at: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/regional-innovation-scoreboard_en (Accessed on 13/12/2023)

European Commission (2023c). Directorate-General for Research and Innovation. Regional Innovation Scoreboard 2023. doi: 10.2777/70412

Farrokhi, M., Khankeh, H. R., Amanat, N., Kamali, M., & Fathi, M. (2020). Psychological aspects of climate change risk perception: A content analysis in Iranian context. *Journal of Education and Health Promotion*, *9*.

Ferguson, L., Chan, S., Santelmann, M., & Tilt, B. (2017). Exploring participant motivations and expectations in a researcher-stakeholder engagement process: Willamette Water 2100. Landscape and Urban Planning, 157, 447-456.

Ford, J. D., & King, D. (2015). A framework for examining adaptation readiness. Mitigation and Adaptation Strategies for Global Change, 20, 505-526.

Foster, K. A. (2007). A case study approach to understanding regional resilience. IURD Working Paper Series Publication. Institute of Urban & Regional Development. https://escholarship.org/uc/item/8tt02163

Gram-Hanssen, I., Aall, C., Drews, M., Sirkku, J, Jurgilevich, A., Klein, R.J.T., Mikaelsson, M.A., Lyngtorp Mik-Meyer, V., (2023). Comparison and analysis of national climate change adaptation policies in the Nordic region. *Nordic Council of Ministers*. Available at: https://pub.norden.org/temanord2023-525/about-this-publication.html

Gustafsson, K. M., & Lidskog, R. (2018). Boundary organizations and environmental governance: Performance, institutional design, and conceptual development. *Climate Risk Management*, *19*, 1-11.

Hanssen, G. S., Mydske, P. K., & Dahle, E. (2013). Multi-level coordination of climate change adaptation: by national hierarchical steering or by regional network governance? Local Environment, 18(8), 869-887.

Heikkinen, M., Karimo, A., Klein, J., Juhola, S., & Ylä-Anttila, T. (2020). Transnational municipal networks and climate change adaptation: A study of 377 cities. Journal of Cleaner Production, 257, 120474.

Hölscher, K. (2019). Transforming urban climate governance: Capacities for transformative climate governance.

IPCC. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp

IPCC. (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press

IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

Island Press and Kresge Foundation. (2015). Bounce forward: urban resilience in the era of climate change. Retrieved from here.

ISO/TS 37107:2019; Sustainable Cities and Communities—Maturity Model for Smart Sustainable Communities. International Organization for Standardization: Geneva, Switzerland, 2019

Juhola, S., Heikkinen, M., Pietilä, T., Groundstroem, F., & Käyhkö, J. (2022). Connecting climate justice and adaptation planning: An adaptation justice index. Environmental Science & Policy, 136, 609-619.

Klein, J., Araos, M., Karimo, A., Heikkinen, M., Ylä-Anttila, T., & Juhola, S. (2018). The role of the private sector and citizens in urban climate change adaptation: Evidence from a global assessment of large cities. *Global environmental change*, *53*, 127-136.

Kuznets, S. (1965). Economic Growth and Structure: Selected Essays. London: Heinemann Educational Books Ltd

MAinSTreaming Experiences at Regional and Local Level for ADAPTtion to Climate Change – MASTER ADAPT. (2019) Guidelines for the regional adaptation strategy. Available at: https://masteradapt.eu/strumenti/?lang=en

Manyena, B., Machingura, F., & O'Keefe, P. (2019). Disaster Resilience Integrated Framework for Transformation (DRIFT): A new approach to theorising and operationalising resilience. World development, 123, 104587.

Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. Landscape and urban planning, 147, 38-49.

ND-GAIN (2019) Urban Adaptation Assessment. Available at: https://gain.nd.edu/assets/256491/new_uaa_indicator_list.pdf (Accessed on 14/12/2023)

ODI. (2016). Analysis of resilience measurement frameworks and approaches. The Resilience Measurement, Evidence and Learning Community of Practice (CoP)

OECD. (2020). A territorial approach to climate action and resilience. OECD Programme. Available at: https://www.oecd.org/cfe/cities/overviewTACAR.pdf

OECD. (2021). The Inequality-Environment Nexus: Towards a people-centred green transition. OECD Green Growth Papers. OECD Publishing, Paris. https://doi.org/10.1787/ca9d8479-en

Olazabal, M., Galarraga, I., Ford, J., Sainz De Murieta, E., & Lesnikowski, A. (2019). Are local climate adaptation policies credible? A conceptual and operational assessment framework. International Journal of Urban Sustainable Development, 11(3), 277-296.

Olazabal, M., De Gopegui, M. (2021). Adaptation planning in large cities is unlikely to be effective, Landscape and Urban Planning, 206, https://doi.org/10.1016/j.landurbplan.2020.103974.

Ostrom, E. (2010). Beyond Markets and States: Polycentric Governance of Complex Economic Systems. The American Economic Review, 100(3), 641–672.

Petruzziello G., Mazzonetto M., Simone A., Pellizzone A. (2023), Cookbook - The MOSAIC recipe for co-creation. Available at: https://mosaic-mission.eu/sites/default/files/2023-11/MOSAIC%20Cookbook%20D5.4%20-%20Web.pdf

Petzold, J., Hawxwell, T., Jantke, K., Gonçalves Gresse, E., Mirbach, C., Ajibade, I., ... & Garschagen, M. (2023). A global assessment of actors and their roles in climate change adaptation. *Nature climate change*, 1-8.

Pöppelbuß, J., & Röglinger, M. (2011). What makes a useful maturity model? A framework of general design principles for maturity models and its demonstration in business process management.

Quay. (2010). Anticipatory Governance. Journal of the American Planning Association, 76:4, 496-511, DOI: 10.1080/01944363.2010.508428

Regional Adaptation Support Tool (2023). ClimateADAPT. Available at: https://climate-adapt.eea.europa.eu/en/mission/knowledge-and-data/regional-adaptation-support-tool (Accessed on 14/12/2023)

Smith, E. K., & Mayer, A. (2018). A social trap for the climate? Collective action, trust and climate change risk perception in 35 countries. *Global Environmental Change*, *49*, 140-153.

SMR Smart Mature Resilience (2016). Available at: https://smr-project.eu/home/ (Accessed on 13/12/2023)

Stead, D., & Meijers, E. (2009). Spatial planning and policy integration: Concepts, facilitators and inhibitors. *Planning theory & practice*, *10*(3), 317-332.

Stoker, G. (1998). Governance as theory: five propositions. International social science journal, 50(155), 17-28.

Swim, J. K., Clayton, S., & Howard, G. S. (2011). Human behavioral contributions to climate change: psychological and contextual drivers. American Psychologist, 66(4), 251.

Termeer, C., Dewulf, A., Van Rijswick, H., Van Buuren, A., Huitema, D., Meijerink, S., ... & Wiering, M. (2011). The regional governance of climate adaptation: a framework for developing legitimate, effective, and resilient governance arrangements. *Climate law*, *2*(2), 159-179.

Treib, O., Bähr, H., & Falkner, G. (2007). Modes of governance: towards a conceptual clarification. Journal of European public policy, 14(1), 1-20.

Uittenbroek, C. J. (2016). From policy document to implementation: organizational routines as possible barriers to mainstreaming climate adaptation. Journal of Environmental Policy & Planning, 18(2), 161-176.

Uittenbroek, C. J., Mees, H. L., Hegger, D. L., & Driessen, P. P. (2019). The design of public participation: who participates, when and how? Insights in climate adaptation planning from the Netherlands. Journal of Environmental Planning and Management, 62(14), 2529-2547.

UNDRR (2017) Disaster Resilience Scorecard for Cities. Available at: https://mcr2030.undrr.org/sites/default/files/2021-08/UNDRR_Disaster%20resilience%20scorecard%20for%20cities_Detailed_English_Jan2021.pdf (Accessed: 01/12/2023).

van den Ende, M. A., Mees, H. L., Hegger, D. L., & Driessen, P. P. (2023). Mechanisms influencing mainstreaming of adaptation in spatial development: case studies in three Dutch municipalities. *Journal of Environmental Planning and Management*, *66*(14), 2903-2921.

van der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, 112-124.

Vaughan, E. (2018). Resilience Measurement Practical Guidance Note Series 3: Resilience Capacity Measurement. Produced by Mercy Corps as part of the Resilience Evaluation, Analysis and Learning (REAL) Associate Award

Wamsler, C. (2014). Cities, disaster risk and adaptation. Routledge.

Watkiss, P. and Cimato, F. (eds) (2020). What Does Transformational Adaptation Look Like? Literature review synthesis paper. Deliverable 10 of the Resilient Regions: Clyde Rebuilt project.

Ziervogel, G., Cowen A., Ziniades J. (2016). Moving from Adaptive to Transformative Capacity: building Foundations for Inclusive, Thriving, and Regenerative Urban Settlements; Sustainability, 8,955

8. Appendices

8.1. Annex 1 : CRML pre-assessments

The pre-assessments of Climate Resilience Maturity Levels conducted in the proposal phase of R4C took in consideration the following resilience building solution sectors :

- *Participatory governance*
- *Transboundary policy instruments (e.g., resource management, DRR and climate)*
- *Innovative business models (e.g., blue & green economy, circular economy)*
- *Innovative asset management models (e.g., co-ownership, co-management)*
- *Innovative finance models*
- *Robust citizen & stakeholder engagement*
- *Initiatives to promote behavioural change*
- *Social equity and social justice*
- *User-centred digital platforms*
- *User-centred digital tools for decision-making*
- *Climate resilient built infrastructure solutions*
- *Sustainable and low-carbon energy systems*
- *Sustainable public transport system (e.g., low-emissions, multimodal, adaptive)*
- *Nature-based solutions*
- *Innovations for healthy living (community health initiatives)*
- *Biodiversity restoration/ protection*
- *Cultural heritage protection*

For each of the categories above, the level of Climate Resilience Maturity had to be selected based on the following definitions :

- *CRML 1: climate resilience issues have been identified*
- *CRML 2: specific climate resilience targets have been identified; relevant stakeholders have been identified; potential impacts and trade-offs have been identified*
- *CRML 3: initial testing of proposed climate resilience innovations has been undertaken together with stakeholders*
- *CRML 4: climate resilience innovations have been validated through pilot testing in a relevant environment to substantiate proposed impact and feasibility*
- *CRML 5: climate resilience innovations have been validated by relevant stakeholders in the sector(s) affected*
- *CRML 6: climate resilience innovations have been demonstrated in a relevant environment and in co-operation with relevant stakeholders; feedback on testing of innovations has been gathered from stakeholders to gain an understanding of potential impact*

- *CRML 7: in-depth analysis of inter-sectoral relationships and trade-offs has been undertaken with the relevant stakeholder groups and climate resilience innovations(s) refined or adapted as needed, including re-testing in a relevant environment with relevant stakeholders*
- *CRML 8: proposed climate resilience innovation(s) as well as a clear plan for societal adaptation is complete and qualified including integration of cross-sectoral solutions and conceptual impact identification*
- *CRML 9: full-scale, integrated cross-sectoral climate resilience innovations have been validated in a relevant environment, including assessment of social, ecological and economic impacts*

CRML 1-3 represent the early stages of climate resilience issue identification and strategy development during which stakeholder co-creation and identification of local challenges occurs, and possible solutions and trade-offs are identified. The concept of the future integrated solutions is developed throughout these stages.

CRML 4-6 represent the more advanced stages of climate resilience innovation development and testing, when applicable resilience innovations have been selected and pilot tested but not yet integrated within full-scale operations.

CRML 7-9 represent the final stages of climate resilience innovation deployment and include the completion of a holistic analysis of the efficacy of deployed resilience innovations coupled with the extensive involvement of stakeholder groups.