ICARIA
Improving climate resilience of critical assets

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D5.4 STAKEHOLDER ENGAGEMENT PLAN

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D5.4 Stakeholder Engagement Plan

Summary

The Stakeholder Engagement Plan, drawn up within the ICARIA project, is the main document defining the methodology to create, manage and make operational the Communities of Practice (CoPs) in each case study region. It facilitates dialogue and cooperation between different stakeholders, thus improving knowledge transfer, coordination among parties involved, co-creation of suitable adaptation solutions facing climate impacts, and participative governance in a climate-resilient development perspective.
Being the reference document for both activating CoPs and developing and implementing related activities, this material should be used regularly by all partners involved for efficient and effective stakeholder engagement aimed at achieving the purposes of the project.

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D5.4	WP5	
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List of Acronyms and Abbreviations

CCA	Climate Change Adaptation
CoP	Communities of Practices
CS	Case Study
CSF	Case Study Facilitators
DRG	Disaster Risk Governance
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSS	Decision Support System
KPI	Key Performance Indicators
SSH	Social Science and Humanities
SSM	Soft Sistems Methodology
SSO	Specific SubObjectives
TGM	Trial Guidance Methodology
WP	Work Package

Executive summary

This document presents the ICARIA Stakeholder Engagement Plan and outlines the methodology for establishing, overseeing, and implementing Communities of Practice (CoPs) within case study regions. The Plan aims at facilitating dialogue and cooperation among several different stakeholders, intensifying knowledge exchange, coordination among parties involved, co-creation of efficient and effective adaptation strategies and measures facing climate change-related impacts, and the development of climate-resilient and sustainable governance. Therefore, this document will serve as a guidance for both the activation of CoPs and the related activities towards its implementation, in practice, by the consortium.

With these purposes in view, the document primarily highlights the importance of stakeholder engagement within the ICARIA project (WP5, T5.4) and explains the reason why a specific Plan is extremely needed to achieve the project objectives (Section 1). Secondarily, the document introduces the CoP defining its main purposes, explains its function and describes the methodological background followed to interact and co-create with relevant stakeholders through CoPs (Section 2). This section also stresses the correlation between Communities of Practices and case study regions (i.e., Barcelona Metropolitan Area, South Aegean Region, and Salzburg region) that will be used to test the technical and organisational solutions developed through ICARIA trial and minis-trials. The document describes the case study regions in terms of geographical location, climate hazards, risk receptors, and expected impacts, in order to frame each of them also in relation to the selection of relevant stakeholders (Section 3). Finally, the Plan proposes a tentative timeline of activities and interactions, built around a detailed roadmap of CoP's workshops (Section 4).

1 Introduction

The present document is the Stakeholder Engagement Plan within the ICARIA project, which has received funding from the European Union's Horizon Europe Research and Innovation program under Grant Agreement number 101093806. Specifically, this document corresponds to Deliverable 5.4 and is one of the results of Task 5.4 - Stakeholder engagement (WP5 - Dissemination and exploitation).

1.1 ICARIA in short

The number of climate-related disasters has been progressively increasing in the last two decades and this trend could be drastically exacerbated in the medium- and long-term horizons according to climate change projections. It is estimated that, between 2000 and 2019, 7,348 natural hazard-related disasters occurred worldwide, causing 2.97 trillion US$ losses and affecting 4 billion people. These numbers represent a sharp increase in recorded disaster events over the previous twenty years. Much of this increase is due to a significant rise in the number of climate-related disasters (heatwaves, droughts, flooding, etc.), including compound events, whose frequency has been dramatically increased due to the effects of climate change and the related global warming (UNDRR, 2020 and IPCC, 2021). For the future, by mid-century, the world stands to lose around 10% of total economic value from climate change if the temperature increase stays on the current trajectory, and both the Paris Agreement and 2050 net-zero emissions targets are not met (Guo *et al.,* 2021).

In this framework, **Project ICARIA** (Improving ClimAte Resilience of crItical Assets) has the overall objective of promoting the definition and the use of a comprehensive asset-level modelling framework to achieve a better understanding of climate-related impacts produced by complex, compound and cascading disasters and the possible risk reduction provided by suitable, sustainable, and cost-effective adaptation solutions.

Special regard is devoted to critical assets and infrastructures particularly susceptible to climate change, in a sense that its local effects can result in significant increases in the cost of potential losses for unplanned outages and failures, as well as maintenance – unless an effort is undertaken in making these assets more resilient. Therefore, ICARIA aims to understand how future climate might affect the life-cycle costs of these infrastructures and assets in the coming decades and to ensure that, whenever possible, investments in adaptation measures are made up front to face these changes. This requires planning that considers a comprehensive multi-risk assessment and uncertainties associated with climate change, rather than reliance on models solely based on past events and single climate hazards [Barr & Nider, 2015].

To achieve this goal, ICARIA has identified 7 Strategic Subobjectives (SSO) related to one or several work packages, among which the SSO7 concerns ensuring the implementation, the replicability and the exploitation of ICARIA methods and outputs (WP4 - Case studies implementation, replicability and exploitation) through a participatory process engaging relevant stakeholders and citizens within and outside the project framework (WP5).

1.2 Objective of the Deliverable 5.4

In project ICARA, Task 5.4 has been set up to coordinate the activities to involve, within the project, stakeholders acting in the field of climate change resilience and adaptation of critical assets to extreme weather events.

The task aims to bridge the research community, which is focused on risk analysis and assessment, with institutions and entities involved in implementing climate resilience plans, programmes, and strategies. This interaction will be ensured by establishing local Communities of Practice (CoPs), one for each case study region identified within the project (Metropolitan Area of Barcelona, Archipelago of South Aegean Region, and Salzburg Region). Considering that a CoP is understood as a group of significant individuals that may be crucial to address an issue and may be available to share experiences, skills, ideas, resources, and actions to go further embracing shared collective and societal challenges (Freitas *et al.,* 2018), the ICARIA aims at to achieve a better understanding of climate change-related risks (focus on complex and compound disasters, with cascading effects on critical assets), multi-risk management, and long-term resilience planning practices through the CoPs. In this sense, the CoP represents a valuable key-instrument to ensure that the outcomes of the project are meaningful, relevant, and useful for their potential end-users.

The Stakeholder Engagement Plan, which corresponds to Deliverable 5.4, defines the methodology to create, manage, and make CoPs operational within case study regions facilitating dialogue and cooperation between different parties, and improving governance, coordination and knowledge transfer. The Plan has to be translated into participatory processes through a series of workshop activities with the purpose of better understanding risk perception and awareness, identifying priorities and needs of communities, and co-creating suitable adaptation solutions facing climate impacts. While remaining in a general methodological engagement framework, workshop activities need to be adapted to each case study region, thus maximising ICARIA impacts. Furthermore, this document also describes the process to identify and cluster third-party stakeholders, according to their potential role within the project itself. Considering that each individual assumes an active role in shaping the project's research and outcomes to align the work developed in ICARIA with their needs and concerns, the selection of relevant stakeholders represents a crucial step in determining the customization of workshop activities case-by-case, thus facilitating and ensuring a successful and fruitful engagement process.

The objectives of D5.4 are as follows:

- define the organisation of and identify the expectations of the Communities of Practitioners in ICARIA, focusing on each case study region;
- explain how CoPs may contribute to the project objectives through testing and validation workshop activities, paying attention to the selection of attendees (i.e., stakeholders) and to the outputs of encounters;
- define the relationship between ICARIA trials (WP4) and the CoPs.

2 Community of Practices (CoP)

2.1 What is a CoP and why is it important for ICARIA

A **Community of Practices** (**CoP**) is a group of individuals who share a common interest or concern for a specific activity, practice, etc. and engage in regular interactions to share and enhance their skills and knowledge in that domain (Wenger-Trainer, 2015). The concept was initially introduced by cognitive anthropologist Jean Lave and educational theorist Etienne Wenger in *Situated Learning* (Lave & Wenger, 1991). Subsequently, Wenger further expanded on the concept in *Communities of Practice* (Wenger, 1998). A CoP can naturally emerge when individuals with a shared interest come together, or it can be intentionally created to facilitate knowledge acquisition in a specific field. By exchanging information and experiences with the group, members learn from each other and have the opportunity to grow both personally and professionally (Lave & Wenger, 1991).

Inspired by past experiences carried out in several EU H2020 projects (i.e., BINGO - "Bringing INnovation to onGOing water management - a better future under climate change", and ESPREssO - "Enhancing Synergies for disaster PRevention in the EurOpe Union"), ICARIA CoPs will bring together scientific experts from academia and technological research centres, relevant local/regional/national stakeholders from industry and administration, decision-makers, and citizens to enhance the comprehension of climate change-related risks and their management by developing climate resilience strategies that bring long-term environmental, social and economic co-benefits. As a matter of fact, risk owners managing public and private strategic assets and infrastructures, investors, and citizens will be crucial to provide data/information on their risk knowledge background, contribute to Decision Support System (DSS) development, and react and validate ICARIA methodologies and tools.

In this regard, in each case study region, a CoP will be created by providing a **Case Study Facilitator** (CSF) who, chosen among the scientific partners of the Project and charged with the role of local CoP coordinator, will support the region and local problem owners. On the other hand, the action of each CoP will be articulated via a series of workshops - each meeting will be thematised with respect to important issues concerning the project objectives and evolving needs - that each CSF will organise with all the stakeholders of the CoP. All workshops will aim at fostering a participatory co-creation process using engagement tools and exercises to identify gaps and needs, achieve a better understanding of risk perception and awareness, validate adaptation solutions and ensure that the outcomes of the project are in line with the local priorities, needs and expectations. Within these CoPs, collaboration and communication channels in local languages will be established to foster participation and facilitate dialogue avoiding communication barriers.

With the support of the human social science department from UNINA, social science methodologies and approaches will be applied to these cross-cutting activities. With a broader vision of public involvement in the co-generation process of scientific knowledge and opportunities for learning and collaboration, ICARIA CoPs will foster the first three levels of engagement of the Haklay pyramid [Figure 1; Haklay *et al.,* 2014], from participation as Data collectors (Crowdsourcing, Level 1), Interpreters of data (Distributed intelligence, Level 2) to Active actors in defining problems and related solutions (Participatory science, Level 3).

The organization of the participatory process and the specific objectives to be addressed through the involvement of citizens will be defined according to the specific needs and characteristics of each CoP and its corresponding Case Study. In addition, UNINA's department of Human Social Science can provide the expertise and background to define the methodology to support this engagement process.

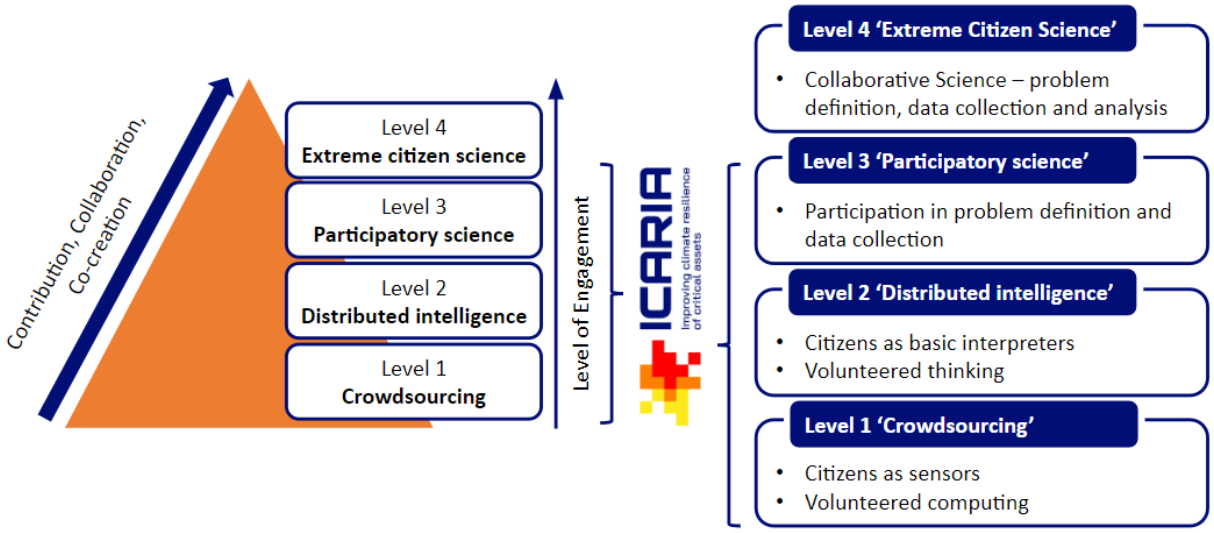

Figure 1. Classification of citizen science by increasing levels of engagement, according to Haklay (Haklay *et al.,* 2014).

The CoPs are expected to grow during the project lifetime according to the needs identified within the workshop activities. Therefore, CSF will maintain a constant action to identify and engage relevant stakeholders throughout the whole project lifespan in order to meet the objectives of each step of ICARIA.

Therefore, the CoP is evidence that a collaborative approach is extremely needed to produce knowledge alliances on climate change-related risks and to foster the implementation of innovative solutions. In relation to the complexity of the issues involved, the collaboration allows a holistic understanding of problems and challenges to be addressed, integrating different perspectives and expertise. Furthermore, it allows interdisciplinary insights enhancing problem-solving capabilities and thus the development of more effective and efficient site-specific solutions. Collaborative research also fosters stakeholder engagement ensuring relevance and ownership of outcomes. Additionally, it promotes knowledge transfer and capacity building facilitating long-term collaborations, and taking into account the specificities and interests of different parties involved.

CoPs also contribute to the outreach of ICARIA's contents and outputs at different scales. Disseminating the project focussing on local impacts is important because it gives relevance to a specific local community. It addresses local challenges and priorities, empowers and involves relevant stakeholders, supports policy and decision-making at the local level, and contributes to sustainable long-term "structural" changes (e.g., values, practices, priorities, etc.). By disseminating the project results locally, research becomes more meaningful, actionable, and likely to create a positive and lasting impact within the community.

Furthermore, thanks to the activation of CoPs, scientific partners from technical and social sciences disciplines provide innovative methods and instruments to achieve a comprehensive evaluation of socio-economic and climate scenarios (WP1). They also test activities (WP4; trial and mini-trial, Section 2.3.3), identify effective and resilient adaptation measures at local scale taking into account stakeholder engagement outputs and related co-creation processes through workshops, and improve risk perception and awareness of local communities (WP5).

2.2 Specific objectives of the CoP

In order to fulfil the previously mentioned SSO7, ICARIA will establish a CoP in each case study region to promote and achieve the following main specific objectives:

1. Involve relevant stakeholders of multiple disciplines (e.g., academia, adaptation measures policy-making, critical infrastructures operators, problem owners, local authorities, third sector, decision-makers, citizens, etc.) in the project development to ensure that ICARIA's tools and methods are in line with their needs and expectations.

2. Integrate the point of view of potential end-users within the tools and methods design process, including the DSS, in order to improve their usability.

3. Generate a participatory process to achieve a better understanding of risk perception and awareness, and to identify gaps and needs fostering the co-creation of resilient adaptation solutions.

4. Promote the involvement of relevant stakeholders in collecting data - thus contributing to fill data gaps - and participating in the conceptualization and development of the ICARIA decision support system and model.

5. Assess societal impact and possibilities for exploitation of ICARIA results.

6. Foster ICARIA project outreach and dissemination.

Considering the nature of the Community of Practices it is desirable that the objectives of the CoP are flexible in order to adapt to the stakeholders' needs, priorities, expectations, and interactions. Therefore, maintaining an open-minded attitude and being receptive to methodological adaptations, while remaining faithful to the primary ICARIA commitments, should be crucial.

2.3 Methodological behind CoP organization

2.3.1 Former EU projects related to CoPs

The methodological background followed to organize the involvement and interaction with external stakeholders in ICARIA is based on successful past experiences carried out in EU H2020 projects such as BINGO and ESPREssO.

The BINGO project - "Bringing INnovation to onGOing water management - a better future under climate change"

From a conceptual point of view, BINGO project identified the need to shift the classical cooperation approach between scientific and non-researchers stakeholders, where the latter are often seen as mere data and validation providers, to an actual co-creation collaborative process. Such a change means being able to improve the knowledge production processes by better assessing society's needs, aligning innovation with end-users' needs and feeding from external expertise and experience. Furthermore, it has been assessed that the involvement of relevant stakeholders enhances the relevance, usability, awareness and legitimacy of the project outcomes among potential receivers of such developments (Pulutikof *et al.,* 2019).
BINGO embraced this challenge by creating local CoPs for each case study to engage relevant and diverse actors in order to align the process of knowledge co-production and to go further than just knowledge transfer, by bringing "techne" and "phronesis" to the process of knowledge production, and by aiming to practise these alliances and assuming the consequences of these co-productions. (Van Alphen *et al.,* 2020). Based on that experience, an extensive description of

guidelines to design, organise and manage a CoP was given in Deliverable 6.5 of BINGO (Freitas *et al.,* 2018). Table 1 summarises these guidelines.

Table 1. BINGO guidelines for CoP management (modified after Freitas *et al.,* 2018).

Num.	Guideline	Objective
1	Designing a double-sided communication strategy.	Enable a communication flow where everyone is able to engage and interact in a meaningful process of communication, as simultaneously "senders" and "recipients".
2	Designate a CoP facilitator and design a roadmap.	A clear roadmap of the face-to-face meetings to be held is crucial to coordinate the topics discussed in each CS CoP and to connect such topics with specific scientific needs taking into account the ongoing developments and maturity time demands of the CoP.
3	Build a solid and diverse base for CoP development.	In order to build a solid member base, it is important to reach out to members that cover all aspects of the community stakeholders to ensure a diverse and robust capacity for the assessment of complex issues.
4	Design storytelling for each interaction's animation and facilitation.	This storyboard helps the facilitation and also often helps to clarify and operationalise the purpose attributed to the session in the global roadmap and to ensure a practical coherence to the CoP dynamic.
5	Make everyone aware and comfortable with the ethics code.	Ensure equal and fair participation, as well as a clear understanding of social expectations in the group.
6	Create a collaborative environment and make room for informal interactions.	Use informal moments to reinforce mutual exchanges, further contacts and even gains in trust and confidence-building between participants.
7	Create a vision and set expectations and common outcomes.	Define clear and concise bidirectional expectations between the stakeholders and the consortium to establish and improve the engagement of all members of the CoP.
8	Engage everyone in co-productions and make room for side-concerns debate and/or detailed side-debates.	Maximise the interaction and debate between the CoP members to ensure a rich and diverse basis of knowledge to support all co-creation processes.
9	Evaluate and celebrate each step's achievements.	Evaluation in CoP has the function of building awareness of the co-production achievements and their added-value. The celebration aims to foster the willingness and engagement of all stakeholders.
10	Take care of co-productions records, feed-back, and technical reports.	Ensure that all participants in CoP co-productions have access to all these experiences in the way they were developed and mainly that they can have access to all relevant information as it was co-produced and to the path it has been processed, integrated and expressed in the technical reports.
11	Follow-up CoP on other initiatives and developments.	Enlarge networks and enhance the participants' curiosity to follow each other's initiatives to enhance cooperation and mutual learning.
12	Prepare the CoP for the long haul.	Plan how the group interactions and connections will be facilitated in between the physical meeting points.

A large set of animation tools have been used in the BINGO project CoPs, all based on the Soft Systems Methodology (SSM) which is a methodology born out of research conducted at Lancaster University to apply Systems Engineering approaches to solve "management/business problems". The choice among different types of instruments depended on

the workshop they were used in, participation, time commitment, and trust among the participants. Each workshop was devoted to a specific, and had pre-established objectives that were in line with the scientific needs and outputs of the project but also with the ongoing developments and maturity time demands of the CoP.

Within BINGO 6 face-to-face workshops were organised, following a predefined roadmap (Table 2). Defined at an initial step of the project, this roadmap was structured by partners who would later act as CoP facilitators. The roadmap design involved both facilitators and WP technical leaders who expected to receive relevant inputs from the CoP co-creation process regarding what it would be desirable to achieve from each workshop.

Table 2. BINGO CoP Workshops' Roadmap.

Workshop	Theme	Topics
Nº 1 (M 8)	Setting the scene.	CoP launching and exchanges & Risk Mapping.
Nº 2 (M 12)	Are we prepared?	Backcasting & Adaptation Measures.
Nº 3 (M 22)	Yes we are (prepared).	Assessment and Resetting the scene for a better future.
Nº 4 (M 28)	Solving the unsolvable.	Actionable Labs around problems of choice of each CoP.
Nº 5 (M 40)	Sharing & expanding.	Open national/local seminars to expand and transfer CoP experience and coproductions.
Nº 6 (M 48)	Up the CoP.	CoP's experience & learnings summing up & Add-value assessment.

Within the workshop CoPs, one of the most relevant tools is the CATWOE teasing exercise that was implemented and tested in order to identify actionable adaptive measures/activities frameable in a certain transformation process (T) following a specific vision (V), identifying the main clients/target groups (C), relevant actors (A), and/or owners (O), and exploring potentials and constraints of the environment (E) in which to apply these measures/activities. Therefore, interactions between key-stakeholders and mutual exchanges were crucial from a shared resilient development perspective.

The ESPREssO project - "Enhancing Synergies for disaster PRevention in the EurOpe Union"

The ESPREssO project set out to provide ways of creating more coherent national and European approaches to Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA), and resilience strengthening - thus integrating DRR and CCA fields -, to enhance risk management capabilities by bridging the gap between science and legal/policy issues both at local and national level, and to address the issue of efficient management of trans-boundary crisis (Luta *et al.,* 2018; Zuccaro *et al.,* 2020). In particular, ESPREssO focused on identifying existing obstacles to effective collaboration between different parties, finding new areas of common ground, and methods to strengthen cooperation in relation to DRR and CCA policy-making (Abad *et al.,* 2020.).

Within the project, thematic Think Tanks had a crucial role as they represented an optimal and efficient instrument for establishing interaction networks with key players. Unlike CoPs, which are strongly anchored to a specific geographical context and related site-specific issues, ESPREssO Think Tanks focused on three main challenges: Climate Change

Adaptation vs Disaster Risk Reduction, Science vs Legal/policy issues in DRR and National regulations for the preparation to trans-boundary crises.

As the main operational outcome of Think Tanks, the project designed the SHIELD model framework (Figure 2) which identified six domains that revolve around the four traditional Disaster Risk Management (DRM) phases: promoting knowledge sharing, aligning capacities, institutionalising coordination, involving stakeholders, maximising investments, and fostering effective communication in order to improve disaster governance at different scales (Luta *et al.,* 2018; Albris *et al.*, 2020). The model is based on a set of recommendations/guidelines concerning six domains, which stressed the need to concentrate on several "broader" societal activities that complement and optimise conventional Disaster Risk Management (DRM) practises through Disaster Risk Governance (DRG), showing interlinkages and interdependencies between DRM and DRG. These activities aimed to enhance European disaster resilience by bringing together stakeholders with distinct expertise, capabilities, and requirements. Each recommendation is directly linked to a follow-up question and the set of all follow-up questions represents a comprehensive checklist that can be used by policy-makers, public officials and DRM practitioners to evaluate how to enhance their risk management capabilities. The model development process shows how serious games such as RAMSETE I, II, and III developed within the project (Abad *et al.*, 2020) can be valuable, if not crucial, tools for communicating information in the correct way, catalysing debate in different policy arenas, and for creating suitable conditions to enhance stakeholders' networks. Indeed, a game has the power to inform - showing criticalities, potentials, strengths, and weaknesses of a system without necessarily leading to a policy choice -, engage different parties at the same time, facilitate dialogue among stakeholders, and collect useful data within the workshop and think tank sessions (Abad *et al.*, 2020).

Figure 2. ESPREssO SHIELD model framework to support integrated approaches to DRM (Luta *et al.,* 2018).

2.3.2 Risk perception, communication, and awareness

Within natural hazards literature, risk awareness is often used interchangeably with another term, risk perception. Both concepts are found in several disciplines, and have been studied from multiple perspectives, including social studies, anthropology, geography, and medical sciences.

Shortly, risk awareness can be defined as the knowledge of a risk, while risk perception is how people judge and evaluate risks. This means that people's level of awareness and the way they perceive a certain hazard are undoubtedly related, but not interchangeable. While in some cases the difference lies mainly in the wording, in others this may not be true. Consequently, different proxies are then adopted to operationalize what is sometimes called risk awareness and

sometimes risk perception.
Indeed, the way people judge and evaluate risks is based on a combination of psychological and socio-cultural factors that shape their behavioural responses. There is no single way to process, understand, and react to risk information, as implied by one-way communication models. Therefore, the assessment of risks and their level of acceptance is highly dependent on attitudes and culture. These factors are influenced by differences between reference social groups within the same culture, resulting in different ways of understanding and responding to risks [Renn & Rohrmann, 2000].

Two basic paradigms can be distinguished: rationalist and constructivist.
The rationalist approach to risk perception stresses individual cognitive processes and assumes that the existence of a threat induces an individual to make an assessment or judgement that feeds a "rational" decision-making process regarding the need to adopt protective or preventive behaviour [Birkholz *et al.,* 2014]. Studies rooted in the rationalist approach have tended to focus on modelling, characterising, and predicting behavioural results regarding various threats. The rationalist paradigm assumes that individual risk preferences and behavioural results are the effects of a logical assessment of the likely outcomes, as well as related costs and benefits. In addition to cost-benefit evaluations conducted in the revealed preferences approach, another important approach in the rationalist paradigm is psychometric research.
The constructivist paradigm largely rejects the idea that the assessment of threats is an objective phenomenon, independent of the social system. [Tierney, 1999). Under this approach, the risk is seen as a contextual phenomenon in which an individual's judgments and decision-making processes are shaped and limited by social environments and therefore recommends an analysis of how the sociocultural context shapes a broader understanding of risk; it draws attention to the mechanisms by which risk perception can be disseminated and legitimised at a broader social level and how closely related to the dynamics of changes in the social system, for example, values, beliefs, culture, institutions, and organisations risk perception is.

In addition, previous literature found that people's perceptions of hazard-related risks have direct effects on their risk mitigation incentives and adaptation behaviours (Lindell & Hwang, 2008). However, there is limited literature investigating the factors that may influence individuals' policy support for hazard adjustment measures. The influences of social-demographic factors are potentially important; indeed, aspects of the surrounding environment, made up of both social and physical contexts, have a significant impact on individuals' behaviours in response to risk (Shao *et al.,* 2017). Furthermore, we must consider that risk perception and risk communication are indeed closely related. Communication can shape perception, and risk perception determines how and whether the risk is communicated to communities. It is important to promote the construction of clear and reliable communication strategies to create effective messages, deliver them through the most convenient and relevant channels, and receive feedback [Walaski, 2011].
Given these premises, a multidisciplinary approach is deemed essential to examine on one side the relationship between socio-demographic characteristics, individuals' perceived hazard-related risks, and contextual measures of hazard-related risks, on the other policy support for multi-hazard adjustment measures.

Among all instruments available to engage stakeholders, the use of questionnaires is universally recognized as the most suitable tool for collecting, analysing, and interpreting social data for specific topics, regardless of the selected delivery mode. [Bird, D. K., 2009]. The previously described concepts can be jointly assessed by exploring stakeholders' risk perceptions and risk management procedures, and creating a tailored questionnaire. Comparison of perceptions associated with multi-hazard provides an in-depth look at existing incoherencies that could bring forward failures in risk and emergency management.

In ICARIA project questionnaire will be specifically designed for each CoP keeping in mind the hazards, hazard receptors, and impacts faced in trials and mini-trials (WP4; Section 2.3.3), and will be structured around **three areas of interest,** in

addition to overarching questions related to impact, sustainability and exploitation:

- risk information and perceived institutional preparedness;
- individual and collective preparedness;
- coordination mechanisms/policy options.

The first area will explore the stakeholder perception of climate-related emergency management and current mitigation measures availability within each case study region allowing to depict a picture of the amount, quality, coverage, and homogeneity of information available to different stakeholders. The second area will be based on factors influencing the stakeholder's intention to prepare, on the preparedness measures currently undertaken, on the attitude towards participatory approaches, and on the level of community involvement. Finally, the third area will allow us to understand the feasibility, social acceptance, expected degree of success, and implementation challenges of several coordination mechanisms and policy options. There will also be a specific section focussed on socio-demographic topics such as age, gender, educational level, occupation, household structures, social and personal networks, and place of work/residence. The questionnaire will be structured with different response formats such as close questions (i.e., yes/no, multiple-choice, Likert-type scale) and open-ended questions.

Through the CoPs, relevant stakeholders will be contacted by phone and/or email to establish personal contact to ensure that the objective and method of the study are understood. Only afterwards, the questionnaires will be provided via email. After completing the questionnaire, respondents will be categorised by organisation type, and sector to analyse their answers. To obtain a broader risk perception, both quantitative and qualitative analyses will be carried out.

2.3.3 CoPs in ICARIA: a link between Trial Guidance Methodology and CoPs

ICARIA project is built around three case studies. Two of them, the Barcelona Metropolitan Area and the Archipelago of South Aegean Region, are located in the coastal area of the Mediterranean Sea and are facing increasingly extreme weather events (i.e., storm surges, pluvial floods, heatwaves, drought and forest fire) with critical socio-economic and environmental impacts. The third one, the Salzburg Region, is located in Austria and is highly affected by climate change with effects (i.e., glacier melt and heatwaves) that directly impact the prevailing energy production assets (extremely critical infrastructures) and other important sectors. Seven additional follower regions (third parties) will be the first candidates for replication beyond the project. In this context, ICARIA also fosters several actions to maximise replication and outreach of the main project outcomes.

In the first project phase, each of the three case study areas will be used to test the risk assessment methodologies and the technical solutions developed in the project through **trials**. As indicated in Figure 3, the lessons learnt in the development and execution of the trials will be subsequently used to implement "**mini-trials**" and finally planned for "**demonstrators**", thus gradually covering different aspects of assessment - from assessing the technology and its acceptance by the relevant stakeholders, over evaluating the replicability and societal impacts to analysing the exploitation potential of the project results. Regional stakeholders represented in the CoPs play a crucial role in the development, execution and assessment of ICARIA results in each of these three phases.

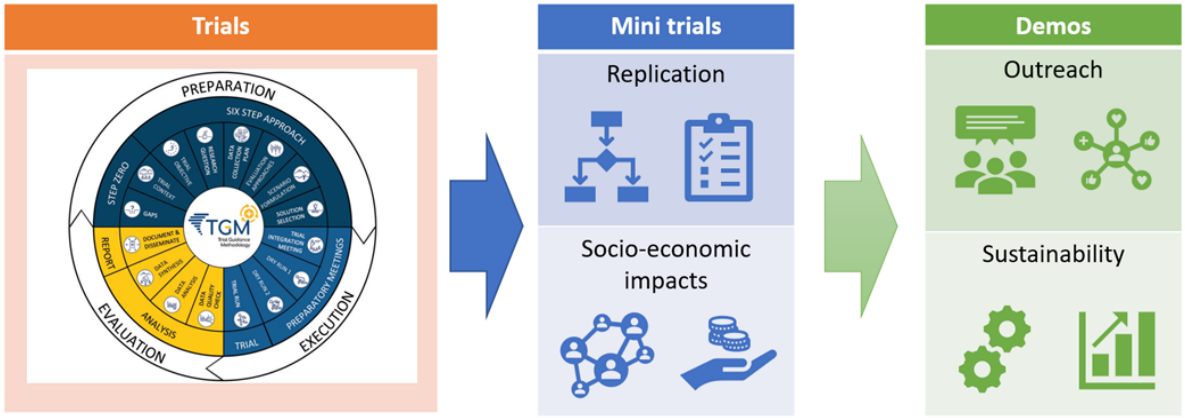

Figure 3. Overarching ICARIA methodology for assessing the solutions developed in the project.

The ICARIA testing and validation process is an extension of the Trial Guidance Methodology (TGM), which has been initially developed and successfully tested by the DRIVER+ project - DRiving InnoVation in crisis management for European Resilience, 2014-2020 (FR7 programme, Grant agreement ID: 607798, 2014-2020; https://www.driver-project.eu/driver-project/). TGM provides a structured approach for assessing the innovative potential of novel solutions to address specific societal or organisational needs (gaps). The TGM handbook (Fonio *et al.*, 2020) provides step-by-step guidelines for designing the trials, a list of roles and responsibilities, tools, and methods to perform a trial through a clear, pragmatic, and systematic approach, evaluate the outcomes and identify lessons learned. TGM rules and methods are strict enough to ensure appropriate replicability of the results while being flexible enough to ensure wide applicability of the methodology.

TGM has already been successfully applied in multiple H2020 and HE projects (Fornio *et al.,* 2023) and entered a standardisation process through the publication of the CEN Workshop Agreement CWA 17514 (CEN-CENELEC Management Centre, 2020). Despite being designed for use in a crisis management context, its successful application in the RESILOC - Resilient Europe and Societies by Innovating Local Communities (H2020, Grant agreement ID: 833671, 2019-2022) project indicates that TGM is applicable in a wider context of societal resilience, with minor adaptations. Most importantly from the ICARIA perspective, TGM helps to objectively assess the project results, by insisting on an up-front definition of the gaps, objectives and research questions the trial will address as well as on the up-front definition of data that will be collected during the trial and the ways this data will be interpreted in trial assessment.

Moreover, TGM foresees active involvement of key stakeholders in trial preparation, execution, and assessment of the trial results. In ICARIA, this link between the core trial team and relevant stakeholders will be established through CoPs and, more specifically, through CoP events that are defined in Section 4 of this report.

Trial Team

In the so-called "step zero" of the Trial Guidance Methodology, the **Trial Owner**, and the **Trial Technical Coordinator** first need to agree on strategic and operative gaps that should be addressed in the trial (**Trial Gaps**) and on the main conditions and parameters of the trial (**Trial Context**) such as location and timing of the trial, and initial ideas on the trial scenario, participants, tools and procedures to be evaluated. They also need to assign the roles of **Evaluation Coordinator** and **Practitioner Coordinator** to specific people and organisations, to assure that trial evaluation and stakeholder involvement are adequately considered in the trial design phase.
Key TGM roles and their naming conventions in TGM and ICARIA context are summarised in Table 3.

Table 3. Key trial roles in TGM and ICARIA context.

TGM Role	ICARIA naming convention	Organisations	Objective
Trial Owner	Problem Owner	VERBUND (At), SAR (Gr), AMB (Es)	Ensures that the needs of the infrastructure provider/problem owner are adequately represented.
Technical Coordinator	Technical Coordinator	AIT (At), DMKT (Gr), AQUA (Es)	Ensures that the solutions developed by ICARIA are well understood and adequately positioned in the Trial. Coordinates the technical integration, training and trial execution. In project ICARIA, the Technical Coordinator will also be responsible for scenario definition, hosting and directing of the trial, including the related event management; despite these tasks are often developed by the trial owner.
Evaluation Coordinator	Evaluation Coordinator	AIT (At), DMKT (Gr), AQUA (Es), PLINIVS (It)	Ensures that the evaluation of the trials is adequately designed in the trial preparation phase and that the necessary data is correctly collected during the trials and interpreted afterwards.
Practitioner Coordinator	Case Study Facilitator	AIT (At), DMKT (Gr), SAR (Gr), AQUA (Es)	Manages the relationship between the core trial Team and the CoP members. Ensures adequate participation of the CoP members in trial preparation (co-design) and execution phase of the trials.
CM Practitioners	Community of Practices	Three regional CoPs	Represent the needs of regional stakeholders beyond those of the three problem owner organisations. CoP members thus need to be involved in trial design as well as in the trial execution phase. Typically, CoP members are provided opportunities to assess solutions and the trial organisation, and their feedback is collected through interviews or questionnaires as a part of the trial execution.
Core Team	Core Team	VERBUND (At), SAR (Gr), AMB (Es), AIT (At), DMKT (Gr), AQUA (Es), PLINIVS (It)	The core team includes Trial Owner (Problem Owner), Technical Coordinator, Evaluation Coordinator and Practitioner Coordinator (Case Study Facilitator).
Extended team	Core Team & CoP members	VERBUND (At), SAR (Gr), AMB (Es), AIT (At), DMKT (Gr), AQUA (Es), PLINIVS (It) & CoP members (Section 3.2)	It is important to keep in mind that CoP members are an essential part of the trial team and are involved in all phases of the Trial design and execution, even though their participation is far less intense than that of the core team. This is reflected in the design of the CoP Events in Section 4.

Considering the requirements on CoP members, and the organisational capabilities of the partners, most of the trial work will be shared by the problem owners (VERBUND (At), SAR (Gr), AMB (Es)) and a designated regional technical partner:

- VERBUND and AIT in Austria
- SAR and DMKT in Greece
- AMB and AQUA in Spain

Moreover, the event organisation will be delegated to regional technical partners, with Trial Owner/Problem Owner merely overseeing the organisation.

Trial preparation - Step zero

Trial preparation starts with the so-called "**step zero**", where two key pieces of information have to be considered: the overarching trial goals, circumstances and boundaries for the trial organisation. Trial goals are defined through **Trial Gaps,** whereas the circumstances and boundaries are defined through **Trial Context**.

Trial Gaps

The overarching goal of every trial is to identify and evaluate one or more innovative socio-technological solutions that can bridge gaps the stakeholders are experiencing in their operations. The first step in trial preparation is thus to identify gaps that will be addressed in a trial. This needs to be done in close relation to the practitioners - that means, with the problem owners and CoP members.

The following strategic gaps are implicitly contained in ICARIA project objectives and thus need to be addressed in ICARIA trials:

1. lack of adequate **assets-level models for impacts of climate hazards and adaptation options**;
2. lack of adequate decision support for **holistic multi-hazard/multi-assets resilience assessments and planning**;
3. lack of **guidance and decision support for optimising the interactions between climate change, climate adaptation and society**.

Furthermore, several trial-specific gaps have been already identified in the ICARIA project plan:

4. planning of **resilient 100% renewable electricity production in the alpine region** (Austrian trial);
5. planning of **sustainable and resilient infrastructure in tourist regions with extreme seasonal population fluctuations** (Greek trial);
6. anticipating the **impacts of future compound extreme weather events in major metropolitan areas in SE Europe** (Spanish trial).

These initial gap definitions now need to be reassessed and amended in a dialogue between the Trial Owners (problem owners) and the CoP members (stakeholders, practitioners) and included in trial design documents (D4.1 Trial design).

Trial Context

Trial gaps are specific to stakeholder organisations, individual roles and responsibilities within the organisation and the surroundings. Even when facing the same gaps, different stakeholders will often experience them differently, in terms of situations where they encounter the gaps, and expectations inherent to their roles. For example:

- Possible "fluctuation of water supply and demand" will be experienced in a very different way by energy producers, stakeholders from the agroforestry sector, the tourist sector or by the regional government, leading to different gap definitions and different expectations on adequate solutions;

- In areas with strong seasonal population fluctuations, different stakeholders will approach the issue of dimensioning the critical infrastructure facilities from different angles depending on their role in financing, maintaining or using such infrastructures, as well as on direct and indirect damage temporary infrastructure collapse would have on their business;
- Relative importance that will be assigned to the resilience of different critical infrastructures in metropolitan areas, as well as the preferential approaches for increasing the regional resilience to extreme weather events will likewise depend on the stakeholders' background and responsibilities.

In ICARIA, much of the trial context is pre-defined by project objectives. Since the project as a whole addresses the need for asset-level impact modelling, planning and decision support, the trials will inevitably need to be organised as computer-assisted desktop exercises and not as e.g. field trials. In this context, some representatives of the problem owners and other CoP members will attempt to perform impact and resilience assessments using the solutions developed in ICARIA, whereas other trial participants will monitor their progress and help to assess the results.

The Six step approach

The second part of the preparation phase is called “the six-step approach”. In this phase, six main aspects of the trial are defined in an iterative process: Trial objectives, research questions, data collection plan, evaluation approaches and metrics, scenario formulation and solutions selection.

Trial objectives

Trial objectives indicate the overarching goals and aspirations of the trial team. They are intimately related to trial gaps and must be formulated in a SMART way. SMART stands for Specific, Measurable, Achievable, Reasonable and Time-bound. Trial objectives are typically defined in a brainstorming session, by asking the participants to answer the following questions:

1. SPECIFIC: What are the main “problems” that you wish and would like to resolve through this trial?
    - These “problems” must relate to trial gaps, otherwise, the team will have to go back to step zero and redefine the trial gaps and context.
2. MEASURABLE: What measurable effects should be achieved to resolve these problems?
    - Do you need to be faster? More accurate? To be able to perform some task you cannot do at all today?
3. ACHIEVABLE: is it possible to achieve this within the trial context?
    - In subsequent iterations, this question will change to “is this possible to achieve within the planned scenario and with solutions that will be trialled?
4. REASONABLE: is it possible to achieve this with resources available for the trial?
    - In this context, it is important to ask if the organisations involved in a trial would ever be able to implement the trialled solutions - be it for legal, organisational or budgetary reasons.
5. TIMELY: can this objective be reached within the time available for the trial?
    - For example, ICARIA is a three-years project and even if it would have stated the interest and the budget to implement any recommendations for climate change adaptation within the trial, it wouldn’t have enough time to monitor the effects of implemented measures.

Each trial has to define at least one SMART overarching objective as a “trial slogan”. This overarching objective can be accompanied by a small number of secondary objectives. As a rule of thumb, a trial should have three to five objectives.

Research questions

Research questions are specific questions of interest to the trial team. They need to be formulated as questions so that they can be answered in a simple way (yes, no, likert scale, etc). Research questions connect different aspects of the trial: they address specific trial gaps, need to be answerable in an objective way within the trial, and need to be understood and approved by all trial stakeholders.

ICARIA trials and mini-trials will include questions related to various topics, including: science and technology (e.g., "how good are the model predictions?", "how well does the DSS work?"), user experience (e.g., "How much training do potential users need to use the solutions?"), user acceptance and sustainability (e.g., "Do potential users want to use this type of solution in their work?", "how well do the solutions support their decision-making process?"), socio-economic impacts (e.g., "what socio-economic impacts do CoP members anticipate from trialled solutions?")

Good research questions are formulated in a simple and easy-to-understand way and have a clear relation to trial gaps and objectives.

Data collection plan

Well-formulated trial questions must be answerable in an unambiguous way by collecting specific data during the trial and assessing it afterwards. The data collection plan defines what needs to be measured and how. What data needs to be collected and how, depends on the trial objectives and research questions, but also on the characteristics of solutions and the overall trial context. Typically, some data may be collected automatically or using technical tools and sensors (e.g., "time needed to perform a task"), whereas other data may be collected through initial mind-storming, round table discussions, retrospective sessions, surveys, or interviews.

In many trials, part of the trial team is asked to observe the trial execution and report their findings in a structured way - e.g., by keeping a diary during the trial, answering a survey or participating in a 1:1 interview before and/or after the trial.

Evaluation approaches and metrics

Collecting the data without a clear understanding of the ways this data will be processed and used to answer them would be an exercise in futility. A clear up-front definition of the evaluation approaches and metrics by which measured data and indicators based on this data will be used to assess the trial results and resolve the research questions and objectives is the main difference between merely "playing with the solutions to see if we like them" and objectively assessing them in a trial.

Our experience from previous trials shows that defining the evaluation approaches and metrics is the single most difficult task for the trial teams. Two measures will be implemented in the ICARIA project to address this issue:

1. primarily, T1.1 and T4.1 leaders from PLINIUS and AIT respectively will closely work with the three evaluation coordinators to ensure the SMARTNes and relevance of evaluation approaches and metrics for the project as a whole and enforce similar evaluation standards across three trials;
2. secondarily, the roles of evaluation coordinators will be delegated to technical partners that are deeply involved in trialling but aren't actively involved in the trial in which they play the evaluation coordinator role: AIT will fulfil this role for the Greek trial, DMKT for the Spanish trial, and AQUA for the Austrian trial.

Scenario formulation

Once the question of "what needs to be measured, why and how" has been answered, the trial team has to design specific activities and situations in a trial where such data can be collected. A detailed description of such situations, with definitions of all involved roles, their activities and the information exchanged is called "trial scenario".

Typically, a rough trial scenario is already part of the trial context definition and subsequently refined to accommodate the definitions of trial objectives, research questions and data collection plan. Our experiences from the application of the TGM in the crisis management context indicate that defining a trial scenario is usually considered far easier than e.g. defining the research questions or defining the evaluation approaches and metrics because the stakeholders often need to define scripts for training, exercises or demonstration. They are often already using surveys, interviews, retrospectives and similar methods to assess the lessons learnt in such events, but may be reluctant to define the criteria for success or failure upfront for organisational and psychological reasons.

One interesting meta-question that needs to be answered by ICARIA is if this is also the case for stakeholders in the climate change adaptation (e.g. "On a scale 1-5, how difficult was it to define each of the six steps for the trial?" in a survey or "What were the most challenging aspects of trial preparation and how were they resolved?" in an interview or retrospective).

Solutions selection

In TGM logic, the solutions already exist in some form and can be chosen for use in a trial once the previous steps have all been defined. In research project reality, this is often not the case and solutions are developed in the same project where they will be trialled and in-parallel with the trial preparation and execution. This is also the case in ICARIA.
In such context, "solution selection" must be understood as a combination of two factors:

1. collecting additional requirements on solutions from the trial team - requirements that will be gradually implemented by the developers during the trial execution phase and finally tested in the final trial event;
2. potentially choosing which of the project solutions to test in which of the trials.

Trial execution

Similarly, to the six-step approach, the trial execution is also defined as an iterative process where all aspects of the trial are gradually assembled and tested in several preparatory meetings, before executing the final "trial event": initial trial integration meetings, two "dry runs" and the final "trial run".

Trial integration meeting is a kind of "trial execution kick-off" where all the people who will be involved in the trial come together and align their understandings and expectations. In addition to the trial core team and the CoP members, the scientist and developers that weren't previously involved in trial preparation for the first time (officially) join the trial team at the integration meeting. Typically, the solution owners are asked to demonstrate their solutions (or solution prototypes) to the trial team at this meeting, while the trial owner and the core team present the final trial plan to both the solution owners and the practitioners that will participate in trial execution as testers or observers.

Two dry runs are used to test the technical setup of the trial and rehearse specific parts of the trial scenario.

Finally, the grand finale is the trial itself, also known as the **trial run** - a final event where all the people involved in the trial come together for the second time, execute the complete trial scenario, and collect the data necessary for trial assessment.

Trial evaluation

After the trial, most of the participants will celebrate the successful finalisation of the work and go to their respective homes or workplaces. Most, but not all: the core trial team still has one very important task to do and that is to analyse the data collected during the trial, answer the research questions, indicate to which extent the objectives were met and formulate the lessons learnt. This phase starts with a data quality check and continues with data analysis and data synthesis.

Mini-trials and demos

According to TGM, the final step of the trial evolution is "dissemination of the results". One of the unintended effects of this design decision is that the final trial event often mixes the elements of trialling and dissemination and is sometimes difficult to differentiate from demonstrators. In short, the TGM often puts too much pressure on the trial team to ensure that the trial "works", because any negative findings will be perceived as a failure of the project by numerous guests who do not understand the difference between a trial and a demonstrator.

In ICARIA, a more structured approach is added to bridge the gap between trialling the solutions (step one - trial itself), trying to figure out to what extent these solutions can have socio-economic impacts (step 2 - mini-trials) and maximising the project impacts through the dissemination of the trial results (step three - demo).

Mini-trials are specific to ICARIA and do not exist in TGM, but largely follow the same methodology. As the name indicates, mini-trials feature their own objectives, research questions, data collection plans, evaluation approaches and metrics. However, the mini-trials are designed by choosing the "best parts"[1] of the initial trials and transferring them to the trial region where these "parts'' weren't initially trialled. With technology already being tested in trials, the mini-trials will mainly be used to assess the socio-economic impact potential of the trialled solutions and scenarios. However, the risk assessments in the mini-trials are likely to be performed under the limited availability of data and resources. Hence, different strategies to mend data gaps will be implemented and the success of these strategies measured, to answer the research questions related to the transferability of the models to new regions.

The main objectives of the mini-trials will thus be "to assess transferability" and "to assess socio-economic impacts", with related research questions assessing the existence and severity of the data gaps, methods for mending the discovered data gaps, acceptance of solutions in new regions and the anticipated socio-economic impacts of ICARIA solutions for these regions. Task 1.3 of the project will be specifically devoted to this matter.

Finally, the **demos** are designed as a tool to advertise the project results to the wider public and assess their interest in the exploitation of the project results. They could be organised as a "second coming of the mini-trials", or as a presentation of the key findings of ICARIA trials and mini-trials (e.g., we might decide to show a recording made at previous events and discuss it with demo participants). More detailed planning for demo event(s) will be made later in the project and depend on the lessons learnt in trials and mini-trials.

[1] The best parts are those one that have worked well in the trial and therefore have been considered particularly interesting by the members of CoP.

3 The local ICARIA CoPs

The local ICARIA CoPs, one for each case study region, are crucial to engaging relevant stakeholders in order to implement and validate methods and tools developed in the project (trials and mini-trials). Furthermore, as CoPs integrate the point of view of potential end-users in the project development from the beginning, they thus encourage members to believe in their active role and ensure that the outcomes of the project are credible and relevant. The CoPs are functional also to define a participatory process with the aim of enhancing comprehension of risk perception and awareness, as well as identifying gaps and needs for the co-creation of resilient adaptation solutions.

Therefore, the structure, organisation, and functioning of a Community of Practices are closely linked to the geographical context where the CoP has been established, due to several site-specific aspects: climate hazards and risk receptors that characterise each case study region where trials and mini-trials are developed (Section 3.1), and relevant stakeholders and citizens that are essential to establish knowledge alliances concerning climate change-related risks, and to encourage the co-creation in a resilient development perspective (Section 3.2).

3.1 Case study region overview: trial and mini-trial

The Barcelona Metropolitan Area

The Barcelona Metropolitan Area, comprising 36 municipalities, is the largest conurbation in Catalonia (Spain) with a population of over 3.2 million.
As the largest metropolitan agglomeration in the Western Mediterranean, it plays a significant role in developing and implementing climate change solutions. According to the Climate and Energy Plan 2030, throughout the 21st Century, the climate will continue to change and the major threats will include higher temperatures, lower annual average rainfall, and more extreme weather events such as storm surges and heavy rains, increasing their impacts (e.g., heat islands, heatwaves, floods) on human beings, housing, infrastructures, services, and environment. Therefore, the Plan outlines a comprehensive strategy until 2030, focusing on adaptation to enhance resilience at local and regional scale.

The trial will be developed considering the following aspects:

- Hazards: flood compound events such as pluvial floods-storm surges-sea level rise;
- Assets and services potentially exposed (hazard receptors): properties, natural areas, water/waste/electricity assets, and transport system;
- Tangible impacts to address: flood direct and indirect damages.

The mini-trial will be developed considering the following aspects:

- Hazards: heatwaves, droughts forest fires and compound events among previous ones;
- Assets and services potentially exposed (hazard receptors): properties, natural areas, water/waste/electricity assets, and transport system;
- Tangible impacts to address: water demand/supply, and energy demand/supply.

The South Aegean Region

The South Aegean Region, an archipelago region at the South-eastern edge of Greece, administratively includes the island clusters of the Cyclades and the Dodecanese with a population of 308,957 inhabitants (2.9% of the total population).

As evidenced by historical data spinning 30 years, climate change has a more pronounced effect in this region compared to continental Greece of Europe and, up to now, the major threat included sea level rise, higher temperatures, fires, and more extreme weather events such as heavy rains, increasing their impacts (e.g., heatwaves, floods) mainly on human beings, housing, infrastructures, services, environment, and local economy. Considering the geographical location of the region, which hinders the satisfaction of primary needs (e.g., water, food supplies, electricity, healthcare, etc.) by inhabitants - this condition is further aggravated during the tourist season with the increase in the overall population -, infrastructures and assets are crucial even if particularly vulnerable to direct and indirect effects of climate change.

The trial will be developed considering the following aspects:

- Hazards: heatwaves, droughts, wildfires, and winds and gusts as well as the occurrence of compound events;
- Assets and services potentially exposed (hazard receptors): properties, natural areas, water/waste/electricity assets, transport system, and tourism sector;
- Tangible impacts to address: water demand/supply.

The mini-trial will be developed considering the following aspects:

- Hazards: flood compound events such as pluvial floods-storm surges-sea level rise;
- Assets and services potentially exposed (hazard receptors): properties, natural areas, water/waste/electricity assets, transport system, and tourism sector;
- Tangible direct and indirect impacts on critical assets.

The Salzburg Region

The Salzburg Region, situated in the Eastern Alps, has 562,704 inhabitants. Since 1880, a significant increase (approx. 2°C) in the average air temperature has been recorded in Austria and the mountainous regions are already suffering from the effects of global warming such as rapid melting of glaciers, thawing of permafrost, increasing number of hot days, or changes in rain patterns towards extreme values, increasing their impacts mainly on human beings, housing, infrastructures, services, environment, and local economy. The region represents one of the major tourist areas of Austria and plays an important role in energy production as it incorporates various hydro power plants. Therefore, changes in precipitation patterns make more vulnerable both hydro power plants themselves and related connecting roads to direct and indirect effects of climate change. Considering the ongoing increase in electricity consumption (up to 66% in 2050 compared to 2017, according to Austria's National Energy and Climate Plan) and also the importance of renewable energy (already 77% due to hydro power plants) even more enhanced in the Austrian climate and energy strategy "#mission2030", any repercussions on the energy production system could drastically compromise the future energy stability of the entire region.
The trial will be developed considering the following aspects:

- Hazards: floods and droughts;
- Assets and services potentially exposed (hazard receptors): properties, electricity assets, transport system, and tourism sector;
- Tangible impacts to address: energy demand/supply, and flood damages.

The mini-trial will be developed considering the following aspects:

- Hazards: heatwaves/high temperatures, and storms/low wind periods;

- Assets and services potentially exposed (hazard receptors): properties, electricity assets, transport system, and tourism sector;
- Tangible impacts to address: energy demand/supply.

The site-specific aspect (i.e., hazards, assets/services potentially exposed, and tangible impacts) inaround which trials and mini-trials will be developed for each case study region are summarized in Figure 4 as follows:

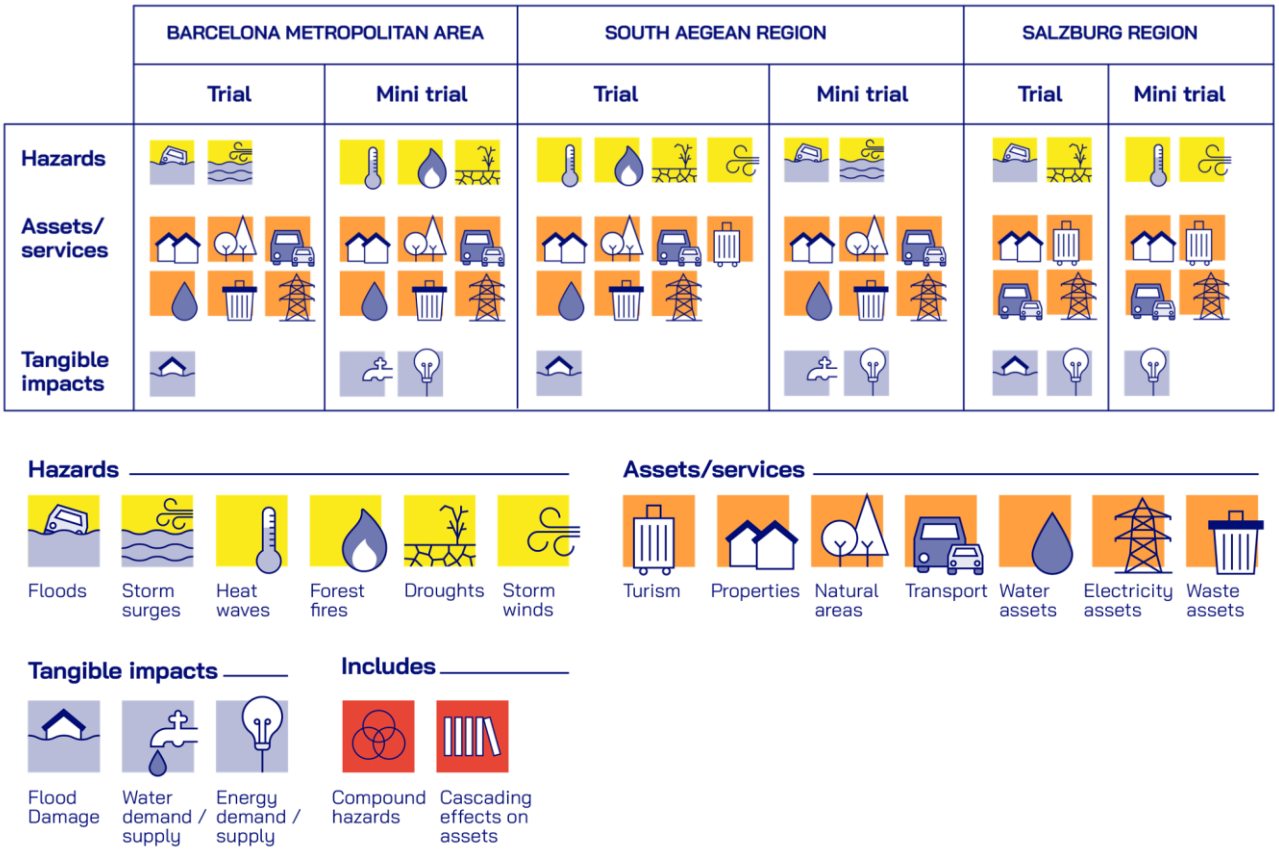

Figure 4. Simplified impact assessments to be implemented (trials) and replicated (mini-trials) within each case study.

3.2 Relevant stakeholders

The CoP has been conceived to reach an adequate level of representation of both main critical assets/infrastructures operators and government bodies in charge of climate change adaptation policy-making and natural resources management in each case study region.
According to the CoPs planning, main governmental and non-governmental actors will be identified and consulted, covering all relevant socio-economic sectors and administrative levels, including those involved in management processes and those whose activities could be potentially affected by multi-hazard impacts. Moreover, further relevant stakeholders will be able to join the ongoing CoPs in relation to the project developments and CSs' specific needs, thus expanding the arena of interaction, exchange, and co-creation.

3.2.1 The Barcelona Metropolitan Area CS

The CoP of this CS has been conceived to reach an adequate level of representation of both main critical assets and infrastructure operators in the region and government bodies in charge of climate change adaptation policy making and natural resources management.

Table 4. Description of relevant stakeholders and their role (expected) in the CoP for the Barcelona Metropolitan Area CS.

Barcelona Metropolitan Area			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category**
Aigües de Barcelona (AB)	AB is the public-private operator of the majority of the drinking water services and infrastructures in the AMB	AB's expertise in the water supply sector will provide expertise in the assessment of impacts in the critical infrastructures of this sector	ICARIA consortium member
AQUATEC	AQUATEC is a private company with a research and development department focused on urban climate resilience and flooding risk assessment.	Apart from coordinating the whole case study, AQUATEC will provide expertise in the whole process of development of models for the hazard, vulnerability and risk assessment steps of the Trials and the Mini trials. Furthermore, AQUATEC will provide expertise and background to the consortium on flood modelling.	ICARIA consortium member and Case study coordinator

Barcelona Metropolitan Area			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category**
Àrea Metropolitana de Barcelona (AMB)	The Barcelona Metropolitan Area (AMB) is the public administration of the metropolitan area of Barcelona, which encompasses 36 municipalities with more than 3.2 million inhabitants.	As members of the consortium, AMB will be an essential bridge between local authorities and administration. Furthermore, being responsible for the management of several assets of interest for the project (public transport, natural areas…), AMB will provide expertise during their risk and impact assessment.	ICARIA consortium member and Risk Owner
CETAQUA	CETAQUA is a research private company with extensive expertise in EU research projects related to a wide variety of topics.	CETQUA will support the whole consortium in the development of methodologies to quantify in monetary terms the impacts of extreme weather events on the assets of interest.	ICARIA consortium member
Consorcio de Compensación de Seguros (CCS)	CCS is a public business organisation that is attached to the Ministry of Economic Affairs and Digital Transformation. It performs many functions within the insurance field among which those related to coverage of extraordinary risk, compulsory vehicle insurance, combined agricultural insurance and liquidation of insurance companies stand out.	CCS is expected to provide expertise and background in assessing the economic impacts of extreme meteorological events on assets. Hence, it possesses extensive historical data on economic losses associated with these events. Furthermore, it can provide support on the methodology to follow in order to estimate monetary impacts on assets where data is scarce.	CoP 3rd party
ECOPARC 1	ECOPARC 1 is a waste management facility belonging to the Barcelona Metropolitan Area authority. It joins the CoP as a local representative of waste facility operators.	ECOPARC 1 is expected to get involved in the process to identify the main climate vulnerabilities of waste management facilities.	CoP 3rd party

Barcelona Metropolitan Area			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category**
ENDESA	ENDESA is the largest company in the electric sector in Spain. It is responsible for the electricity distribution network and related infrastructures (e.g., substations) in the context of the Barcelona Metropolitan Area CS.	As the operator of an essential service, ENDESA is expected to provide expertise in identifying key assets and their areas of influence in case of operation failure. Similarly, to other asset operators included in the CoP, it is expected to provide feedback on the project outcomes and developments from an end-user perspective as well as to indicate specific matters of its sector that could be included in the scope of ICARIA.	CoP 3rd party
Oficina Catalana del Canvi Climàtic (OCCC)	OCCC is the technical unit of the Government of Catalonia, being in charge to promote the establishment of climate change strategies, plans and projects in Catalonia. Hence, the OCCC is also responsible for submitting to the Government proposals relating to the mitigation of emissions and climate change adaptation.	OCCC will represent a policy-making actor at a regional scale for the case study region. Its knowledge of the status of adaptation policies will help to align the work done in ICARIA with the current urban resilience context of the AMB. Additionally, it will help to identify gaps and weaknesses in risk assessment on specific assets that ICARIA could help to address.	CoP 3rd party
Servei Meteorològic de Catalunya (SMC)	SMC is a public company ascribed to the Government of Catalunya. It is the organisation responsible for the weather observation system and meteorological forecast in Catalonia.	SMC will provide both historical datasets of methodological information (e.g., rain, temperature, humidity) and expertise in evaluating future climatic projections.	CoP 3rd party
Institut de Recerca en Energia de Catalunya (IREC)	IREC is a publicly owned research centre specialized in the field of energy, sustainability and development.	IRECS's expertise in the electricity supply sector will provide expertise in the assessment of impacts in the critical infrastructures of this sector	ICARIA consortium member

Barcelona Metropolitan Area			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category**
TERSA Group	The TERSA Group is a public company that operates a large number of waste management services and facilities in the Barcelona Metropolitan Area.	The TERSA Group will provide insight into the waste management sector to both help identify the most critical/relevant assets of the sector and to translate methods to quantify CC-related impacts in monetary terms. Also, it will participate in identifying knowledge gaps that ICARIA could focus on.	CoP 3rd party
Transport Metropolitans de Barcelona (TMB)	TMB is the main operator of public transport in the city of Barcelona. It is responsible for all metro lines and almost all local bus services.	Being an extensive metropolitan area, the Barcelona Metropolitan Area is highly dependent on its public transport network. TMB will be involved in the evaluation of risk assessment results related to transport assets and it will provide useful key-data.	CoP 3rd party

3.2.2 The South Aegean Region (Syros and Rhodes Islands) CS

Due to the geographical complexity of the region, spread over several islands, the CoP in this CS has been conceived considering two groups of relevant stakeholders in relation to the trial sites of Syros and Rhodes. The same stakeholders will also be involved in mini-trials.

Table 5. Description of relevant stakeholders and their role (expected) in the CoP for the South Aegean Region - Syros CS.

South Aegean Region - Syros			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category** (public, private, third sector)
Chamber of Commerce and Industry of the Cyclades	The Chamber of Commerce and Industry of the Cyclades is a national/international body that consults relevant local businesses through targeted institutional interventions and initiatives, strategically cooperating in the best interest of its members, entrepreneurship of the whole Cyclades as well as of the whole local society.	The Chamber of Commerce and Industry of the Cyclades will provide economic data related to the effects of several hazards on local businesses.	CoP 3rd party
DEYA Syros	DEYA Syros is a water and wastewater utility company.	DEYA Syros will provide water production/consumption data as well as a GIS database of water network infrastructures.	CoP 3rd party
Environmental Quality Observatory of Syros (EQOS)	EQOS is an environmental association that emerged after a spontaneous meeting of residents of Syros in October 2019.	EQOS will contribute with data and expertise related to the preservation of the environment, the identification of causes and foci of environmental degradation and data related to industrial and urban pollution.	CoP 3rd party
Fire Brigade	The Fire Brigade is responsible for the whole island of Syros.	The Fire Brigade will provide data on forest fire and flooding events, as well as regional fire safety/evacuation plans.	CoP 3rd party

South Aegean Region - Syros			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category** (public, private, third sector)
Hellenic Coastguard (HCG)	HCG is the official port authority of Syros. It is responsible for the management of the port area.	HCG will provide both port traffic data and marine traffic delays/cancellations due to extreme weather events.	CoP 3rd party
Ministry of Health - Syros General Hospital (SGH)	SGH representing at local level the Ministry of Health is the main healthcare facility of the island and the Cyclades as a whole.	SGH will provide health-related data, based on civilian hospitalisation.	CoP 3rd party
Municipality of Syros - Hermoupolis (MoSH)	MoSH is the first degree of local public administration.	As the first degree of local public administration, MoSH will provide all available data on the social, environmental, and infrastructure impact of hazards in the area of interest.	CoP 3rd party
National Centre of Scientific Research "Demokritos" - INRASTES	The Institute of Nuclear & Radiological Sciences and Technology, Energy & Safety (INRASTES) is an interdisciplinary R&D establishment pursuing basic, translational, and applied research to address challenges of great scientific and socio-economic impact in a broad spectrum of scientific and technological fields.	CoP coordinator and Case Study Facilitator.	ICARIA consortium member
South Aegean Region - Civil Protection (SAR-CP)	SAR is the second degree of local public administration.	The SAR-CP department will provide disaster data (e.g., fires, landslides, floods etc.) and emergency response plans and support to operational personnel.	ICARIA consortium member
Social Cooperative Enterprise "Apano Meria"	Social Cooperative Enterprise "Arpano Meria" is the legal entity of the citizens' assembly of North Syros.	Social Cooperative Enterprise "Arpano Meria " is involved in the environmental development of the Northern part of Syros, which is a Natura 2000 protected area.	CoP 3rd party

Table 6. Description of relevant stakeholders and their role (expected) in the CoP for the South Aegean Region - Rhodes CS.

South Aegean Region - Rhodes			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category** (public, private, third sector)
Chamber of Commerce and Industry of the Dodecanese	The Chambers of Commerce and Industry of Dodecanese is a national/international body that consults local businesses through targeted institutional interventions and initiatives, strategically cooperating in the best interest of ιτσ members, entrepreneurship of the whole Dodecanese as well as of the whole local society.	The Chamber of Commerce and Industry of Dodecanese will provide economic data and also specific ones related to the impacts of several hazards on local businesses.	CoP 3rd party
Commercial Association	The Commercial Association of Rhodes is the association of commercial enterprise owners.	The Commercial Association of Rhodes will provide economic data related to the effects of several hazards on local businesses.	CoP 3rd party
DEYA Rodos	DEYA Rodos is a water and wastewater utility company.	DEYA Rodos will provide water production/consumption data as well as a GIS database of water network infrastructures.	CoP 3rd party
Environmental Protection Association of Rhodes (EPAR)	EPAR deals with the active protection of the environment, intervening publicly as well as organising awareness-raising actions. It collaborates with other agencies promoting sustainability on the island.	EPAR will provide data and information on the effects of several hazards on the environment and urban zones.	CoP 3rd party
Fire Brigade (RFB)	RFB is responsible for the whole island of Rhodes.	RFB will provide data on forest fires and flooding events, as well as regional fire safety/evacuation plans.	CoP 3rd party

South Aegean Region - Rhodes			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category** (public, private, third sector)
Hellenic Coast Guard (HCG)	HCG is the official port authority of Rhodes. It is responsible for the management of the port area.	HCG will provide both port traffic data and marine traffic delays/cancellations due to extreme weather events.	CoP 3rd party
Hellenic Institute of Transport (HIT)	HIT is a public research entity.	HIT will provide data and information related to the effects of several hazards on land transportation infrastructure.	CoP 3rd party
Hellenic Red Cross - Rhodes branch (HRC)	HRC - Rhodes branch is a volunteering organisation for health emergencies.	HRC - Rhodes branch will provide health-related data, based on civilian assistance during emergencies.	CoP 3rd party
Municipality of Rhodes (MRH)	MRH is the first degree of local public administration.	MRH will provide all available data on the social, environmental, and infrastructure impact of hazards in the area of interest.	CoP 3rd party
National Centre of Scientific Research "Demokritos" - INRASTES	The Institute of Nuclear & Radiological Sciences and Technology, Energy & Safety (INRASTES) is an interdisciplinary R&D establishment pursuing basic, translational and applied research to address challenges of great scientific and socio-economic impact in a broad spectrum of scientific and technological fields.	CoP coordinator and Case Study Facilitator.	ICARIA consortium member
South Aegean Region - Civil Protection (SAR-CP)	SAR is the second degree of local public administration.	The SAR-CP department will provide disaster data (e.g., fires, landslides, floods etc.) and emergency response framework and plans.	ICARIA consortium member
Solid Waste Management Agency of the South Aegean S.A.	The Solid Waste Management Agency on the South Aegean S.A. is a waste collection and management services company.	The Solid Waste Management Agency on the South Aegean S.A. will provide insight into the waste management sector.	CoP 3rd party

South Aegean Region - Rhodes			
Stakeholder name	**Description of the stakeholder**	**Expected role in the CoP**	**Category** (public, private, third sector)
Technical Chamber of the Dodecanese (TCG - Dodecanese)	TCG - Dodecanese develops Science and Technology in sectors related to the disciplines of its members, for the economic, social, and cultural development of the country, in accordance with the principles of sustainability and environmental protection.	TCG will provide data related to the impacts of climate hazards on infrastructure, and houses, having field experience from related data collection activities.	CoP 3rd party

3.2.3 The Salzburg Region CS

As a starting point, the CoP of this CS has been set up with main members of the public bodies from the Salzburg overall and Pinzgau region. On the one side, the regional perspective is needed to have a comprehensive overview of principal climate hazards impacting Salzburg, and to gather enough data on past events, on their impacts on inhabitants, economy and infrastructure. On the other side, the Pinzgau area is a dedicated climate adaptation region already highly engaging public and private stakeholders in order to bring more awareness of climate impacts to the community, and further is engaged in different projects which focus on the implementation of climate adaptation measures.

Table 7. Description of relevant stakeholders and their role (expected) in the CoP for the Salzburg Region CS.

Salzburg Region			
Stakeholder name	**Description of the Stakeholder**	**Role**	**Category** (public, private, third sector)
AIT Austrian Institute of Technology GmbH	AIT is the largest non-university research organisation; the research focus of the participating group is on climate change impacts, improved climate projections (from local to regional scale) and quantification of adaptation measures.	AIT will coordinate the case study and further, will provide high-resolution climate projections to gain a better understanding of future hazards.	ICARIA consortium member
ASFINAG Freeways and expressways financing stock company	ASFINAG is a road network provider.	ASFINAG is responsible for the road network. It will provide information on possible climate hazards for the (local) road network.	ICARIA advisory board
Austrian Economic Chambers of Salzburg	The Austrian Economic Chamber of Salzburg represents the local member companies.	The Austrian Economic Chamber of Salzburg will help estimate the impact of climate hazards on the local economy such as tourism.	CoP 3rd party
Catastrophe Funds	Catastrophe Funds is a financial support after natural disasters.	Catastrophe Funds will be asked to share data on economic loss after extreme events. It will be a potential DSS user or informant.	CoP 3rd party

Salzburg Region			
Stakeholder name	**Description of the Stakeholder**	**Role**	**Category** (public, private, third sector)
Climate adaptation coordinator	Municipalities can contact their state's climate change coordination office with questions about adapting to climate change.	This stakeholder coordinates and oversees the climate adaptation actions happening within the Salzburg region. It will therefore help to connect to stakeholders, gather data etc. It will be a potential DSS user.	CoP 3rd party
Climate adaptation region Pinzgau	The Climate Change Adaptation Regions (KLAR!) funding program aims at giving regions and municipalities the opportunity to prepare for climate change through adaptation measures and to take advantage of the opportunities that arise.	The Climate Change Adaptation Regions (KLAR!) enables the region to engage a local person responsible for supporting climate adaptation measures and awareness building in the municipalities. It is well connected to local stakeholders and therefore it will help to establish the CoP. It will be a potential DSS user.	CoP 3rd party
Climate and Energy Model Region	The Climate and Energy Model Regions is a program of the Climate and Energy Fund. The program co-finances regional climate protection projects and regional model region management.	The Climate and Energy Model Regions focuses on climate mitigation measures of the region. It will be important for renewable energy supply aspects.	CoP 3rd party
Climate mitigation coordinator	Municipalities can contact their state's climate change coordination office with questions about the mitigation of climate change.	This stakeholder coordinates and oversees the climate mitigation actions happening within the Salzburg region. It will therefore help to connect to stakeholders, gather data, etc.	CoP 3rd party
Division of Forestry Salzburg	The Division of Forestry Salzburg is responsible for forest management.	The Division of Forestry Salzburg is a public body managing the forest within the region, and it will give information on the impact of climate change on prevailing forests.	CoP 3rd party

Salzburg Region			
Stakeholder name	**Description of the Stakeholder**	**Role**	**Category** (public, private, third sector)
Hydrological Service Salzburg	The Hydrological Service Salzburg is engaged in observation, research, analysis and evidence-keeping of the basic data of the quantitative water cycle.	The Austrian Economic Chamber of Salzburg is a public body overseeing the hydrological conditions of Salzburg and it will provide information on flooding, droughts, etc.	CoP 3rd party
Mayor of Mittersill	The Municipality of Mittersill is already affected and engaged in climate adaptation.	The Municipality of Mittersill will provide information on past hazards, damages, and current actions. It will be a potential DSS user and multiplicator.	CoP 3rd party
Regional Planning Salzburg	The Regional Planning Salzburg is a body responsible for the designation of areas.	The Regional Planning Salzburg will provide information on designated area types, important for setting up protected areas.	CoP 3rd party
Torrent and Avalanche Protection	The Torrent and Avalanche Protection agency is responsible for ensuring protection against the torrent and avalanches.	The Torrent and Avalanche Protection agency is a public body in charge of torrent and avalanche protection, so far mainly built protection is applied. It will be important for information about needed protection as well as potential DSS users.	CoP 3rd party
VERBUND AG (VERBUND stock company)	VERBUND is an energy provider.	VERBUND is the owner of hydropower plants in this region. It will provide data on past hazards and information on future/expected climate impacts.	ICARIA consortium member

4 Timeline of activities

To foster a fruitful participatory co-creation process, a detailed roadmap has been defined in order to organize a set of face-to-face workshops over a three-year period, 6 for each ICARIA CoPs (Table 8; Figure 5).

Considering that a workshop is a valuable instrument to enable the exchange and dialogue between a wide variety of stakeholders around specific common interests, ICARIA has designed and scheduled several workshops focusing on relevant topics closely related to the goals and potential impacts of the project. Since a Community of Practices is directly linked to a specific case study region and also to relevant stakeholders in the area, workshop activities will be customised case-by-case while remaining in a general methodological engagement framework. Therefore, facilitators will have a crucial role in choosing the most effective tools that will determine group dynamics and interactions. Furthermore, these workshops will enhance the project outreach and future exploitation by presenting its development to potential end-uses of the developed tools.

The roadmap has been also useful to ensure connections with the overall ICARIA WPs working plan in terms of inputs/outputs needed to validate methodology and activities.
If the timeline needs to be readjusted, due to internal or external reasons, such circumstances shall be effectively addressed and explained to ensure comprehension and consensus among all stakeholders.

Workshop 1 - Presentation of ICARIA and identification of challenges and opportunities

Workshop 1, concerning both the presentation of ICARIA to relevant stakeholders and the identification of project challenges and opportunities for development, will be held in M7 (July 2023).

This workshop has the purpose of a) informing CoP members about the ICARIA project by providing a general overview, b) introducing CoP objectives and procedures in order to activate a Community of Practices within each case study region. Besides that, the workshop aims to c) identify risks, gaps, and opportunities (e.g., key-hazards, and assets/services at risks not sufficiently well assessed today) faced by the problem owners and the rest of the CoP members. The workshop will address both Climate Change related risks affecting the region and the scope and methodologies expected to implement in ICARIA (e.g., potential impacts on own work, and potential socio-economic impacts). This will be done through a participatory co-creation process based on engagement tools and exercises. Inputs provided will be crucial not only to the trial preparation but also to provide initial inputs for ICARIA sustainability and exploitation planning. The workshop will also allow to d) define the contribution from stakeholders in a bidirectional perspective through a focused discussion on mutual expectations, and to e) characterise/define the specific trial context of the CS.

Considering the objectives, adopted procedures, and related expectations the workshop 1 is interconnected to WP1, WP2, WP3, and WP4.

Workshop 2 - Discussion and validation of the Risk Assessment approach

Workshop 2, concerning the discussion and validation of the Risk Assessment approach adopted in the ICARIA project, will be held in M13 (January 2024).

This workshop has the purpose of a) presenting the solutions that the project is developing, getting feedback on stakeholders' needs and expectations concerning DSS features, giving an evaluation of the adaptation measures portfolio, and validating the ICARIA risk assessment methods. Besides that, the workshop also aims to b) present

data/knowledge gaps behind the models and define possible valuable solutions. To achieve both objectives, after a short explanatory presentation on the overall framework (T.1.1) and hazards & impacts assessment methods (T.2.2, T.3.1), a participatory co-creation process based on engagement tools and exercises will be developed to identify stakeholders' needs and expectation regarding DSS features, and to evaluate the portfolio.
This workshop will include a re-evaluation of the risks, gaps and opportunities identified in the first workshop.
Finally, the workshop will also allow us to c) present the TGM methodology and its organisation in order to evaluate trial gaps, objectives and related questions, examine the proposed scenario and discuss the role of CoP stakeholders within scenario/trials, and figure out how to measure the success of the trials. Therefore, an exhaustive presentation on the TGM methodology will be prepared.

Considering the objectives, adopted procedures, and related expectations the workshop 2 is interconnected to WP1, WP2, WP3, and WP4.

Workshop 3 - Evaluation of preliminary results

Workshop 3, concerning the evaluation of preliminary results obtained in the ICARIA project, will be held in M19 (July 2024).

This workshop has the purpose of a) presenting the results of three "Lab Tasks" (WP 1, 2, & 3) to stakeholders, and b) discussing the newly identified data/results gaps of current risk assessment methods through a concise presentation on these topics. Besides that, the workshop aims to c) present and validate both trial organisation and planning, focusing on trial objectives, specific roles of CoP members, and their expectations during the trial. To achieve this goal a presentation of the trial implementation plan with all roles and duties will be prepared. The workshop will also allow to d) re-evaluate alignment between project results and CoP expectations through a participatory co-creation process based on engagement tools, as further input to ICARIA impact, sustainability, and exploitation planning.
Considering the objectives, adopted procedures, and related expectations the workshop 3 is interconnected to WP1, WP2, WP3, WP4 and WP5.

Workshop 4 - Trial execution

Workshop 4, concerning the Trial execution, will be held in M28 (April 2025).

This workshop has the purpose of executing the trial scenarios and collecting the data necessary to evaluate the trials, as defined in the "six-step approach". It will start with a concise presentation of the trial (gaps, objectives, research questions, scenarios) and a briefing of participants concerning their roles and tasks as active testers of the ICARIA solutions and observers. The main part of the workshop will consist of the execution of the scenario and data collection, with a final discussion serving to identify those trial aspects that were particularly (un)successful and (ir)relevant for the end-users. The results of this final discussion will be used for dissemination/communication (short term), to decide what trial aspects to include in mini-trials and demonstrators (short term), and as inputs for ICARIA sustainability and exploitation planning.

Considering the objectives, adopted procedures, and related expectations the workshop 4 is interconnected to WP3 and WP4.

Workshop 5 - Mini-Trials and socio-economic impacts

Workshop 5, concerning the evaluation of the Trials, Mini-trial implementation and assessing the socio-economic impacts, will be held in M31 (July 2025).

This workshop has the purpose of a) presenting the final results learnt from the Trial implementation and validation of these findings through the organisation of a participatory co-creation process in order to assess their adequacy to the CS, strengths and weaknesses. Besides that, the workshop aims to b) execute the Mini-Trial through a demonstrative process with the whole CoP. As indicated in Section 3 of this document, Mini-Trials shall be mainly used to assess the transferability of ICARIA results and to evaluate the socio-economic impacts of ICARIA solutions.

Considering the objectives, adopted procedures, and related expectations the workshop 1 is interconnected to WP3, WP4, and WP5.

Workshop 6 - Outreach beyond CoPs

Workshop 6, concerning the evaluation of results obtained in the ICARIA project by the wider public, will be held in M35 (November 2025).

This workshop has the purpose of a) showing the final outcomes of the project by preparing an overall presentation on ICARIA results beyond the CoPs, and by a concise specific presentation on Trials implementation and Mini-Trials replication results. Besides that, the workshop aims to b) demonstrate result applicability, c) foster the outreach of results to potential end-users beyond the CoP, and d) evaluate the interest of workshop participants in potential replication and exploitation of results in other regions/stakeholder groups. To achieve these goals a demonstration of the capabilities of ICARIA tools will be organised.

Considering the objectives, adopted procedures, and related expectations the workshop 6 is interconnected to WP4 and WP5.

During the period in which workshops take place, there will also be a questionnaire that participants will be asked to fill in. The questionnaire will be submitted digitally (e.g., by email, etc.) in order to avoid any bias regarding information on risk knowledge, perception, and awareness given through the CoPs. Indeed, the questionnaire will allow data collection also from stakeholders who may not participate physically in the workshop, thus enlarging the data set.
A second questionnaire will be submitted at the end of the project, to evaluate any change in responses, considering the activation of CoPs.

Table 8. Roadmap of CoPs' workshops in the ICARIA project.

Workshop (month)	Theme	Topics to be covered	Link to ICARIA WPs	Matters to be considered
Workshop 1 (M7)	Presentation of ICARIA and identification of challenges and opportunities	1. Inform stakeholders about the ICARIA project. 2. Introduction to CoP objectives and procedures. 3. Risk & gaps identification: key hazards and assets and services at risk that aren't sufficiently well assessed today. 4. Define contribution from stakeholders (bidirectional perspective: ICARIA to stakeholders and stakeholders to ICARIA). 5. Definition of the specific Trial context of each CS.	WP 1, 2, 3 & 4	• Provide a general overview of the ICARIA project. • Participatory process to identify risks and assets based on the expertise of UNINA's SSH department. • Prepare a discussion/debate to find agreements on bidirectional expectations.
Workshop 2 (M13)	Discussion and validation of the Risk Assessment approach	1. Present the solutions project is developing and get feedback on needs, expectations etc. • Expected DSS features • Evaluation of Portfolio of Adaptation Measures • Validation of risk assessment methods developed 2. Present data/knowledge gaps and define possible solutions gaps of the models. 3. Present the Trial methodology and organisation. • Assess the trial gaps, objectives and research questions • Assess the proposed scenarios and discuss the roles of CoP members in these scenarios/trials	WP 1, 2, 3 & 4	• Prepare a concise presentation of the following: ○ Overall framework (Task 1.1) ○ Hazard assessment methods (Task 2.2) ○ Impacts assessment method (Task 3.1) • Participatory process to identify needs and expectations of the DSS and Portfolio tools. • Prepare a presentation of the TMG methodology.

Workshop (month)	Theme	Topics to be covered	Link to ICARIA WPs	Matters to be considered
		• Assess how to measure the trials are success		
Workshop 3 (M19)	Evaluation of preliminary results	1. Presentation of the results of the three "Lab Tasks". 2. Discuss the newly identified gaps in the risk assessment methods and results. 3. Present and validate the Trial organisation and planning • Define Trial objectives • Define specific roles and expectations of CoP members during the Trial 4. Revaluation of alignment between project results and CoP expectations.	WP 1, 2, 3 & 4	• Prepare a concise presentation of the following: ○ Results of the 3 Lab tasks (WP 1, 2 & 3) ○ Data/results gaps identified • Present a plan of the trial implementation with all the roles and duties already defined. • Participation process to reevaluate CoP needs and expectations.
Workshop 4 (M28)	Trial execution	1. Evaluate preliminary DSS design and features (may also be of Portfolio of Adaptation Measures, risk assessment methods - depends on the trial design and scenarios). 2. Execution of the Trial: CoP Members are actively involved in it as observers and evaluators of the results. 3. Identify further interests of CoP that can be developed in the Mini-Trial phase. 4. Identify which aspects of the trials are particularly relevant for the end-users/suitable for demonstrators, and for the dissemination/communication.	WP 3, 4 & 5	• Prepare a concise presentation of the following: ○ Results of the trial implementation ○ Data/results gaps identified • Execute the Trials with the whole CoP in a demonstration process. • Participation process to identify further CoP needs and expectations. • Participatory process to evaluate current features of DSS and define further developments of interest.

Workshop (month)	Theme	Topics to be covered	Link to ICARIA WPs	Matters to be considered
Workshop 5 (M31)	Mini-Trials and socio-economic impacts	1. Present the final results learnt from the Trial implementation ● Organise a participatory process to assess their adequacy to the CS, strengths and weaknesses 2. Execute the Mini-Trials following the same methodology as for the Trials. In this case, the models and scenarios and risk assessment executed will be a simplified approach with respect to the trials.	WP 3, 4 & 5	● Validate the D4.2 findings and lessons learnt from the trials. ● Execute the Mini-Trials with the whole CoP in a demonstration process.
Final workshop (M35)	Outreach beyond CoPs	1. Present final results of project ICARIA. 2. Demonstration of results applicability. 3. Foster the outreach of ICARIA results to potential end-users beyond the CoP (including the follower regions). 4. Evaluate the potential for further actions to enhance the exploitation of ICARIA results on other regions/stakeholder groups.	WP 4 & 5	● Overall presentation of project outcomes beyond the ICARIA CoPs. ● Prepare a concise presentation of the following: ○ Results of the Trials implementation ○ Results of the Mini-Trials replication ● Organise demonstration of the capabilities of the tools developed in the project.

5 CoP first workshop

This section presents the organisation of the first CoP workshop celebrated in the Barcelona Metropolitan Area (Area Metropolitana de Barcelona) Case Study on June the 26th 2023. The meeting, which was face-to-face, was held in the headquarters of AQUATEC, in Barcelona, and lasted for 2.5 hours. At least one representative of all stakeholders indicated in Table 4 did attend personally.

In line with the roadmap presented in Table 8, the main objectives of this initial meeting were:

1. Present an overview of the ICARIA project to external 3rd parties, paying special attention to the project outcomes that could be of interest to them as potential end-users.
2. Present the concept of CoP, the reason why it has been set up in ICARIA, its main objectives and how it will be organised.
3. Identify a preliminary stakeholder's perception of risks, gaps and opportunities regarding climate hazards, and climate resilience of critical infrastructure identification.
4. Define initial expectations and contributions from stakeholders to establish a bidirectional flow of efforts and information.
5. Define the case study context for the Trials and Mini-Trials.

The figure below depicts the agenda of the day:

1st Community of Practice workshop: Area Metropolitana de Barcelona Case Study

Passeig de la Zona Franca 48, Barcelona, June the 26th 2023

AGENDA

- 9:45 – 10:00: Welcome to the attendees
- 10:00 – 10:20: Presentation of project ICARIA
- 10:20 – 10:35: Community of Practice: reasons and objectives
- 10:35 – 10:50: Presentation of CoP members
- 10:50 – 11:50: 1st Participatory process: identification of risks, gaps and opportunities
- 11:50 – 12:20: 2nd Participatory process: definition of expectations and contributions
- 12:20 – 12:30: Meeting closing

Figure 5. Agenda of the 1st CoP workshop in the AMB Case Study

The first three items in the agenda were addressed with a PowerPoint presentation on both the project and the CoP organisation and objectives. While the presentation of the members of the group was organised as a short roundtable where all the attendees presented themselves, the stakeholder that they represented and their main interest and/or contributions to ICARIA.

The second part of the workshop involved participation porches where the attendees were asked to provide their opinion and points of view regarding several topics related to the projects: 1) evaluate the importance of a set of climate hazards in the context of the Barcelona Metropolitan Area; 2) assess the current level of knowledge about the impacts and risks that these hazards can cause on the CS; 3) rating of the most vulnerable infrastructures (to climate hazards) of a series of essential sectors; 4) identify the climate hazards that can more severely affect these assets; and 5) assess the current level of knowledge about the specific impacts that can affect these assets.

This 1st participatory process was articulated with a survey that enabled all participants to respond to the questions posed while visualising the answers live. This method was a useful approach as it enabled the discussion and evaluation of the answers provided by all stakeholders in real-time. The figure below shows the results of the answers to one of the questions of the survey:

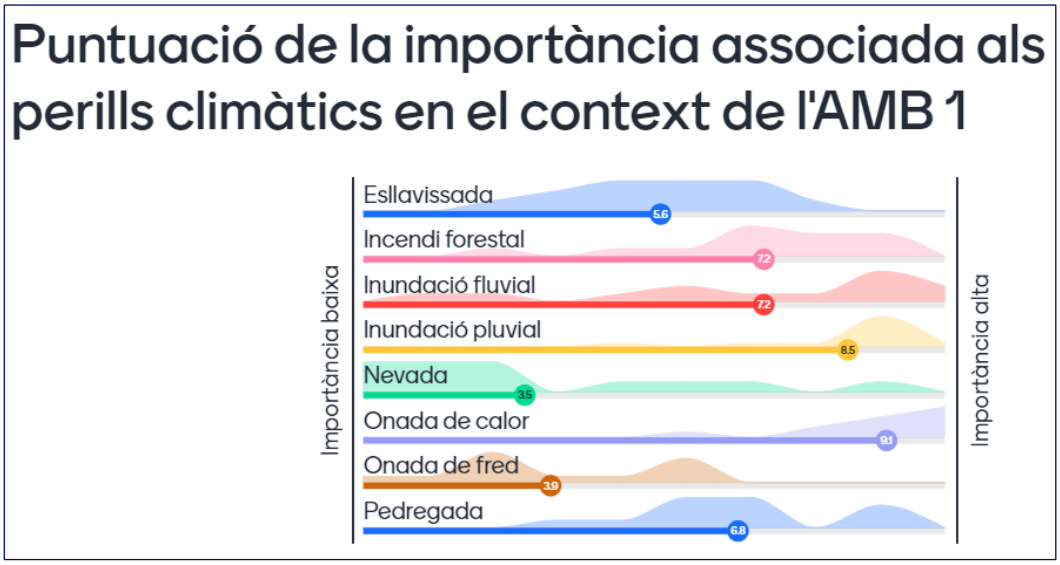

Figure 6. Example of the answers to one of the questions about climate hazards included in the survey of the 1st workshop of the AMB Case Study CoP (in Catalan).

The 2nd participatory process, aiming at identifying the main expectations and contribution of each participant to the CoP, was organised as a roundtable. All attendees wrote down in coloured “post-its“ which of the ICAIRA outcomes could be of more interest for their specific field and in which aspects of the project they could provide expertise, resources and/or data. All the answers provided were registered to be re-evaluated in the following workshops of the CoP as it is planned in the roadmap.

6 Conclusions

The ICARIA Stakeholder Engagement Plan (D5.4) provides the methodology to establish, organise, and implement the so-called Communities of Practices (CoPs) within three case study regions: Metropolitan Area of Barcelona, South Aegean Region, and Salzburg Region and explains the relationship between the CoPs and the trials that will be conducted within the scope of ICARIA WP4 “Case studies: implementation, replicability and exploitation”.

These different regions, exposed to climate hazards whose impacts are further aggravated by the ongoing climate change and socio-economic challenges, represent ideal sites for testing technical and organisational solutions developed through ICARIA trials and mini-trials. Considering the close relationship between the Community of Practices and the region where the CoP will be activated, this plan is needed in order to facilitate dialogue and cooperation between different stakeholders, intensifying knowledge exchange and coordination of activities among parties involved. The overarching purpose of this work is to facilitate the co-creation of efficient and effective adaptation strategies and measures against climate change-related impacts and co-develop a climate-resilient and sustainable governance.

With these purposes, the Stakeholder Engagement Plan which acts across the whole ICARIA project, has been structured according to the following points:

- contextualization of the ICARIA stakeholder engagement;
- explanation of the reasons behind the Stakeholder Engagement Plan development and adoption;
- characterization of the CoP in terms of objectives, functions, and methodology behind;
- overview of the case study regions in terms of geographical location, climate hazards, risk receptors, and expected impacts;
- selection of relevant stakeholders to be engaged within each CoP;
- development of a tentative timeline of activities and interaction, according to the roadmap of CoP workshops.

It is our strong belief that the Stakeholder Engagement Plan is a valuable document that will guide the ICARIA Consortium during the activation of CoPs, and implementation of related activities.

The plan will be closely monitored to check closely the progress results, and the possible potential need for any adjustment that will be done in time and accordingly to the plan assessment and evaluation.

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