SOlutions TEsting for Regions through

Insurance for Climate Adaptation

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SOTERIA Replication Manual

Methods and tools to design and implement innovative insurance-based adaptation solutions within the RAST framework

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9	National Center for Scientific Research Demokritos	DEMO	GR	Beneficiary
10	Hochschule Weihenstephan-Triesdorf	HSWT	DE	Beneficiary
11	Association for the Development of West Athens	ASDA	GR	Beneficiary
12	Behavior SMART OOD	BES	BG	Beneficiary
13	Generalitat Valenciana	GVA-A	ES	Beneficiary
14	Municipality of Gabrovo	MoG	BG	Beneficiary
15	Empower Insight	EI	FR	Beneficiary
16	Stiftung Global Infrastructure Basel	GIB	CH	Associated Partner
17	Verbraucherzentrale Sachsen e.V.	VZS	DE	Associated Partner
18	Landesamt für Umweltschutz (Regional Env. Protection Agency)	LAU	DE	Associated Partner
19	KLP Skadeforsikring AS (insurance)	KLP	NO	Associated Partner
20	Gjensidige Forsikring ASA (insurance)	GJE	NO	Associated Partner
21	Allianz Agrar	AZA	DE	Associated Partner
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23	German Insurance Association	GDV	DE	Associated Partner
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27	The County Governor in Trøndelag	CGT	NO	Associated Partner
28	DZI at KBC Group	DZI	BG	Associated Partner
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30	Hellenic Association of Insurance Companies	HAIC	GR	Associated Partner

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EXECUTIVE SUMMARY

Across Europe, regions and local authorities face increasing climate risks, limited public budgets, and growing protection gaps (underinsurance, unaffordable coverage, low risk awareness, limited data, or misaligned incentives). Insurance can play a key role in supporting adaptation not only by transferring risk, but also by enabling prevention, preparedness, and “build back better” approaches when appropriately integrated into adaptation planning.

However, territories often lack a clear, practical process to identify protection gaps, co-design feasible insurance pathways with stakeholders, and move from assessment to implementation within regional adaptation planning processes. Evidence from SOTERIA regional case studies shows that this gap is mainly operational rather than informational, with challenges linked to stakeholder alignment, data availability, and governance coordination.

The SOTERIA Replication Manual fills this gap by providing a practical, step-by-step approach aligned with the Regional Adaptation Support Tool (RAST) to help regional and local actors design, assess and implement insurance-based adaptation solutions. The approach is grounded in SOTERIA case studies and complemented with tools, templates and examples to support real decision-making contexts.

This Manual is primarily intended for regional and local authorities, but it can also support other actors involved in insurance-based adaptation, including insurance partners, civil protection bodies, and technical practitioners or researchers. It is designed for users with different starting points: from those beginning adaptation planning to those with existing risk assessments who want to explore where insurance can reduce protection gaps.

This Manual supports users to:

- Clarify the adaptation challenge and the realistic role of insurance
- Identify protection gaps and barriers to effective coverage or risk reduction
- Co-design solutions with stakeholders through structured and inclusive process
- Select and implement feasible solutions using evidence and transparent criteria

The Manual follows a step-by-step logic aligned with the RAST. Each step presents its purpose, expected outputs, RAST alignment, and practical tools and templates for application.

By the end of the process, users should have:

- A clear problem definition and stakeholder map
- A shared understanding of risk, vulnerability, and protection gaps
- A shortlist of suitable insurance-based adaptation options
- An assessment of feasibility, enabling conditions, and barriers
- A selected innovative insurance solution pathway with an implementation plan

The Manual follows the six-step RAST adaptation cycle - preparation, risk assessment, solution identification, option appraisal, implementation, and learning. Each step combines guidance on what to do with practical tools, templates and case-study insights tested in SOTERIA pilots.

- Step 1 (“Preparing the ground to co-design insurance adaptation solutions”) establishes the governance, stakeholder engagement and institutional context needed before detailed risk analysis or solution design.
- Step 2 (“ Assessing risks and vulnerabilities to identify potential innovative insurance solutions for adaptation”) focuses on climate risk and vulnerability assessment, with particular attention to data availability, quality and loss information as key constraints for insurance-based adaptation.
- Step 3 (“Identifying suitable insurance solutions”) helps regions identify and structure feasible innovative insurance solutions across product, business model, data and partnership dimensions.
- Step 4 (“Assessing and selecting adaptation options”) supports transparent evaluation and selection of options using consistent criteria, including feasibility and sustainability considerations.
- Step 5 (“From selected insurance solutions to implementation: how to implement insurance solutions for climate change adaptation?”) addresses implementation, highlighting enabling conditions such as governance coordination, policy alignment and shared data infrastructures.
- While the Manual follows the logic of a six-step RAST pathway, SOTERIA’s timeframe did not allow a full monitoring cycle to be developed as a complete Step 6 (“Monitoring, evaluation and learning”). Monitoring components will be further developed through the SOTERIA Platform.

To facilitate uptake and reuse, the Manual is complemented by the SOTERIA Platform, which provides interactive access to tools, templates, and the project resources. Together, the Manual and Platform support regional and local authorities, insurers and practitioners seeking to integrate insurance into climate adaptation strategies.

Table 1: Overview of the Manual structure

EU MISSION RAST Steps	SOTERIA Rast Steps	Focus	What it contains
Step 1 – Preparing the ground for adaptation	Step 1 – Preparing the ground for co-design insurance adaptation	Establish governance and co-design foundations	Problem framing tools (story maps), stakeholder mapping, Communities of Practice and Climate Resilience Dialogues to align actors and define the adaptation challenge.
Step 2 – Assessing climate risks and vulnerabilities	Step 2 – Assessing risks and vulnerabilities to identify potential innovative insurance solutions for adaptation	Build the evidence base for protection gaps	Practical risks assessment workflows, guidance on hazard-exposure-vulnerability-loss data, and methods to identify data gaps and improve risk and loss information.
Step 3 – Identifying adaptation options	Step 3 – Identify suitable insurance solutions	Structure feasible insurance options	Typologies and examples of innovative insurance solutions.
Step 4 – Assessing and selecting adaptation options	Step 4 – Assessing and selecting adaptation options	Compare and select preferred options	Evaluation criteria, feasibility assessment tools and sustainability considerations to justify solution choices.
Step 5 – Implementing adaptation policies and actions	Step 5 – Implementing insurance-based adaptation solutions	Translate solutions into operational pathways	Guidance on governance coordination, policy integration, and data-sharing arrangements, with lessons from SOTERIA case studies.
Step 6 – Monitoring, evaluation and learning (MEL)	Step 6 – Monitoring, evaluation, and learning (MEL)	Track results and improve over time	Monitoring elements linked to the SOTERIA Platform to support iterative learning and replication.

GLOSSARY

Calibration (modelling): Adjusting model parameters so that model outputs match observed data, improving the model's ability to represent the system and support reliable analysis.

Climate-induced risk: Risk that results from the interaction of climate-related hazards (events and trends) with the exposure and vulnerability of human and natural systems.

Climate-related data: Data describing the climate system and its changes (e.g., temperature and precipitation trends, sea level, drought indices) and related drivers and indicators used to monitor climate impacts.

Climate-related risk: Risks arising from climate change, commonly grouped into:

- **Physical risks**: risks from the physical impacts of climate change (acute events and chronic trends).
- **Transition risks**: risks linked to the transition to a low-carbon economy (policy, technology, market, legal, reputational).

Climate risk data vs. loss data:

- **Climate risk data**: data used to assess potential future impacts and risk (e.g., hazard frequency/severity, exposure and vulnerability indicators, scenario-based projections).
- **Loss data**: data describing realised impacts and costs from events (e.g., insured/uninsured losses, repair costs), used to quantify past damages and inform modelling and policy.

CoP (Community of Practice): A group of practitioners and stakeholders who meet regularly to exchange knowledge, build shared understanding, and co-develop solutions around a common challenge.

CRD (Climate Resilience Dialogue): A facilitated stakeholder process designed to structure discussions on climate risk, vulnerability, protection gaps and feasible solutions, helping participants move from a shared problem definition to practical pathways for action (including insurance-related options).

Damage: Negative physical impacts on assets, infrastructure, ecosystems, or human well-being caused by a hazardous event (e.g., damaged buildings, destroyed crops).

Exposure: The presence of people, assets, infrastructure, economic activities, or ecosystems in places that could be adversely affected (e.g., population in a floodplain, critical infrastructure in a wildfire-prone area).

Extreme event: A weather, climate, or environmental event that is rare for a particular place and time of year, ranking near the upper or lower ends of the observed historical range (e.g., extreme rainfall, heatwave, drought).

Hazard: A potentially damaging physical event or trend (e.g., flood, drought, heatwave), or human-induced condition, that can cause loss of life, injury, damage, disruption, or environmental harm.

Innovation (in insurance/adaptation): A new or significantly improved product, process, business model, data approach, or partnership that differs from established practice and improves climate resilience outcomes.

Insurance protection gap: The difference between total losses from climate-related hazards and the share that is insured or financially protected (through insurance or comparable mechanisms). A protection gap can be financial (uninsured losses), social (unequal access/affordability), or institutional (missing systems for risk transfer and recovery).

Loss (direct and indirect):

- **Direct losses**: immediate physical destruction or damage caused by the event (e.g., infrastructure damage from flooding).
- **Indirect losses**: secondary effects resulting from the direct impacts (e.g., business interruption, supply-chain disruption, loss of services).

NatCat insurance: Insurance coverage related to natural catastrophes (e.g., floods, storms, wildfires, earthquakes), depending on the product and national system.

Parametric insurance: An insurance product that pays out when a pre-defined index or trigger is met (e.g., rainfall below a threshold, wind speed above a threshold), rather than paying based on assessed damages. It is typically designed for faster payouts and lower claims-processing burdens, but requires careful trigger design to reduce “basis risk”.

Regional Data Hub: A coordinated arrangement (platform, agreement, and governance process) that enables stakeholders to collect, manage, share and use climate, exposure, vulnerability, loss and claims-related data to support risk assessment, adaptation planning and the design/operation of insurance-based solutions.

Risk: The potential for adverse consequences where something of value is at stake, arising from the interaction of hazard, exposure, and vulnerability, together with the likelihood of occurrence over a given time period.

Risk assessment: A process to identify hazards and analyse the likelihood and consequences of adverse events, to estimate risk and support decision-making.

Risk transfer: Arrangements that shift financial consequences of risk from one party to another (e.g., from households to insurers, from insurers to reinsurers). Long-term risk transfer refers to sustained, multi-year arrangements supporting financial resilience to recurring or evolving climate risks.

Vulnerability: The degree to which exposed elements are susceptible to harm and unable to cope with or adapt to adverse impacts, influenced by physical, social, economic, and environmental factors.

INTRODUCTION

The challenge

Climate change is altering weather patterns across Europe and increasing the frequency and intensity of extreme weather events. The European Climate Risk Assessment (EUCRA) identifies Europe as the fastest-warming continent, with increasing risks related to heatwaves, droughts, and floods (EEA, 2024; ESABCC, 2026). These trends are expected to continue, increasing both economic and non economic losses and damages (including social impacts).

In response to these challenges, climate change adaptation is a central pillar of climate policy and risk management, together with mitigation and finance The Intergovernmental Panel on Climate Change (IPCC) defines adaptation in human systems as "the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities" (IPCC, 2023). Effective adaptation aims to reduce vulnerability to climate impacts and to strengthen resilience, understood as the capacity of systems to absorb shocks and recover. In the context of the upcoming AR7 report a lot of focus will be placed on the effectiveness of adaptation and the adaptation solution space, to which this Manual aims to contribute.

Insurance is closely linked to adaptation because it manages climate-related risks. Insurance can be defined as a financial mechanism that transfers risk from individuals or organizations to a collective pool, providing financial compensation in the event of a loss. Through this risk-transfer function, insurance supports recovery after climate-related disasters and can reduce the financial consequences of extreme events. It is also now increasingly seen as a key element in prevention due to requirements under the EU Taxonomy on adaptation.

Traditionally, insurance has been considered primarily as a reactive tool, as it compensates losses after damage has occurred. While this function is essential for recovery, it does not directly reduce exposure or physical damage. As a result, insurance alone cannot fully address the objectives of climate change adaptation. Moreover, insurance may create moral hazard if insured actors reduce their investment in preventive measures, relying instead on post-event compensation or if insurance does not incorporate risk appropriately (for example through premiums).

However, when integrated into a broader adaptation framework, insurance is a key lever for a more proactive, transformational adaptation as called for by the UNFCCC. Insurance pricing and innovative product designs can provide economic incentives for risk-reducing measures, insurers' risk models can support the identification of high-risk areas, and insurance mechanisms can facilitate timely recovery, particularly for vulnerable populations. In this context, innovative insurance solutions can contribute directly to adaptation by reducing vulnerability and strengthening resilience. Furthermore, it can also play other roles like investments in line with the "triple dividend" approach.

Examples of such solutions include parametric insurance schemes that provide rapid liquidity following extreme events; financial incentives linked to preventive and risk reduction actions;

data sharing to support adaptation planning; improved risk communication; “build-back better” approaches that promote more resilient reconstruction after disasters, guided by a longer-term vision that incorporates a changing climate. These mechanisms extend the role of insurance beyond compensation and align it more closely with adaptation objectives.

Despite this potential, there remains a gap between the identification of climate risks and the practical implementation of insurance-based adaptation solutions at the regional level.

The SOTERIA project

SOTERIA (SOlutions TEsting for Regions through Insurance for Climate Adaptation) project is an EU Mission of Adaptation project that has been developed to address this gap by providing a methodological structured approach to designing and implementing innovative insurance solutions that support climate adaptation. SOTERIA was a Horizon Europe Research and Innovation Action (project 101112867) under the HORIZON-MISS-2022-CLIMA-01 call that started September 2023 and ran for 30 months.

SOTERIA aimed to advance innovative insurance solutions for climate change adaptation across European regions and local communities. The project’s approach was organised around three complementary tracks:

- documenting best practice (on data, insurance solutions, and enabling frameworks);
- testing selected solutions in real regional contexts; and
- establishing Communities of Practice (CoPs) connecting regions and the insurance sector as a long-term legacy.

The purpose of the SOTERIA Replication Manual

During the SOTERIA project, a large amount of material was produced: methods, tools, templates, summaries, research outputs, case study insights, videos and even podcasts ! SOTERIA’s final objective was to produce a final consolidated project report that collects all knowledge gathered through the project activities

The challenge was not a lack of information. On the contrary, the project produced a wide range of outputs. The main aim was to organise and present this knowledge in a way that is clear, usable and easy to apply in practice.

This Manual turns SOTERIA results into practical guidance that different key actors can actually use. The primary audience is regional and local authorities working on climate adaptation, but it is also designed for practitioners, researchers, and policy makers who need to understand how insurance can support adaptation or simply access and learn about SOTERIA results.

To organise this knowledge in a coherent way, we structured the Manual around the Regional Adaptation Support Tool (RAST) underpins the current EU Mission on adaptation effort by regions and local authorities to follow the adaptive planning framework as set out and adapted from the UNFCCC. The RAST provides a step-by-step logic for adaptation planning, from preparing the ground and assessing risks, to identifying options, selecting measures and supporting implementation. Using this structure helps users quickly locate what they need depending on where they are in their own process (e.g., risk assessment, data and loss information, option identification, evaluation, implementation).

Using the RAST was also a useful exercise for the SOTERIA project itself. It helped to reflect on

how each output can support decision-making in practice: what each tool or method actually is, who the tool is for, when it should be used, and why. In this way, the Manual does not only compile project results, it aims to explain how these can be applied.

The Manual was developed in parallel with the SOTERIA Platform, which presents the same content in an interactive format and makes it easier to access resources step by step and will provide a dynamic platform that can also be updated and complemented as knowledge and evidence is developed or experienced. The Platform will be maintained as a living resource, so updates and new relevant materials will be added over time. It also serves as a long-term repository: all SOTERIA materials (deliverables, tools, videos and podcasts) are hosted there, so they remain available and do not disappear after the project ends. Indeed, the aim of this platform is to avoid the common issue of project platforms becoming inactive after a few years, SOTERIA has chosen to host the Platform at BC3, with the objective of maintaining and progressively enriching it beyond the project lifetime.

Beyond hosting SOTERIA outputs, the Platform is designed to become a shared repository for results from other relevant projects and initiatives. By organising content using the RAST structure, it can help create greater coordination and consistency across projects: bringing resources together in one place, reducing duplication, and making it easier for users to compare approaches and reuse tools.

How to use the Manual ?

This Manual is organised into Steps aligned with the RAST adaptation planning cycle. You can use it in different ways depending on your needs:

- Start where you are. If you are at the beginning of the process, start with Step 1. If you already have a risk assessment, you can go directly to Steps more suitable to your needs like solution design, appraisal or implementation.
- Each step outlines the main topic, objectives, and typical inputs, helping you understand what is covered and what information is commonly needed.
- Each Step includes links to tools, templates, examples, summaries and other materials developed in SOTERIA. These are designed to be used directly in workshops and stakeholder processes.
- Adapt the materials to your context. The case studies illustrate how regions and local authorities have approached the process, but the tools and templates are intended to be tailored to different hazards, governance settings.social context and insurance markets.
- Combine the Manual with the Platform. Use the Manual for offline reading and structured guidance, and the SOTERIA Platform for quick navigation, interactive access to resources, and updated materials.

A **practical quick-start pathway** is provided in the SOTERIA Roadmap for Regions and Local Authorities (see ANNEX 7.)

METHODOLOGICAL FRAMEWORK

The Adaptation Cycle: conceptual and scientific basis

Climate change adaptation is structured as a cycle because it is **decision-making under persistent uncertainty**, where interventions must be implemented, monitored, evaluated and revised as risks, knowledge and system responses evolve. This rationale is grounded in **adaptive management**: adaptive management emerged explicitly in response to "the extent of uncertainty involved in management" (Rist, Campbell & Frost, 2012) and frames action as a learning-oriented process in which management interventions are treated as "experiments to monitor and learn from" (West et al., 2019). Recent synthesis work makes this explicit as a **"step-wise iterative process**" where interventions are implemented, effects are monitored and evaluated, and subsequent interventions are adapted accordingly (Månsson et al., 2023). In this scientific lineage, "cycling" is methodological (feedback and learning loops), not metaphorical, and reflects iterative risk management approaches developed to guide decision-making in complex and uncertain systems.

In climate adaptation research and practice, this scientific logic is operationalised through structured planning frameworks commonly referred to as the ***adaptation cycle*** (Khaemba et al. 2025). A synthesis of adaptation guidance notes that new guides often re-invent the details of the adaptation cycle of planning and implementation and that there is a recurring need for guidance on applying the whole cycle across contexts (Stafford-Smith et al., 2022). Applied frameworks in municipal, regional and sectoral contexts consistently organise adaptation into recurring phases of risk assessment, planning, implementation and review, reflecting iterative risk management approaches to climate impacts. European policy guidance mirrors this **learning-loop logic** by treating monitoring and evaluation as the mechanism that feeds evidence back into future decisions.

This cyclical architecture is also institutionalised in climate governance and policy processes (European Scientific Advisory Board, 2026). The UNFCCC NAP technical guidelines emphasise that the NAP process is designed so countries can "monitor and review on a regular basis, and update their NAPs in an iterative manner" (UNFCCC LEG, 2012) and operationally specify updating NAPs by repeating selected steps as appropriate. In policy practice, this structure is often labelled the **adaptation policy cycle**, with overarching elements that include planning, implementation, and monitoring–evaluation–learning (MEL). The same four-step iterative logic is also summarised in OECD guidance as climate risk assessment → policy planning/design → implementation (with monitoring) → evaluation and adjustment (OECD, 2024).

Taken together, these scientific foundations, practice syntheses and governance framings establish the adaptation cycle as the methodological architecture for adaptation planning and delivery, reflecting a structural requirement for continuous learning, reassessment and adjustment in dynamic climate risk environments. This conceptual basis underpins operational tools for adaptation planning, including the **Regional Adaptation Support Tool (RAST)**

described in the following section.

Link between Adaptation Cycle and the RAST

In EU adaptation practice, the adaptation cycle (often expressed as an adaptation policy cycle) is operationalised through decision-support tools that organise guidance according to the timing of key policy tasks. Climate-ADAPT's Adaptation Support Tool (AST) and Urban Adaptation Support Tool (UAST) provide step-by-step guidance across the main stages of adaptation planning and implementation—preparation, risk and vulnerability assessment, identification and appraisal of options, implementation, and monitoring and evaluation—representing a practical expression of an iterative policy cycle rather than a linear planning process (European Commission, 2013; EEA, 2020).

Building on this EU methodological lineage, the RAST translates the adaptation cycle logic to regional and local governance contexts under the **EU Mission on Adaptation to Climate Change** (European Commission, DG RTD, 2023). Developed within the Climate-ADAPT knowledge framework, RAST provides practical guidance structured in six steps aligned with the key features of climate adaptation policy processes and is designed as a flexible and iterative instrument supporting strategy development, implementation, monitoring and updating over time (EEA, 2024). The tool has been applied in Mission technical assistance activities, including regional planning support under MIP4Adapt. Mission resources further confirm this operational framing: the MIP4Adapt Regional Adaptation Planning DIY Toolkit, aligned with RAST, provides step-by-step guidance and practical templates across all six stages of the adaptation cycle, supporting authorities in developing, implementing and monitoring adaptation plans.

RAST adopts the adaptation cycle concept because its primary function is to sequence evidence, methods and decision support around recurring policy tasks, ensuring that knowledge and tools are aligned with assessment, planning, implementation and learning stages and are accessible at relevant decision points. In this sense, **RAST represents the EU's operational implementation of the adaptation cycle for regional and local planning,** translating the conceptual cycle into a structured six-step workflow for policy design, delivery and continuous improvement.

The SOTERIA MANUAL and the RAST Framework

The SOTERIA Replication Manual is explicitly structured around the Regional Adaptation Support Tool (RAST), the six-step adaptation planning framework developed under the EU Mission on Adaptation to Climate Change and implemented through the Climate-ADAPT knowledge platform. RAST operationalises the adaptation cycle into a policy workflow guiding regional and local authorities through preparation, risk assessment, option identification, appraisal, implementation, and monitoring–evaluation–learning.

SOTERIA adopts RAST as its methodological backbone to ensure alignment with EU adaptation governance, policy alignment, and replicability across regional contexts. Structuring project outputs within the RAST pathway allows knowledge, tools and methods to be organised according to the timing of adaptation decision-making processes, enabling policy makers to access relevant guidance depending on their stage in the planning cycle.

Within this framework, the Manual translates SOTERIA project results into a practical "how-to" pathway aligned with the adaptation planning cycle, linking insurance-based adaptation solutions to mainstream public adaptation processes rather than treating them as standalone financial instruments. This approach supports usability, comparability and integration of insurance mechanisms within iterative adaptation planning and implementation processes across European regions.

Figure 1: The six-steps RAST framework for insurance-based adaptation.

How does the Manual differ from the RAST?

RAST structures and sequences policy tasks across the six steps of the adaptation planning cycle, defining the core decision stages and their ordering within the iterative policy process. The SOTERIA Replication Manual adds the *how* for the insurance domain: it operationalises each RAST step with co-designed, insurance-relevant methods, tools, data linkages and examples, so that insurance mechanisms are treated as part of the iterative planning–implementation–MEL loop, not as standalone financial products.

Concretely, the Manual contributes (without changing the six-step RAST structure):

- Step-level methods and templates to translate RAST tasks into insurance-oriented workflows (from scoping to evaluation and learning).
- Co-design and governance mechanisms (e.g., Communities of Practice / Climate Resilience Dialogues) to embed insurance solutions in policy processes and stakeholder

decisions.

- Data and analytics bridges linking climate risk assessment to loss/risk information and implementation choices (including practical data-governance arrangements, where relevant).
- Adoption and feasibility diagnostics (e.g., behavioural/system diagnostics such as PESTEL/COM-B) to address real barriers to uptake.
- Case-based operationalisation (Valencia, Gabrovo, Saxony-Anhalt) showing how tools plug into the right decision points across the cycle.

In summary, RAST provides the policy-aligned adaptation architecture, while the SOTERIA Manual constitutes a sector-specific operational layer that renders insurance-based adaptation implementable within that framework. The Manual remains non-prescriptive and adaptable to different institutional and market contexts.

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STEP 1: PREPARING THE GROUND FOR CO-DESIGN INSURANCE ADAPTATION

Understanding RAST Step 1 "Preparing the ground"

In the RAST adaptation planning cycle, Step 1 establishes the foundations required before any detailed climate risk assessment or solution design can begin. It ensures that regions start the adaptation process with a shared understanding of the problem, the right stakeholders involved, and clear governance and organisational arrangements to guide the work.

At this stage, regions organise existing information on climate impacts and socio-economic conditions, identify relevant actors and institutions, clarify roles and responsibilities, and define how adaptation planning will be coordinated. The aim is not yet to analyse risks in depth, but to create the institutional and knowledge base needed for later steps to be credible and implementable.

Typical outputs include an initial evidence base, stakeholder and governance mapping, and a common framing of the adaptation challenge that supports the risk assessment and option-design steps that follow.

If Step 1 is skipped or incomplete, later stages often produce technically sound analyses or solutions that cannot be implemented because stakeholders are not aligned, mandates are unclear, or key constraints were not identified early.

About

Step 1 focuses on preparing the ground for the adaptation planning process at the local level. It establishes the essential foundations required before undertaking detailed risk assessments (Step 2) or identifying specific adaptation and insurance solutions (Steps 3 and 4).

Objective

The objective of Step 1 is not to analyse risks, nor to define final adaptation options. Instead, it focuses on the activities required to initiate the adaptation planning process. This includes for example, structuring the initial evidence base, identifying key stakeholders, setting up appropriate governance arrangements, and establishing early communication and engagement mechanisms at the local level.

RAST alignment

This step corresponds to RAST Step 1: Preparing the ground for adaptation.

In the RAST, Step 1 consists of assembling and organising the essential elements needed to initiate the adaptation planning process, including: building the evidence base; securing long-term political commitment; establishing adaptation governance; planning stakeholder engagement and communication; assessing resource needs; and developing a clear communication strategy for all actors.

In this Manual, we provide the practical "how-to" for each of these elements, with a specific focus on insurance-based adaptation solutions.

A detailed assessment of resource needs (RAST 1.4) such as budgeting and personnel allocation should also be considered although it is not covered in this Manual.

Step 1 substeps

- **Substep 1.1 (RAST 1.1):** This substep focuses on **context-setting**, provides a standardized template (the story map) to help practitioners gather and structure the foundational qualitative and/or quantitative data needed for building the evidence base.
    - Main output: a storymap to help characterise the area where the IIS will be developed.
- **Substep 1.2 (RAST 1.2)**: To support the securing of **political commitment, buy in and ownership**, this step provides a mapping of legal and institutional frameworks relevant to climate adaptation insurance in Europe. This approach is justified by the need to identify specific legal and regulatory enablers and barriers that may act as catalysts for action, helping practitioners pinpoint key allies and decision-makers at every level.
    - Main output: a description of the main legal and institutional context for the level considered in relation to adaptation and innovative insurance solutions.
- **Substep 1.3 (RAST 1.3)**: Regarding **governance and organizational structures,** Communities of Practice (CoPs) are introduced in this substep. These served innovation ecosystems within the case studies, offering a flexible and adaptable structure for multi-stakeholder collaboration and project ownership. CoPs provide the long-term structure for collaboration, since CoPs are flexible and can be adapted to the needs of the community and build on previous formal and/or informal institutions.
    - Main output: A CoP is designed and /or created to address the identified priority in relation to the IIS.
- **Substep 1.4 (RAST 1.5)**: The Climate Resilience Dialogues is presented in this substep as the primary format for initiating **stakeholder engagement and communication**. The CRD serves as a participatory mechanism designed to bring all relevant actors, from local authorities to community members, to the same table from the start. This format ensures that stakeholders are aligned on the evidence base and that the adaptation process is grounded in a shared understanding of local needs.
    - Main output: a shared understanding and potential alignment between different stakeholders after series of CRDs.

How SOTERIA tools contribute to RAST Step 1

RAST Step 1 elements	***What it means (Mission level)***	***SOTERIA tools / content***
Build the evidence base	Gather initial qualitative and quantitative information on climate context	Story Map
Secure political commitment	Identify institutional mandates, policy frameworks, and decision-makers	Legal & institutional mapping
Establish governance structures	Create structures for multi-stakeholder collaboration and coordination	Communities of Practice (CoP)
Plan stakeholder engagement & communication	Ensure early shared understanding among actors	Climate Resilience Dialogues (CRD)

1.1. Define the problem: Using Story Maps to establish a strategic baseline

About

This substep introduces the Story Map as the main tool used in Step 1 to support problem definition and context-setting at the local level.

The Story Map is a practical method used in the SOTERIA project to collect and organize essential information about a region's climate risk and insurance landscape in a way that is systematic and accessible to both technical experts and local citizens. It works as both a structured questionnaire and a participatory tool to support the dialogue with all stakeholders with regions and insurance stakeholders as key actors for IIS.

The different sections of the story map include the problem definition and also provide the link and outline to the next steps. They also cover, for example, risk analysis, which will be addressed in Step 2, as well as the data landscape, also discussed in Step 2. Supply and demand analysis is covered in Steps 3 and 4, along with the proposed solution in Step 5.

In the context of SOTERIA, the story map was completed progressively; it was initially just a starting point to help the regions and local authorities to fully understand their context in a systematic way.

RAST alignment

Support RAST Step 1.1 : Building the evidence base.

Substep inputs

- [GUIDE] Instructions on gathering information from stakeholders and timelines for development.
- [EXAMPLE] Real-world Story Maps from Valencia, Gabrovo, and Saxony-Anhalt that demonstrate how to translate complex data into a regional "story" of risk and resilience.

Linked deliverables and other materials

- [D1.2] Pilot Story Maps (2)
- [TEMPLATE] Light story map template (ANNEX 1.)

1.1.1. Guide on how to fill in Story maps and gather information (GUIDE)

Authors: Kamelia Georgieva (BES)

Executive Summary

This guide presents a practical approach for regional and local authorities, other public administrations, and potentially other actors (e.g., from the insurance industry) to use story maps as both a tool and a process for understanding and addressing climate adaptation needs. Story maps provide a structured way to collect, organise, and visualise information on climate risks, socio-economic vulnerabilities, and the role insurance could play in supporting climate resilience and adaptation investment.

The resulting story map is structured in five interrelated sections:

1. General description of the case study
2. Risk analysis
3. Supply and demand analysis (insurance)
4. Data – gathering, use, and sharing
5. Innovative insurance solutions

When used effectively, Story maps bridge science, policy, and practice. They enable administrations to make informed, strategic decisions on climate adaptation and to design insurance mechanisms and investment frameworks that strengthen the resilience of both the public and private sectors.

1. Story maps as a strategic tool

The Story map is a tool borrowed from storytelling or project/ product design. It helps participants see the “big picture” — how individual parts connect to the whole. Story maps are both an analytical tool and a participatory process that enable public administrations to explore, connect, and visualize information about climate risks, socio-economic vulnerabilities, and the role of insurance in climate adaptation and investment. Story maps serve not only as a product that organizes data and findings in a structured and visual form, but also as a collaborative process through which institutions, experts, and communities collectively identify key challenges, gaps, and opportunities for innovation, particularly in the case of innovative insurance adaptation solutions.

The process of developing a Story map is as valuable as the final Story map product. The process itself is very valuable because it brings together diverse stakeholders: representatives of public administrations, insurers, research institutions, civil society, and local actors, in a shared effort to understand territorial risks and resilience capacities. This interaction supports trust-building, knowledge exchange, and the development of evidence-based policy recommendations. Stakeholder engagement should therefore be seen as an integral and continuous element of every phase of the story map process, from data collection to interpretation and validation of results.

2. The Story Map development process

Developing a story map involves several interlinked steps that together ensure a comprehensive and credible outcome.

- The process begins with **defining the territorial scope and understanding the local context.** This step involves selecting the area of analysis, such as a municipality or a region and identifying its environmental and socio-economic characteristics. Establishing a clear geographical boundary and institutional framework is essential for ensuring the coherence of the subsequent stages.
- **Stakeholder identification and engagement** follow immediately. This step ensures that all relevant voices are included from the beginning. Key actors may include representatives of municipal administrations, insurers, reinsurers, public agencies responsible for disaster risk management, research institutions, farmers, local businesses, and community organizations. Workshops, interviews, and surveys are usually used to explore interests, awareness, access to data, perceptions of risk, barriers to insurance uptake, and shared interests in adaptation measures. The early inclusion of these perspectives helps shape the data collection priorities, diverse knowledge systems and strengthens the legitimacy of the results.
- The next stage concerns **data collection and analysis.** While these activities contribute to multiple sections of the Story map, data is central to understanding the baseline situation and quantifying climate risks. Relevant data should be drawn from public sources - such as meteorological services, EU and international data bases and open source portals, environmental agencies, and national statistics offices, as well as from insurers, academic research, and local observations. Where gaps exist, participatory methods, including stakeholder surveys or workshops, interviews and personal meetings can also provide valuable complementary information. These methods also help map and understand behavioral factors that shape current perceptions, misperceptions, and attitudes of local audiences. The goal is to produce an integrated picture of the risks, vulnerabilities, and existing mechanisms by collecting as much data as possible for strategic planning purposes.
- **Visualization techniques,** including maps, charts, and qualitative narratives, help to make the information understandable and engaging. These can be applied across the different sections of the story map wherever appropriate visuals are available. Visual tools facilitate communication among diverse audiences, enabling technical and non-technical actors alike to grasp complex interactions between climate hazards, socio-economic factors, and insurance coverage.
- The process culminates in **validation** and refinement setting up the scene complemented by other tools and methods such as a Community of practice or a Climate Resilience Dialogue. The r**esults should be presented and discussed in multi-stakeholder settings** to ensure that the findings accurately reflect the realities on the ground.

The validated Story map then becomes a decision-support instrument, helping public administrations, local stakeholders and insurers to identify priority areas for intervention, design innovative insurance solutions, and align local actions with broader climate adaptation strategies.

3. Data sources and methods

Reliable and verifiable data are crucial for the credibility of the whole process of story map

development as well as for the story map document. In the co-creation process different sources of information are used. Public and official data sources form the foundation for quantitative analysis, while stakeholder inputs add contextual depth and insight. Key sources include meteorological and hydrological data from national and European agencies, socio-economic indicators from statistical institutes, and environmental datasets such as land use maps and biodiversity inventories. Insurance-related data can be obtained from regulatory authorities, insurance associations, or the European Insurance and Occupational Pensions Authority (EIOPA). Policy frameworks, including national and regional adaptation and disaster risk reduction strategies, provide the enabling conditions and institutional context for interpreting the findings.

Complementary information should be collected directly through participatory methods. Workshops and interviews with local authorities, insurers, and community representatives help capture perceptions of climate risk and barriers to insurance coverage. Surveys among citizens, farmers, and small businesses reveal levels of awareness and willingness to invest in risk reduction. These methods ensure that the story map reflects both quantitative evidence and the lived experience of those affected by climate hazards.

Beyond complementing quantitative datasets, participatory methods play a critical role in uncovering the behavioural layer that shapes how climate risk information is interpreted and acted upon. Structured discussions, interviews, and surveys reveal perceptions and misperceptions of risk, levels of trust in institutions, attitudes toward insurance and public intervention, and other intangible factors that cannot be derived from statistical sources alone. These behavioural dynamics influence whether data is considered credible, whether insurance solutions are perceived as relevant or affordable, and whether adaptation measures are likely to gain support. Understanding this layer is essential for ensuring that the solutions explored in later stages of the process are not only technically sound, but also socially feasible and aligned with local realities.

4. Conclusion

Using story maps allows stakeholders to combine analytical rigor with participatory insights. By treating the development process as a platform for dialogue and learning, authorities can strengthen collaboration between the public sector, private businesses (including insurers), and local communities. The final story map is not merely a static product, but a living, context-rich reference that can be updated over time, inform decision-making, and help guide investment. It can also support the design of innovative insurance solutions that enhance climate resilience.

Quote "Using story maps allows stakeholders to combine analytical rigor with participatory insights".

1.1.2. Examples of Story Maps (EXAMPLE)

SOTERIA Story map - Valencia

Authors: Ciro Pascual, Marina Torres de Fuentes, Javier Marzo (GVA), Oihana Luque, Juan Medina, Alejandro Espinosa, Yara Shennan-Farpon, Jose Acosta, Elena Lopez Gunn (ICA), Jesus Soler (AQUATEC), Gabriela Alonso, Mar Fabregat and Maria Jose Sanz (BC3).

Executive Summary

The Valencia case study focuses on the Marjal dels Moros, a protected coastal wetland facing increasing climate and development pressures. By actively engaging local stakeholders to identify context-specific vulnerabilities, the initiative seeks to strengthen collective climate resilience through the conservation and restoration of the site. Over the course of three years regional authorities, researchers, farmers, and private-sector actors co-designed and prioritized restoration measures as part of the update to the wetland's Management Plan. Recognizing that adaptation finance is critical to long-term resilience, the case study explores innovative financing approaches—including public-private partnerships—to meet the needs identified in the Plan Directivo of Marjal dels Moros. The process was developed in alignment with Spain's climate and insurance system and examined new financial and insurance tools could support nature-based solutions.

It resulted in a shared resilience framework, based on a series of indicators that are both country-driven and locally grounded in the priorities established with stakeholders, ensuring the KPIs are meaningful and consistent with national, regional, and local policy frameworks; and a data-needs roadmap—contributing practical insights for advancing climate-adaptation and ecosystem investment-financing approaches in Valencia and beyond.

Part 1: General introduction to the Marjal del Moro case study

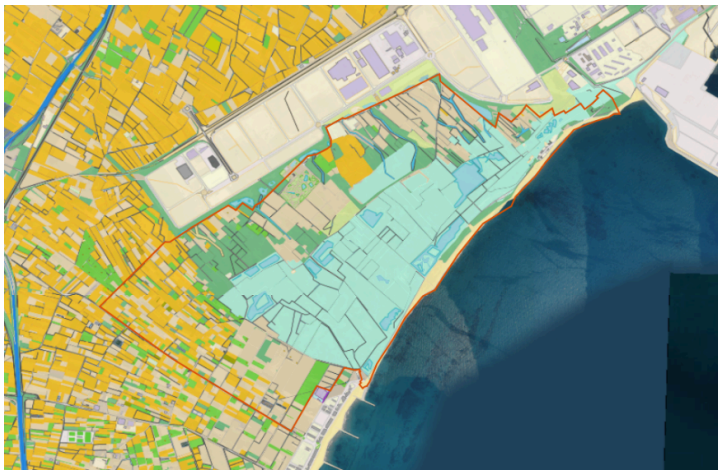
Case Study Name: Marjal del Moros | Country: Spain | Region type; urban and rural

Key economic sectors: Morvedre Camp (Province of Valencia) is a sub-regional area of 16 municipalities (271 km²) with around 98,000 inhabitants (2023), forming part of the second ring of the Valencia metropolitan area. Sagunto acts as a demographic and economic hub, showing strong recent population growth and benefiting from high connectivity (rail, road, and port infrastructure). The regional economy is shaped by three main pillars:

- Agriculture: Around 60% of the territory has high agricultural potential. There are about 9,500 ha under cultivation, mainly citrus, organised in small plots (average 3.38 ha, 2018).
- Industry and logistics: A long industrial tradition (since the early 20th century), with around 230 industrial companies (about 1.9% of the province's industrial base). Manufacturing—especially metallurgy—is dominant, alongside logistics (e.g., Mercadona) and automotive-related activities (e.g., Pilkington).
- Tourism and services: Strong growth in residential tourism, particularly in Canet and Sagunto (in Canet, 70%+ of homes are secondary residences), supported by retail and other service activities.

Short description; The Valencia case study focuses on the Marjal dels Moros, a 620-hectare coastal wetland located between Sagunto and Puçol in the Camp de Morvedre region. The area integrates urban, rural, and agricultural land uses, forming a complex socio-environmental system. Managed by the Generalitat Valenciana since 1994, the wetland is part of the Natura 2000 Network and enjoys multiple layers of environmental protection (LIC, ZEPA, ZEC).

Figure 2: Cartographic description (COSCV) - Marjal del Moros



Legend:
Red line: Marjal area
Marshes (Dark blue)
Fruit trees (Orange)
Meadows and Pastures (Dark Green)
permanently irrigated land (Light green)
Beaches, Dunes and Sandbanks (White)

Stakeholders included the GVA (case study owner), municipalities of Sagunto and Puçol, local cooperatives and irrigation communities, industrial actors from Parc Sagunt I and II, the Port of Sagunto, and the agricultural sector. The process was coordinated with project partners AQUA, ICA, and BC3.

The study aligns with Spain's National Climate Change Adaptation Plan (PNACC) and regional climate strategies.

The proposed actions include the development and implementation of an investment financial mechanism aimed at supporting the preservation and restoration of the Marjal dels Moros wetland. A resilience assessment framework has been selected as a strategic tool. This approach seeks to enhance ecosystem services such as flood mitigation, water regulation, and biodiversity conservation, while reinforcing climate resilience across the Valencian coastal wetlands network (over 34,000 ha).

Key insights include:

(i) nature-based solutions (NBS) as essential tools for resilience;

(ii) the need for investment diversification beyond public funding;

(iii) the development of a participatory resilience framework; and

(iv) a timely opportunity to integrate adaptation measures into the forthcoming 2025 Master Plan revision.

Part 2: Risk Analysis of the Marjal del Moro and surrounding areas

The Marjal dels Moros is part of the Mediterranean **biogeographical region**, characterized by irregular and torrential rainfall (annual average 464 mm), dry summers, and high erosion risk.

Risk assessment summary:

The site is highly exposed to multiple climate-related hazards - floods, heatwaves, droughts, and coastal erosion - aggravated by industrial and urban development around Sagunto.

According to the Territorial Action Plan on Flood Risk Prevention (PATRICOVA), the wetland is a **high-frequency (25-year) flood zone** with shallow depth (<0.8 m). **Wildfire risk** is generally low but increases during drought periods. The area also experiences significant **shoreline regression** due to altered sediment transport near the Port of Sagunto. **Heatwaves** are becoming more frequent, with record numbers of tropical nights (113 in 2022).

Climate projections (RCP 4.5 and 8.5) predict a temperature increase of 2–4°C and longer, more intense heatwaves by the end of the century.

The Valencian Community ranks as a “Transition Region” under the EU Cohesion Policy, facing high vulnerability in natural ecosystems, water resources, agriculture, and tourism. Farmers in Puçol and industries in Sagunto have reported more frequent flood damages, confirmed by insurance data showing recurring payouts for flood events (€68 million in 2020 alone).

Part 3: Supply and Demand Analysis

Existing Insurance portfolio: Spain has an advanced climate risk insurance system integrating public and private sectors. Spain’s public-private insurance model (through the Consorcio de Compensación de Seguros, CCS) and Agroseguro system provide coverage for extraordinary risks and agricultural losses, though natural assets like wetlands remain uninsured. The CCS provides compulsory coverage for extraordinary risks (floods, storms, earthquakes), ensuring national risk pooling and affordability. The Combined Agricultural Insurance (Agroseguro–ENESA) system covers multi-peril crop losses and is subsidized at national and regional levels (up to 60% of premiums).

Barriers to insurance uptake: Despite high insurance penetration, farmers in Puçol, near the Marjal dels Moros have increasingly withdrawn from insurance due to low profitability and high insurance premiums.

Addressing the insurance gap: All the industries surrounding the Marjal dels Moros are insured.

Barriers to effective adaptation include fragmented financing, insufficient recovery funds, limited local autonomy, and coordination gaps among levels of government. Nonetheless, Spain’s strong insurance structure provides a foundation for integrating nature-based solutions into climate adaptation finance.

Part 4: Data

Data collection: The Insurance Compensation Consortium (CCS) collects and publishes data on disaster damages and insured capital by postal code.

Data sharing: This open-access database supports risk mapping and policy planning across Spain. Data is available in multiple formats (map viewer, Excel, CSV) through the CCS website.

Data barriers and gaps: However, integration of environmental and insurance datasets remains limited, and systematic post-disaster needs assessments are underdeveloped.

Part 5: Innovative Insurance Solutions Explorer/ Radar

Identified needs and Barriers: Spain's insurance penetration for climate-related risks is among the highest in Europe, resulting in a small protection gap. The CCS model successfully combines universal participation, affordability, and rapid payouts, but the growing frequency and intensity of extraordinary events driven by climate change is putting additional pressure on this model. The Marjal dels Moros case demonstrates how insurance can evolve from compensating losses to actively supporting resilience and ecosystem restoration by moving earlier in the disaster risk reduction cycle and investing into adaptation solutions like IIS.

Potential Innovative solutions: The co-creation process identified potential solutions:

(i) 'insuring nature' concepts that recognize wetlands as insurable assets;

(ii) resilience-linked agricultural insurance rewarding ecosystem services;

(iii) mutualized insurance pools for vulnerable communities;

(iv) blended public–private finance mechanisms; and

(v) NBS spatial investment mapping. Engagement with Zurich, Zurich Resilience Solutions, and Swiss Re is ongoing to explore replication opportunities.

Expected mid-term impacts (5 years) include tested insurance prototypes, enhanced data infrastructure, and stakeholder coordination. Long-term impacts (10 years) foresee reduced damages, ecosystem restoration, and new green insurance markets.

SOTERIA Story map - Gabrovo

Authors: Kamelia Georgieva (BES), Nikolay Dimitrov, Mihaela Ivanova (MoG) and Polina Dikova (DZI).

Executive Summary

This case study focuses on exploring additional and new financial avenues (including innovative insurance-related solutions) for the protection and restoration of urban areas and forest areas of Gabrovo to conserve its environmental services, including its buffering and absorption capacity in extreme weather events. This type of ecosystem is widely distributed in the pre Balkan areas where Gabrovo is situated. The case study aims to create scalable solutions to support the resilient development of the region. The first focus is on industrial enterprises and private homes in terms of their insurance adoption based on cultural and social aspects of what we have called "insurance culture".

Part 1: General introduction to the municipality of Gabrovo

Case Study Name: Gabrovo | Country: Bulgaria | Region type: Urban

Key economic sectors include SMEs, industry, tourism, and public infrastructure.

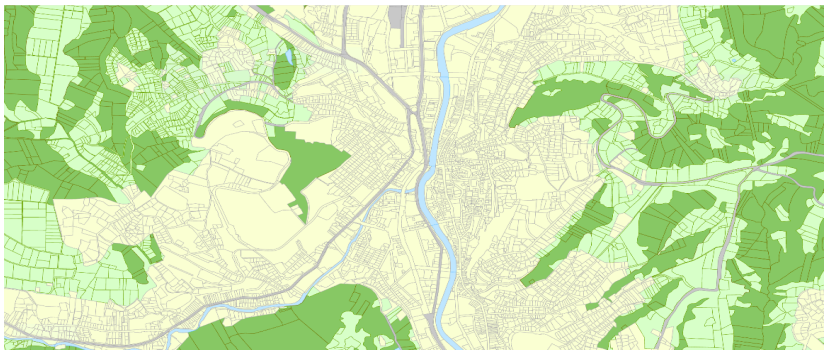
The **main partner** is the Gabrovo Municipal Administration, supported by DZI (KBC Group) and BES.

Key stakeholders include the Ministry of Environment and Water, local utilities, fire (civil protection) and forestry departments, the Technical University, regional statistical office, regional chamber of commerce, association of insurers, local water management company, the departments of the municipal administration, etc.

Short Description: The Gabrovo case study explores innovative financial and insurance mechanisms to enhance resilience of urban and forest areas. The study emphasizes low local insurance culture and behavioral barriers. **The first focus is on industrial enterprises and private homes** in terms of their insurance culture.

Over the last decade, the city's residents have witnessed **extreme weather events :** Atypical gale **force winds** for the region accompanied with heavy rain, oftentimes along with hailstorms, that lead to **local floods** in summer months and intense short-term snowfalls in late autumn, winter months leading to a standstill, disrupting the normal rhythm of life. Investments in the prevention of the factors leading to the aforementioned meteorological events are accompanied by low insurance coverage. There is also a very low level of interest in climate insurance. Insurance penetration is extremely low—less than 10% of property owners had coverage for natural disasters. There is a lack of prerequisites and motivation for citizens and employers to insure their homes and businesses. Trust in insurers was limited, and many citizens lacked financial capacity or awareness. Businesses, however, generally maintained partial insurance, often linked to bank requirements.

Figure 3: Central area of Gabrovo city and river Yantra through densely built business and residences



Proposed interventions include behavioral approaches to improve risk awareness, nature-based solutions (NBS) for hazard reduction, and incentives for property owners to adopt risk reduction measures combined with reduced premiums.

Part 2: Risk analysis

Gabrovo lies in the **Continental/Mountain biogeographical region** with a warm-temperate climate, average annual temperature of 10.7°C, and significant rainfall. It is classified as a "Transition" region (Orange) under EU Cohesion Policy (GDP 75–100% of EU average).

Main hazards identified include floods, droughts, heatwaves, strong winds, landslides, forest fires, and invasive species. Recent years have shown increasing temperature extremes (up to 39°C), irregular rainfall, and frequent storms leading to infrastructure damage and erosion.

Figure 4: Photos of floods in Gabrovo city in 1993 (r) and 2016 (l).

Climate Projections (RCP4.5 & RCP8.5): Expected temperature increase of 2–6°C by 2100, with summer precipitation decreasing by up to 30%. More frequent extreme weather events are anticipated.

Risk Assessment Summary:

- Floods and Storms: High probability and major impact; insufficient level of protection along the Yantra River;
- Fires: Moderate to high risk, especially in forest–settlement zones;
- Droughts: High probability, major social and economic impact due to reduced dam reserves;

Data gaps: Absence of monitoring and forecasting systems limits preparedness.

Part 3: Supply and Demand Analysis

Existing Insurance Portfolios: Business properties are typically insured under “Fire and Other Perils,” but natural disaster coverage is limited. For households, insurance is mostly linked to mortgage requirements. Insurance penetration is about 7%, leaving residents highly exposed.

Barriers to Insurance Uptake: Low risk perception, financial constraints, complex policy terms, and distrust in insurers. Public compensation schemes exist but provide minimal coverage, reinforcing dependency on government aid.

Addressing the Insurance Gap: To mitigate the financial impact of natural disasters, a combination of strategies is necessary: Public-Private Partnerships (PPP) are recommended to close the protection gap, combining risk reduction investments with affordable insurance options.

Part 4: Data

Data Collection and Sharing: Each local institution (municipality, fire service (civil protection), meteorological institute, insurers) collects data separately. There is no unified database or routine sharing protocol. Access to disaster data requires requests or payments.

Barriers: Lack of interoperable digital infrastructure; Varied data formats and ownership restrictions; Institutional reluctance and limited understanding of the collective benefits of open data.

Data Gaps: No comprehensive database for damage assessment, risk modelling, or insurance claims. Improved data integration is essential for developing evidence-based climate risk

insurance solutions.

Part 5: Innovative Insurance Solution Explorer/ Radar

Identified Needs and Barriers: Low awareness and data availability, limited institutional cooperation, and technical barriers hinder the development of innovative climate insurance products. Risk perception remains the foundation for any change.

Proposed Innovative Solutions: Risk reduction measures; Risk-based pricing encouraging preventive measures; Public-private partnerships for high-risk zones; Simple and affordable insurance products.

SOTERIA Story map - Saxony-Anhalt

Authors: Sina Rühland, Oleksandr Sushchenko and Reimund Schwarze (UFZ).

Executive Summary

This Story map was prepared to summarize the Saxony-Anhalt case study within the SOTERIA project, aimed at improving climate resilience in agriculture through innovative insurance solutions. Saxony-Anhalt is one of Germany's most drought-affected agricultural regions, experiencing rising temperatures, declining soil moisture, and repeated extreme droughts since 2018. Despite significant climate-related losses, insurance penetration remains extremely low – around 2% of farmers are covered against drought – resulting in high reliance on ad-hoc public aid.

The process of story map development investigates farmers' risk perceptions, needs, and barriers to insurance adoption, revealing key obstacles such as low perceived risk, high premiums, limited product knowledge, and distrust in payouts. Current insurance offerings are primarily parametric drought products, supplemented by limited state subsidies focused on viticulture and fruit farming.

Part 1: General introduction to Saxony-Anhalt

Case Study Name: Saxony- Anhalt | Country: Germany | Region type: Urban and rural

Key economic sectors Saxony-Anhalt, a **primarily agricultural region**, has faced repeated droughts and heatwaves. Around 2% of farmers are insured against drought losses, and state subsidies apply only to viticulture. Existing products focus on hail or multi-risk coverage with optional drought components based on physical indices.

Key Important stakeholders; The main partner is UFZ with the involvement of Genillard & Co (G&Co). Important stakeholders are the Association of farmers, State Ministry of Economics, Tourism, Agriculture and Forestry (Saxony-Anhalt)**,**

The Saxony-Anhalt case study under the SOTERIA project examines **how climate-related insurance solutions can improve resilience among agricultural stakeholders.** Conducted by UFZ and partners, the study replicates lessons from Bavaria's Innovative Insurance Solution (IIS) and explores barriers to adoption in a drought-prone region.

Part 2: Risk Analysis

Climate data reveal **increasing temperatures** (+0.4°C since 1980), more summer days, and intensifying drought conditions. Precipitation remains stable, but extreme rainfall events and heatwaves have grown more frequent. The region is classified as a 'transition area' under EU cohesion policy and belongs to the continental biogeographical region.

Main hazards: drought, water imbalance, and heat stress – each with major implications for agricultural productivity. Droughts from 2018–2023 were the most severe on record, with significant yield losses in grain and maize. Groundwater levels dropped to historic lows, and climate models (RCP4.5–8.5) project further warming (+3–5°C by 2100).

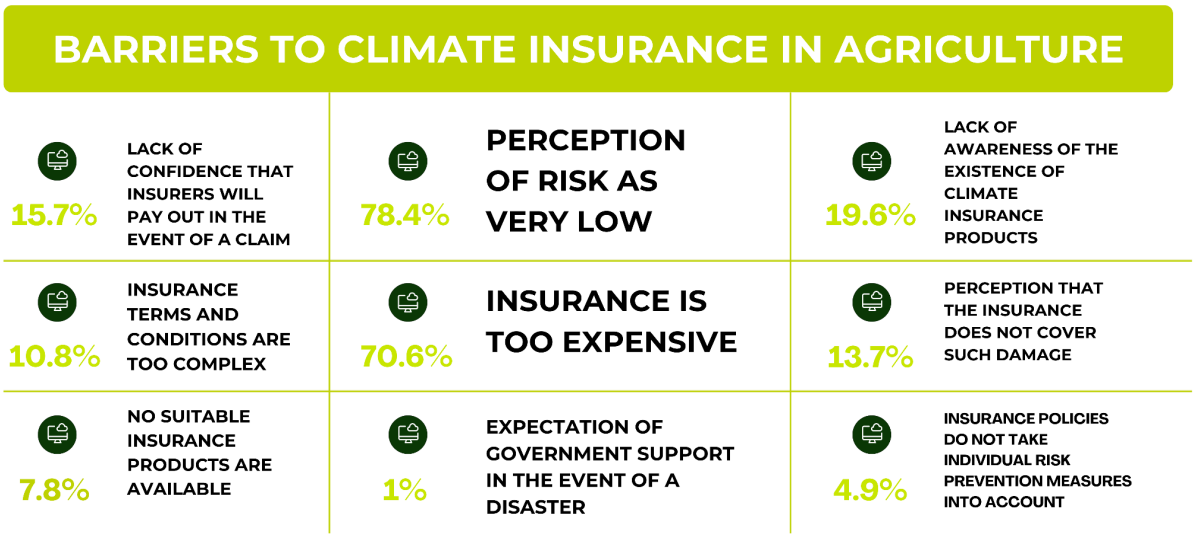
Hazard modelling integrates meteorological data, insurance claims, and risk zoning via tools such as ZÜRS Geo and DWD datasets. Outputs inform underwriting, adaptation planning, and reinsurance calculations. The main findings show that data granularity and availability remain critical constraints for accurate pricing and adaptation measures.

Risk profiling differentiates between urban and rural vulnerabilities. Urban areas face heat stress and pluvial flooding, while rural regions experience drought and soil degradation. The state's adaptation strategy prioritizes sustainable land use, improved water management, and soil conservation practices.

Farmers past experiences confirm drought as the dominant hazard. In 2018 and 2022, yields dropped sharply, and the government provided EUR 56 million in aid (plus EUR 28 million federal). Farmers bear the highest cost, while limited insurance and ad hoc aid cover part of losses.

Part 3: Supply and Demand Analysis

Figure 5: Barriers for climate insurance in Germany (demand side, farmers). Source: UFZ, AgriExperts



Existing insurance products include parametric drought insurance (Vereinigte Hagel) and multi-peril coverage for hail, frost, and flood. Subsidies of up to 50% exist for wine and fruit sectors. However, less than 5% of farmers in Saxony-Anhalt hold any crop insurance, reflecting affordability and trust barriers.

Survey insights show **key reasons for non-adoption**: 82.5% of farmers perceive low risk, 74.2% cite high premiums, 20.6% lack awareness, and 16.5% distrust insurers. Farmers value quick payouts and transparent contracts but express dissatisfaction with delays and high costs.

Those insured typically do so after extreme events or on financial advice.

Policy context: since 2013, Germany reduced insurance tax rates and expanded subsidies for agricultural risk coverage. The 2024 Climate Adaptation Act now mandates regular risk analyses and uniform state strategies on the local level. Saxony-Anhalt's adaptation policy focuses on resilient crop systems, water-saving irrigation, and advisory support.

DRM governance is multi-level: federal ministries provide frameworks and data; the state oversees adaptation and civil protection; regional and municipal levels manage preparedness and local measures. Cross-sectoral working groups promote coordinated risk management and awareness.

Part 4: Data

Data sources include: UFZ drought monitor, DWD climate datasets, LAU agricultural reports, and GDV insurance statistics. While yield and drought data are public, insurance and financial loss data are limited due to GDPR and ownership issues. Data on farmers' personal experiences and risk perception remain scarce but are being collected through SOTERIA surveys.

Data Gaps persist in integrating physical, economic, and behavioral data. Better data access and harmonization between state agencies, insurers, and research institutions are essential for improving parametric insurance design and adaptation monitoring.

Part 5: Innovative Insurance Solutions

Identified needs and Barriers: Insurance penetration is extremely low (around 2%).

Proposed innovative solutions: new parametric insurance products, hybrid public–private funding models, improved modelling tools, and shared resilience frameworks with ESG-linked incentives. Our expected results include increased insurance uptake, reduced financial vulnerability, and greater adoption of climate-smart agriculture. In five years, farmers should have improved financial resilience; in ten years, Saxony-Anhalt aims for a drought-resilient and biodiversity-positive agricultural sector.

Stakeholder engagement through the Climate Resilience Dialogues (CRDs) ensures participatory design, fair access, and affordability. The project's long-term ambition is to replicate the model across Germany, integrating farmers, insurers, and governments in a shared climate resilience framework.

1.2. Map the context: Aligning with the legal and policy enabling framework

About

This section helps to understand and document the legal and institutional context relevant to the potential development of climate adaptation insurance. At the local level, adaptation planning is strongly influenced by policy frameworks, regulatory obligations, and institutional responsibilities that shape what actions are feasible and who is involved in decision-making. The resources in this step provide tools and methods on how to collect the necessary evidence to navigate multilevel governance contexts, understand insurance mechanisms, and some insights on how to secure institutional and long-term political support.

RAST alignment

Supports RAST Step 1.2 : Securing political support and ownership.

Substep inputs

- [SUMMARY] Overview of the European policy environment influencing climate adaptation insurance.
- [INFOGRAPHIC] Visualisation tool presenting the key policy and legal frameworks that enable climate adaptation insurance in Europe.
- [DOSSIER] Detailed insurance system profiles across 11 countries from NAIAD project.

Linked deliverables and other materials

- [D4.3] Policy Briefing Series on policy enabling framework.

1.2.1 Mapping the enabling legal and institutional frameworks for climate adaptation insurance in Europe (SUMMARY)

Authors: Mar Fabregat (BC3)

Executive Summary

This document provides an overview of the legal and institutional environment that shapes the role of insurance in climate adaptation across Europe. It outlines the main EU policies that create a shared foundation for resilience and examines how these frameworks take shape in different national and regional contexts. The comparison between different SOTERIA case studies shows that the potential for innovative insurance solutions depends not only on EU aspirational objectives but also on diverse local conditions, including governance, institutional capacity, and market structure. Understanding these variations is essential for identifying where insurance can support adaptation most effectively and how solutions may need to be tailored to fit specific contexts.

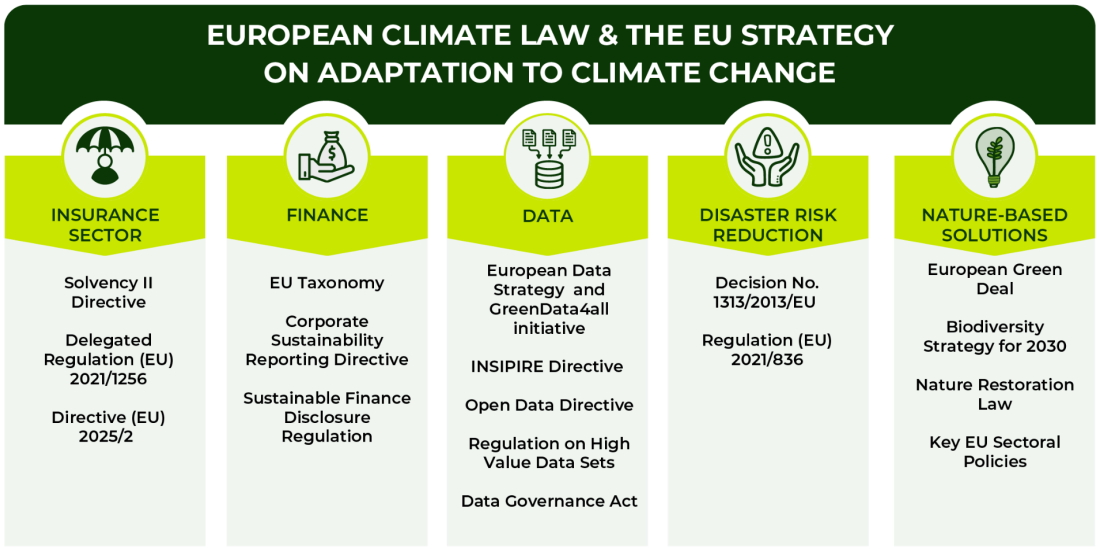
The European framework — the common enabling environment

The European Union has developed a set of policies and regulations that, taken together, create the foundations for insurance to actively contribute actively to climate adaptation. Although these frameworks come from different policy domains, these increasingly shape how climate risks are assessed, managed, and shared across Europe.

The **European Climate Law** and the **EU Adaptation Strategy** place resilience at the centre of EU action and recognise insurance as a tool to reduce protection gaps and improve risk understanding. Then the **Sustainable Finance Framework** and updates to **Solvency II** further encourage insurers to integrate climate risks into investment, disclosure, and governance practices.

In parallel, EU data initiatives, such as the **European Data Strategy** and the **Data Governance Act**, aim to improve access to climate, environmental, and loss data, a key requirement for innovative insurance solutions. Moreover, **environmental**, nature restoration, and **disaster risk reduction policies** reinforce the shift toward prevention. Therefore, these frameworks create the enabling conditions for insurance to support climate resilience across Europe.

Figure 6: European Climate law and the EU strategy on adaptation to climate change



The enabling conditions from EU to national and regional levels

The way EU frameworks translate into practice varies widely across countries. The SOTERIA case studies illustrate how different legal, institutional, and market conditions shape the space for climate adaptation insurance.

Figure 7: Map of 3 of the 8 SOTERIA case studies

Spain – Valencian Community: Spain has a mature and highly regulated insurance system, built on strong public–private cooperation through the Consorcio de Compensación de Seguros (CCS). National and regional climate laws integrate insurance into adaptation planning, creating a multilevel enabling environment.

Greece – Attica Region: Greece is shifting from a reactive model to a more proactive, anticipatory insurance system. New legislation, incentives, and institutions are strengthening governance, though affordability challenges and limited trust in insurance persist.

Bulgaria – Gabrovo Municipality: Bulgaria's insurance framework remains fragmented. In terms of insurance, there is low insurance penetration and weak coordination between public and private actors. Adaptation and DRR strategies exist but offer limited formal linkage to insurance, and implementation capacity is uneven.

Norway – Trøndelag: Norway offers a well-established insurance system where natural hazard coverage is automatically included in insurance policies. Strong cooperation, data sharing, and integration with land-use planning create a highly effective enabling context.

The comparison shows that national contexts strongly shape the feasibility of climate adaptation insurance. Where governance is clear and cooperation is established, as in Spain and Norway, conditions are more supportive for innovation. In countries with weaker coordination or limited institutional capacity, such as Greece and Bulgaria, the scope for new solutions is narrower. Understanding these differences is essential for designing innovative insurance approaches that fit the realities of each national and regional environment.

Conclusion

Mapping the European, and national legal frameworks shows that the potential for climate adaptation insurance is shaped by a combination of shared EU-level ambitions and diverse local realities. While the European Union provides an increasingly coherent foundation for integrating insurance into resilience efforts, its impact ultimately depends on the governance structures, institutional capacities, and market conditions of each country. Recognising these differences is essential to understand where innovative insurance solutions can emerge, how they might need to be adapted, which barriers must be addressed, and which enabling conditions matter most.

1.2.2. The key policy and legal frameworks enabling climate adaptation insurance in Europe (INFOGRAPHIC)

Authors: Mar Fabregat (BC3)

https://public.flourish.studio/visualisation/27198893/

Description

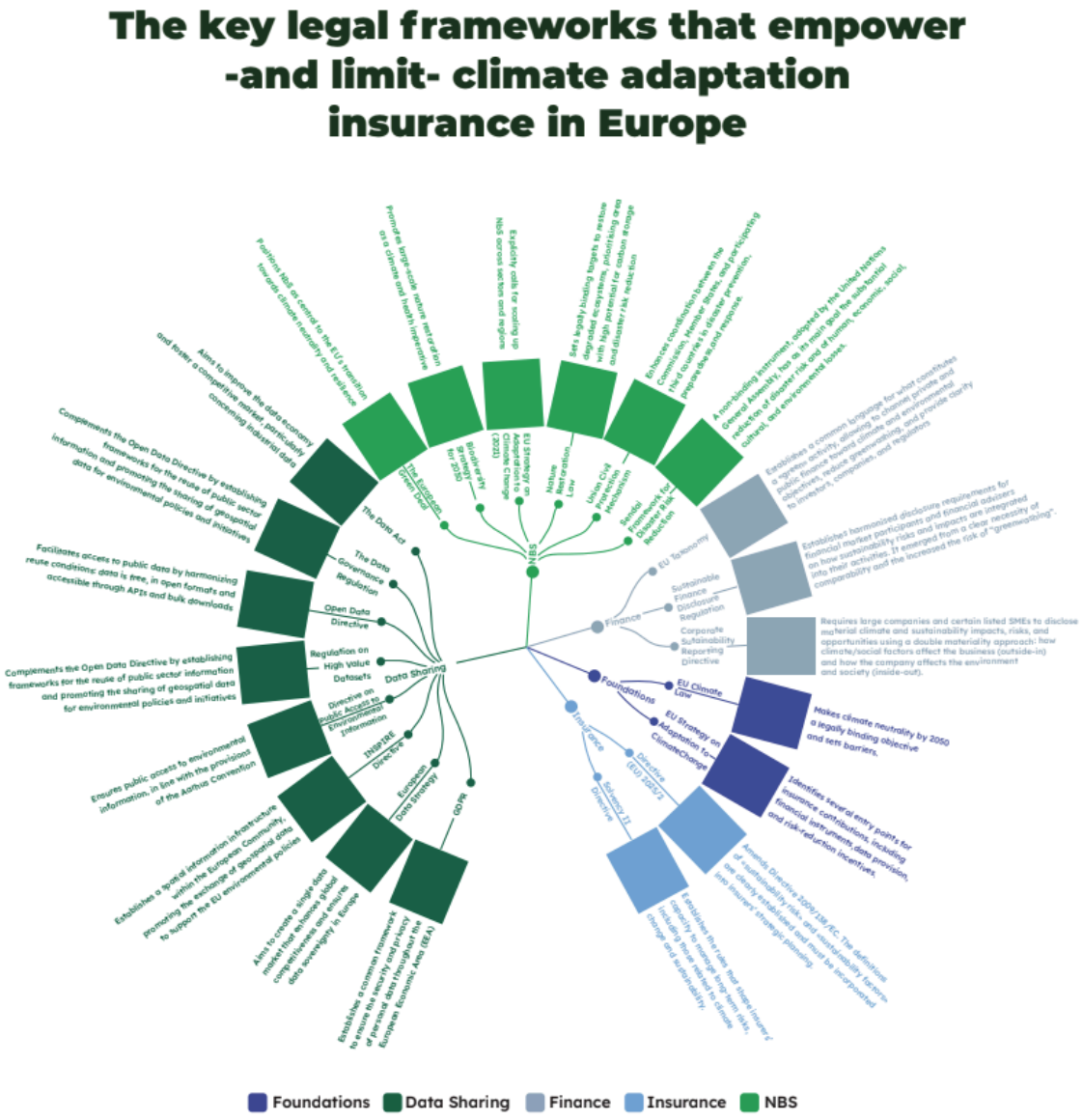
This infographic provides a visual overview of the main European policy and legal frameworks that shape the role of insurance in climate change adaptation. It brings together the different regulatory strands and shows how they collectively influence the conditions under which insurance can support resilience and adaptation across Europe.

Rather than focusing on a single policy area, the infographic illustrates how climate adaptation insurance is shaped by a combination of interrelated frameworks. These include general foundations such as the European Climate Law and the EU Adaptation Strategy, alongside insurance regulation, sustainable finance frameworks, data and data-sharing rules, disaster risk reduction policies, and nature-based solutions. Together, these frameworks define the regulatory, institutional, and technical context that can either enable or constrain the role of insurance in adaptation.

While few European regulations have been explicitly designed to link insurance and climate adaptation, many legal and strategic instruments have a direct or indirect influence on this relationship. Understanding how these frameworks interact is therefore essential to identify synergies, address gaps or inconsistencies, and recognise where policy improvements in the regulatory and institutional enabling framework could strengthen the integration of insurance into adaptation and resilience strategies.

From this perspective, these frameworks should not be seen as isolated tools, but as part of an interconnected regulatory landscape that shapes how the insurance sector can contribute to climate adaptation. By visually mapping these connections, the infographic complements the written summary in Subsection 1.2.1 and helps readers better understand how different policy domains jointly influence the potential role of insurance in supporting resilience.

Figure 8: The key legal frameworks that empower and limit climate adaptation insurance in Europe



1.2.3. Detailed profiles of insurance systems across 11 European countries from NAIAD project (DOSSIER)

dossier

Description

The dossier presents 11 profiles of natural hazard insurance systems developed by the NAIAD (Nature Insurance Value: Assessment and Demonstration) project partners. NAIAD was a Horizon 2020 project that ran for three and a half years (2017–2020).

It includes 11 country infographics covering: France, Germany, Greece, Italy, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, and Sweden.

Each infographic visually explains how natural hazard insurance operates in that national context. They are organised along the timeline of a disaster event : Before (Prevention) and After (Recovery) and map the main actors and financial flows involved, including policyholders (households and/or businesses), insurers and reinsurers, public authorities and disaster funds, and, where relevant, EU solidarity support.

Across countries, the infographics highlight key design features that shape the insurance protection gap, such as whether coverage is voluntary, semi-voluntary, or compulsory; whether natural hazard cover is bundled with standard property/fire insurance; how premiums, deductibles, and compensation are defined; and the role of public–private partnerships or state backstops (including thresholds and eligibility conditions).

By presenting comparable “system maps” for each country, the dossier helps readers quickly understand how institutional arrangements, governance roles, and financing mechanisms differ across Europe and why these differences matter when designing or replicating insurance-based adaptation solutions in a specific regional context.

1.3. Identify and engage stakeholders: Building and managing Communities of Practice (CoP)

About

This substep focuses on establishing local adaptation governance and stakeholder engagement structures. It introduces Communities of Practice (CoPs) as a practical mechanism for bringing together key actors involved in climate adaptation, risk management, and insurance-related discussions.

RAST alignment

Support RAST Step 1.3 : Setting up governance structures to support adaptation.

Substep inputs

- [GUIDE] Best practices for creating and managing the local CoPs.
- [EXAMPLES] Specific case study implementation details for Valencia, Gabrovo, and Trøndelag.

Linked deliverables and other materials

- [D1.5] Documentation of regional capacity building through IIS.
- [TEMPLATE] CoP template (ANNEX 2.).

1.3.1. Guide on creating a Community of Practice (best practices) (GUIDE)

Authors: Oihana Luque, Manuel Bea, Marianne Wehbe, and Elena Lopez Gunn (ICA)

Executive Summary

This guide presents a concise and practical approach to creating a Community of Practice (CoP) for climate resilience, with a focus on insurance and risk-financing solutions, drawing directly from the experiences and key lessons learned in the Case Study.

Key takeaways :

- CoPs serve as capacity-building tools and spaces for stakeholder engagement and the co-creation of climate-related adaptation solutions. They provide a structured space where municipalities, insurers, policymakers, researchers, and communities collaborate, learn from each other, and develop IIS.
- To ensure information gathered on the ground has a systemic impact, a Three-Level CoP structure was developed to scale knowledge from local case studies to the project level and finally to EU-wide policy dialogues. The aim was to allow local evidence to inform European directives and platforms ensuring policy is grounded in local reality.
- Evidence from practice shows that CoPs work best when they build on existing initiatives, are supported by public authorities, and focus on a clearly defined challenge.

This guide outlines core principles, a four-phase lifecycle, and a limited set of recommendations to support effective and sustainable CoPs.

Introduction

In the academic literature, Communities of practice are defined as “groups of people or organizations who share a concern or a passion for something they do and learn how to do it better as they interact regularly” (Wenger-Trayner, 2015). CoPs can be seen as a social learning system (Wenger, 2010) in which groups of people engage in shared activities and regular interactions, exchange knowledge, and jointly develop skills and solutions. Through this process of interaction and knowledge exchange, members learn collectively and gain a deeper understanding of each other’s positions and concerns. Learning may be the primary motivation for forming a community, or it may emerge as a result of members’ interactions. Mature CoPs are typically informal and self-sustaining (Lave & Wenger, 1991; Wenger, 1998).

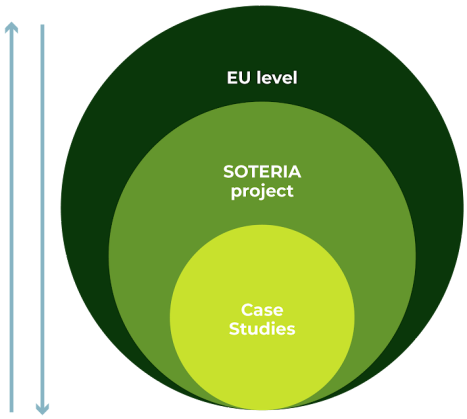
The CoPs are therefore a core methodological approach for regional capacity building. While the primary focus was on knowledge sharing - based on a three-level approach (see Figure 8) - local-level CoPs also functioned as co-creation spaces. In several CS, the CoP, aimed to incorporate end-users' needs, such as those of farmers, homeowners, and businesses directly into the development of IIS. To achieve this, it was essential to bring specific stakeholders into the CoP process.

The three level CoP Structure

Within SOTERIA, three levels of CoPs were implemented:

- **Level 1 – Local CoPs:** Formed in each case study, involving local actors, municipalities, and stakeholders. These CoPs focused on identifying region-specific insurance challenges, raising awareness, and co-developing innovative solutions.
- **Level 2 – Project-Level CoPs:** Designed to facilitate collaboration and knowledge exchange across all case studies. Activities included bi-monthly webinars featuring presentations, lessons learned, and contributions from external participants, notably insurance companies as well as sister projects.
- **Level 3 – EU-Level CoPs:** Aimed at creating synergies with sister projects (e.g. NATURANCE, PIISA), EU platforms (e.g. DRMKC Risk Data Hub), and institutions including EIOPA and MIP4Adapt. Engagements included shared sessions at major events such as ECCA 2025 and MAIA Policy Roundtables, contributing to broader European dialogue on climate finance and insurance innovation.

Figure 9: The three levels of Communities of Practice.



While this document focuses primarily on the creation and development of Level 1 (the local CoP within each region) it also recognizes the crucial role played by Levels 2 and 3. These higher-level CoPs were essential in enabling knowledge transfer across case studies, sharing best practices between regions, highlighting key project results, and showcasing insights from other partners and sister project initiatives. Together, these three levels form an integrated approach to regional capacity building through insurance innovation to help strengthen multilevel governance needed to address complex adaptation challenges.

Best practices from SOTERIA local CoPs

The following observations are derived from the experiences of the SOTERIA local CoPs. While every region faces unique challenges, certain patterns emerged among the CoPs that successfully facilitated stakeholder engagement and moved toward implementation. These are not golden rules, but rather a collection of **best practices and guiding principles identified in our case studies.**

The experience of the case studies suggests that the following design elements can help foster a more resilient CoP:

- **Build on what already exists**: Wherever possible, leverage existing projects, networks, or institutional processes. This increases credibility, legitimacy, ownership, reduces start-up effort, and supports long-term legacy and potential continuity.

- **Focus on a clear, high-impact risk**: Focusing on a specific, locally recognized climate risk if possible helps to maintain stakeholder motivation and helps to align the CoP's work with regional policy priorities.
- **Secure public authority support**: While CoPs are often informal, having the support or "backing" of public authorities often provides the necessary legitimacy, stability and resources for long-term viability.
- **Start small, scale gradually:** Many case studies benefited from starting with a small core group, allowing the CoP to manage complexity before expanding to a broader audience.
- **Monitor and adapt:** Success often depended on the ability to monitor progress and adapt the CoP's strategy as local conditions or institutional priorities shifted.

In terms of day-to-day operation, the following practices were observed to support collaboration:

- **Continuous stakeholder engagement**: Maintain regular, structured interaction using workshops, surveys, and targeted meetings, and ensure that engagement is a two-way process (not just extracting information). For example, case study diaries were developed as a way to systematically document progress.
- **Manage partnerships actively** : CoPs require proactive partner management. If key actors are unavailable or disengaged, CoP leads should quickly involve alternative organizations with sufficient authority or reach.
- **Clear scope and roles**: Keep objectives and expectations explicit, even where decision-making is informal, to guide the collaboration effectively.
- **Knowledge sharing:** Systematically document and share lessons learned to support replication and long-term impact beyond the core group.
- **Find a neutral space and responsibility:** Designate a responsible actor for continuity and ensure the meeting space (physical or virtual) is perceived as neutral and non-hierarchical.
- **Maintain flexibility:** Allow for flexibility in participation; people should be able to join and leave as their relevance or capacity dictates.
- **Mix interaction formats:** Combine online tools with in-person interaction to maximize reach and depth of collaboration.
- **Recognise contributions:** Actively acknowledge and recognise stakeholder contributions to foster ownership and sustained participation.

Guidelines - the CoP lifecycle

Based on the case studies, the development of a local CoP can be understood through a four-phase evolutionary process. This is intended as a flexible guide rather than a mandatory checklist:

Phase 1: Define the challenge

Objective: Co-define the specific challenge and establish the scope with key partners, building a flexible, inclusive core group.

Key actions:

- Assess the local regulatory, institutional, and social context.
- Map and engage key stakeholders (public authorities, businesses, researchers, citizens, associations, etc).
- Hold an in-person session to collectively define the scope, purpose, objectives and sustainability of the CoP.

Phase 2: Explore, exchange and co develop ideas

Objective: Identify realistic solution pathways through regular interaction, ensuring continuous engagement and flexible participation.

Key actions:

- Establish a consistent rhythm of interaction (e.g., a planned series of structured workshops or meetings).
- Actively involve the broader stakeholder group in the discussion, exploration, and generation of initial concepts and potential approaches.
- Confirm partner commitment and adjust the partnership where needed to ensure sufficient authority and reach.

Phase 3: Consolidate learnings and define next steps

Objective: To consolidate the options explored and define the most promising approaches and next steps, seeking direct feedback and co-creation on emerging learnings.

Key actions:

- Crucially, return to participants with proposed concepts or findings from Phase 2.
- Validate the most promising approaches/concepts through workshops or structured dialogue.

Phase 4: Learn and maximise impact

Objective: Capture lessons transparently and maximize the value of the CoP's work for broader impact and policy action.

Key actions:

- Document challenges and limitations transparently, focusing on systemic barriers.
- Explain why certain approaches were not viable.
- Translate findings into actionable insights and recommendations for the relevant stakeholders (e.g., higher-level governance, local actors, practitioners).

Conclusion

The case studies experience demonstrates that the CoP can be more than meeting groups or simple knowledge exchanges; CoP can function as powerful co-creation tools. By shifting the focus from passive discussion to active partnership, these communities ensure that climate

adaptation solutions are technically sound, socially accepted, and more likely to be implemented in time.

Ultimately, the success of a CoP is measured not just by the specific solutions it creates, but by the legacy of collaboration it creates, developes and leaves behind.

1.3.2. SOTERIA CoP examples (EXAMPLE)

Valencia CoP description

Authors: Ciro Pascual, Javier Marzo, Marina de Torres (GVA) and Gabriela Alonso (BC3).

CASE STUDY	Valencia, Spain
GEOGRAPHICAL SCOPE	Camp de Mortverde area focusing on the, Marjal dels Moros wetland (Sagunto and Puçol).
KEY STAKEHOLDERS	Key stakeholders include the local stakeholders surrounding the area: i) Municipal officials from Sagunto and Puçol; ii) Industries surrounding the Marjal dels Moros that are members of the ASECAM (Asociación de Empresarios del Camp de Morvedre) iii) the University of Valencia; iv) EU-funded projects such as Restore4Cs, SOTERIA, and Wetlands4Change; v) the Júcar River Basin Authority (Confederación Hidrográfica del Júcar); vi) the Generalitat Valenciana; and vii) NGOs active in the area, including Fundación Global Nature, SEO/BirdLife, Acció Agroecologista, and Sapiens.
SH INVOLVEMENT	☑ **High:** ***They are consistently involved in activities, providing input and attending meetings or workshops regularly and whenever they are invited.*** ☐ Moderate ☐ Low ☐ Varies (please explain)
SH CONTRIBUTION	☑ **Contribution for the specification of technical characteristics.** ☑ **Consideration of expectations of end-users throughout the solution design and development.** ☑ **Convincing end-users and stakeholders about the benefits from the implementation.** ☑ **Increase of communication and dissemination of the results.** ☐ Other (please explain) create adaptation measures.

	_____
PARTICIPATION How often do these CoPs meet or engage with members?	☐ Weekly ☐ Bi-weekly ☐ Monthly ☑ **Ad-hoc : *at least twice a year*** ☐ Other (please specify)
GOAL & AMBITION	The ROSSETA-UV Living Lab is a collaborative hub for climate adaptation. The Lab is designed as a trusted space for open dialogue and collaboration, where diverse actors can come together to share ideas and co-create solutions that strengthen collective resilience around the Marjal dels Moos. The ROSSETA-UV Lab brings together academia, public institutions, the private sector, and civil society to foster shared resilience through the conservation and restoration of the wetland. It aims to become a long-term, collaborative platform for sustainable co-creation that goes beyond the timeframe of EU projects such as SOTERIA. The three priority objectives are: 1. To promote citizen participation and the involvement of relevant stakeholders in decision-making processes related to biodiversity protection and climate change adaptation in Sagunt and the Camp de Morvedre area (Palancia River Basin), with special attention to the Marjal dels Moros ecosystem and its surroundings. 2. To enhance coordination among research projects whose mission is to improve the resilience of both natural systems and the region's social and economic structures. At the same time, to foster synergies between these projects and encourage the involvement of various stakeholders. 3. To identify opportunities for ecological restoration, while also promoting the adaptation of local ecosystems to climate change and increasing citizens' resilience to the effects of global warming.
IIS DEVELOPED	Within the framework the CoP, aims to co-create a shared resilience framework for the Marjal dels Moros wetland. Given that the Marjal is publicly owned by the Generalitat Valenciana, its management and conservation are the responsibility of the Regional Ministry for the Environment (Conselleria de Medio Ambiente). To ensure its long-term conservation, the Conselleria has developed this innovative and participatory approach through

	SOTERIA. Following a series of sectoral dialogues, not only was a shared interest in conserving the wetland confirmed, but also the need to combine diverse measures with effective cross-sectoral cooperation. These dialogues also opened a conversation on potential financing mechanisms to support future conservation and restoration efforts. Currently, the vast majority of investments aimed at restoring and protecting the Marjal dels Moros come from public funding. In order to diversify and expand financing, investments must be strategically designed and closely aligned with sectoral priorities, acknowledging the current and future roles of different actors in conservation. This moment presents a unique opportunity: the existing Management Plan (Plan Director) of the Marjal dels Moros, originally approved in 2018, is now in the process of being updated. The revision—scheduled for autumn 2025—will be carried out through a participatory process using the ROSSETA Living Lab as a platform for co-creation. The updated Plan will define priority actions for restoration and conservation, and it will seek to strengthen local stakeholder engagement in both the design and implementation of these strategies. This will enhance intersectoral coordination, generate shared benefits, and, through SOTERIA, explore new financing pathways. As part of this process, a Climate Resilience Dialogue (CRD) was held on June 5th, 2025, during which key local stakeholders identified a series of resilience indicators. These indicators draw from the EU Taxonomy, Spain's National Adaptation Plan, and local planning instruments, while also considering the potential for private sector contributions. They will be directly linked to the updated Management Plan's activities and will help establish clear priorities and measurable outcomes. Ultimately, the updated Plan Director will include a clear set of activities, each with associated indicators to measure progress in implementation. The aim is for this plan to serve as a strategic tool for securing funding, including sources beyond the public sector, to

	support the long-term restoration and conservation of the Marjal dels Moros. The ROSSETA-UV Lab will facilitate this co-creation process, ensuring the framework is inclusive, actionable, and responsive to both environmental and socio-economic priorities.
HOW THE COP WORKS ? Formal decision making and/or only information. What is discussed ?	The CoP originated around protecting the Marjal dels Moros. This wetland, owned and managed by the Generalitat Valenciana, serves as a case study across several European projects, most recently RESTORE4Cs and SOTERIA, which were launched at approximately the same time. Its public ownership allows decision-making capacity, reinforced by the CECV and supported by available infrastructure for in-person stakeholder meetings. Observing this convergence, the two projects decided to align their efforts by establishing a living lab, which takes the form of a consultative platform known as “Roseta UV Lab”. The formal development of ROSSETA as a Living Lab followed several key steps. The ROSSETA-UV Lab builds on the research and stakeholder engagement activities carried out under two European projects—SOTERIA and RESTORE4Cs—in which the Marjal dels Moros wetland serves as a pilot ecosystem. To ensure the long-term sustainability of the Living Lab beyond the projects' timelines, the initiative is led by the University of Valencia (UV), and its platform will also be hosted by UV. As part of this process, a workshop was held on December 4th at the Port de Sagunt Civic Center to further develop ideas for this citizen laboratory focused on social and environmental innovation. The event was coordinated by members of the RESTORE4Cs project (University of Valencia and MedWet) and the SOTERIA project. Finally, the formal launch of the ROSSETA-UV Lab took place on June 11th, 2025, at the Environmental Education Center (CEAV) located in the Marjal dels Moros. Through this platform, key stakeholders can learn about ongoing European projects in the region, identify active initiatives within

	those projects and contribute ideas and actions toward the conservation and restoration of this critical ecosystem.
KEY CHALLENGES	The main challenge is to maintain this community of practice beyond SOTERIA. Consequently, the platform will be maintained in the long term by the University of Valencia, specifically the Sagunto campus.
NEXT STEPS	Continue the activities linked to the Marjal and others project activities to continue to deepen the level of collaboration.

Gabrovo CoP description

Authors: Kamelia Georgieva (BES), Nikolay Dimitrov and Mihaela Ivanova (MoG).

CASE STUDY	Gabrovo, Bulgaria
GEOGRAPHICAL SCOPE	Gabrovo Municipality
KEY STAKEHOLDERS	Gabrovo tech university, business (services and industry and connection with the local chamber of commerce), governmental regional departments, municipality administration directorates, insurance (DZI- member KPC group, local brokers group that represent all insurance companies), Forestry department - Gabrovo, National statistical Institute regional department, Regional Fire Safety Service, Electricity Distribution Company, Water Supply and Sewerage - Gabrovo, Chamber of Commerce and Industry, District Administration - Gabrovo.
SH INVOLVEMENT	☐ High ☑ **Moderate : *individual contact, email and also in workshops, CRD, working meetings. Seasonal contact with them. Contact with the SH on a regular basis (not only with SOTERIA project).*** ☐ Low ☐ Varies (please explain) _____
SH CONTRIBUTION	☑ **Contribution for the specification of technical characteristics :** ○ ***for the regional data hub (risk department, universities, IT experts and GIS department from the university) + connection with other EU projects. University here has a big role*** ○ ***For the IIS : Mitigrate + DZI.*** ☑ **Consideration of expectations of end-users throughout the solution design and development.** ○ ***For the IIS : test with the business*** ☑ **Convincing end-users and stakeholders about the benefits from the implementation.** ☑ **Increase of communication and dissemination of the results**

	☐ Other (please explain) _____
PARTICIPATION How often do these CoPs meet or engage with members?	☐ Weekly ☐ Bi-weekly ☐ Monthly ☑ **Ad-hoc : *What is planned : To discuss regional data hub, to discuss IIS and test behavioral solutions*** ☑ **Other (please specify) Upcoming open day event in Gabrovo**
GOAL & AMBITION	To develop a model for IIS based on risk reduction measures baked up by behavioral and awareness actions - a field test of behavioral tactics To develop a Regional Data Hub
IIS DEVELOPED	Ideas were developed, and after obtaining information about possible risk reduction measures, the IIS were presented. A mapping of the city was carried out, identifying potentially areas at risk. Contacts were made with property owners (both public and corporate) to verify their attitude towards undertaking new preventive measures and exploring potential innovative insurance models.
HOW THE COP WORKS ? Formal decision making and/or only information. What is discussed?	To date, several workshops have been held, both in person and online. The opinions of all stakeholders were taken into account regarding the possibility of preventing the consequences of rapidly changing climate processes. It was found that it is imperative to increasingly allocate resources, both from the local budget for risk prevention, and from citizens and businesses for a larger share of insured property. The need for greater awareness among all stakeholders, based on analyses of already collected data, justifies the creation of a regional data hub.
KEY CHALLENGES	(1) Low awareness = insufficiently educated, lack of information (2) Low insurance culture = uninformed decisions Technical challenge for the Regional data hub

NEXT STEPS	- Based on the developed road map for establishment of a regional data hub the MoG will try to attract funding for its establishment. - Based on the tested model of IIS - combination of risk assessment with suggested risk reduction measures, behavioral approaches and new pricing model from the insurers, next steps will be undertaken for its implementation

Trøndelag CoP description

Authors: Berit Time and Eli Sandberg (SINTEF).

CASE STUDY	Trøndelag, Norway
GEOGRAPHICAL SCOPE	Trøndelag county with municipalities (38)
KEY STAKEHOLDERS	County authority, county governor, municipalities, insurance companies like KLP and Gjensidige, insurance brokers, federation of municipalities, governmental agencies, performers of RVA
SH INVOLVEMENT	☑ **High** ☐ Moderate ☐ Low ☐ Varies (please explain) _____
SH CONTRIBUTION	☐ Contribution for the specification of technical characteristics ☑ **Consideration of expectations of end-users throughout the solution design and development** ☑ **Convincing end-users and stakeholders about the benefits from the implementation** ☑ **Increase of communication and dissemination of the results** ☑ **Other (please explain) : we discuss and design each thematic meeting and workshops with the Norwegian partners and associated partners. We use Network Climate adaptation Trøndelag to reach out**
PARTICIPATION How often do these CoPs meet or engage with members?	☐ Weekly ☐ Bi-weekly ☑ **Monthly** ☑ **Ad-hoc** ☑ **Other (please specify)** Meetings with stakeholders separately several times over a year. Common core group meetings with stakeholders several times in advance of an event (thematic meetings). Events approx. twice a year.

GOAL & AMBITION	KPI from the CS
IIS DEVELOPED	(1) Data sharing is highly developed (have the legal framework). Challenge as the Knowledge bank is “on hold” pending funding and security issues. (2) Insurance in public procurement (no legal rules), but environment and climate shall be weighted 30% (legal from 2024) (3) Gjensidige are adapting their products to the EU taxonomy (4) KLP is piloting a green insurance product
HOW THE COP WORKS ? Formal decision making and/or only information. What is discussed ?	We are bringing the various SH together through thematic meetings (x3), and invite through Network climate adaptation Trøndelag. Through them we also reach municipalities in other counties. The thematic meetings have been in the format of oral presentations and discussions. External experts have been invited and joined the thematic meetings. We have also arranged two workshops with specific invites to discuss procurement more in detail.
KEY CHALLENGES	Integrating physical climate-related risk and damage prevention into public procurement is very immature. The municipalities differ in size and risks, resources and competence There is a high turn-over of personnel in many municipalities

1.4. Engage the stakeholders through a Climate Resilience Dialogue

About:

This substep presents the Climate Resilience Dialogue (CRD) as the primary format for initiating stakeholder engagement and communication at the local level. The CRD is designed as a participatory process that brings together a broad range of actors from local authorities and insurers to community representatives and civil society organisations to establish a shared understanding of local climate risks and adaptation challenges and potential solutions.

RAST alignment

Support RAST Step 1.5 Communicating adaptation and raising awareness.

Substep inputs

- [GUIDE] Facilitation guide outlining the key steps for designing and running a CRD.
- [EXAMPLES] Examples of CRDs implemented in the SOTERIA case studies.

Linked deliverables and other materials

- [D4.2] Climate Resilience Dialogue Series
- [DOSSIER] Set of blog posts documenting reflections and take-aways from the CRD (ANNEX 3.)

1.4.1. Guide for organizing and facilitating a regional CRD plenary meeting (GUIDE)

Author: Amanda Radstake and Vivian He (GIB)

Introduction

The European Commission has proposed increasing insurance coverage and investment amount in climate adaptation and resilience, with the objective of narrowing the climate protection gap—the difference between total and insured losses (European Commission, 2024). In addition, it initiated the Climate Resilience Dialogues (CRD) in 2022, which brought together a broad spectrum of stakeholders, including insurers, reinsurers, risk managers, public authorities, regional representatives, and consumer associations. The aim was to explore strategies for closing climate protection gaps across Europe and to identify measures to strengthen climate resilience, particularly through adaptation (European Commission, 2024).

Building upon this, a series of regional CRDs were carried out to share knowledge about how the climate protection gap in various regions could be narrowed. These consisted of a series of activities aimed at promoting knowledge exchange and collaboration among local stakeholders within different case studies. Topics of focus included addressing the climate protection gap, improving insurance penetration and coverage, enhancing risk data and risk transfer mechanisms, and sharing best practices and state-of-the-art knowledge.

The SOTERIA's CRD series consists of two main components: (1) **knowledge sharing webinars** to provide participants with insights on key topics, including the climate protection gap, innovations in climate insurance, and recent policy developments; (2) **regional CRD plenary meetings** to foster regional stakeholder engagement through interactive workshops and discussions, encouraging open dialogues and exploring opportunities for mutual learning.

This guide focuses specifically on the organization of the Regional CRD Plenary Meetings.

The regional CRD activities showed that there is no one-size-fits-all approach. On the one hand, building trust and strengthening partnerships with local stakeholders should be core objectives. On the other hand, clear objectives and tangible benefits for stakeholders should be identified and communicated to ensure effective discussions and meaningful follow-ups. Successful dialogues should also be adapted to local contexts, institutional capacities, and cultural norms.

Methodology

This section presents a step-by-step “How-To Guide” for organizing and facilitating a regional CRD plenary meeting, on the basis of our experiences. These dialogues enable case study regions to develop more structured conversations among municipalities, local communities, insurers, and other key stakeholders to exchange information, discuss challenges, explore potential solutions and co-design resilience strategies, including enabling factors for policy and governance.

The Dialogues are commonly centred around a number of main questions, as listed below. Depending on primary climate risks and affected sectors in each case study, additional topics could also be included.

- What are the main barriers and opportunities to increase the insurance coverage and narrow the climate protection gap in the region?
- What enabling conditions or specific support are necessary to boost the insurance solution and/or the procurement to transfer risks and compensate for financial losses?
- What is the current climate strategy?
- What are the main natural hazards and climate-related insurance solutions (if any) in the region?

Phase-by-phase organization

Preparation

The preparation for the CRD plenary meeting begins with defining the concept note, approximately 2 months in advance. It is recommended to present the latest findings from existing climate-related projects and clarify the primary goal of the discussion and highlight possible benefits for relevant stakeholders. It might also be useful to consider likely risks in the organizational process, e.g. the attendance of key decision-makers, and prepare alternative plans.

Next, a stakeholder mapping exercise is conducted to identify relevant participants, those who can contribute to the discussion, benefit from the proposed solutions, or play a decision-making role. Potential stakeholders may include local authorities (across relevant departments), (re)insurers, risk data specialists, SMEs, researchers, and industrial associations. This ensures the diversification of stakeholders across areas of expertise.

Afterwards, an agenda and a short briefing note should be developed to provide participants with insights into what will be discussed and provide any background information or research conducted beforehand. In our case studies, the common approach was to send out an official

letter or email signed by the local authority to invite key stakeholders.

- Agenda: The agenda should specify proposed time slots, topics, speakers, and invited organizations. The agenda can be adapted based on the status of local partnerships and the project process.
- Briefing note: It provides attendees with a brief overview of the ongoing project and the case study, including local hazards, current measures, and identified needs. It is important to capture their interest by highlighting potential benefits of attending the sessions. Add if possible relevant visuals to the briefing note.

It is important to organize logistics in advance to ensure a successful plenary meeting. It is recommended to keep the dialogue to no more than half a day, focusing on interactive discussions. Ideally only 2-3 hours to ensure the engagement of key decision-makers. It is necessary to choose the suitable format of the meeting such as online, in-person or in a hybrid form, depending on the regional needs. Ensure all technical, accessibility, inclusivity (e.g. gender) and venue arrangements are in place.

The Plenary Meeting

The opening remarks usually include a welcome note, the purpose of the meeting and an introduction of the speakers and participants. They should reflect diverse voices from main stakeholders, such as the coordinator, local representative, mayor or keynote speakers. This part of the session could also present the current state of local climate hazards and challenges and introduce the audience to the agenda.

The meeting can be structured into thematic modules. It is very important to encourage interactive sessions, such as workshops, roundtable discussions, or Q&A segments to foster the dialogue. Topics of thematic modules could include risk assessment, risk data sharing, insurance solutions, and policy trends.

It may be helpful to have a note-taker or record the sessions to capture key points, feedback, and actionable recommendations. After the meeting, it is good practice to summarize key takeaways, outline next steps, and thank participants for their engagement. This supports the dissemination of follow-ups and encourages continued collaboration.

Dissemination and communication

One week after the event, prepare a summary report of the CRD, including key discussion points, recommendations, and identified follow-up actions. The report can be distributed to all participants and relevant stakeholders via email, newsletters, or project platforms to reach a wider audience.

Event highlights may also be published on social media, websites, or other communication channels to raise awareness of the CRD outcomes and promote climate resilience efforts. It is also beneficial to gather feedback from participants to improve future CRDs, assess engagement, and identify further needs or topics for follow-up sessions.

BOX 1. Additional recommendations

1. **Focus on partnership building.** The ultimate objective of CRD plenary meetings is to build partnerships and engage with stakeholders, which enables collaboration and concrete actions. A safe and trusting environment can enable participants to share their opinions and ideas openly. Listen to their challenges and then focus on problem-solving. Be action-oriented when discussing next steps and follow-ups.

2. **Tailor the CRD to the local context**. Ensure that you address specific topics relevant for your region and invite key local stakeholders. Adapt to the cultural setting and preferred ways of engaging with stakeholders. This is important for building trust and establishing a long-term partnership.

3. **Share relevant data and information.** Make sure that relevant data, real-life examples or case studies are shared with participants. These inputs will enrich the interactive discussions and feed into the exploration of solutions and opportunities for collaboration.

4. **Position the CRD within the broader climate efforts.** Consider the CRD as one building block within your broader climate efforts, so you may choose the timing strategically, either at the beginning to engage stakeholders, in the middle to share preliminary results and gather feedback, or at the end to disseminate findings and outline next steps.

Key takeaways on climate resilience dialogues

The Regional CRD Plenary Meetings facilitate a deep understanding of local communities and establish a collaborative framework. By leveraging regional outputs, these dialogues inform EU and national policy, contributing to the UNFCCC Adaptation Goals and sustainable finance initiatives.

1.4.2. Best practice examples and key takeaways (EXAMPLES)

Author: Amanda Radstake and Vivian He (GIB)

This section is showcasing the best practice example of the organization of the regional Climate Resilience Dialogues hosted in Gabrovo in Bulgaria and Valencia in Spain. Interviews with the case study leads were held to understand their experience of hosting the Climate Resilience Dialogues.

Regional Climate Resilience Dialogues in Gabrovo: Insurance, Risk Data & Urban Adaptation

Date: November 21, 2024

Location: Gabrovo, Bulgaria

Key organizers: Municipality of Gabrovo (MoG) and Behaviour Smart (BES)

Key audience: around 30 participants including the mayor, municipal departments, regional authorities, utility providers, insurers, academics.

Topics: Local climate risks, insurance behaviour, and tools like the Risk Data Hub through cross learning from the Norwegian case.

1. Key steps in making the CRD happen

- Preparation and stakeholder mapping:

GIB played the role as the overall coordinator of the regional CRDs, initiating a programme with high-level suggestions and the structure of events. Following its instructions, a stakeholder mapping exercise was carried out by MoG and BES to identify the most relevant parties. Key responsibilities were allocated to MoG in order to ensure effective logistics and external outreach.

- Logistics:

The organization of the meeting went through the approval process from the local administration. After that, official invitation letters, signed by the mayor, were sent out to confirm attendance.

The event was held in a hybrid mode, both online and in-person. Language support through a translator was enabled to facilitate communication with partners and international participants. The municipality in Gabrovo has lots of experience in hosting similar events and has all the necessary technical equipment.

The municipal council venue was preferred due to its central location, large capacity, and technical facilities for hybrid participation and live translation.

- Public communication:

Information about this CRD meeting was shared on the municipality's website and its Facebook page. Event registration was open to all interested partners, and event updates were published online to encourage transparency and raise awareness of the topic.

It is worth noting that existing long-term relationships with local stakeholders made it much

easier to invite and engage with participants. Invitees included municipalities, water management agencies, the fire department, and business representatives. While business partners were generally easier to involve, public institutions often had competing priorities.

2. Biggest challenges faced during the organization process

The main challenge was scheduling the meeting with key decision makers. It was hard to find a suitable time when all necessary stakeholders were available, given their other duties and the municipality's busy schedule. Limited administrative capacity within the municipality also made the coordination more difficult. Event planning also took into consideration other factors, such as the weather events and political elections.

3. What could be done differently next time to overcome or mitigate this challenges faced

Building trust and maintaining relationships over time helps ensure easier stakeholder engagement in future events.

4. Main benefits of the CRD

The CRD plenary meeting was a starting point for stakeholder engagement on climate adaptation and resilience. Following the meeting in November 2024, a similar plenary meeting was organized with the same group of stakeholders in May 2025 to continue the discussions, leading to cooperation with the same and additional institutions on co-creating a regional Data Hub roadmap. The outcomes of the Data Hub Roadmap were shared at the SOTERIA General Assembly and Open Day, opening the process to a wider audience.

5. Changes observed after hosting the CRD

More stakeholders expressed interest in participating and became more involved in project activities on a daily basis. The CRD meeting improved internal collaboration on climate-related projects and involvement among municipal colleagues across different departments.

6. Advice to other regions

There is no one-size-fits-all approach, the CRD must be adapted to local context, relationships, and cultural norms. Ensure clear objectives, transparent communication, and realistic scheduling. Focus on building long-term relationships and maintaining consistent engagement to achieve sustainable outcomes.

Regional CRD in Valencia: Building a Common Framework for Shared Resilience

Date: June 5, 2025

Location: Valencia, Spain

Key organizers: Conselleria de Generalitat Valenciana (GVA), Basque Centre for Climate Change (BC3)

Key audience: around 55 participants including municipal departments, regional authorities, industrial representatives, academic institutions and NGOs.

Topics: national climate strategy, local natural hazards, shared resilience framework, Marjal dels Moros case study.

1. Key steps in making the CRD happen

- Getting a clear mandate and objective:

The first step was having a clear objective. In the Valencian case study, project partners have been working with local stakeholders for a year to understand the perceived climate risks, the envisioned adaptation solutions, and the different roles of the sectors. Therefore, this CRD plenary meeting was directly responding to the expectation of local stakeholders while making sure of the best use of time.

- Mapping and inviting stakeholders:

Key stakeholders were identified at the beginning of the SOTERIA project, including local and regional authorities, insurers, the industry representatives, farmers, researchers, and NGOs. Pre-dialogue preparation was the key. About five months before the CRD meeting, the initiation of the Rosseta Living Lab — a permanent community of practice — had been envisioned among the stakeholders. So it was easy to invite the right participants who were not only members of this living lab but were also complemented by the Consorcio de Compensación de Seguros.

- Designing the agenda:

A shared folder among organizers was created to gather all the information related to the event. The co-creation process was undertaken to design the agenda, format and guiding questions with the stakeholders.

- Organizing the logistics:

Valencia generalitat helped organize the venue, catering services, invite stakeholders (official letter with signature), and communications (published the event on governmental website).

Existing trust building activities with local stakeholders and the established long-term relationships with them contributed to a successful CRD plenary meeting.

Key organizers, including ICA, BC3, and AQUA, had weekly catch-ups to catch up on the event organisation, logistics, agenda and session set-up.

- Following up:

A CRD summary report was shared among participants. A clear roadmap of next steps was developed and sent to relevant stakeholders.

2. Biggest challenges during the organisation process

Aligning different perspectives of both organizers and external partners was challenging, especially when defining clear objectives and the meeting purpose that would address the needs of case study and key stakeholders.

It was more challenging to engage farmers in the region. Although they attended the project kick-off meeting with other stakeholders, they were not motivated to participate in subsequent discussions.

3. What could be done differently next time to overcome or mitigate this challenges

We would invest more time to build partnerships with farmers and clarify their expectations. Because this project was not responding to the needs of farmers who wanted to receive subsidies for the GVA. Farmers are not interested in climate insurance products in general.

The one-day event was a bit too long and key decision-makers were not able to join the all sessions. It could have been better to shorten it to half of the day, like 3-4 hours in total, focusing on key topics and interactive discussions. It was crucial to clarify with invitees what to expect and how this event could benefit them.

4. Main benefits of the CRD

Relationships with local stakeholders across sectors were strengthened, and clear progress in trust building was made.

A shared understanding of the Valencian community's climate risks was improved; raising awareness of Shared Resilience and the concept that everyone has a role to play was well perceived.

Participants gained a clearer understanding of the role of climate insurance solutions and how climate events are covered.

Concrete solutions and a list of key indicators for the Management Plan of the Marjal dels Moros, which will support the next steps of a public–private partnership, was developed.

5. Follow up on the CRD afterwards

The CRD plenary meeting provided an opportunity for the case study partners to engage external stakeholders who were highly relevant to the topic and could contribute to the main outputs of the case study.

In addition, four follow-up meetings were held with the core case study team, as part of the Community of Practice (CoP), to further develop and refine Shared Resilience framework indicators discussed during the CRD sessions. These meetings were scheduled in advance to ensure a committed follow-up on the plenary discussions and to secure tangible outcomes from the CRD process.

STEP 1 Completion Checklist

Use this checklist to confirm that your region is ready to start Step 2 risk assessment within the SOTERIA methodology.

Area	Key question	Verified
Problem definition- Story Map	Has a Story Map been completed or started to describe the regional climate-risk and insurance context?	☐
Context mapping	Have relevant legal, institutional, and policy frameworks affecting climate-adaptation insurance been identified?	☐
Stakeholder identification	Have key actors been mapped (local authorities, insurers, regulators, sectors at risk, community groups)?	☐
Community of Practice	Has a Community of Practice or working group been created or planned to coordinate stakeholders?	☐
Climate Resilience Dialogue	Has at least one CRD or structured engagement activity been organised or scheduled?	☐
Shared understanding	Do stakeholders have a common understanding of the adaptation problem and insurance protection gaps?	☐
Governance clarity	Are roles and responsibilities clear for who leads Step 2 risk assessment?	☐
Data awareness	Do stakeholders know where key climate, exposure and loss data exist (even if not yet analysed)?	☐
Institutional support	Is there support from a local or regional authority to continue the adaptation process?	☐
Implementation relevance	Have potential links to real policy processes (plans, strategies, investments) been identified?	☐

STEP 2: ASSESSING RISKS AND VULNERABILITIES TO IDENTIFY POTENTIAL INNOVATIVE INSURANCE SOLUTIONS FOR ADAPTATION

Understanding RAST Step 2 "Assessing climate risks and vulnerabilities"

Step 2 of the Regional Adaptation Support Tool provides the standard framework for understanding where climate impacts are most significant and why. It builds on Step 1 by combining information on climate hazards, exposure and vulnerability to identify priority risks that adaptation planning must address.

At this stage, regions define how risk will be assessed, identify current and future climate risks affecting sectors and communities, analyse vulnerabilities and cross-regional impacts, and agree on the key risks that should guide adaptation objectives.

The purpose of Step 2 is not yet to design solutions, but to create a shared and evidence-based understanding of risk that allows informed decisions in later steps.
Typical outputs include a structured climate risk assessment, identification of priority risks and vulnerable groups, and a clear basis for exploring adaptation and insurance options in subsequent steps.

If Step 2 is skipped, adaptation strategies may focus on the wrong risks, underestimate vulnerable groups, or invest in solutions that do not reduce real impacts-leading to ineffective or maladaptive policies.

About

Step 2 focuses on the assessment of climate-related risks and vulnerabilities as a basis for identifying the main protection gaps that need to be addressed for climate change adaptation. It supports practitioners in moving from an initial framing (Step 1) towards an evidence-based understanding of risk that can inform potential insurance-based adaptation solutions.

Objectives

The objective of this step is to help practitioners to assess climate-related risks and vulnerability assessment in order to identify the main protection gaps that need to be addressed for climate

change adaptation, with a view to informing potential innovative insurance adaptation solutions.

RAST alignment

This step builds upon the preparatory work carried out in Step 1.

This Step corresponds broadly to RAST Step 2: “Assessing climate change risks and vulnerabilities”.

In the RAST, Step 2 includes: defining the core elements of the risk assessment (2.1), identifying risks (2.2), assessing those risks (2.3), and defining key risks and adaptation objectives (2.4).

The point of departure in this Manual is to adopt a more explicit and operational treatment of data-related challenges. Within the RAST framework, the collection of relevant information is primarily addressed in RAST Step 1.1 (“Building the evidence base”) while RAST Step 2 focuses on structuring and carrying out the assessment of climate risks through the combination of climate hazards, exposure and vulnerability. In practice, however, the transition from evidence gathering to risk assessment is often not straightforward. In many regions climate, exposure and loss data are fragmented across institutions, stored in heterogeneous formats, subject to access constraints, or not recorded with sufficient consistency and granularity. While these challenges are recognised in the RAST, they are not addressed through detailed procedural guidance.

For this reason, the SOTERIA Manual makes explicit several steps that remain implicit across the RAST. Rather than treating data-related issues solely as a preparatory activity, Step 2 considers data availability, data quality, data governance and loss recording as integral components of the risk and vulnerability assessment process itself, particularly when the objective is to support insurance design and decision-making.

Accordingly, Step 2 is structured to distinguish on the one hand, between the enabling conditions for risk assessment and on the other, the application of risk assessment principles.

Step 2 substeps

- **Substep 2.1 (RAST 2.1–2.2–2.3)**: This substep outlines the risk assessment process and the core elements required to conduct a climate risk and vulnerability assessment. It provides practical guidance to support practitioners, including a summary and a video.
    - Main output : An agreed risk assessment method to support protection-gap identification.
- **Substep 2.2 (RAST 2.2–2.3):** This substep supports the identification and mapping of relevant datasets for risk and vulnerability analysis (hazard, exposure, vulnerability and impacts/losses), as well as the documentation of key data gaps and access constraints that may limit the assessment of protection gaps.
    - Main output : Completed data-mapping inventory plus a data-gap and access constraints log that explains what is missing and why it matters for the protection gap.
- **Substep 2.3 (RAST 2.3 and enables insurance-relevant analysis)**: This substep provides guidance on standardising risk and loss data to enable consistent collection and introduces 2 software prototypes: 1) the first was developed and tested based on

Norwegian data, and demonstrates how harmonised historical loss data can be analysed and visualised to support municipal planning and climate risk management. 2) The second prototype was developed and tested in Valencia, focusing on forward-looking surface flood risk assessment and prioritisation of mitigation measures.

- Main output: a standardised/harmonised risk and loss dataset plan (what to standardise, how, by whom) and/or a prototype-informed analysis/visualisation that supports prioritisation and insurance-relevant decisions.

How SOTERIA tools contribute to RAST Step 1

RAST Step 2 elements	What it means (Mission level)	SOTERIA tools / content
Define risk assessment framework	Scope, methodology, governance of risk assessment	Risk assessment workflow guide
Identify risks	Identify hazards, exposure, vulnerable sectors/groups	Data-mapping template
Assess risks	Combine hazard, exposure and vulnerability	Risk modelling examples & software prototypes
Identify key risks & objectives	Prioritise risks for adaptation planning	Protection-gap analysis

2.1. Risk assessment process

About

This substep introduces the process for climate risk assessment that can support adaptation planning. It explains how to move from climate hazard information to an assessment of impacts and expected damages by combining hazard modelling (historical observations + future climate projections) with exposure, vulnerability and (where available) insurance loss data, to produce damage functions and indicators such as Expected Annual Damage (EAD).

RAST alignment

Supports RAST Step 2.1 Defining the core elements of your climate risk assessment, Step 2.2 Identifying risks and Step 2.3 Assessing climate risks.

Substep inputs

- [SUMMARY] Risk assessment workflow.
- [VIDEO] Risk assessment guidelines.

Linked deliverables and other materials

- [GUIDE] Risk assessment guidelines.

2.1.1. Risk assessment workflow (SUMMARY)

Authors: Jesús Soler and Julia del Pozo (AQUATEC).

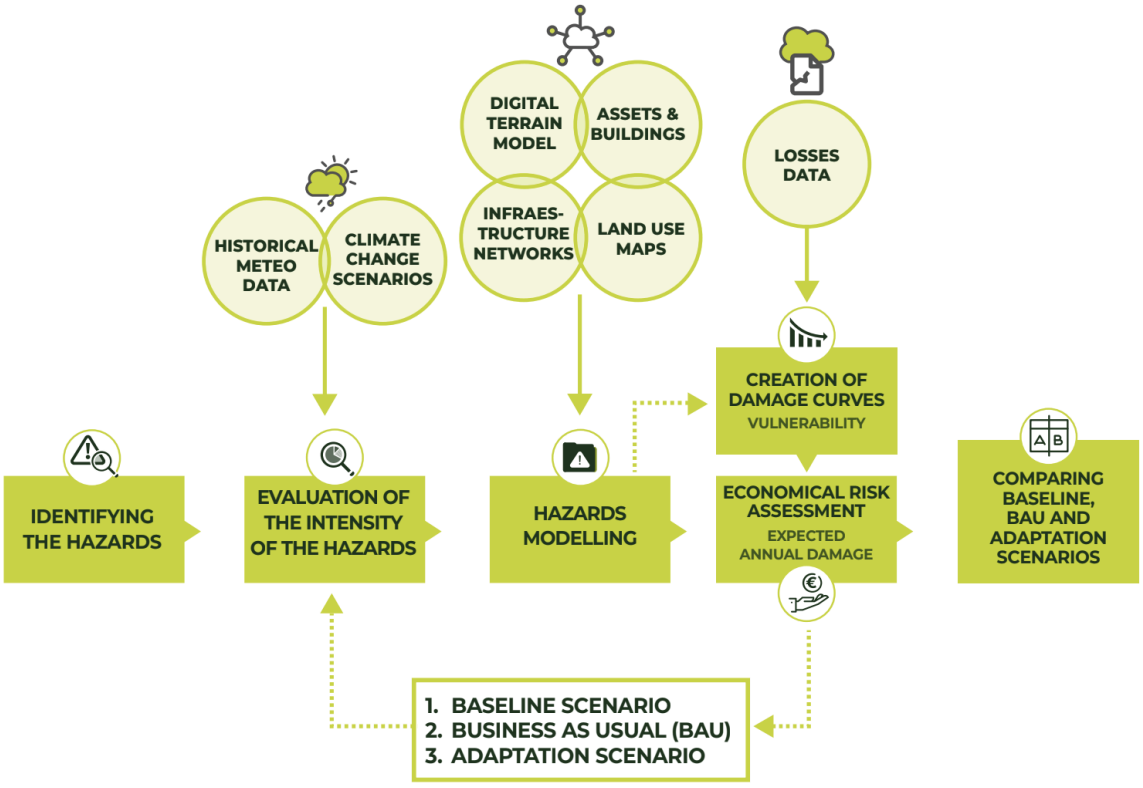
Executive summary

Climate risk assessment provides the scientific and economic basis for identifying priority adaptation actions and evaluating their cost-effectiveness. The process combines hazard modelling from historical and future climate data with exposure, vulnerability, and insurance loss data to generate damage curves and calculate Expected Annual Damage (EAD), enabling comparison between Business as Usual and adaptation scenarios.

A key limitation is the scarcity and low quality of historical loss data, especially for high-impact, low-frequency events. The SOTERIA risk assessment guidelines therefore emphasize the IPCC hazard–exposure–vulnerability framework, the use of Shared Socioeconomic Pathways, and stronger collaboration and data sharing between public authorities and the insurance sector to improve modelling and support resilient decision-making.

Risk assessment is a fundamental process for climate adaptation planning because it enables the identification of priority areas and evaluates the cost-effectiveness of various intervention strategies against growing threats. By providing a scientific evidence base, it allows stakeholders like municipalities and insurers to assess potential adverse consequences under different socioeconomic scenarios, which is crucial for making robust decisions and protecting vulnerable systems.

Figure 10: Risk assessment workflow, Source : Jesus Soler (AQUA)



According to the sources, this evaluation follows a structured workflow (figure 9) that begins with **identifying the primary hazard** and assessing its intensity through historical meteorological data and future climate projections. Once the hazard is modeled and calibrated, these values are integrated with exposure and vulnerability data—specifically by cross-referencing them with insurance sector loss data—to **create damage curves**. This process leads to the calculation of **Expected Annual Damage (EAD)**, allowing for a direct comparison between "Business as Usual" (BAU) scenarios and those incorporating adaptation measures to quantify their economic damage reduction capacity.

Within this framework, the **importance of loss** data is paramount, as it serves as the fundamental input required to validate models and construct accurate damage curves that reflect real-world economic impacts on assets. Currently, the **scarcity and low quality of historical loss data** represent a significant hurdle, as they limit the predictive accuracy of actuarial models regarding high-impact, low-frequency events. Therefore, enhanced collaboration and **data sharing of losses** between public administrations and the insurance sector are essential to develop truly effective and transferable climate resilience strategies.

Quote : The importance of loss data is paramount, as it serves as the fundamental input required to validate models and construct accurate damage curves that reflect real-world economic impacts on assets. Currently, the scarcity and low quality of historical loss data represent a significant hurdle, as they limit the predictive accuracy of actuarial models regarding high-impact, low-frequency events.

Step 2.2 presents the methodology developed regarding the losses data, its harmonization, and the proposed ontology to include these data in the climate risk assessment.

2.1.2. Risk assessment guidelines (VIDEO)

Communities of Practice // Episode 5 // Risk Assessment Guidelines by Jesus Soler

Description

This video is part of the SOTERIA Communities of Practice. In this session, Jesus Soler from AQUATEC presents the Risk Assessment Guidelines.

Climate-related risk assessment is a foundational tool for adaptation planning because it provides a scientific evidence base for identifying priority areas and evaluating the economic viability of intervention strategies against escalating threats. Developed as part of the SOTERIA project, this document establishes a robust framework that bridges climate science and practical planning to support municipalities and the insurance sector in making resilient decisions. The guidelines are grounded in a systematic literature review of 62 core publications refined from an initial dataset of 449 articles, which classified current scientific approaches into five main modeling categories, including catastrophe and actuarial models.

Key best practices identified in the sources include the universal adoption of the IPCC's hazard-exposure-vulnerability framework and the integration of forward-looking Shared Socioeconomic Pathways (SSPs) to ensure that adaptation measures remain effective under diverse future conditions. Despite these advancements, significant gaps persist, such as the critical scarcity of high-quality historical loss data for high-impact but low-frequency events, which restricts the predictive capacity of actuarial models. Furthermore, challenges remain regarding the absence of spatially explicit hazard values for individual events and the lack of institutional partnerships necessary for the development of accurate damage curves within the insurance sector. Addressing these hurdles requires enhanced data sharing and collaboration between public administrations and insurers to develop sophisticated modeling capabilities that account for both current vulnerabilities and evolving climate scenarios.

Box 2.- Understanding risk Perception as part of risk assessment

STEP 2 is dedicated to refining the objective understanding of climate risk and vulnerability through structured data collection, modelling, and analytical methods. These processes are essential for establishing a robust evidence base for adaptation planning and insurance design.

However, SOTERIA case studies demonstrate that objective risk estimates do not automatically translate into local action. Very often there is a measurable gap between statistically assessed risk and how risk is perceived by local stakeholders. Risk is often underestimated, normalised due to past experience, or interpreted as unlikely to result in significant personal impact.

Because behavioural responses are shaped primarily by perceived rather than objective risk, this divergence has practical implications. Insurance uptake, preventive investment, and policy prioritisation depend on how risk is understood at household, business, and municipal levels. Where perceived risk is significantly lower than modelled risk, implementation of adaptation measures may face inertia or limited engagement.

For this reason, risk assessment under STEP 2 should incorporate a structured analysis of risk perception. This includes identifying how different stakeholder groups interpret climate hazards, what information sources they rely on, and where systematic misperceptions or optimism biases may exist. Comparing perceived and modelled risk levels provides an additional diagnostic layer, revealing potential barriers to implementation that are not visible in quantitative datasets.

Data-driven visualisation tools, scenario simulations, and spatial representations can support this process by making projected impacts more tangible and locally relevant. Integrating perception analysis strengthens the assessment phase by ensuring that technical findings are interpreted within the behavioural context in which decisions will be made.

Practical Implications for RAST Implementation

- Identify any relevant input from stakeholders gathered at STEP 1 that may reveal risk perceptions.
- Include targeted questions on risk perception in stakeholder interviews and surveys during STEP 2.
- Compare perceived risk levels with modelled hazard and loss projections to identify significant gaps.
- Identify stakeholder groups where underestimation of risk may hinder insurance uptake or preventive action.
- Use high-resolution visualisations and scenario-based tools to communicate projected impacts in accessible formats.
- Document perception gaps explicitly, as they may inform communication strategies and policy design in subsequent RAST steps.

2.2. Identify data sources relevant for climate risk and vulnerability analysis

About

Substep 2.2 provides guidance to identify and map the datasets required for climate risk and vulnerability analysis, covering hazard, exposure and vulnerability data, and where possible, impacts and loss data. It helps practitioners document who holds the data, under what access conditions it can be used, and what gaps or limitations may constrain the assessment of protection gaps and the development of insurance-based adaptation solutions.

RAST alignment

Supports RAST Step 2.2 Identifying risks and Step 2.3 Assessing climate risks.

Substep inputs

- [GUIDE] Guide to complete the data-mapping template.
- [TEMPLATE] Data mapping template.
- [EXAMPLES] Examples and summary. insights from the SOTERIA case studies.

Linked deliverables and other materials

- [PPT] Soteria Pilot regions - European risk typology.
- [Milestone 2.1] Data recording, collection and sharing methods.
- [D1.3] Recommendation for developing regional data hubs: Mechanisms, challenges, and best practices for climate-related risk and loss data integration. on regional data hubs.
- [POLICY BRIEF] Building Resilient Regions Through Better Climate Risk Data.
- [PODCAST] : Insurance loss data as a tool for climate resilience - Insuring tomorrow's world : with Nicolas Jeanmart (Insurance Europe).

2.2.1.Data mapping guide (GUIDE)

Authors: Kristian Stenerud Skeie, Eli Sandberg, Christine Roxanne Hung and Luis Caetano (SINTEF)

Executive summary

The data mapping guide, available here, provides a structured procedure for identifying, documenting and evaluating datasets required for climate risk and vulnerability analysis within a defined geographic area (e.g., municipality, region or watershed). Rather than only listing available information, the mapping establishes a documented evidence base describing what data exists, who maintains it, how it can be accessed, and whether it is fit for use in risk assessment and insurance-relevant analysis.

At present, the mapping is carried out manually because relevant datasets are distributed across multiple institutions and portals and are not consistently described. The template therefore functions as a harmonised inventory.

Its structure follows EU metadata practices (GeoDCAT-AP), enabling future automated discovery through standardised APIs and data portals once providers expose compliant metadata. For risk datasets, complementary guidance can be drawn from domain-specific

initiatives such as the Risk Data Library Standard (https://docs.riskdatalibrary.org/).

Data mapping also underpins the development of climate risk data hubs. In practice, such hubs combine metadata catalogues with data services and documentation to help users locate, interpret and apply datasets. The template can therefore be understood as a minimal operational model for a regional climate risk data hub: a catalogue describing relevant datasets, their quality and how they can be used together. In this way, the mapping provides the foundation for analytical services supporting Risk and Vulnerability Assessments (RVA) and Climate Risk Assessments (CRA), where multiple datasets are combined to evaluate exposure, sensitivity and adaptive capacity across an area.

From data mapping to data hubs and analytical services

The principles behind this template can be implemented in spatial analysis services that run on-demand analyses for a user's selected area (e.g., parcel, plan boundary, municipality), e.g. using OGC API-Processes. In these settings, datasets are processed, compared, and visualized to support decision-making for a local area. Typical capabilities include:

- combining hazard, exposure and vulnerability layers from multiple sources,
- identifying intersections between hazards and exposed assets,
- estimating impacts or historical losses for selected areas and scenarios,
- assessing whether available datasets are complete and reliable for the specific analysis.

Coverage and quality indicators are particularly important. Local maps showing where data are complete, partial or not applicable should accompany analytical outputs so that uncertainty and limitations are transparent to users. Coverage information should therefore distinguish between:

- **Fully mapped areas**: complete and reliable data coverage
- **Partially mapped areas**: incomplete coverage requiring caution or supplementary information
- **Not relevant/outside distribution**: the hazard or phenomenon does not occur in the area

Metadata and coverage information should therefore be presented alongside analytical outputs, not only during data discovery. This reduces the risk of misinterpretation and clarifies limitations. The template therefore includes recommended metadata fields and practical fit-for-purpose criteria, including completeness, spatial accuracy, temporal validity, thematic accuracy, accessibility/interoperability.

Documentation requirements for the template

Background (exposure) data

Datasets describing terrain, hydrography, land cover, soils, buildings and critical infrastructure should be documented individually to preserve traceability and allow independent evaluation of their quality and coverage. Additional datasets that exist from multiple national or regional sources can be added as needed.

Risk data

Each hazard dataset (e.g., flood, landslide, heat, coastal flooding, wind, wildfire or snow/ice) should be recorded separately. For each dataset, document spatial coverage, quality indicators and references to any available coverage or validation layers.

Loss data

Loss datasets should include classification of loss type and aggregation level (asset, grid, post code, municipality, county or national) together with notes on anonymisation, privacy or access restrictions. Different typologies may be used (e.g., national classifications or GED4All/OSM-based approaches), but the reporting structure should be clearly documented.

Wish list

The template also contains a section to record missing but relevant datasets. For each entry, users may document the intended use, desired spatial or temporal resolution, potential source or owner, barriers to access and relative priority.

The completed templates therefore serve two purposes. First, they provide an inventory of datasets that can support risk assessment. Second, they reveal practical constraints related to accessibility, metadata quality and data governance. The aggregated findings from the case studies are analysed in Section 2.2.2.

2.2.2. Data mapping results analysis from the SOTERIA case studies (EXAMPLE)

Authors: Kristian Stenerud Skeie, Eli Sandberg, Christine Roxanne Hung and Luis Caetano (SINTEF)

Executive summary

The data mapping exercise provides an overview of what climate-relevant datasets the SOTERIA partner regions actually have access to and use in practice, and therefore what can realistically support climate risk and vulnerability assessment and insurance-related analyses.

Across the case studies, datasets could be identified in all three categories (background, hazard/risk and loss data), but with clear differences in maturity and usability.

Background (exposure) data

Detailed exposure-related information is generally available at municipal or national level, especially data on buildings, land use and infrastructure. These datasets form a usable basis for analysing climate vulnerability. However, accessibility varies significantly between countries and organisations. The differences observed between regions broadly follow national Open Data Maturity levels: in some cases data are openly available and reusable, while in others they exist but are difficult to discover or access. Harmonised publication of cadastral and building data (e.g., INSPIRE-aligned services and the Open Maps For Europe Initiative) represents emerging best practice because it allows consistent cross-regional analysis of authoritative information.

Hazard and risk data

All partner regions reported publicly available flood-related datasets, making flooding the most consistently analysable hazard across the case studies. In contrast, national or regional datasets for other hazards (e.g., landslides, wildfires and extreme weather) are less consistently available. Where hazard datasets exist, best practice is to provide several risk levels or return periods and clearly define the spatial extent and scenario assumptions, which improves their usefulness for risk assessment and adaptation planning.

Loss data

Loss data is the most limited dataset category. Where available, it is typically aggregated at regional and municipal scale (or to post codes) and therefore difficult to link to specific exposed assets. A notable best-practice example is Norway, where insurance companies share address-level loss data with municipalities under controlled conditions. In other regions, compensation information may exist through public statistics (e.g., disaster compensation from government or EU sources), but these datasets remain fragmented and not standardised.

Implications

Although many datasets exist, the mapping revealed that data catalogues often lack sufficient metadata aligned with DCAT-AP requirements (coverage, resolution, legal access conditions). Consequently, significant manual investigation was required to understand dataset scope and applicability. The mapping also highlighted an “awareness gap”: regions sometimes reported only datasets they actively use, even where additional relevant data likely exists but is insufficiently discoverable.

The main limitation for risk assessment is therefore not only data availability but data

accessibility, standardisation and governance. In particular, the lack of detailed loss records constrains validation of damage estimates and identification of protection gaps. Nevertheless, robust exposure and hazard datasets may partially compensate for data gaps through modelling approaches, including satellite-based damage estimation and simulation using elevation, terrain and building characteristics combined with loss estimates from national analytical tools for cost-benefit and damage assessment.

The mapping therefore shows that the primary constraint for insurance-relevant risk assessment is not the absence of data, but the inability to consistently combine datasets across institutions and scales. Exposure, hazard and compensation information are produced and maintained by different actors, using different classifications, aggregation levels and access regimes. In practice this prevents systematic linkage between a hazard event, the affected asset and the resulting economic loss, which is required for model validation, damage estimation and identification of protection gaps.

2.3. Climate risk and loss data: Establishing frameworks for consistent data collection, structuring, sharing and visualisation

About

Substep 2.3 provides guidance on improving the consistency and usability of climate risk and loss data through better recording, structuring, sharing and visualisation. It addresses practical issues such as interoperability, governance and access constraints, and the harmonisation of loss data to support risk assessment and protection-gap analysis. The substep also introduces two software prototypes: (1) a prototype developed and tested using Norwegian data, demonstrating how harmonised historical loss data can be analysed and visualised to support municipal planning and climate risk management; and (2) a prototype developed and tested in Valencia, focusing on forward-looking surface flood risk assessment and the prioritisation of mitigation measures.

RAST alignment

This substep supports RAST Step 2.3 (assessing risks) by improving the usability and consistency of climate risk and loss data needed for analysis and communication, particularly in insurance-relevant contexts.

Substep inputs

- [GUIDE] Best practices for data recording / collecting / sharing.
- [SUMMARY] Framework to structure economic loss data.
- [SUMMARY] Presentation of a prototype for an ontology-driven visualisation.
- [EXAMPLE] Valencia surface-flood risk platform prototype.

Linked deliverables and other materials

- [D2.3] Guidelines on loss data.
- [WEB PAGE] Online published Ontology.
- [D2.4] Software Prototype.
- [PPT] Visualisation prototype for economic loss data.
- [PPT] Valencia surface-flood risk platform prototype.

2.3.1. Best practices for data recording/collecting/sharing (GUIDE)

Authors: Kristian Stenerud Skeie, Eli Sandberg, Christine Roxanne Hung and Luis Caetano (SINTEF)

Executive summary :

This section describes best practices for recording, storing and sharing data so that Risk and Vulnerability Assessments (RVA) and Climate Risk Assessments (CRA) can be carried out using consistent and usable information. The focus is on enabling secure, standardised, and interoperable exchange across insurers, public authorities, and other parties, while respecting confidentiality and legal constraints.

The data mapping results presented in substep 2.2 show that the main limitation to operational

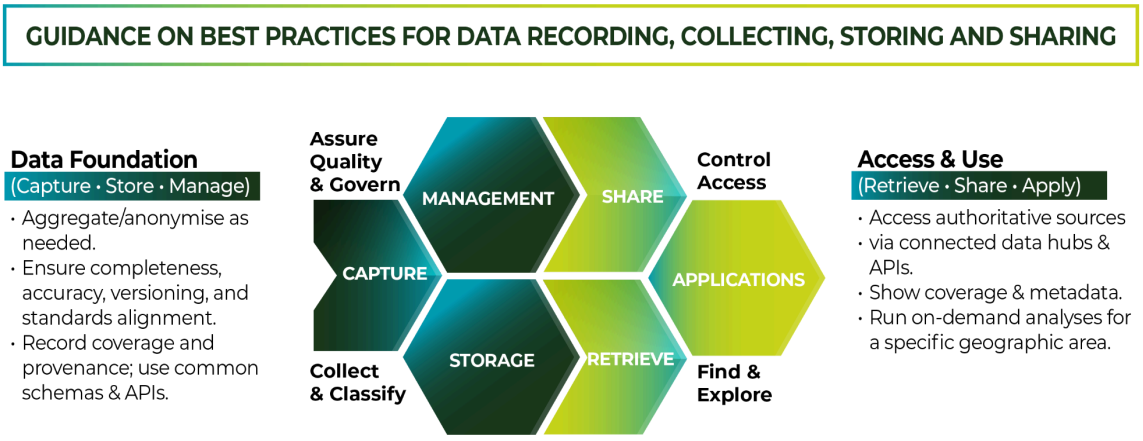
climate risk assessment is not the absence of datasets, but the difficulty of accessing, combining and interpreting information that already exists. Relevant data are distributed across institutions and recorded using different definitions, formats and aggregation levels. As a result, hazard information, exposure data and observed impacts cannot be systematically linked. Since risk modelling requires connecting these elements, data recording and sharing practices become part of the analytical workflow rather than a separate administrative activity.

Because loss information is typically held by different organisations and subject to access restrictions, reliable model validation depends on structured and trusted data-sharing arrangements.

The data lifecycle: foundation and use

We have to distinguish between two complementary components of the data lifecycle, namely the **data foundation** and the **use of data in the assessment** (see Figure 11). The data foundation concerns how datasets are captured, structured and maintained so they can be reused and combined. The access and use component concerns how stakeholders retrieve, interpret and apply the information in risk assessment and decision-making.

Figure 11: Conceptual data lifecycle for climate risk assessment
distinguishing the data foundation (capture, storage and management) from access and use in analysis and decision-making.



Building a reliable data foundation

The first requirement is to ensure that datasets are fit for reuse. Sensitive information should be anonymised or aggregated where necessary, while maintaining sufficient detail for analysis in controlled environments. Datasets should be maintained with completeness, accuracy, versioning and standards alignment. Critically, each dataset should record spatial coverage and provenance so that limitations are explicit.

Using common schemas and APIs at this stage reduces downstream integration costs and

improves comparability across regions, hazards and institutions. Where feasible, a higher degree of automation, through data pipelines, scheduled updates and standardised processing helps ensure datasets remain current and reduces the operational burden of maintaining them.

A robust data foundation also enables enrichment and validation by combining multiple sources. Cross-checking economic loss records against exposure inventories, aligning asset attributes across registers, or reconciling loss observations with event footprints is only possible in a systematic way when asset-level insurance loss data can be analysed in controlled environments. At the same time, public dissemination often requires aggregation. A practical approach is therefore to maintain multiple access layers: a restricted layer for detailed analysis and validation, and a public layer that provides aggregated indicators and mapped outputs.

Access, sharing and operational use

Effective risk assessment also depends on being able to retrieve and apply data reliably. Users should be able to access authoritative sources via connected data hubs and APIs, discover datasets efficiently, and interpret outputs with clear signals on metadata and coverage. Where possible, services should support on-demand analyses for a defined geographic area, so stakeholders can move from data discovery to actionable assessment without bespoke processing each time.

Because asset-level loss information is sensitive and held by different actors, governance and legal arrangements form part of an analytical infrastructure. Governance establishes stewardship, quality assurance and shared practices: so roles, quality checks and update cycles are clear, and communities of practice can sustain capability over time.

Legal and policy alignment ensures compliant and trusted exchange, including GDPR considerations, appropriate safeguards (e.g., DPIAs where needed), and data-sharing agreements that define permitted uses, licensing, access conditions and retention.

Technical implementation translates these requirements into interoperable architectures with controlled access, where public aggregated layers can be shared broadly while detailed loss data is protected through access control, secure environments and well-defined APIs.

Implications for economic loss data

Economic loss data, including insurance loss data where available, is especially valuable for hotspot detection, model validation and targeted adaptation design. However, this is also the domain where interoperability challenges frequently arise. Losses are recorded by many actors using different definitions, formats, and reporting practices, making it difficult to integrate data across regions, event types, or time periods. These inconsistencies reduce the reliability of damage estimates and hinder the construction of robust damage curves.

Linking hazard events to a specific affected asset and its economic consequence is often challenging using conventional data management approaches. This creates a clear need for a shared semantic structure capable of consistently linking assets, damages and claims across datasets, which is the motivation for the ontology-based integration framework introduced next.

2.3.2. Structuring economic loss data for Climate Risk Assessment (SUMMARY)

Authors: Luis Caetano, Kristian Skeie, Reidar Kind (SINTEF) and Paul Eberlein (G&Co).

Executive summary

Reliable economic loss data is a cornerstone of climate risk assessment, adaptation planning, and disaster risk reduction. Public authorities, insurers, researchers, and infrastructure operators all depend on loss information to understand vulnerabilities, evaluate past events, and design future risk mitigation measures. In practice, however, economic loss data is difficult to use in a consistent and integrated way.

Loss data is collected by many different actors, each with distinct mandates and reporting requirements. Insurance companies record claims at asset level, focusing on compensation and coverage. Municipalities and national authorities often work with aggregated figures to support spatial planning and compliance reporting. Research institutions develop hazard and impact datasets for modelling purposes. As a result, economic loss data varies widely in structure, terminology, spatial resolution, and temporal reference. Even basic concepts such as *damage*, *loss*, *event*, or *asset* may be defined differently across datasets. This heterogeneity makes it difficult to combine sources, trace losses back to specific hazard events, or compare impacts across regions and time periods.

Traditional data management approaches struggle with these challenges. Relational databases require rigid schemas that are costly to adapt as new data sources or classifications are introduced. Data lake approaches allow more flexibility but often lack clear semantic definitions, leading to ambiguity, inconsistent interpretation, and reduced analytical value. In both cases, the meaning of the data is frequently documented outside the system, relying on human interpretation rather than machine-readable structures. This limits interoperability, transparency, and reuse.

From fragmented data to shared meaning

To overcome these limitations, economic loss data needs to be structured around a shared conceptual model that explicitly defines what is being described and how different elements relate to each other. This includes clear representations of:

- Natural hazard events and their types,
- Exposed assets such as buildings, infrastructure, and agricultural land,
- Damage instances affecting those assets,
- Insurance claims and compensation outcomes,
- Spatial and administrative contexts.

An ontology provides such a model. In this context, an ontology is a formal, machine-readable description of domain concepts and their relationships. It does not store the data itself, but defines the semantic framework that gives data its meaning. By aligning heterogeneous datasets to a common ontology, information from different sources can be interpreted consistently, linked automatically, and queried across traditional boundaries.

The SOTERIA Ontology

The SOTERIA Ontology was developed to address the specific challenge of structuring climate-related economic loss data, with a particular focus on insurance-based information. Its purpose is to provide a standardized semantic framework that connects hazards, assets, damages, and claims within a single, coherent model. Rather than treating loss figures as isolated numbers, the ontology embeds them in their full context: which asset was affected, by which hazard, when, where, and with what economic consequence.

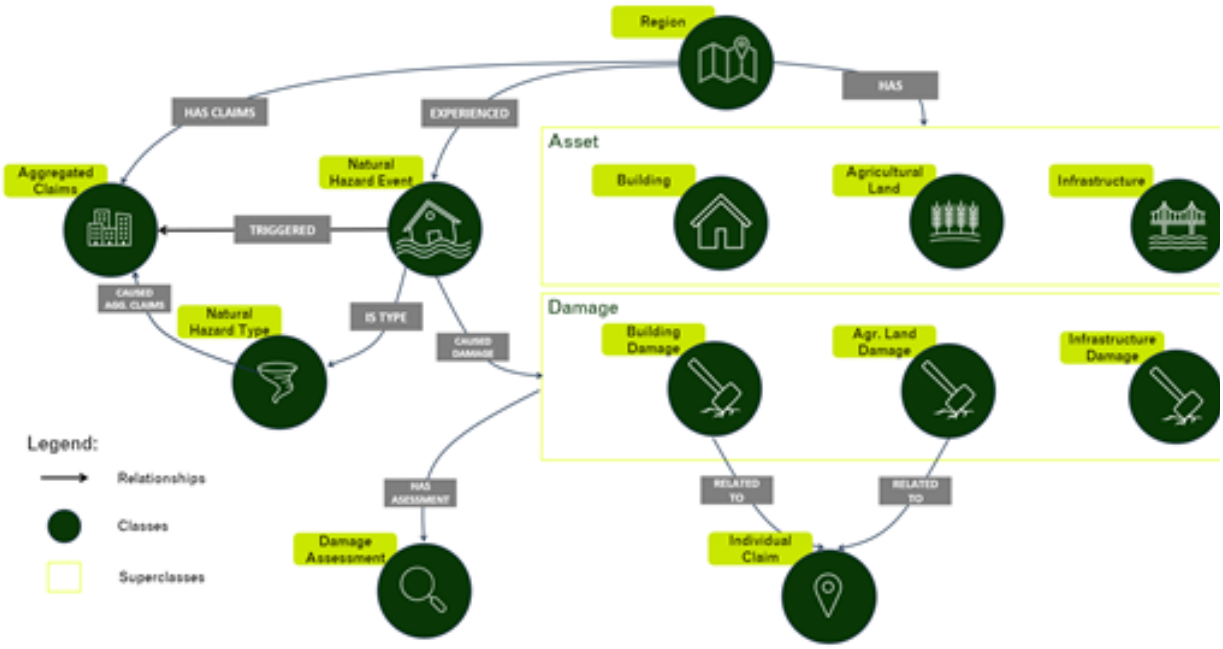
Key characteristics of the SOTERIA Ontology include:

- **Explicit semantics**: Core concepts such as assets, damages, hazard events, and claims are clearly defined and formally related.
- **Interoperability**: The ontology aligns with European risk governance frameworks, enabling integration with external systems and reporting platforms.
- **Traceability and provenance**: Data sources and assessment details can be captured directly in the model, supporting transparency and validation.
- **Scalability**: New hazard types, asset categories, or loss metrics can be added without restructuring existing data.

By using the ontology as the backbone for data integration, economic loss information from insurers, authorities, and research institutions can be combined into a unified, queryable knowledge base. This approach supports advanced analysis, consistent aggregation, and evidence-based decision-making, while reducing ambiguity and manual reconciliation effort.

An overview of the SOTERIA Ontology is shown in figure 12, and a detailed description can be found in the report [D2.3] Guidelines on loss data, available here. The ontology is also published online at https://soteria-public.pages.sintef.no/soteria_ontology_documentation/, where users can access documentation with clear definitions of all ontology entities and download RDF/Turtle (.ttl) files for direct import into graph databases such as Neo4j or GraphDB. This supports seamless integration into Semantic Web technologies, enabling advanced querying, reasoning, and linked data applications.

Figure 12: SOTERIA Ontology overview.



2.3.3. Visualising economic loss data for risk insight and decision support (SUMMARY)

Authors: Luis Caetano, Kristian Skeie, Reidar Kind (SINTEF) and Oihana Luque (ICATALIST).

Executive summary

Visualisation plays a critical role in transforming economic loss data into actionable knowledge. While structured and harmonised data provides the foundation for analysis, it is through visual representations that patterns, trends, and anomalies become accessible to decision-makers. For climate adaptation, disaster risk reduction, and insurance analysis, effective visualisation is essential to support understanding across technical and non-technical audiences alike.

Economic loss data is inherently multi-dimensional. Each loss record may be associated with a hazard type, a specific event, an asset, a geographic location, a time period, and a monetary value. When these dimensions are examined in isolation, such as through static tables or summary statistics, important relationships are often obscured. For example, aggregated national loss figures may conceal local hotspots of recurring damage, while time-series plots without spatial context may fail to reveal exposure-driven patterns. Poorly designed visualisation can therefore limit insight, misrepresent risk, or lead to suboptimal decisions.

Challenges in visualising economic loss data

Visualising loss data presents several recurring challenges. First, scale and granularity vary widely. Stakeholders may need to move seamlessly between national summaries, regional comparisons, and asset-level details, while maintaining consistency in interpretation. Second, heterogeneity of data sources complicates visualisation. Differences in definitions, units, and aggregation rules can result in misleading comparisons if not handled carefully. Third, contextual information, such as hazard exposure, asset characteristics, or administrative boundaries, is often stored separately from loss figures, making it difficult to visualise causal relationships between hazards and impacts.

Traditional dashboard solutions typically rely on pre-aggregated datasets and fixed indicators. While useful for reporting, these approaches limit exploratory analysis and make it difficult to answer *ad hoc* questions, such as how losses vary with distance to hazard zones, building characteristics, or exposure metrics. Moreover, when the underlying data model lacks explicit semantics, visualisations depend heavily on custom queries and manual interpretation, increasing the risk of inconsistency and error.

Semantic Foundations for Meaningful Visualisation

An ontology-driven data model addresses many of these challenges by embedding meaning directly into the data structure. When economic loss data is organised according to explicit semantic relationships, linking hazards, assets, damages, claims, and regions, visualisation tools can leverage these relationships to generate consistent and interpretable views of the data.

In a semantic framework, visualisations are not built on isolated tables, but on connected entities within a knowledge graph. This enables:

- **Consistent aggregation**, as losses can be summed or grouped along well-defined dimensions such as hazard type, region, or asset category.
- **Multi-dimensional filtering**, allowing users to explore how losses change across space, time, exposure, and asset characteristics.
- **Traceability**, where aggregated figures can be drilled down to underlying damage instances or claims.
- **Comparability**, ensuring that visual outputs align with standardized definitions and reporting frameworks.

By grounding visualisation in an ontology, the logic behind charts, maps, and indicators becomes transparent and reproducible. This is particularly important in regulatory and policy contexts, where results must be explainable and defensible, as well as making it more accessible and comprehensible for non technical experts.

Ontology-Driven Visualisation

Within the SOTERIA project, the ontology defines the concepts and relationships that govern how data can be grouped, filtered, and compared, while the knowledge graph enables efficient querying across these relationships. A prototype for a visual interface was built on top of this to support interactive exploration of economic loss data, allowing users to move between spatial, temporal, and thematic perspectives without redefining the underlying data logic.

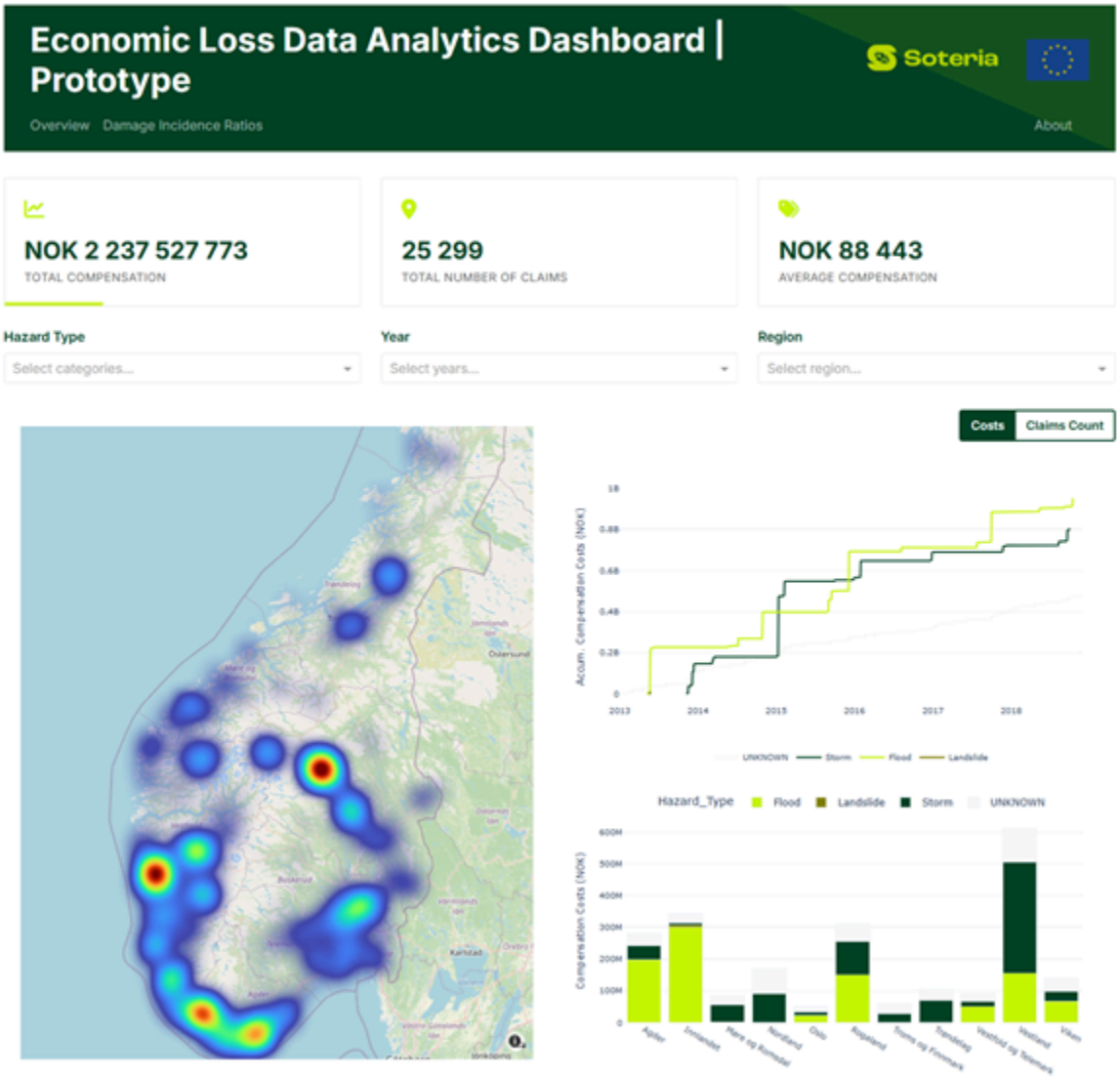
Typical visualisations supported by this approach include:

- Spatial maps highlighting loss hotspots and exposure patterns,
- Time-series views showing cumulative or event-based losses,
- Comparative charts by hazard type, region, or asset characteristics,
- Summary indicators that remain consistent across scales.

For users, this means that visual insights are directly linked to the underlying data semantics, reducing ambiguity and increasing confidence in the results. For system designers and analysts, it ensures that visual outputs remain aligned with the conceptual model and can evolve as new data sources or analytical needs emerge.

The prototype for visualising economic loss data, including its architecture, functionality, and analytical capabilities, is introduced in a separate document, which provides a detailed overview of the system design and user interface: SINTEF_videos_demo_interface_prototype_loss_data.pptx. Figure 13 shows the prototype dashboard for exploring Norwegian loss data, combining high-level indicators, spatial hotspots, temporal accumulation and regional breakdowns in a single view.

Figure 13: Overview of economic losses related to natural hazards.



2.3.4 Practical example for surface flood risk assessment and risk mitigation (EXAMPLE)

Authors: Caterina Gilli, Stefano Balbi (BC3) and Ghazal Moghaddam (Mitigrate)

Executive summary

Historical loss data helps to understand past impacts, but for instance municipalities/regions also need predictive, forward-looking tools to assess future flood risk and design targeted prevention strategies. To address this need, a prototype of an Integrated Flood Risk Platform was developed and applied to the city of Valencia. More information can be found in the report [D2.4] Software Prototype, available here.

The prototype demonstrates how high-resolution hazard modelling, exposure data, and vulnerability indicators can be combined into a single, operational decision-support system. Although the implementation focuses on a 20-year return period flood scenario in Valencia, the methodology is intentionally modular and transferable. With appropriate local datasets, the same approach can be implemented in other cities and regions.

The goal of the framework is to help practitioners move from traditional flood hazard mapping toward integrated flood risk management. Conventional flood maps typically describe where flooding may occur, but they rarely explain how flooding affects individual buildings, people, and infrastructure, or how risks can be reduced in practice. The proposed prototype closes that gap by linking:

- Flood hazard modelling
- Property-level vulnerability assessment
- Population risk analysis
- Identification of mitigation and adaptation measures

The result is a workflow that transforms flood hazard data into actionable risk information that supports planning, prevention, and investment decisions.

Modular Structure of the Prototype

The prototype is organised into two complementary risk modules that can be replicated independently or together depending on local needs and data availability.

A) Infrastructure and Property Flood Risk
This module assesses how surface water flooding interacts with the built environment at building level. Instead of providing a single generic risk score, the methodology identifies four distinct physical mechanisms of flood impact:

- Runoff risk
- Basement flooding risk
- Obstruction risk
- Inundation risk

By distinguishing between these mechanisms, the framework enables a more realistic

understanding of flood behaviour and supports the selection of targeted risk mitigation measures.

B) Risk to People (Pedestrian Safety)
This module evaluates how floodwaters may affect population safety in public spaces. It combines flood hazard depth with social vulnerability indicators such as age distribution, population density, and demographic characteristics to identify areas where citizens may face increased risk during flood events.

Together, these modules provide a comprehensive assessment of risk to assets and people, forming the basis for an integrated urban flood risk management plan.

From Risk Assessment to Risk Reduction

A central principle of the methodology is that risk assessment should directly support practical prevention and adaptation. The prototype therefore includes procedures for:

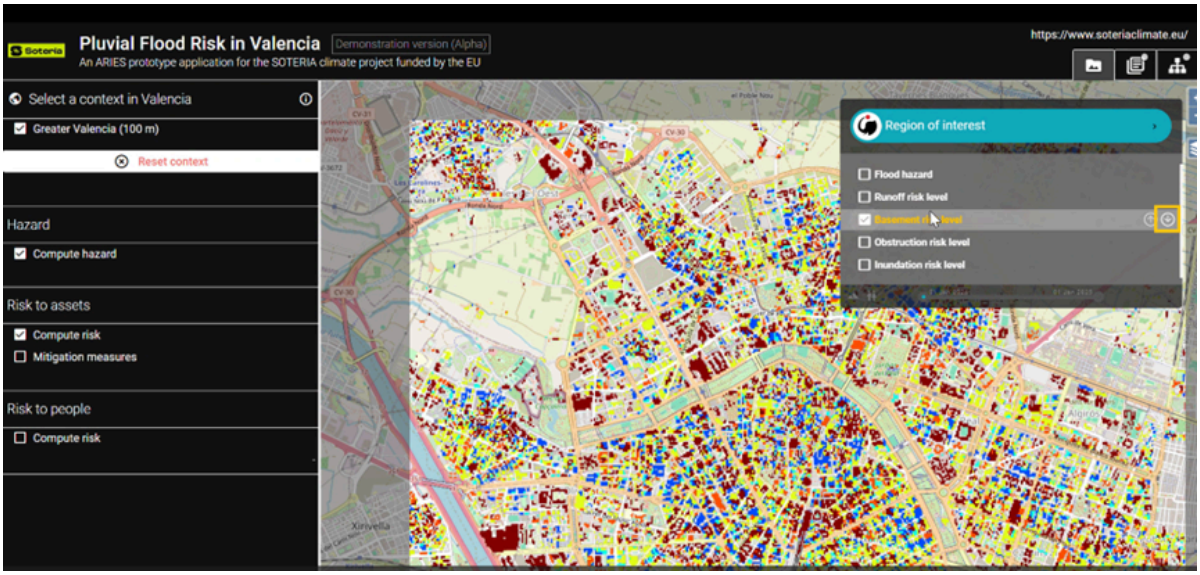
- Identifying suitable risk mitigation measures for each property,
- Sizing and costing those measures,
- Prioritising interventions across a city or portfolio.

This ensures that outputs can be used directly by municipalities, insurers, planners, and infrastructure managers without requiring additional interpretation.

A Transferable Decision-Support Workflow

The prototype is implemented as a web-based geospatial application as shown in figure 12 and demonstrated in detail here, that dynamically assembles modelling workflows and provides transparent access to intermediate results. The system is designed around openness, reproducibility, and interoperability so that it can be adapted to different regions and datasets.

Figure 14: Layers in the web-app with the download button highlighted in yellow.



Step 2 Completion Checklist

Use this checklist to confirm that your region is ready to move from risk assessment (Step 2) to identifying suitable insurance solutions (Step 3).

Area	Key question	Verified
Risk assessment scope	Have we defined the scope and approach for assessing climate risks and vulnerabilities relevant to innovative insurance solutions?	☐
Risk assessment level	Have we applied a clear process for analysing climate risks based on hazard, exposure and vulnerability?	☐
Data identification	Have we identified and documented available datasets on hazards, exposure, vulnerability and impacts/losses?	☐
Data availability	Have we assessed whether relevant data are accessible and usable for insurance-relevant analysis?	☐
Data gaps	Have we identified key data gaps or limitations that may affect the assessment of protection gaps?	☐
Loss data	Have we reviewed available loss data and explored options for improving consistency or standardisation where needed?	☐
Risk results	Have we identified the main climate-related risks affecting sectors, assets or communities in the case-study area?	☐
Protection gaps	Have we identified protection gaps that could be addressed through innovative insurance solutions?	☐
Stakeholder validation	Have risk and data findings been discussed with relevant stakeholders or data providers?	☐
Step 3 readiness	Are results sufficiently clear to support the identification of suitable insurance-based adaptation solutions in Step 3?	☐

STEP 3: IDENTIFY SUITABLE INSURANCE SOLUTIONS

Understanding RAST Step 3 "Identifying adaptation options"

In the RAST adaptation planning cycle, Step 3 focuses on identifying potential adaptation options that address the priority risks identified in Step 2. At this stage, regions explore broad potential responses, drawing on existing practices, experiences from other regions, and innovative approaches across sectors.

The aim is not yet to choose final solutions, but to build a structured catalogue of candidate options that can later be assessed and selected. This helps ensure that decision-makers consider multiple pathways before committing to a specific strategy.

Typical outputs include a catalogue of adaptation options, documentation of good practices, and an initial understanding of feasibility and implementation barriers that will guide the selection process in Step 4.

Skipping Step 3 often leads regions to jump from risk assessment directly to a preferred solution, without exploring alternatives. This can result in choosing options that are ineffective, too costly, or difficult to implement.

About

Step 3 helps practitioners move to the identification of potential insurance-based adaptation options. It therefore builds on risk and protection-gap assessment from Step 2.

It introduces the main types of innovative insurance solutions. Users can explore the multiple ways in which insurers can support climate change adaptation, by:

1. targeting a higher insurance penetration,
2. incentivizing risk reduction with the policy holders,
3. incentivizing and cooperating with governmental entities.

Examples of emerging and best-practice innovative insurance solutions are given, together with the implementation pathway of several insurance solutions in the project's case studies which are described.

This section also presents the tangible and intangible barriers to the implementation of climate adaptation via insurance.

Objectives

The objective of this step is to help regions and local authorities or other interested actors to identify existing insurance solutions that can lead to innovation and support climate change

adaptation through insurance in their region. Practitioners can also learn about potential tangible and intangible barriers that can be encountered during the implementation of insurance solutions.

RAST alignment

This step aligns to RAST Step 3: Identifying adaptation options which is divided in 2 parts : Identifying adaptation options (3.1) and taking inspiration from good adaptation practices (3.2). It builds upon the work done in Step 2 ("Assessing climate change risks and vulnerabilities")

In this Manual, substeps 3.1 and 3.2 correspond to these two RAST components. Substep 3.3 goes further by identifying key barriers (tangible and behavioural) that affect feasibility and uptake. This helps practitioners avoid proposing options that cannot be implemented in practice and prepares the ground for the option selection and design process in Step 4.

Step 3 substeps

- **Substep 3.1 (RAST Step 3.1)**: This substep provides a diverse range of innovative insurance solutions that can support climate change adaptation.
    - Main output : a longlist of candidate IIS options (structured using the SOTERIA typologies).
- **Substep 3.2 (RAST Step 3.2)**: This substep supports practitioners in learning from best-practice examples of insurance solutions.
    - Main output : Radar of IIS
- **Substep 3.3 (beyond the RAST framework)**: This substep helps to identify potential barriers to the implementation of insurance solutions, to prepare the ground for optimal implementation planning (Step 4).
    - Main output : a barrier profile for any territory (tangible and behavioural).

How SOTERIA tools contribute to RAST Step 3

RAST Step 3 elements	What it means (Mission level)	SOTERIA content / tools
Identify adaptation options	Explore possible responses to priority risks	Catalogue of innovative insurance solutions
Learn from good practices	Analyse examples from other regions	Best-practice radar and case-study diaries
Explore innovation pathways	Identify emerging or hybrid solutions	IIS typologies and implementation examples
Understand feasibility	Identify practical barriers early	Barrier analysis (PESTEL-COM-B)
Prepare for option selection	Build structured option set for Step 4	Solution shortlist templates

3.1. Explore innovative insurance solutions

About

Substep 3.1 introduces the different types of insurance solutions that can support climate change adaptation. It supports regional and local authorities in identifying and describing a set of potential insurance-based adaptation options that could address the protection gaps and that can be explored with stakeholders in subsequent steps with other tools and methods presented in the manual.

RAST alignment

Supports RAST Step 3.1: Identifying adaptation options.

Substep inputs

- [INFOGRAPHIC] Overview of different insurance solutions that can support climate change.

Linked deliverables and other materials

- [D3.7] Guidance on insurance pricing, product and services: Best practices and emerging insurance solutions
- [D3.1] Mapping and evaluation of best practices of insurance pricing and innovative insurance solutions (1)
- [D3.2] Mapping and evaluation of best practices of insurance pricing and innovative insurance solutions (2)
- [CATALOGUE] Catalogue of weather and climate insurance solutions (ANNEX 5.)

3.1.1. Overview of different insurance solutions that can support climate change (INFOGRAPHIC)

Authors: Maria de Vries (G&Co)

Description

We have identified a number of different types of insurance solutions that can support climate change adaptation as presented in the overview in Figure 15**.**

The solutions are grouped according to four types:

1. Product and Pricing,
2. Business Models,
3. New Data, Technology, Models,
4. Shared Resilience.

The solutions in each type work towards a slightly different set of benefits.

The benefits of the **Products & Pricing (P&P) type** include 1) increasing insurance affordability, 2) increasing insurance attractiveness, e.g. through better client contact and demand awareness, 3) development of a more resilience-oriented and innovative product palette, e.g. by increasing transparency on the value of natural assets (e.g. NBS) and sustainable practices.

The **Business Models (BM) type** benefits include 1) extra income streams (e.g. certification,

cooperations, investment in resilience bonds), 2) reduced risk or damage (prevention), and 3) increased client satisfaction, risk understanding and motivation for risk reduction (through increased service pallet).

The benefits of the **New Data, Technology, Models (DTM) type** include 1) better price differentiation and higher affordability for lower-risk-clients, 2) improvement of (early-warning and information) services and risk modelling, e.g. for a reduced parametric product's basis risk, 3) improved risk management via forward-looking hazard scenarios, and 4) increase of parametric product scaling potential.

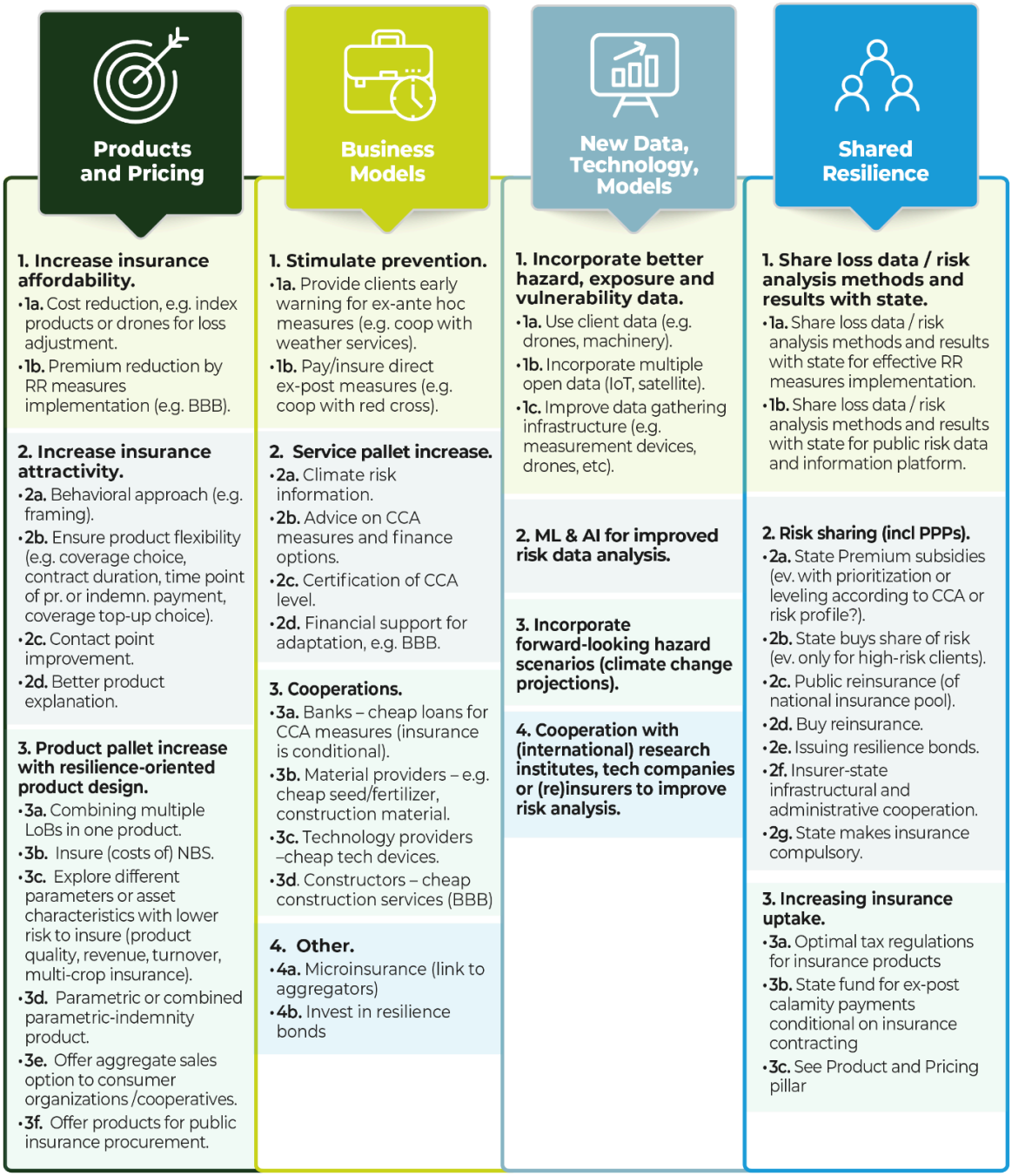
The **Shared Resilience (SH) type benefits** include 1) increased resilience and motivation for adaptation through sharing of loss data and analysis methods, 2) improved governmental citizen risk view, awareness and capacity development, 3) complete risk coverage through risk layering, and 4) increased insurance uptake.

It is important to note that, while most insurance solutions support climate change adaptation via closure of the insurance gap by increasing insurance penetration, some foster resilience to climate change by incentivizing individual risk reduction measures. In Figure 13, these include :

- In Products & Pricing (P&P)
  - Premiums reduction by risk reduction measures implementation (1b)
  - Insurance coverage for the costs of Nature-based Solutions (NbS) (3b)
  - Exploring alternative parameters or asset characteristics that reduce risk and improve insurability (e.g., product quality, revenue/turnover-based coverage, multi-crop insurance) (3b).
- In Business Models (BM):
  - Providing early warnings to enable ex-ante measures (e.g., cooperation with weather services) (1a).
  - Supporting or insuring direct ex-post response measures (e.g., cooperation with the Red Cross) (1b).
  - Offering advice on climate change adaptation (CCA) measures and financing options (2b).
  - Providing financial support for adaptation, including "build back better" approaches (2d).
  - Facilitating affordable resilient construction services (build back better) (3d).
  - Investing in resilience bonds (4b).
- In Shared Resilience :
  - Issuing resilience bonds (2e).

Cooperation mechanisms such as providing materials (e.g., affordable seeds/fertiliser or construction materials) (BM-3b) and sharing loss data and risk analysis methods and results with public authorities to support the implementation of effective risk-reduction measures (SH-1a) can foster resilience at a broader scale. They do so by enabling the insurance of the costs of natural assets (NbS) and, respectively, public risk-reduction measures. For climate change adaptation, it is important to pursue both increased insurance coverage and risk reduction.

Figure 15: Overview of different insurance solutions that can support climate change adaptation is shown, grouped according to four pillars.



3.2. Discover stories of success and failure.

About

Substep 3.2 supports learning from practices by providing examples of emerging and best-practice innovative insurance solutions.

RAST alignment

Supports RAST Step 3.2: Taking inspiration from good adaptation practices.

Substep inputs

- [SUMMARY] Short overview of emerging and best-practice insurance solutions.

Linked deliverables and other materials

- [D3.5] Radar of Success Stories of best practice insurance solutions and financial risk transfer mechanisms.
- [D3.2] Mapping and evaluation of best practices of insurance pricing and innovative insurance solutions (2).
- [CATALOGUE] Catalogue of weather and climate insurance solutions (ANNEX 5.)

3.2.1. Emerging innovations radar (SUMMARY)

Authors: Oleksandr Sushchenko and Reimund Schwarze (UFZ)

Executive summary

The RADAR is SOTERIA's structured "market watch" of innovative insurance solutions and financial risk-transfer mechanisms that can support climate adaptation, strengthening resilience while reducing the protection gap. It is designed as a communication and learning tool for regional stakeholders, bringing together concrete examples ("success stories") and the conditions that make them feasible. The RADAR shows which types of innovations exist, how they work in practice (actors, data, governance, funding),and what typical bottlenecks limit replication.

SOTERIA case studies repeatedly faced barriers that block the uptake of climate/disaster insurance (e.g., **lack of localised data**, **high premiums/affordability problems**, **low awareness and trust**, and **constraints in legal/regulatory frameworks**). RADAR was developed to help regions navigate these barriers by learning from tested approaches and emerging practices.

How was RADAR constructed ?

The RADAR was built through a screening and filtering process:

- 80 innovative climate insurance solutions were screened (see ANNEX 5.)
- 14 best practices (reported at TRL 4–6) were shortlisted for deeper analysis.
- The shortlist was further filtered using the ECB/EIOPA "ladder approach", Investment Readiness Levels (IVRL), and key Climate Resilience Dialogue drivers (data, adaptation investments, risk awareness)

The RADAR does not select "the best solution overall"; it selects solutions that are both (i) promising for reducing the protection gap and (ii) sufficiently mature/transferable to be useful for

regions.

In summary, the following features of best insurance solutions have been identified: rapid and fair payouts; inclusivity and accessibility; promoted improved resilience; alignment with sustainability criteria; facilitate access to private and public sustainable finance

The four RADAR "families"

RADAR groups innovations into four families because "innovation" in insurance is not only about products. It can happen through

- **New product and/or pricing design**: Innovations in what is insured and how payouts/premiums are designed. This includes new product structures (e.g., parametric triggers, multi-peril designs), pricing approaches that better reflect risk, and designs that can reward or require risk-reduction measures.
- **Business and financing models**: Innovations in how insurance is delivered, funded, and made affordable. This includes new partnerships and distribution models, links between insurance and finance (e.g., loans, bonds, resilience financing), and mechanisms that share costs and responsibilities between public and private actors.
- **Data/technology and modelling**: Innovations that improve the data and analytical capacity needed for insurance and adaptation. This includes loss-data collection and sharing, digital technologies (e.g., sensors/IoT, platforms), improved risk modelling and calibration, and tools that reduce transaction costs and increase transparency.
- **Shared governance frameworks that create enabling conditions**: Innovations in governance, coordination and performance measurement that make solutions workable at scale. This includes public–private coordination arrangements, resilience indicators/KPIs, agreements on roles and responsibilities, and frameworks that align insurance with risk reduction and adaptation objectives.

Shortlisted Innovative Insurance Solutions (IIS)

Table 2: 14 Shortlisted Innovative Insurance Solutions

ID	RADAR family	IIS	Description	Why shortlisted ?
001	**Data / technology & modelling**	Trockenheitsversicherung / Ernteschutz Vario	Operational drought insurance for agriculture using quantified indicators to support coverage against drought impacts on yields. Illustrates how insurers translate drought conditions into an insurable product with clear parameters.	Shows a **deployable drought solution** and the role of **data/indices** in making drought insurable and scalable.

ID	RADAR family	IIS	Description	Why shortlisted ?
002	**Data / technology & modelling**	Parametric forestry wildfire cover	Parametric wildfire cover for forestry, linked to measurable wildfire conditions/indices and designed for fast settlement. Demonstrates how remote sensing/index logic can support rapid liquidity after wildfire impacts.	Best-practice example of **parametric logic** in a hard-to-insure domain (wildfire), highlighting trigger design and data reliability.
003	**Data / technology & modelling**	Opti-crop Index tracker	An index-based approach/tool supporting agricultural risk management, relying on quantified indicators to monitor conditions relevant for crop outcomes. Useful as an example of how risk quantification tools underpin insurance design and decisions.	Demonstrates **risk quantification as an innovation** (not only products) and how indices support underwriting and risk awareness.
004	**Data / technology & modelling**	Soil Moisture Deficit Index Insurance	Index insurance built around soil moisture deficit indicators rather than only rainfall totals. Highlights the use of alternative indices to better match real agricultural impacts (and potentially reduce basis risk).	Demonstrates how **better-fit indices** can improve parametric insurance credibility and transferability where soil moisture data exists.
005	**Data / technology & modelling**	CyStellar TerraRisk Re	A satellite/AI-enabled risk intelligence platform that supports assessment and management of climate/natcat risks for insurers and decision-makers. Shows how analytics and multi-source data can support underwriting, portfolio insights, and potentially claims processes.	Best practice for **data infrastructure** enabling resilience/insurability—useful when your barrier is **lack of granular risk information**.
006	**New business & financing models**	Construction All Risk (CAR) policy for NBS	Insurance approach designed to cover risks during implementation of nature-based solutions (NBS) projects (construction/installation phase). The key is insurance as an *enabler* of adaptation investment by de-risking project delivery.	Demonstrates insurance supporting adaptation **investment feasibility**, not just post-disaster compensation (important for Step 5 enabling conditions).

ID	RADAR family	IIS	Description	Why shortlisted ?
007	**New business & financing models** *(and product add-on)*	Green-building restoration	Insurance coverage features that support "green" reconstruction/repair choices after damage (e.g., materials/standards), encouraging improved rebuilding practices. Typically positioned as a value-added feature to shift recovery toward resilience/sustainability.	Demonstrates **build-back-better incentives** embedded in insurance processes (claims/reinstatement).
008	**New products & pricing** *(affordability mechanism)*	Flood Re (UK) – Build Back Better	A mechanism linked to the UK Flood Re scheme that supports resilient reinstatement measures during repair after flooding. It operationalises adaptation by connecting recovery spending to resilience upgrades.	Strong "best practice" for integrating **adaptation into claims/recovery** and addressing affordability/availability in high flood risk contexts.
009	**New products & pricing**	FLOW Insurance (Swiss Re)	Parametric water-level insurance product where payouts are triggered by predefined water-level thresholds. Demonstrates fast payout design for specific exposures and clients (with clear trigger logic).	Good best practice for **rapid liquidity** and **trigger-based design**—also illustrates basis-risk and calibration needs.
010	**New products & pricing**	HAIL Damage Insurance (Swiss Re)	Parametric hail solution with predefined trigger conditions and rapid settlement. Useful as a clear example of parametric mechanics in a hazard where measurement/verification can be strong.	Best practice for explaining **parametric insurance** simply (trigger → payout) and its operational efficiency.
011	**New products & pricing** *(with resilience framing)*	Resilience Risk Transfer (RRT) (Munich Re)	Risk transfer product framed explicitly around resilience outcomes and structured approaches to managing climate risk. Shows packaging of insurance with broader resilience logic/services.	Demonstrates moving from "pure transfer" to **risk transfer + resilience proposition** (useful for shared resilience narratives).

ID	RADAR family	IIS	Description	Why shortlisted ?
012	**New products & pricing**	Weather risk insurance (Munich Re)	Weather-risk coverage (often index/parameter-based) designed for industry clients whose revenues/costs depend on weather variability. Not only catastrophes—also weather deviations that affect operations.	Good example that IIS can target **non-cat extremes** and support business continuity (broadens the solution space).
013	**New products & pricing** *(incentives for standards)*	FORTIFIED Home Insurance (Travelers)	Insurance offering linked to stronger building standards ("FORTIFIED" approach), using incentives and product features to encourage resilient construction/retrofit. Highlights insurer influence on household mitigation decisions.	Best practice for **behaviour change via insurance incentives** and upgrading building resilience.
014	**Shared resilience frameworks** *(PPP / incentives)*	Discount Program to promote Best Practice in Agriculture (Iowa)	Public–private programme providing crop insurance premium discounts to farmers implementing risk-reducing practices (e.g., cover crops). It operationalises prevention by rewarding verified practices financially.	Strong example of "shared resilience": using insurance pricing + public action to **incentivise risk reduction** at scale.

Conclusion

Three categories of innovative insurance solution emerged as most promising:

1. **Risk quantification and resilience indicators**, aimed at improving data quality and alignment with international frameworks (Sendai Framework, UAE GCR, ISO/DIS 37125).
2. **Innovative business models**, including resilience bonds and nature-based solution-linked insurance products.
3. **Public–Private Partnerships (PPP)**, particularly parametric insurance solutions designed to enhance affordability and ensure rapid payouts.

Our analysis highlights the potential of parametric insurance to provide swift and cost-efficient payouts, reduce administrative burdens, and enhance financial resilience. It also underlines the importance of integrating digital technologies (e.g., distributed ledger technologies and IoT) to reduce transaction costs and improve transparency. However, parametric insurance must be coupled with resilience-building measures to avoid moral hazard and ensure long-term sustainability.

A key finding is that innovative solutions remain unevenly distributed across the core functions of climate insurance, with limited coverage of loss compensation and investment risk reduction. Greater efforts are needed to mobilise adaptation finance, expand risk-transfer instruments, and improve loss-data collection.

Finally, we stress the importance of knowledge and data-sharing platforms at international (e.g., Resilient Planet Data Hub), regional (Regional data hubs), and national levels (e.g., Norway's Knowledge Bank). These platforms enhance transparency, improve risk modelling, and facilitate coordination among stakeholders.

Overall, RADAR concludes that closing the climate insurance protection gap requires synchronised action across governance levels, strengthened data ecosystems, expanded PPP models, and systematic integration of resilience indicators into financial and insurance mechanisms.

3.3. Identify adaptation barriers

About

This section describes tangible and intangible barriers to the implementation of climate adaptation via insurance. Furthermore, examples of the implementation of the PESTEL/COM-B tool to map intangible drivers and barriers in several case studies of the SOTERIA project, as well as a template of the PESTEL/COM-B mapping tool, are provided.

RAST alignment

This step goes beyond the RAST framework.

Substep inputs

- [SUMMARY] Overview of tangible barriers to the implementation of insurance solutions.
- [SUMMARY] Detailed explanation of intangible drivers and barriers to implement insurance solutions, and presentation of the PESTEL/COM-B mapping tool.
- [EXAMPLE] Barriers identified across SOTERIA case studies.
- [EXAMPLE] Examples of the implementation of the PESTEL/COM-B tool to map intangible drivers and barriers in several case studies of the SOTERIA project.
- [VIDEO] Seeing the Invisible: Mapping Tangible and Behavioral Barriers with the PESTEL–COM-B Matrix.

Linked deliverables and other materials

- [D2.2] Tech Briefing on Data Drivers and barriers.
- [D3.7] Guidance on insurance pricing, products and services: Best practices and emerging insurance solutions.
- [D3.5] Radar of Success Stories of best practice insurance solutions and financial risk transfer mechanisms.
- [TEMPLATE] Template of the PESTEL/COM-B mapping tool (ANNEX 6.).

3.3.1. Tangible adaptation barriers (SUMMARY)

Authors: Maria de Vries (G&Co)

Executive Summary

Market participants may face multiple barriers when identifying and implementing insurance solutions that support climate adaptation. These include limited availability of localised risk data, constrained insurer capacity, high premiums and affordability concerns, low risk awareness, and distrust in insurers.

To structure these barriers, we group them into four overarching challenges:

1. Barriers to resilience development (which do not necessarily hinder insurance uptake directly, but limit risk reduction and adaptation progress more broadly).
2. A missing accurate and shared risk view.

3. Barriers to insurance uptake due to insufficient demand.
4. Barriers to insurance uptake due to insufficient supply.

These categories partly overlap and are not mutually exclusive.

Barriers to resilience development

Resilience development can be constrained by both supply-side and demand-side barriers, as well as cross-cutting institutional challenges.

Supply-side barriers (insurance and market-related)

- Limited integration of climate/ESG considerations into underwriting strategies and product development.
- Lack of insurance products that address climate risks and actively promote risk-mitigating or risk-reducing behaviour.
- Limited availability of prevention and risk-prevention consulting services for (business) clients (for various organisational, capacity, or incentive-related reasons).
- Competitive disadvantages for insurers that financially support Build-Back-Better (BBB) implementation, compared to competitors who do not incur these additional costs.
- Uncertainty about the effectiveness of risk reduction (RR) or adaptation measures, including a perceived lack of quantifiable evidence to justify premium reductions or product adjustments.

Demand-side barriers (households, businesses, and communities)

- Limited financial capacity to implement resilience measures (e.g., property-level protection, retrofits, or Nature-based Solutions).
- Reliance on state protection, including ex-post calamity payments or calamity funds activated after severe events. This reliance can reduce incentives to invest in RR/CCA measures or to transfer risk through insurance.
- Uncertainty and dissatisfaction with state compensation, due to weak communication systems, unclear procedures, limited administrative capacity, and unclear budgets. This can create high insecurity among affected citizens regarding the timing and amount of payments.

Cross-cutting barriers (governance, capacity, and enabling conditions)

- Lack of technical expertise and implementation capacity, for example within government or among technicians/craftsmen, and/or insufficient data to design and implement measures such as NbS.
- Insufficient public promotion of risk awareness, risk assessment, and adaptation strategies.
- Political instability or weak internal cooperation (including inefficiency or lack of willingness to coordinate across departments), which can significantly hinder effective resilience development.

Missing accurate and shared risk view

- A shared and forward-looking understanding of risk is often a prerequisite for designing adaptation-oriented insurance solutions. Several barriers can prevent stakeholders from developing a common risk view:

- Limited forward-looking risk assessment that adequately represents climate change impacts and their implications for portfolio management and long-term strategy.
- Insufficient high-quality hazard, exposure, and vulnerability data, as well as limited modelling capacity and analytical skills, which restrict robust risk quantification and strategy development.
- Limited willingness to share data and information transparently across stakeholders, which prevents the creation of a shared evidence base.
- Lack of a clear risk management mandate in the public sector, reducing ownership of risk coordination and data governance.
- Low awareness of the scale and nature of climate risk, including misunderstandings of how risk is changing over time.
- Limited understanding of insurance mechanisms and benefits, which undermines informed discussions about the role insurance could play in risk sharing and resilience.

Barriers to insurance uptake due to insufficient demand

Insurance is one potential mechanism for financial risk sharing in the face of climate change. However, uptake can be hindered by several demand-side barriers:

- Product complexity and limited flexibility: existing insurance products may be perceived as too complex, inflexible, or not sufficiently customisable.
- Limited recognition of risk-reduction efforts: insurance products may not sufficiently reflect the client's own risk-reduction (RR) or adaptation measures (e.g., through pricing or coverage conditions).
- Intangible barriers: misconceptions and wishful thinking about climate risk; psychological biases; and cultural factors that can shape perceptions of risk and insurance.
- Distrust in insurers: potential distrust of the insurance sector due to cultural factors or previous negative experiences (discussed further in Section 3.3.2).
- Perceived lack of suitable products: a perception that no appropriate insurance product is available on the market.
- Low insurance literacy: limited understanding of the function, mechanisms, and financial benefits of insurance.
- Reliance on public compensation: low risk awareness and reliance on state ex-post calamity payments or other government support can reduce incentives to invest in RR/CCA measures or to transfer risk through insurance.
    - Even where calamity funds exist, citizens are often dissatisfied with the speed and amount of compensation, partly due to limited public infrastructure and procedural capacity for delivering ex-post payments.
- Affordability concerns: insurance products are often perceived as unaffordable.

Barriers to insurance uptake due to insufficient supply

- Insurance uptake may also be limited by constraints on the supply side. Key supply-side barriers include:
- Limited insurance capacity, for example due to high costs across the insurance value chain (e.g., loss adjustment, marketing and sales, reinsurance).

- Challenges with parametric products, including high basis risk and lack of accurate, high-resolution risk data.
- Insufficient reserves to absorb increasing losses.
- Increasing uninsurability of extreme climate events because impacts become too large to design affordable products.
- Increasing uninsurability due to frequency, where events become too frequent for effective risk pooling.
- High competitive pressure in insurance markets, which can reduce incentives to invest in new products or services.
- Lack of an enabling legal and regulatory framework for innovation and risk-sharing arrangements.
- Information asymmetry, increasing the risk of adverse selection and moral hazard.
- Compulsory insurance remains highly controversial: depending on scheme design, it can create competitive advantages for national insurers compared to international insurers.

Policy and market-design barriers affecting uptake and implementation

Some barriers relate to the design and implementation of public policies and market arrangements and can influence both demand and supply.

Barriers related to premium subsidy schemes

Insurance premium subsidy schemes may involve perceived barriers such as:

- Heavy bureaucracy,
- Legal implications, for example whether an insurer is allowed to apply a discount based on an expected subsidy in advance of receiving the actual subsidy payment (potentially implying that the insurer functions like a bank).
- Competition distortions, as one insurer may offer the discount upfront while others do not.
- Concerns about selective state support: subsidies differentiated by risk level may be viewed by some stakeholders as disruptive to market functioning.

Barriers for (re)insurance purchase by the government

Government purchase of (re)insurance may be constrained by:

- Concerns that public money flowing to (international) private companies can be politically undesirable.
- The perception that a calamity fund is a cheaper alternative, for example if crisis-funded (e.g., through sale of state assets), or because the state expects EU support in extreme cases.

Finally, making insurance obligatory holds the negative consequence of competitive disadvantage for international insurers, who are not included in the pool.

3.3.2. Barriers identified SOTERIA across case studies (EXAMPLE)

Authors: Oleksandr Sushchenko and Reimund Schwarze (UFZ)

Executive summary

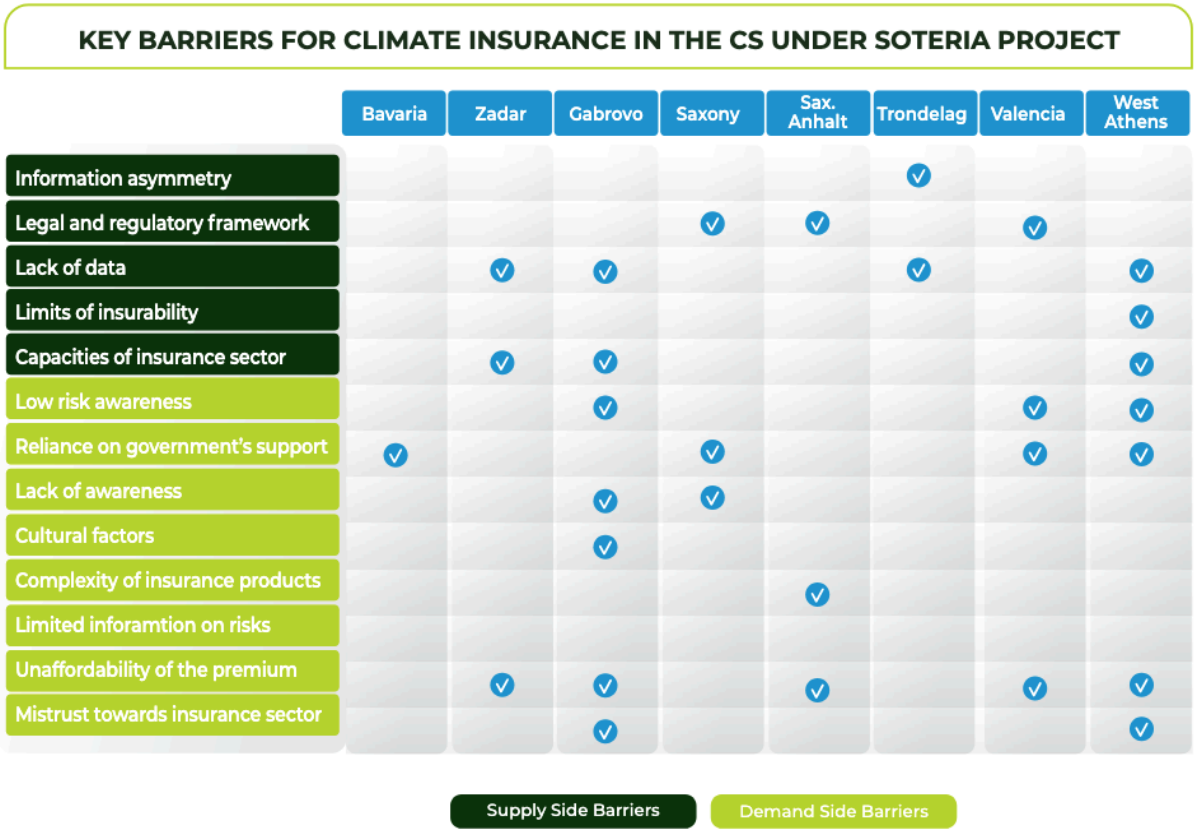
This section summarises the main barriers to innovative insurance systems (IIS) identified across SOTERIA case studies. The results are based on reports from the Climate resilience Dialogues (CRD) and a survey that was conducted among own Case Studies to identify the most pressing challenges.

SOTERIA evidence shows that barriers to IIS development and uptake arise on both the supply side (insurance market and enabling environment) and the demand side (users' ability and willingness to purchase and use insurance). These barriers are distinct but interrelated, and they often reinforce each other.

Barriers identified for the SOTERIA CS

The supply side and demand side barriers identified in Bavaria, Saxony, Zadar, Gabrovo, Trøndelag, and Valencia are presented in Figure 16.

Figure 16: Supply and demand side barriers identified in the case studies under SOTERIA.



Supply-side barriers include a lack of localized, accurate data, making it difficult for insurers to price products fairly – especially in climate-prone regions. This gap leads to poor risk assessment and low client trust. For example, the SOTERIA project in Bavarian Case Study showed that reliance on German Weather Service (DWD) data increased basis risk in multi-peril insurance schemes, highlighting the need for innovative IT solutions like remote sensing and satellite imagery. Outdated legal and regulatory frameworks often fail to accommodate innovative products such as parametric insurance. Additionally, rising climate-related claims are reducing insurer capacity, limiting their ability to offer or expand coverage.

Demand-side barriers include unaffordable premiums, particularly for low-income or high- risk groups. Government disaster aid reduces incentives to buy insurance, creating moral hazard. Low awareness of climate risks and insurance products further depresses demand, and cultural preferences for informal coping mechanisms also hinder uptake.

The barrier matrix highlights recurring barriers such as information asymmetry between insurers and policyholders, insufficient or fragmented climate-loss data, legal and regulatory rigidities, limited insurability under increasing climate volatility, low risk awareness and misperception of probabilities, reliance on post-disaster government compensation, product complexity and cognitive overload, premium unaffordability, mistrust towards the insurance sector, and capacity limitations within insurance markets. Two critical findings emerge from the systematic barrier identification analysis:

- Barriers are multidimensional, spanning financial, behavioural, institutional and technical domains.
- Barriers configuration varies significantly across regions and sectors.

For example, agricultural cases such as Bavaria and Saxony-Anhalt are primarily constrained by affordability challenges and climate-loss volatility, whereas municipal contexts such as Trøndelag reveal governance and procurement bottlenecks as dominant constraints. Southern European cases, including Zadar and Valencia, display pronounced behavioural and trust-related dimensions that shape low insurance uptake.

Focus on Germany

These preliminary findings have been confirmed as a result of a survey which was conducted among the farmers in Germany conducted by Helmholtz Center for Environmental Research.

The goal was to capture diverse perspectives and assess regional representativeness and methodological effectiveness. In total, 1,275 German farmers were contacted for an online survey conducted from May 17 to May 27, 2025. To increase participation, respondents were entered into a randomized prize draw offering items such as pruning shears, a multifunctional Swiss Army knife, and insect bite relievers. Question coding followed a standardized approach developed in collaboration with the Helmholtz Centre for Environmental Research (UFZ)

A total of 102 valid responses were received, representing an overall response rate of approximately 8%. Respondents came from 13 federal states, providing reasonable geographic coverage. Despite limitations regarding sample size and regional representation, the survey dataset provides valuable initial insights into German farming communities. The provided data highlights key barriers preventing farmers from adopting climate insurance.

The primary obstacle, identified by 78.4% of respondents, is the perception that climate-related

risks are very low. Another significant barrier (70.6%) is the high perceived cost of insurance premiums. Additionally, 19.6% of farmers are unaware of the existence of suitable insurance products, while 15.7% lack trust in insurers' willingness to pay out claims. Further issues include overly complex insurance conditions (10.8%), absence of suitable products (7.8%), perceived insufficient coverage (13,7%), the belief that individual preventive measures are not rewarded by insurers (4,9%), and reliance on governmental assistance in disasters (1%).

Conclusion

Closing the climate insurance gap requires addressing both supply- and demand-side barriers simultaneously. Insurers must improve access to accurate, localized data and adopt innovative technologies to reduce basis risk and enhance the reliability of climate insurance products (e.g., parametric insurance products). In some cases (e.g., German legal framework) regulatory conditions need updating to better accommodate new solutions (e.g., privacy law, data protection). Additionally, the financial resilience of the insurance sector must be strengthened to sustainably manage rising climate-related claims.

On the demand side, affordability and risk awareness are critical challenges.

3.3.3. A PESTEL/COM-B Matrix: Understanding and accelerating system-level behaviour change (SUMMARY)

Authors: Milena S. Nikolova (BES), Mia Ebeltoft (CRA) and Kristian Stenerud Skeie (SINTEF)

Executive Summary

Effective climate adaptation depends not only on technologies and funding but also on people's and organisations' willingness and ability to change behaviour at scale. Yet policy responses often fail because they overlook the intangible drivers and barriers that shape real-world decisions, such as trust, fear, habit, or institutional norms. The PESTEL/COM-B matrix developed under the EU Horizon Europe project **SOTERIA** offers a structured way to map these tangible and intangible conditions that influence action within complex systems.

By combining two complementary frameworks - **PESTEL** (Political, Economic, Social, Technological, Environmental, Legal) and **COM-B** (Capability, Opportunity, Motivation → Behaviour), the matrix helps identify not only *what* structural barriers exist (laws, resources, technology) but also *why* people or organisations act or hesitate (their perceptions, incentives, and social norms). Applied within SOTERIA to the case of climate-risk and loss data sharing, it revealed how regulatory and economic factors intersect with behavioural ones such as trust and risk aversion, and why tangible policy changes alone may not trigger new behaviour patterns.

The tool provides policy-makers and regional authorities with a rapid diagnostic framework for understanding system readiness for change, prioritising interventions and designing coherent policy mixes that address both institutional and behavioural barriers. While developed for climate-risk data governance, the PESTEL/COM-B matrix can be applied to any policy domain requiring coordinated behavioural transition – from nature-based solutions and energy efficiency to sustainable finance and disaster risk reduction.

Introduction and context

Climate adaptation demands a rapid shift toward new patterns of behaviour across governments, markets, and communities. Yet such change is often blocked by a mix of **tangible** and **intangible** barriers. Tangible barriers include regulatory gaps, data restrictions, or a lack of resources and technology. Intangible barriers include mistrust, fear of the new, institutional inertia, and difficulty perceiving benefits. Sometimes these factors interact; for example, new data-sharing laws may exist, but organisations still withhold data because they fear commercial risk or misuse.

Recognising and distinguishing these barriers is crucial for designing effective policy responses. The PESTEL/COM-B matrix was developed within SOTERIA (Task 2.3) precisely to address this need. It provides a diagnostic lens to capture the full range of conditions that shape behaviour in systems where change depends on collective action, such as climate-risk data ecosystems involving public authorities, insurers, researchers, and communities. A template for the PESTEL/COM-B matrix is provided in the ANNEX 6.

This approach builds on earlier research from the Norwegian “Knowledge Bank” case, where a decade of public-private collaboration led to a national platform for sharing insurance loss data to support municipal climate adaptation. Studies showed that even when technical and legal solutions were available, progress depended on building mutual trust, clear mandates, and perceived value for participants. The matrix translates these lessons into a replicable analytical tool for policy and practice.

Recommendations

What the tool is

The PESTEL/COM-B matrix combines two well-established frameworks:

- **PESTEL Analysis** identifies external conditions in six domains that influence action: Political, Economic, Social (cultural and behavioural), **Technological, Environmental, and Legal.** It captures *structural* drivers and constraints.
- **COM-B Model** explains behavioural change through three internal/external conditions: **Capability** (knowledge, skills), **Opportunity** (environment and resources), and **Motivation** (perceptions, attitudes, incentives). These factors combine to produce Behaviour. (Michie et al., *Implementation Science* 2011.)

By cross-analysing PESTEL and COM-B dimensions, the matrix helps map whether a barrier is primarily **tangible** (e.g., legal restriction, data infrastructure gap) or **intangible** (e.g., low trust, weak motivation), and how these interact. This enables policy-makers to match solutions to the true nature of the problem, i.e. legal reform for structural gaps, capacity building for capability deficits, or trust-building and incentive design for behavioural ones.

How it is used

- **Map the context:** Use PESTEL to scan political, economic, social, technological, environmental, and legal conditions affecting the desired change.
- **Diagnose behaviour:** Apply COM-B to identify what limits actors’ capability, opportunity or motivation.
- **Cross-analyse:** Locate where PESTEL factors intersect with behavioural conditions to see which barriers are tangible, intangible, or hybrid.
  Prioritise interventions: Design combined governance, technical, and behavioural measures that remove critical bottlenecks and strengthen enablers.

Guidance for policy use

- **As a diagnostic tool:** assess system readiness for adaptation policies or new data governance mechanisms.
- **As a planning tool:** guide the co-creation of measures within Communities of Practice and multi-stakeholder platforms.
- **As a monitoring tool:** track which barriers have shifted after policy interventions and

where behavioural bottlenecks persist.

Conclusions

The PESTEL/COM-B matrix demonstrates that system-level behaviour change depends on aligning **tangible frameworks** (laws, resources, technology) with **intangible conditions** (motivation, trust, and social norms). Its application in SOTERIA has helped explain why some regions progress faster,data sharing, risk governance or the development of IIS than others, despite similar regulations.

While first applied to climate risk and loss data, the tool can be used across many adaptation contexts: introducing new insurance schemes, mainstreaming nature-based solutions, or mobilising private investment in resilience. By making behavioural factors visible alongside institutional ones, it allows policy-makers to design policies that are *behaviour-smart*, aligning what people want to do, what they can do, and what systems enable them to do.

3.3.4. PESTEL/COM-B analysis of three case studies (EXAMPLE)

Authors: Milena Nikolova (BES)

Executive Summary

By applying this integrated framework to three regional case studies within the SOTERIA project - Gabrovo (Bulgaria), Valencia (Spain), and Trøndelag (Norway) - we can compare how different political, economic, and social contexts shape stakeholder behaviour and collaboration patterns. Each matrix in this section highlights the key barriers currently influencing data management dynamics in the respective region, illustrating both the systemic constraints and the behavioural realities that need to be addressed to enable efficient, trustworthy, and sustainable data exchange.

Together, these matrices form the basis for identifying targeted actions - policy adjustments, institutional reforms, or behavioural interventions - that can bridge the gap between what is technically possible and what is behaviourally achievable in advancing smart climate-risk data ecosystems.

Gabrovo

The PESTEL/COM-B matrix for Gabrovo (Bulgaria) captures a context characterised by low institutional maturity and fragmented capacities for climate risk and loss data management. The analysis reveals that most barriers are structural—stemming from unclear mandates, lack of investment in skills and infrastructure, and the absence of legal or financial incentives for collaboration. At the same time, behavioural barriers such as limited awareness, weak motivation, and minimal trust across institutions further constrain progress. Despite increasing climate impacts that raise awareness of risk, these pressures have not yet translated into coordinated action or data-driven decision-making. The matrix highlights the need to build both capability and motivation across public institutions, private actors, and the general public to create the foundation for systematic data exchange.

Table 3: PESTEL/COM-B matrix for Gabrovo (Bulgaria)

COM-B \ PESTEL Capability	Political	Economic	Social	Technological	Environmental	Legal
Knowledge & skills	●○	○○	○○	●○	●●	○○
Technical infrastructure	●○	●○	○○	●○	N/A	○○

Opportunity	Political	Economic	Social	Technological	Environmental	Legal
Regulatory environment	●○	○○	○○	○○	N/A	●○
Collaboration mechanisms	●○	○○	○○	●○	N/A	●○
Financial incentives	○○	○○	N/A	○○	N/A	N/A

Motivation	Political	Economic	Social	Technological	Environmental	Legal
Awareness of benefits	○○	○○	○○	●○	●○	○○
Market pressure	○○	○○	○○	○○	●○	N/A
Reputational considerations	●○	○○	○○	○○	○○	N/A

Legend: ●● = solid
●○ = inconsistent
○○ = lacking

Valencia

The PESTEL/COM-B matrix for Valencia (Spain) illustrates a context with relatively advanced legal and institutional frameworks but fragmented coordination and uneven motivation among actors. Strong legislation on climate action and flood risk management provides a solid foundation, yet these mandates are not consistently operationalised across governance levels. Economic and behavioural barriers persist, including limited financial incentives, weak collaboration between public and private entities, and low public awareness of the value of data sharing. Despite the availability of rich climate and insurance data, technical integration and cultural readiness for open exchange remain limited. The matrix underscores the importance of translating Valencia's strong regulatory base into practical mechanisms, shared standards, and clearer incentives to convert awareness into sustained behavioural change.

Table 4: PESTEL/COM-B matrix for Valencia (Spain)

COM-B \ PESTEL Capability	Political	Economic	Social	Technological	Environmental	Legal
Knowledge & skills	●●	●○	○○	●○	●●	●●
Technical infrastructure	●○	●○	●○	○○	●●	●●

Opportunity	Political	Economic	Social	Technological	Environmental	Legal
Regulatory environment	○○	○○	○○	●○	N/A	●○
Collaboration mechanisms	●○	○○	○○	●○	N/A	●○
Financial incentives	○○	○○	N/A	○○	N/A	N/A

Motivation	Political	Economic	Social	Technological	Environmental	Legal
Awareness of benefits	●○	●○	○○	○○	●○	●○
Market pressure	○○	○○	○○	○○	○○	N/A
Reputational considerations	●○	●○	○○	●○	○○	N/A

Legend: ●● = solid
●○ = inconsistent
○○ = lacking

Trøndelag

The PESTEL/COM-B matrix for Trøndelag (Norway) demonstrates a mature governance environment supported by robust legal obligations, advanced digital infrastructure, and well-established mechanisms for risk data management. However, the analysis shows that even in a well-developed system, behavioural and motivational barriers continue to limit full collaboration. Institutional silos, inconsistent interpretation of rules, and limited financial incentives prevent actors from turning technical capability into routine practice. Trust, coordination, and shared purpose remain critical for advancing from compliance-based data sharing to proactive, learning-oriented collaboration. The Trøndelag case highlights that structural readiness must be matched by behavioural enablers—such as peer networks, transparency, and shared value frameworks—to sustain ecosystem-level change.

Table 5: PESTEL/COM-B matrix for Trøndelag (Norway)

COM-B \ PESTEL Capability	Political	Economic	Social	Technological	Environmental	Legal
Knowledge & skills	●○	●○	●○	●○	●●	●●
Technical infrastructure	●○	●○	●●	●○	N/A	●○

Opportunity	Political	Economic	Social	Technological	Environmental	Legal
Regulatory environment	●○	●●	●○	○○	N/A	●○
Collaboration mechanisms	●○	○○	○○	●○	N/A	●○
Financial incentives	○○	○○	N/A	○○	N/A	N/A

Motivation	Political	Economic	Social	Technological	Environmental	Legal

Awareness of benefits	●○	○○	●○	●○	●●	●○
Market pressure	●●	○○	○○	●○	●○	N/A
Reputational considerations	●○	●○	●○	●○	○○	N/A

Legend: ●● = solid
●○ = inconsistent
○○ = lacking

Conclusions

The combined PESTEL–COM-B matrix provides a comprehensive view of the barriers and drivers that shape the ability and willingness of different actors to record, collect, store, and share climate-related risk and loss data. By integrating structural analysis (PESTEL) with behavioural insight (COM-B), it reveals not only what conditions exist but also how they interact to enable or block effective data exchange.

Across the three regional cases - Gabrovo (Bulgaria), Valencia (Spain), and Trøndelag (Norway) - the combined approach exposes a spectrum of maturity:

- Gabrovo represents an early-stage context where both structural and behavioural preconditions for data sharing remain weak.
- Valencia illustrates a more developed setting, with strong legal frameworks and insurance mechanisms but persistent coordination and motivation gaps.
- Trøndelag, by contrast, demonstrates an advanced institutional architecture with explicit legal obligations and functioning data systems, yet still faces behavioural and incentive-related barriers that limit collaboration.

This gradient confirms that while capacity and opportunity can evolve over time, motivation and coordination remain the decisive factors for system-wide change.

The combined PESTEL–COM-B analysis confirms that **structural enablers alone cannot ensure effective data sharing**. Political will, regulatory frameworks, and technical systems are necessary but insufficient unless matched by behavioural conditions such as capability, opportunity, and motivation that make collaboration routine and self-reinforcing.

Key cross-cutting **barriers** identified include:

- Fragmented mandates and unclear institutional roles (Political–Capability).
- Misaligned or absent economic incentives (Economic–Opportunity).

- Weak trust and conservative social norms that discourage openness (Social–Motivation).
- Inconsistent use of available technology and lack of operational standards (Technological–Capability).
- Environmental urgency that raises awareness but not sustained engagement (Environmental–Motivation).
- Legal ambiguity and fear of breaching confidentiality (Legal–Opportunity).

Corresponding **drivers** that can enable change include:

- Clear mandates, coordination frameworks, and political continuity.
- Explicit cost–benefit communication and shared investment models.
- Peer influence and Communities of Practice that normalise data exchange.
- Federated, interoperable systems supported by training and SOPs.
- Use of environmental evidence to demonstrate real benefits of sharing.
- Transparent governance and clear legal guidance that institutionalise trust.

In sum, the matrix demonstrates that effective data sharing depends on **aligning structural readiness with behavioural enablers.** By combining the external (PESTEL) and internal (COM-B) dimensions, the analysis provides a nuanced picture of where interventions are most needed and how they can be tailored to each regional context. It highlights that progress will come not from technological fixes or new mandates alone, but from cultivating the **behavioural capability, opportunity, and motivation** required to turn cooperation into an everyday practice across Europe's climate-risk data ecosystem.

3.3.5. "Seeing the Invisible: Mapping Tangible and Behavioral Barriers with the PESTEL–COM-B Matrix (VIDEO)

https://www.youtube.com/watch?v=H4vH5oLtfRA

Description

This video is part of the SOTERIA Communities of Practice.

In this session Milena Nikolova (BES) and Mia Ebeltoft (CRA) presents the PESTEL–COM-B Matrix, a core analytical tool developed under the SOTERIA project to map both tangible system-level conditions and behavioural factors shaping climate adaptation outcomes.

The discussion addressed the persistent challenge of fragmented and underused climate-related risk and loss data across Europe. As highlighted by Mia Ebeltoft, data are often inconsistent, privately held, and insufficiently accessible to public authorities, limiting the ability of cities and municipalities to conduct robust risk assessments and design effective climate adaptation measures.

While granular data are increasingly required under the EU Floods Directive and the EU Climate Adaptation Strategy, technical availability alone does not ensure effective use. Behavioural and institutional factors strongly influence whether data are shared, understood, and applied in practice.

Case study: Norway

The Norwegian Knowledge Bank was presented as a case study illustrating how data sharing between insurers and public authorities can be institutionalised at the national level. The initiative aimed to establish a centralised data hub combining insurance loss data with public authority datasets.

The case highlighted that the primary barriers were behavioural rather than technological, including differing perceptions of data ownership, concerns over competitive advantage, limited trust between actors, and low awareness of the public value of shared data.

Key enabling factors included sustained dialogue between insurers and municipalities, often driven by a motivated individual acting as a broker, securing a formal mandate, and anchoring the initiative at the senior management level. Clearly communicating benefits to all stakeholders was identified as critical for motivation. Remaining challenges include limited awareness among municipalities that the data are available, funding constraints, and technical and capacity limitations affecting data integration.

The PESTEL–COM-B framework

Milena Nikolova presented the PESTEL–COM-B Matrix as a structured framework integrating the PESTEL and COM-B models to assess readiness for change across political, economic, sociocultural, technological, environmental, legal, and behavioural dimensions.

The framework was discussed as being applicable beyond data sharing, with relevance for a wide range of climate adaptation solutions that require new decision making processes, collaboration patterns, and behavioural change.

STEP 3 Completion Checklist

Use this checklist to confirm that Step 3 has explored relevant insurance-based adaptation options and identified potential barriers before moving to Step 4 evaluation and selection.

Area	Key question	Verified
Protection-gap link	Have we linked candidate insurance solutions to priority risks identified in Step 2?	☐
Solution scan	Have we explored different types of innovative insurance solutions (products, business models, data-driven tools, shared resilience approaches)?	☐
Best-practice review	Have we reviewed examples from other regions or case studies to understand feasibility?	☐
Local relevance	Have we checked whether candidate solutions fit local legal, institutional and market conditions?	☐
Barrier analysis	Have we identified tangible and behavioural barriers to implementation?	☐
Stakeholder input	Have insurers, public authorities and stakeholders reacted to the proposed solution options?	☐
Documentation	Do we have a structured catalogue or factsheets for candidate insurance solutions?	☐
Feasibility screening	Have we identified which options are realistic to assess in Step 4?	☐
Learning capture	Have case-study lessons or diaries been reviewed and summarised?	☐
Step 4 readiness	Do we have a shortlist of options ready for structured evaluation in Step 4?	☐

STEP 4: ASSESSING AND SELECTING ADAPTATION OPTIONS

Understanding RAST Step 4 "Assessing and selecting adaptation options"

In the RAST, Step 4 provides the policy framework for deciding which adaptation options should be prioritised in a regional or local adaptation strategy.

At this stage, authorities move from a long list of possible measures to a smaller set of priority options by applying agreed evaluation principles and documenting their decisions transparently. The purpose is to ensure that adaptation planning is based on a systematic comparison of alternatives and reflects technical, economic and societal considerations. Step 4 does not yet focus on implementation. Instead, it ensures that regions have a justified and defensible rationale for the options they choose to pursue.

Typical outputs include an agreed approach for evaluating options and a documented prioritisation of adaptation measures that can be taken forward for implementation planning in Step 5.

If this step is skipped, adaptation planning may rely on ad-hoc or politically driven choices, increasing the risk of selecting options that do not effectively address priority risks or cannot be sustained over time.

About

Step 4 supports practitioners in assessing and selecting the most suitable insurance-based adaptation option(s) identified in Step 3. Building on the protection gaps from Step 2 and the solutions and barriers identified in Step 3, this step helps practitioners compare options in a structured way and move towards a decision on the preferred solution(s) to take forward for implementation planning in Step 5.

Objectives

The objective of Step 4 is to provide a practical process to evaluate, narrow down and select insurance-based adaptation solutions that are more suitable for the local context. This includes defining evaluation criteria, linking options to the barriers they address, and supporting a transparent decision process with stakeholders.

RAST alignement

This step aligns with RAST Step 4: Assessing and selecting adaptation options which is divided into two: Assessing adaptation options (RAST 4.1) and selecting adaptation options (RAST 4.2).

RAST Step 4 emphasises establishing an assessment framework and criteria in consultation with stakeholders and using this framework to select options.

In this Manual, Substep 4.1 provides an evaluation framework and criteria that can be discussed, tailored and validated with stakeholders (e.g., through the CoP/CRD), while Substep 4.2 supports the move from assessment to a documented selection decision. Due to the importance for the IISs of the barriers that need to be overcome are included as a distinct substep of step 4.2 of the RAST.

Step 4 substeps

- **Substep 4.1 (RAST 4.1)**: This substep includes a framework with predefined criteria for supporting the assessment of insurance-based adaptation solutions.
    - Main output : an evaluation framework and criteria set to assess IIS.
- **Substep 4.2 (RAST 4.2):** This substep provides guidance for identifying the barriers that need to be addressed with the insurance-based adaptation solutions.
    - Main output : a “barriers-to-solve” shortlist linked to each candidate option.

How SOTERIA tools contribute to RAST Step 4

RAST Step 4 element	What it means (Mission level)	SOTERIA tools / content
Define assessment criteria	Agree evaluation criteria with stakeholders	Step 4.1 evaluation framework for insurance solutions
Assess adaptation options	Compare options against criteria	Structured comparison templates for IIS options
Consider feasibility barriers	Identify barriers affecting implementation	Barrier analysis from Step 3 integrated into evaluation
Prepare for implementation planning	Ensure selected options are realistic and actionable	Outputs feeding Step 5 implementation planning

4.1. Evaluation of insurance solutions

About

Substep 4.1 supports practitioners in evaluating the insurance-based adaptation options identified in Step 3. It provides a practical evaluation approach to compare options against a consistent set of criteria, taking into account the protection gaps identified in Step 2, the local enabling conditions established in Step 1, and the feasibility barriers identified in Step 3.3.

This evaluation is intended to be used and adapted in discussion with relevant stakeholders (e.g., through the Community of Practice and/or Climate Resilience Dialogue), rather than applied as a fixed scoring exercise.

The evaluation of the sustainability of insurance solutions is deepened in this substep, by reflecting on the integration of ESG principles, the UNEP FI Principles for Sustainable Insurance, and the EU Taxonomy for Sustainable Activities.

RAST alignment

Supports RAST Step 4.1: Assessing adaptation options.

Substeps inputs

- [SUMMARY] Evaluation criteria for best practice and innovative insurance solutions
- [SUMMARY] Sustainable Insurance Solutions (ESG frameworks and reporting standards relevant for evaluation)

Linked deliverables or other materials

- [D3.2] Mapping and evaluation of best practices of insurance pricing and innovative insurance solutions (2)
- [D3.4] Policy Recommendation on Sustainable Insurance – principles and rules (2)

4.1.1. Evaluation criteria for best practice and innovative insurance solutions (SUMMARY)

Authors: Paul Eberlein (G&Co)

Executive Summary

This section provides the bases for the evaluation of "proven" (TRL 9) Innovative Insurance Solutions (IIS), focusing on their ability to address emerging climate risks and promote resilience in agricultural and cross-sectoral contexts. The assessment utilized dual frameworks employing seven criteria weighted by importance. These were tested by three independent evaluators that applied a qualitative 1-5 scoring system to generate weighted average scores, a method noted for its efficiency despite inherent subjectivity. The results indicated that most solutions currently receive average ratings, revealing significant room for improvement in actually promoting adaptation.

Evaluation criteria and weightings framework

The Table 6 below outlines the seven specific criteria used to evaluate solutions, their respective focus areas for the two distinct frameworks (Agriculture and Cross-sectoral), and their assigned weightings.

Table 6: Evaluation criteria and assigned weightings used to assess the IIS

Criteria	Weight	Agriculture Framework Focus	Cross-sectoral Framework Focus
1. Promoting Adaptation & Resilience (a)	**25%**	Promotes climate-proof cultivation methods, risk prevention, infrastructure improvement or early warning systems.	Contributes to adapting to climate change and increasing resilience to climate-related risks.
2. Degree of Innovation (b)	**20%**	Novelty of the solutions (e.g., parametric coverage, satellite data, weather indices, mobile payout, etc.).	Degree of novelty in technology, product design, or business model.
3. Scalability & Replicability (c)	**15%**	Transferability to other regions/forms of agriculture.	Potential for transfer to other contexts, regions, or target groups.
4. Integration into Local Systems (d)	**10%**	Cooperation with governments, agricultural advisory services, microfinance, NGOs, or agricultural associations.	Degree of cooperation with public, private, or civil society actors.
5. Access & Social Inclusion (e)	**10%**	Accessibility for small farmers, women, disadvantaged groups; educational components available.	Accessibility and benefits for disadvantaged or vulnerable groups.

6. Economic Viability & Sustainability (f)	**10%**	Financial sustainability, acceptance by farmers, long-term sustainability for insurers.	Financial viability and attractiveness for insurers and policyholders.
7. Monitoring & Effectiveness (g)	**10%**	Existence of KPIs, evaluation mechanisms, and documented impact.	Existence of clear KPIs, impact measurement, feedback, and learning processes.

Figure 17: The seven criteria used to evaluate IIS

Rationale for weighting distribution

The distribution of weightings influences the overall rating and was determined based on the perceived importance of each aspect for an Inclusive Insurance Solution (IIS), while taking environmental, social, and governmental aspects into consideration:

- **Highest Priority (25%):** "Promoting Adaptation & Resilience" was given the highest rating as it was deemed the most important aspect of an IIS for this evaluation.
- **Secondary Priorities (20% & 15%):** "Degree of Innovation" and "Scalability & Replicability" were viewed as the second and third most important aspects, respectively.
- **Baseline Priorities (10% each):** The remaining four criteria were weighted equally to ensure a balanced assessment of local integration, social inclusion, economic viability, and monitoring.

Note: These weighting *criteria therefore could be modified depending on the priority given to this criteria to fit different policy priorities.*

Scoring methodology and calculation

The evaluation uses a qualitative, time-efficient method executed independently by three experts of G&Co based on their interpretation of available information.

The scoring scale:

A qualitative score ranging from 1 to 5 is assigned to each criterion:

- **1** = Very Bad
- **2** = Weak
- **3** = Average
- **4** = Good
- **5** = Excellent/Exemplary realization

Calculation process:

1. **Individual Scoring:** Three independent evaluators assign a score (1-5) to each of the seven criteria for a single solution.
2. **Averaging:** The scores from the three evaluators are averaged for each specific criterion.
3. **Weighting:** This average score is multiplied by the criterion's designated weighting percentage to produce a weighted score for that criterion.
4. **Total Score:** The weighted scores for all seven criteria are added together to result in a final total score for the solution (with 5 being the highest possible total score).

The framework above can be used as a guideline for the evaluation of innovative insurance solutions. Depending on what aspects are most important for the user/evaluator, weightings can be distributed. A truly comprehensive assessment can only be done if insurers (those who offer the solution), customers (those who bought the solution), and an independent third party (e.g., insurance experts) evaluate a solution from their point of view. The results of this evaluation show that most of the IIS receive an average rating when higher weight is given to the

“Promoting adaptation and resilience”, indicating room for improvement, especially when it comes to promoting adaptation & resilience.

4.1.2. Sustainable Insurance Solutions (ESG frameworks and reporting standards relevant for evaluation) (SUMMARY)

Authors: Marina Lehmann (HSWT)

Executive Summary

Sustainable insurance (SI) integrates environmental, social, and governance (ESG) principles into the insurance value chain, promoting innovation, risk management, and positive social and environmental outcomes. Effective SI implementation relies on clear frameworks, standardized definitions, and reliable reporting mechanisms. Key frameworks include the UNEP FI Principles for Sustainable Insurance (PSI) and the EU Taxonomy for Sustainable Activities. The PSI defines SI and provides four core principles that require insurers to embed ESG considerations, engage stakeholders, manage risks, and ensure transparency. The EU Taxonomy for Sustainable Activities provides a classification system for environmentally sustainable economic activities, specifying criteria for insurance activities to contribute positively to environmental objectives without causing harm.

Reporting standards, including the Principles for Responsible Investment (PRI), the Task Force on Climate-related Financial Disclosures (TCFD), and the Morgan Stanley Capital International (MSCI) ESG pillars, further enhance transparency, comparability, and accountability by guiding ESG integration, climate-risk disclosure, and performance evaluation. Despite progress, significant gaps remain, including the lack of binding standards, inconsistent metrics, and practical implementation difficulties, particularly for smaller insurers. Developing universally applicable frameworks and reporting standards is essential to ensure consistent, accountable, and effective sustainable insurance practices across the industry.

Context

The growing emphasis on ESG considerations has highlighted the need for clearly defined frameworks to guide sustainable practices in the insurance industry. SI aims to integrate ESG principles into all aspects of the insurance value chain, promoting risk management, innovation, and broader social and environmental benefits. However, implementing SI effectively requires standardized rules, definitions, and reporting mechanisms. Key frameworks, such as the PSI and the EU Taxonomy for Sustainable Activities, provide guidance on ESG integration and the classification of environmentally sustainable activities. Complementary reporting standards, including the PRI, the TFCD and the MSCI ESG pillars, further enhance transparency, comparability, and accountability. While these frameworks lay a solid foundation, challenges remain, including gaps in binding standards and practical implementation difficulties.

The UNEP FI PSI and the EU Taxonomy for Sustainable Activities at a glance

The effective implementation of SI practices requires clearly defined and universally applicable rules and guidelines. There are already a number of frameworks in place to promote sustainable insurance, including the PSI and the EU Taxonomy for Sustainable Activities.

Although these frameworks share several core components, they differ in a number of ways. For example, only the PSI provides a definition of SI: “Sustainable insurance is a strategic approach where all activities in the insurance value chain, including interactions with stakeholders, are done in a responsible and forward-looking way by identifying, assessing, managing and monitoring risks and opportunities associated with environmental, social and governance issues. Sustainable insurance aims to reduce risk, develop innovative solutions, improve business performance, and contribute to environmental, social and economic sustainability”.[1]

In addition, the PSI framework contains **four core principles** (see Table 7), which require companies to integrate ESG-related issues into their decision making along the entire value chain and core business processes, engage with clients, suppliers, insurers, reinsurers and intermediaries to raise awareness, manage risk and develop solutions, promote public awareness and action on ESG issues by cooperation with governments, regulators and other key stakeholders and demonstrate accountability and transparency regarding the company’s progress in implementing the PSI.

Table 7: The Four Core Principles for Sustainable Insurance

Principle 1: Embed ESG in Decision-Making Signatories commit to embedding ESG issues relevant to their insurance business into their company strategy, governance, and decision-making processes.
Principle 2: Collaborate with Stakeholders Signatories will work with clients, business partners, and suppliers to raise awareness of ESG issues, manage risks, and develop innovative solutions.
Principle 3: Engage with Governments and Regulators Signatories will work with governments, regulators, and other key stakeholders to promote widespread action across society on environmental, social, and governance issues.
Principle 4: Accountability and Transparency Signatories will demonstrate accountability and transparency by regularly and publicly disclosing their progress in implementing the PSI

Although the PSI provides a cross-functional framework that encompasses all entities of an insurance company, challenges remain. Due to the voluntary nature of the PSI, insurance companies neither can be forced to implement them, nor can they be penalised if they refuse to do so. In addition, insurance companies have to fulfill essential economic principles, for example the guarantee of solvency ratios, which may conflict with ESG principles. Further there is a great variety regarding clients, size, legal form etc. among insurance companies. These differences must be taken into account when implementing the PSI.

The EU Taxonomy for Sustainable Activities, provides a classification system that defines a list of environmentally sustainable economic activities, including guidelines for financial services such as insurance. In contrast to the PSI there is no specific definition of “sustainable insurance”

[1] https://www.unepfi.org/insurance/insurance/ (last access: 19th of September 2025)

in the EU Taxonomy but it outlines criteria which insurance activities must meet to be considered environmentally sustainable. According to the EU Taxonomy, sustainable insurance must make a significant contribution to one or more environmental objectives without having a negative impact on another objective (e.g. climate change mitigation or adaptation, pollution prevention, biodiversity restoration). The EU Taxonomy can be used by insurance companies to develop sustainable insurance products. Although the EU Taxonomy offers a harmonization of classification criteria for sustainable economic activities on EU level, there are still issues that have to be overcome, for example the regulation is difficult to implement for small and medium-sized companies.

Existing reporting standards and metrics on sustainable insurance

The promotion of SI not only requires frameworks that provide definitions, criteria and objectives, but also clear reporting standards and metrics which ensure comparability, traceability and transparency. In this context the PRI, the TCFD Recommendations and the MSCI ESG pillars should be mentioned.

The fundamental objective of the PRI is to promote the development of a more sustainable global financial system. The **six principles** were developed by investors under the patronage of the UN, with the objective of guiding participants (signatories) in integrating ESG considerations into their decision-making processes, ownership policies and disclosures (see table 8). Signatories are obliged to undertake actions such as the promotion of ESG transparency, collaborative efforts to enhance implementation, and the reporting of progress.

Table 8: Principles for Responsible Investment

The 6 Principles for Responsible Investment (PRI) are a set of voluntary guidelines promoted by the United Nations to help investors incorporate environmental, social, and governance (ESG) factors into their processes. Here are the 6 key principles: ● ESG Integration: Incorporate ESG issues into investment analysis and decision-making processes. ● Active Ownership: Be active owners and integrate ESG criteria into ownership policies and practices (such as exercising voting rights). ● Transparency: Ask the entities in which you invest to report transparently on their ESG issues. ● Industry Advocacy: Encourage the acceptance and application of these principles within the investment sector. ● Collaboration: Work together with other signatories to improve the effectiveness of the principles' implementation.

The TCFD framework provides a standardized approach to disclosure climate-related information, which is essential for transparency in SI. It allows companies to demonstrate their commitment to managing climate-related risks and opportunities and to provide consistent and comparable information to stakeholders. The framework also supports the development of

insurance products that promote environmental responsibility, ultimately contributing to a more resilient and sustainable insurance system.

The MSCI ESG pillars are crucial for assessing an (insurance) company's sustainability and ethical performance. Insurers that use these metrics can more effectively evaluate potential risks, develop products that promote sustainable development and encourage responsible business practices. The pillars cover environmental issues as well as social and governance-related issues.

Although all mentioned frameworks emphasise ESG factors, there is a difference in scope and specificity. The PRI provides broad principles for responsible investing, while the MSCI ESG pillars offer specific metrics for assessing companies' ESG performance. The frameworks also differ in their focus. The TCFD focuses primarily on climate-related disclosures, particularly the financial risks associated with climate change, while the PRI and the MSCI ESG pillars address a broader range of ESG issues.

Key issues to consider

Current efforts by regulatory bodies have established a solid foundation and there are already a notable number of policy frameworks for the insurance industry to develop, implement and disclose sustainable insurance practices and products. Nevertheless it should be noted that some issues remain to be addressed. Despite significant knowledge gaps about SI, including **metrics, impacts, costs, accountability**, monitoring, and more, there has been little progress in establishing c**ommon legally binding frameworks** for insurance companies of all sizes, as well as their practical implementation. The same applies to the development of generally applicable and binding reporting standards and metrics. In order to ensure the comparability and assessment of different insurance companies and their activities and products in terms of sustainability, a binding, universally applicable assessment and reporting standard is required. As insurance companies differ in size, clients, legal form, turnover and other key figures, these factors must also be taken into account when developing a common framework.

4.2 Navigating from regional barriers to concrete solutions using guidance trees

About

This substep helps to narrow down and prioritise insurance-based adaptation options. It aims to help local and regional authorities choose which insurance-based solution to prioritise when they hit a specific local barrier (e.g., low demand, low supply, missing shared risk view). It does this by using "guidance trees" that link typical barriers introduced in Substep 3.3. (Explore adaptation barriers) to a shortlist of solution-types introduced in Substep 3.1.(Explore innovative insurance solutions).

RAST alignment

Supports RAST Step 4.2: Selecting adaptation options

Substep inputs

- [INFOGRAPHIC] Guidance trees linking insurance solutions to local barriers

Linked deliverables and other materials

- [D3.7] Guidance on insurance pricing, product and services: Best practices and emerging insurance solutions.

4.2.1. Guidance trees: mapping solutions to resilience barriers across supply, demand and government (INFOGRAPHIC)

Author: *Maria de Vries (G&Co)*

Introduction to the guidance tree infographics (mapping barriers to solution pathways)

This section presents a **set of guidance tree infographics (Figure 18-21)** that support the practical mapping of barriers to climate change adaptation (identified in Substep 3.3) to innovative insurance solution pathways (introduced in Substep 3.1). The purpose is to help users move from a long list of potential solutions to a short, barrier-driven shortlist of options to take forward for assessment and selection in Step 4

The infographics organise recurring barriers and corresponding solution families into four overarching challenges: (1) resilience development, (2) missing accurate and shared risk view, (3) lack of insurance demand, and (4) lack of insurance supply.

- For **resilience development (Figure 18)**, insurance can contribute by expanding resilience-oriented products, rewarding risk reduction through premium reductions (e.g., "building back better"), offering advisory services on adaptation measures and financing options, and sharing data with governments to support effective risk reduction policies and investments.
- To address a **missing shared risk view (Figure 19)**, insurers and public actors need to strengthen forward-looking risk assessment by incorporating climate projections and collaborating with research bodies and data providers to improve hazard, exposure and

vulnerability modelling.

- **Demand-side barriers (Figure 20)** such as perceived unaffordable, complex, or poorly tailored products can be reduced through product flexibility, clearer communication, improved customer interaction, and new product designs (e.g., parametric or multi-crop insurance). Public–private partnerships, and especially premium subsidies, can be critical to improve affordability.
- Finally, **supply-side barriers (Figure 21)** such as limited capacity and high costs can be addressed through cost-reducing innovations (e.g., improved loss assessment methods and digitalisation), risk sharing (reinsurance, insurance pools, resilience/catastrophe bonds), and cooperation with other sectors to offer bundled services and increase competitiveness.

Please note that there is a partial overlap between the barriers and solutions in each group and they are not mutually exclusive.

Also, the information and examples given are partly sourced from personal communication with insurance experts: Senior Manager Climate Change and International, Global head of greenhouse horticulture from Achmea, Policy Advisor from the Dutch Association of Insurers, Expert on Property Insurance Engineering from the German Association of Insurers (GDV), and Head of Emerging Risks, Caisse Centrale de Reassurance.

Resilience development (Figure 18)

Among the barriers for **resilience development**, supply-side barriers like a lack of ESG considerations in the underwriting strategy development, and a lack of insurance products addressing Climate Change risks and promoting risk mitigating or reducing behaviour can be identified. Indeed, among the solutions that can be applied are those that increase the insurance product palette with resilience-oriented products *(P&P #3),* or a premium reduction rewarding the implementation of risk reduction measures *(P&P #1b)*. Insurers may also lack risk prevention consulting services for (business) clients, for which a development of a consulting service on CCA measures and finance options *(BM #2b)* is a suitable solution. This could also address the demand-side barrier of a lack of finances to implement resilience measures. Furthermore, an insurer may more directly support CCA or RR measure implementation by providing (part of) the finances *(BM #2d)* themselves.

Example: The building-back-better (BBB) programme is an approach where, after a loss occurrence, the damage repair is augmented by reducing the asset's vulnerability to damage. An example is replacing greenhouse glass roofs with tempered glass as a protection against hail damage. Achmea (co-)financed the BBB-measure and offered a reduced follow-up policy price[2], which is possible because of a proven reduction in risk of hail damage, and a remaining demand for extreme event coverage. Nevertheless, one of the (supply-side) barriers encountered here is the subsequent competitive advantage of other insurers who did not incur the costs of financially supporting the BBB-measure implementation.

[2] Interviews insurance experts

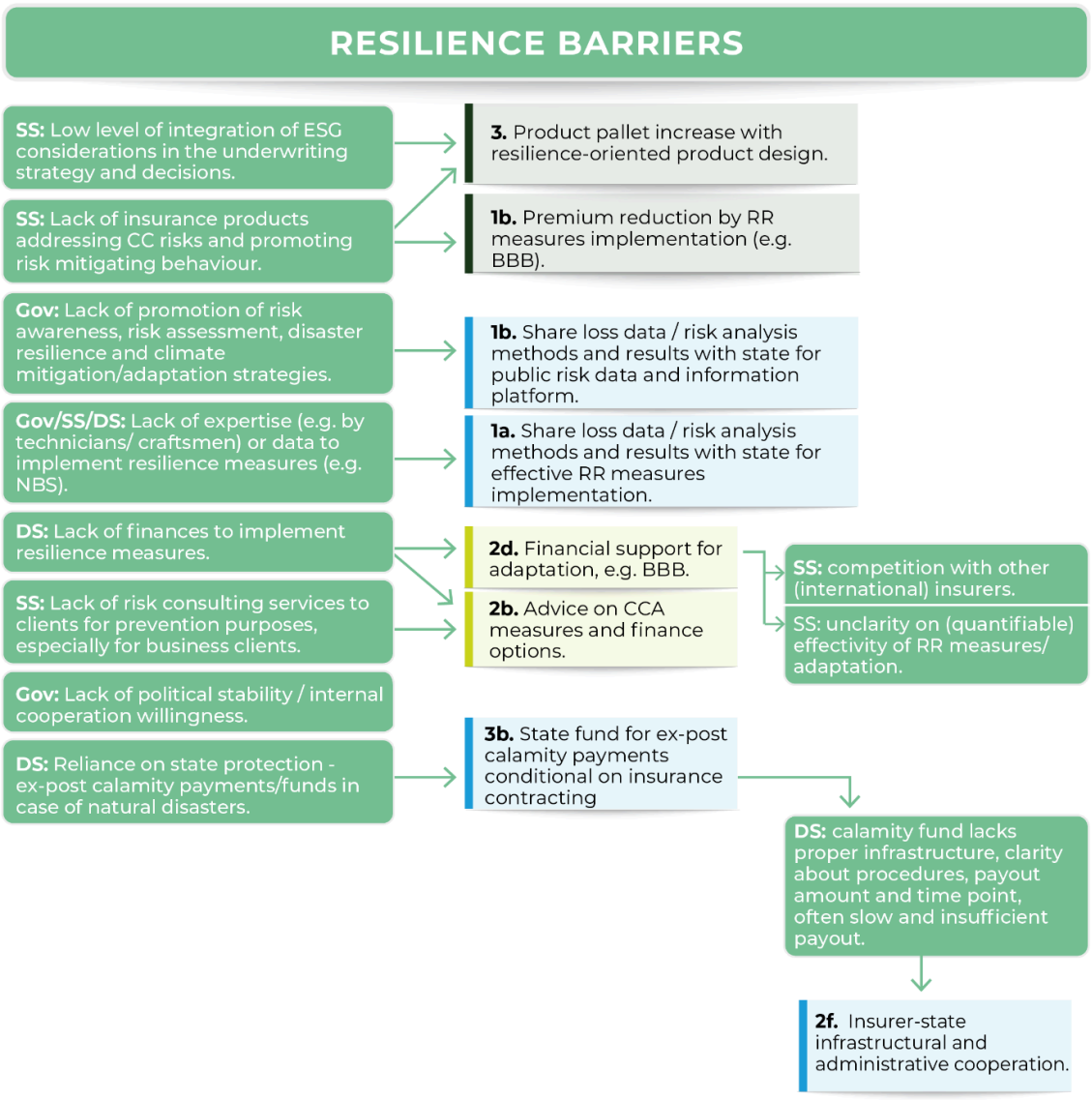
Another (supply-side) barrier is that it's unclear or not well quantified how effective RR or adaptation measures are. There are many different types of measures that can be implemented in building protection against flood or in agricultural management against weather extremes, and of the majority of the measures where there is a lack of proven quantifiable risk reduction, which can be used in pricing calculations.

Another demand-side barrier is a reliance on state protection, like ex-post calamity payments or a calamity fund to be activated after an extreme weather event causing disastrous damage to citizen property. If this is an unintended effect, the state should address this reliance by clear expectation management, announcement of the conditionality on insurance contracting *(SH #3b)* and advice on further personal risk management strategies. State calamity funds do tend to lack proper communication and payment infrastructure and procedural and budget clarity, often leading to high insecurity among affected citizens on the time point and amount of payments they are to receive. A cooperation with the insurance industry, offering the professional experience, infrastructural and administrative set-up *(SH #2f)* for this type of work, could be considered. A general barrier for resilience development is a lack of technical expertise with e.g. the government, technicians or craftsmen, or data, to implement resilience measures, like NBS. The insurance industry could diminish this barrier by sharing detailed damage data or risk analysis methods with the government, who is then better able to implement effective RR measures *(SH #1a)*.

Example: Cooperation with the insurance industry in this way has been successfully done in Norway, improving sewage infrastructure against pluvial flood risks[3], and in the Netherlands, where data has been requested by the City of Amsterdam to reduce risk of flooding in certain neighborhoods[4]. Sharing detailed damage data or risk analysis methods with the government is also beneficial for another potential barrier - the lack of public promotion of risk awareness, risk assessment and adaptation strategies. Using this, the government can develop an augmented public risk data and information platform *(SH #1b).* Finally, a lack of political stability, or government-internal cooperation efficiency or willingness, due to political competition is a significant barrier for efficient resilience development.

Figure 18: Guidance tree linking solutions to barriers for resilience development. SS: Supply-Side barriers, DS: Demand-Side barriers, Gov: governmental barriers.

[3] SOTERIA Deliverable 1.3, 2025, *Recommendation for developing regional data hubs: Mechanisms, challenges, and best practices for climate-related risk and loss data integration* [M. Ebeltoft, O. Luque, B. Lesniewska, K. Skeie].
[4] Interviews insurance experts



Legend

BARRIER (**SS:** supply side, **DS:** demand side, **GOV:** governmental)

Solution from **"Shared Resilience"** pillar (see "Overview Insurance Solutions" for number references).

Solution from "**Products and Pricing**" pillar (see "Overview Insurance Solutions" for number references).

Solution from **"New Data, Technology, Models"** pillar (see "Overview Insurance Solutions" for number references).

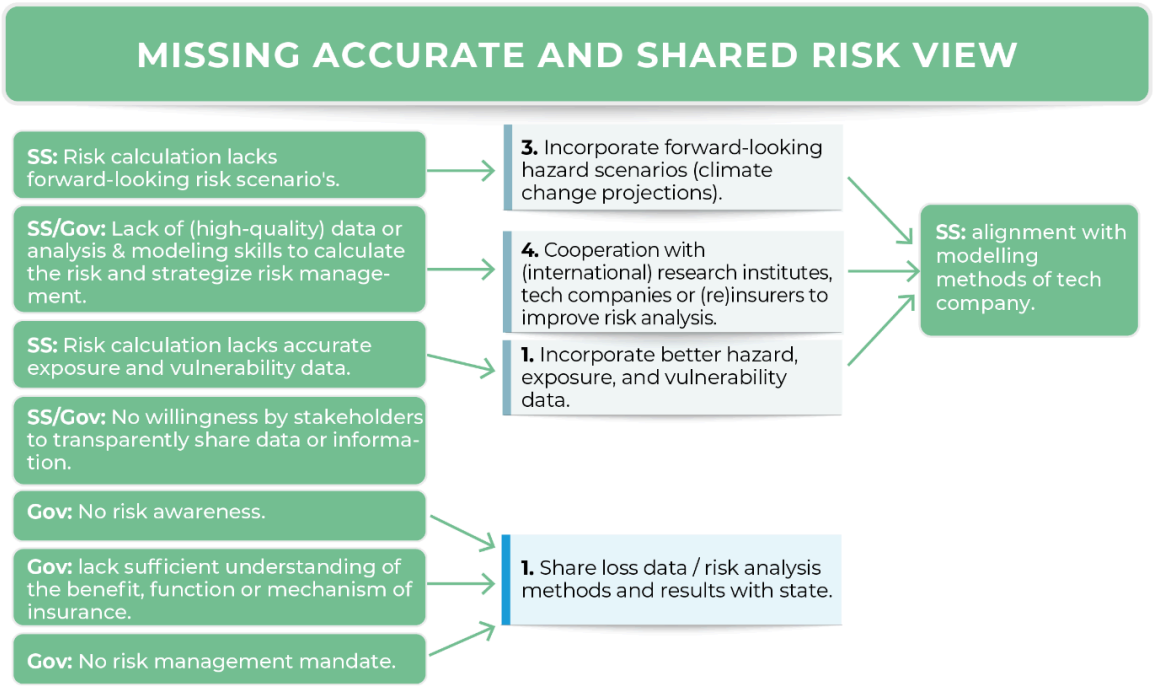
Solution from **"Business Models"** pillar (see "Overview Insurance Solutions" for number references).

Missing accurate and shared risk view (Figure 19)

By sharing risk (loss/damage) data and analysis methods or conclusions, insurers not only alleviate resilience development barriers, but also address the overarching challenge of **a Missing accurate and shared risk view**.
Several barriers hinder the development of a shared risk view, among which there are supply-side barriers like a lack of forward-looking risk calculation depicting the climate change risk and their effects on portfolio management strategies. Incorporating forward-looking hazard scenarios from climate change projections *(DTM # 3)* is a necessary measure to ensure future company sustainability. While there are now regulatory requirements to do this, it remains to be implemented market-wide. Furthermore, a general lack of high-quality hazard, exposure and vulnerability data or analysis and modelling skills hinder an accurate risk calculation and risk management strategy development. Here, insurers can find relief by cooperating with and learning from research institutes, technology companies or (re)insurers *(DTM #4)*, or incorporating better hazard, exposure and vulnerability data *(DTM #1)*, by requesting client-generated risk data (e.g. from drones, agricultural machinery or in-house smart devices) *(DTM #1a)*, incorporating open or proprietary external data from data providers (e.g. IoT platforms, satellite data, climate data) *(DTM #1b)*, and or improve the local data gathering infrastructure (e.g. installation or provision of measurement devices, drones, etc) *(DTM #1c)*.

Development of a shared risk view is also impaired if there is no willingness amongst stakeholders to transparently share data or information, or when the government lacks motivation due to a lack of a risk management mandate, a lack of awareness of the size of the risk or a lack of sufficient understanding of the benefit, function or mechanism of insurance. In this case, insurers do well to (continue to) share their own loss data and risks analysis results with the state *(SH #1)*.

Figure 19: Guidance tree linking solutions to barriers for the development of an accurate and shared risk view. SS: Supply-Side barriers, DS: Demand-Side barriers, Gov: governmental barriers.



Legend

BARRIER (**SS:** supply side, **DS:** demand side, **GOV:** governmental)

Solution from **"Shared Resilience"** pillar (see "Overview Insurance Solutions" for number references).

Solution from "**Products and Pricing**" pillar (see "Overview Insurance Solutions" for number references).

Solution from **"New Data, Technology, Models"** pillar (see "Overview Insurance Solutions" for number references).

Solution from **"Business Models"** pillar (see "Overview Insurance Solutions" for number references).

Lack of insurance demand (Figure 20)

A way to adapt to climate change is financial risk sharing by insurance, but insurance uptake can be challenged by a lack of insurance demand .

One of the demand-side barriers is that existing **insurance products are too complex or inflexible**, that they don't sufficiently take into account the client's own RR measures and aren't customizable. This can be partly addressed by allowing a premium reduction rewarding the implementation of risk reduction measures, for example through Building Back Better *(P&P #1b)*. As mentioned above, however, for the majority of the measures there is a lack of proven quantifiable risk reduction, which can be used in pricing calculations. By increasing insurance attractivity *(P&P #2)*, the customization barrier can be addressed. There are several potential approaches here, for example:

- A behavioral approach *(P&P #2a)*, where research findings on patterns in consumer behaviour and motivation are used in designing a more attractive presentation of the insurance product, for example a different framing[5].
- Ensuring higher product flexibility *(P&P #2b)*, for example allowing the customer more choices and influence on the level of coverage, contract duration, time point of premium or indemnity payments, whether or not they want to add coverage (top-up) later in the year, and more[6,7].
- Contact point improvement at the insurer *(P&P #2c)* and better product explanation *(P&P #2d)*, as it was seen in farmer's survey results in the Bavaria case study[8] (41 respondents), where 65% respectively 58% of respondents think these points would be useful, and for 24% a better product explanation would make them consider buying insurance.

Indeed, increasing insurance attractivity could ameliorate lack of understanding of the general financial benefits, function and mechanism of insurance, often encountered at the demand side, as well as a potential distrust of the insurance sector due to cultural factors or psychological biases. Distrust due to bad experiences, like late indemnity payments in case of damage, or suffering the negative consequences of the basis risk of parametric products, should be addressed. While parametric products *(P&P #3d)* offer a solution to the problematic of late payments, their sometimes considerable basis risk can be reduced by e.g. combining it witZh an indemnity product *(P&P #3d)* or by incorporating better hazard, exposure and

[5] Sustainability Assets for the Tourism Industry

[6] Belissa *et al*., 2019, *Liquidity constraints, informal institutions, and the adoption of weather insurance: A randomized controlled Trial in Ethiopia*, Journal of Development Economics 41, Pages 269-278, https://doi.org/10.1016/j.jdeveco.2019.06.006

[7] Cecchi, Lensink and Slingerland, 2024, *Ambiguity attitudes and demand for weather index insurance with and without a credit bundle: experimental evidence from Kenya*, Journal of Behavioral and Experimental Finance 41 100885, https://doi.org/10.1016/j.jbef.2023.100885

[8] Summary second Climate Resilience Dialogue Bavaria and Saxony-Anhalt (including survey results), 2026, link

vulnerability data *(DTM #1*, see discussion of Figure 16).

The barrier of the **perception that no suitable insurance product is available on the market** should be addressed by investing in increasing the product pallet with resilience-oriented product design *(P&P #3)*. Amongst the possible product innovations:

- Combining multiple lines of business in one product *(P&P #3a)* could be a solution to reduce anti-selection and increase affordability of the specific risk.
- Offering insurance for protection of the community value, maintenance costs and or creation costs of Nature-Based-Solutions (NBS), like mangroves or reefs *(P&P #3b)*, is a strong approach for risk reduction and resilience building.
- Exploring different parameters or asset characteristics with lower risk to insure, especially in agriculture, where the risk can be calculated more accurately, the total risk is lower, or adaptation is automatically rewarded *(P&P #3c)*. For example, instead of using product quantity as the insured value, product quality could show a better explained reaction to the insured risk[9]. Also, business success, measured through e.g., the variability in revenue or turnover, could be taken as the insured value, thereby rewarding the business manager for proper risk management[10]. Another way to innovate crop insurance is multi-crop insurance, shown to reduce overall risk and therefore improving affordability and incentivizing sustainable practices[11].
- Offering a parametric product or combining parametric-indemnity product *(P&P #3d)* is a way of innovation in itself. The parametric offer could be combined with an indemnity top-up or loss validation for clients with a high basis risk (e.g. weather station far away).
- Offering an aggregate sales option to consumer organizations or cooperatives *(P&P #3e)*, where the premium and pay-out is channelled at a group level, leading to lower administrative costs for the insurer, a potential lower premium, and allowing individual differences to be compensated between the group members.
- Insurers could expand their offer of insurance products for public procurement *(P&P #3f),* allowing an increased level of insurance of infrastructure or public buildings[12,13].

An additional demand-side barrier for insurance uptake is a **low risk awareness or a gap between perceived risk and real climate risk**. While some may be aware of their risks, they often undermine them and display overoptimism about the likelihood that they will suffer loss and damage from climate-related disaster events. This is the case even when they have

[9] Dalhaus, T., Schlenker, W., Blanke, M.M. et al., 2020, The Effects of Extreme Weather on Apple Quality. Sci Rep 10, 7919 . https://doi.org/10.1038/s41598-020-64806-7
[10] Interviews insurance experts
[11] Schmitt, Offerman and Finger, 2025, The use of crop diversification in agricultural yield insurance products, Food Policy 134, https://doi.org/10.1016/j.foodpol.2025.102905
[12] Sandberg E., Time B. and Sushchenko, O. 2025, *Sustainable procurement of insurance services on municipal level (Case of Troendelag, Norway),* SOTERIA Policy Brief (DRAFT per 20251028)
[13] Sandberg, B., Time, B., Bråtå, T., Alagic, A.Holterman J., Lilledal, S., Strømø E-B., 2025 Klimatilpasning hører hjemme i forsikringsavtalen, Kommunal rapport 24.09.2025 (Debate post In Norwegian)

witnessed or experienced such. In addition, urgency is even further suppressed by the reliance on state ex-post calamity payments or funds in the case of a natural disaster, or other support by the state. These are a considerable barrier for citizens to actively manage their own risk by implementing RR or CCA measures or by risk transfer. Here:

- It is beneficial for insurers to promote the availability of accurate climate risk information *(BM #2a)* and advice on CCA measures and finance options *(BM #2b)*, see e.g. Hageladapt from Swiss hail[14].
- The government, to reduce the effect on insurance takeup, could makeex-post payments conditional on insurance contracting *(SH #3b),* as is currently being implemented in France[15,16], and properly manage citizen's expectations while doing so. While citizens may rely on state calamity funds. Insurers are professionals at this business and could alleviate the dissatisfaction with the speed and amount of compensation payouts of the state calamity funds by establishing an insurer-state infrastructural and administrative cooperation *(SH #2f)*.

However, the most important demand-side barrier seen for insurance takeup is that **insurance products are perceived unaffordable**. As mentioned above, several solutions can at least partly address this problem, but risk sharing solutions, including PPP's *(SH #2)* are among the most effective. State involvement in enhancing resilience is often motivated by a high societal relevance of the sector in question (e.g. agriculture).

The most common type of risk sharing with the state is the state subsidy on insurance premiums *(SH #2a)*, which alleviates the affordability issue. An additional measure which could be implemented to also promote risk reduction, is to make the (height of) subsidies dependent on the implementation of RR measures by the subsidy applicant.

Example : In Lower Saxony in Germany, eligibility for premium subsidies is prioritized depending on the implementation of RR measures by the subsidy applicant[17].

Often, the state subsidy system often harbours additional perceived barriers like too much bureaucracy and several legal implications, for example the question on whether or not an insurer is allowed to implement a discount based on the expected subsidy in advance of the actual subsidy payment, thereby functioning as a bank[18]. Differences in the approaches of the insurers leads to competition, as one insurer will offer the discount, while others will not.

[14] HagelAdapt / Schweizer Hagel
[15] Interviews insurance experts
[16] fi-compass, 2025, https://www.fi-compass.eu/library/market-analysis/insurance-and-risk-management-tools-agriculture-eu.
[17] Niedersachsen fördert Ertragsversicherungen – neue Richtlinie startet | Nds. Ministerium für Ernährung, Landwirtschaft und Verbraucherschutz
[18] Interviews insurance experts

Other options by the state and insurers:

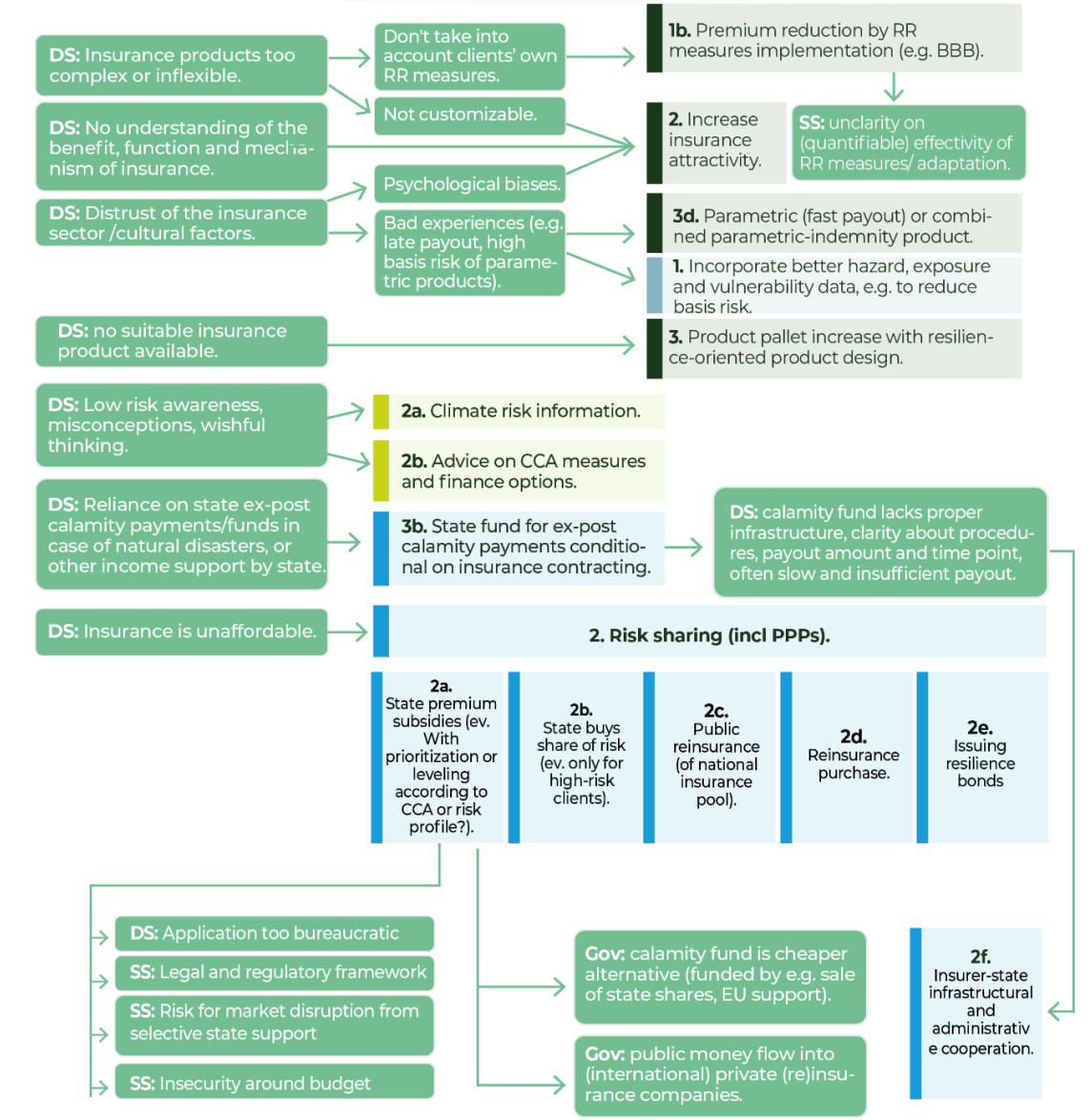
- The state buys or covers a share of the risk *(SH #2b)*, by installing a fund (supported by national, EU- or member payments), as was done in Italy, for example[19]. When this share covers the lower risk layer (higher-frequency but lower severity events), the effect is similar to premium subsidies, in that it reduces the insurance price while maintaining the level of coverage (or the price remains the same and the level of coverage is increased). However, it also increases the capacity of insurers, as higher-frequency events do not affect their results as much. When the share covers the risk layer above the cap by private insurance, the benefit for the insured is an increased level of coverage. To maintain a stable annual budget, the state can also purchase, or fund (e.g. through dedicated levy's) (re)insurance[20]. Nevertheless, payment of public money into (international) private companies can be considered undesirable.
- The state may perceive that having a calamity fund is a cheaper alternative[19], which can be crisis-funded by e.g the sale of state shares, or the state may rely on EU-support in extreme cases.
- The state may also decide to focus on specific high-risk regions or high-risk clients to cover a share of their risk, thereby alleviating the pressure and affordability issue for lower-risk clients. However, selective state support is considered by some to be potentially disruptive for the market function[19].
- The state may alternatively opt to act as a public reinsurer for the national insurers or a national insurance pool *(SH #2c)*. This option offers the benefit of lower reinsurance costs for insurers and a potential reduction of premiums. Nevertheless, it holds the negative consequence of competitive disadvantage for international insurers, who are not included in the pool[19].
- Insurers already broadly apply risk sharing through reinsurance purchase *(SH #2d),* to increase their own capacity. Less frequently, insurers issue resilience (or catastrophe) bonds *(SH #2e)* as a risk spreading option. Resilience bonds have the additional benefit of risk reduction, improving the business' future sustainability.

Figure 20: Guidance tree linking solutions to barriers for insurance uptake due to a lack of insurance demand. SS: Supply-Side barriers, DS: Demand-Side barriers, Gov: governmental barriers.

[19] Dr Ana González Peláez, Prof James Daniell, Rowan Douglas, et al., 2025, Insurance and Risk Management Tools for Agriculture in the EU, EAFRD Report, https://www.fi-compass.eu/library/market-analysis/insurance-and-risk-management-tools-agriculture-eu

[20] Public-private partnerships and (re)insurance pools in Europe

BARRIERS FOR INSURANCE UPTAKE: LACK OF INSURANCE DEMAND



Legend

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Solution from **"Shared Resilience"** pillar (see "Overview Insurance Solutions" for number references).

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Solution from **"Business Models"** pillar (see "Overview Insurance Solutions" for number references).

Insurance uptake can, on the other hand, be challenged by a lack of insurance supply (Figure 21)

One of the supply-side barriers is a **lack of insurance capacity**, caused for example by too high costs of the insurance value chain (e.g. loss adjustment, marketing and sales, reinsurance). Some ways to alleviate this are:

- Optimization of tax regulations for insurance products *(SH #3a)*.
- Cost reductions by innovations like index products or drone technology *(P&P #1a)* to reduce loss adjustment costs, or data and technology solutions for marketing and sales automation.

Index products are still often characterized by a high basis risk and a lack of accurate and high-resolution risk data. Ways to address these problems are:

- Incorporating better hazard, exposure and vulnerability data *(DTM #1).*
- Improving risk data analysis, possibly also by applying machine learning and or artificial intelligence *(DTM #2)*.

A lack of capacity is also characterized by a lack of sufficient reserves. This barrier can be partly addressed by group risk sharing solutions, including:

- Public Private Partnership (PPP´s) *(SH #2).* However, that state premium subsidies *(SH #2a)* do not alleviate the insurer's capacity limits.
- Increasing the product pallet with resilience-oriented product design *(P&P #3)*.
- Sharing detailed damage data or risk analysis methods with the government, who is then better able to implement effective RR measures *(SH #1a)*, by investing in resilience bonds *(BM #4b)* and by stimulating prevention *(BM #1)*, the insurer contributes to risk reduction and the reduction of the needed reserves.
- Prevention can be stimulated by providing clients with early warning for ex-ante ad-hoc measures (e.g. cooperation with weather services) *(BM #1a)*, or by payment/insuring institutions for the implementation of direct ex-post measures (e.g. cooperation with red cross) *(BM #1b)*.

All of the above solutions for a lack of sufficient reserves, are also applicable for the rising uninsurability of extreme climate events due to their impact being too high to be able to design an affordable product. If extreme events become uninsurable because of their frequency becoming too high, insurers can try to adapt by ensuring product flexibility, e.g. increased deductibles/franchises *(P&P #2b)*.

Insurers also struggle with **high market competition**. This barrier can be addressed in part by increasing their service pallet *(BM #2)* including:

- Providing climate risk information *(BM #2a)* to their customers.
- Providing advice on Climate Change Adaptation (CCA) measures and finance options *(BM #2b)*.
- Providing or acknowledging certification of an asset's CCA level *(BM #2c).*
- Providing financial support for adaptation, e.g. BBB *(BM #2d)*.

Also can be addressed by resilience-promoting or business-relevant cooperations *(BM #3)* with e.g. banks, to offer cheap loans for CCA measure implementation:

- With the condition of insurance contracting *(BM #3a)*,
- With material providers to offer cheap input material for the business or the resilience

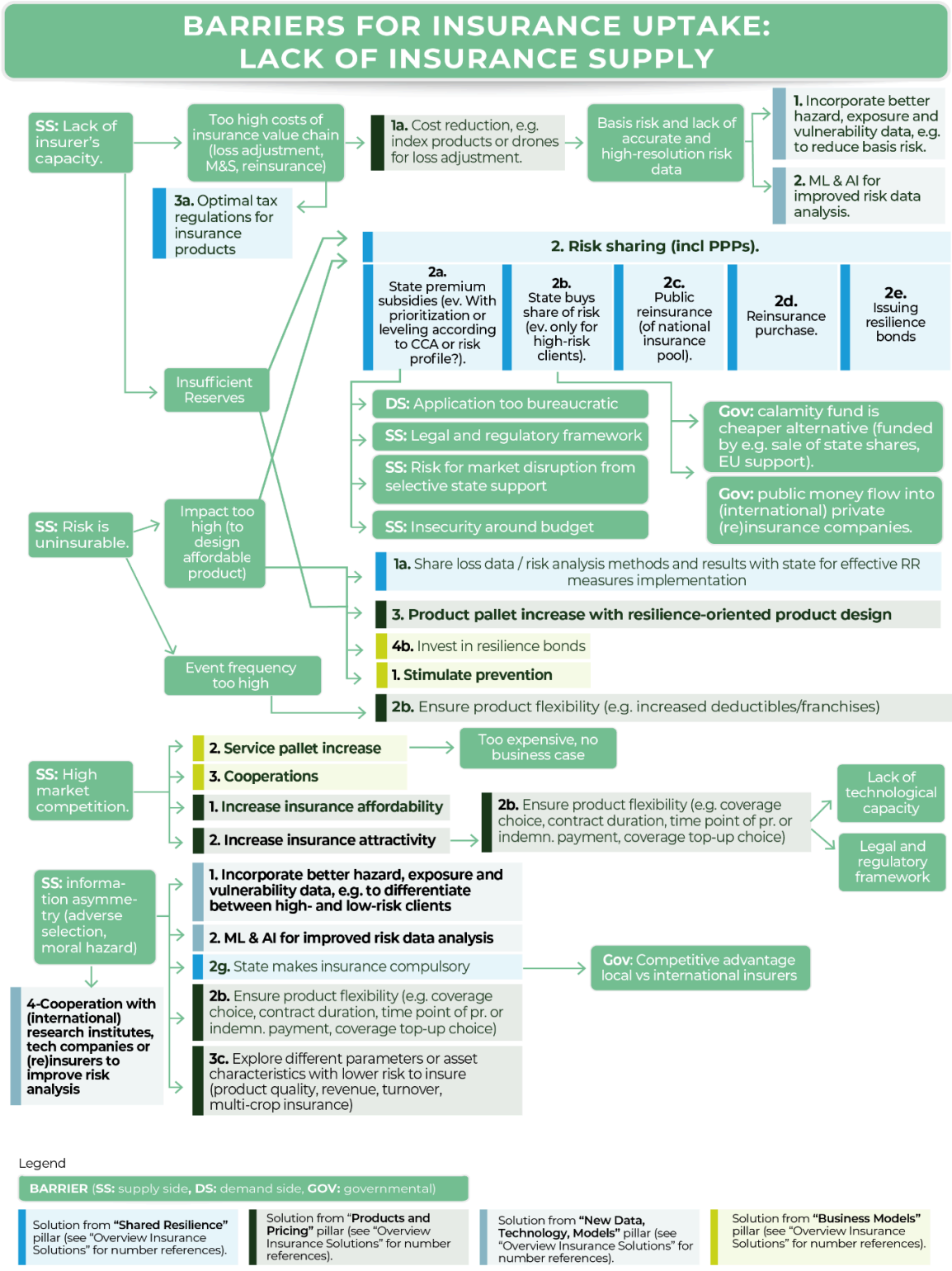
measure, for example seed/fertilizer or construction material *(BM #3b)*(see e.g. Hageladapt from Swiss Hail[21]),
- With technology providers to provide cheap technology devices *(BM #3c)*,
- With constructors for cheap construction services, potentially within a BBB-programme *(BM #3d)*, can incentivize risk reduction, or improve insurance attractivity, and provide a competitive advantage.

Increasing **insurance affordability** *(P&P #1)* through cost reductions by innovations like:
- Index products or drone technology (P&P #1a),
- Premium reduction rewarding the implementation of risk reduction measures (P&P #1b)

Increasing **insurance attractivity** *(P&P #2)* especially through ensuring higher product flexibility *(P&P #2b)*, as discussed above. Nevertheless, such flexibility does require technological capacity and an enabling legal and regulatory framework.
Finally, **information asymmetry** is a real challenge leading to adverse selection or moral hazard. Several alleviating measures can be implemented, including:
- Improving insurer's own hazard, exposure and vulnerability data *(DTM #1)*, as discussed above.
- Improving the risk data analysis with advanced analytics like ML or AI *(DTM #2)*
- Cooperation with (international) research institutes, tech companies or (re)insurers *(DTM #4)*, to be able to better differentiate between high- and low-risk clients and implement stricter underwriting framework.
- Making insurance compulsory *(SH #2g)* is effective against adverse selection, but this measure is very controversial, with one of the constraints being the creation of competitive advantage for nationals compared to international insurers.
- Ensuring higher product flexibility *(P&P #2b)*, like multi-year contract duration, can alleviate adverse selection.
- Exploring different parameters or asset characteristics *(P&P #3c)* where adaptation is automatically rewarded, can reduce moral hazard. Both solutions have been elaborated on above.

Figure 21: Guidance tree linking solutions to barriers for barriers for insurance uptake due to a lack of insurance supply. SS: Supply-Side barriers, DS: Demand-Side barriers, Gov: governmental barriers.

[21] HagelAdapt / Schweizer Hagel


BARRIERS FOR INSURANCE UPTAKE:
LACK OF INSURANCE SUPPLY
SS: Lack of insurer's capacity.
Too high costs of insurance value chain (loss adjustment, M&S, reinsurance)
1a. Cost reduction, e.g. index products or drones for loss adjustment.
Basis risk and lack of accurate and high-resolution risk data
1. Incorporate better hazard, exposure and vulnerability data, e.g. to reduce basis risk.
2. ML & AI for improved risk data analysis.
3a. Optimal tax regulations for insurance products
2. Risk sharing (incl PPPs).
2a. State premium subsidies (ev. With prioritization or leveling according to CCA or risk profile?).
2b. State buys share of risk (ev. only for high-risk clients).
2c. Public reinsurance (of national insurance pool).
2d. Reinsurance purchase.
2e. Issuing resilience bonds
Insufficient Reserves
DS: Application too bureaucratic
SS: Legal and regulatory framework
SS: Risk for market disruption from selective state support
SS: Insecurity around budget
Gov: calamity fund is cheaper alternative (funded by e.g. sale of state shares, EU support).
Gov: public money flow into (international) private (re)insurance companies.
SS: Risk is uninsurable.
Impact too high (to design affordable product)
1a. Share loss data / risk analysis methods and results with state for effective RR measures implementation
3. Product pallet increase with resilience-oriented product design
4b. Invest in resilience bonds
1. Stimulate prevention
Event frequency too high
2b. Ensure product flexibility (e.g. increased deductibles/franchises)
SS: High market competition.
2. Service pallet increase
Too expensive, no business case
3. Cooperations
1. Increase insurance affordability
2. Increase insurance attractivity
2b. Ensure product flexibility (e.g. coverage choice, contract duration, time point of pr. or indemn. payment, coverage top-up choice)
Lack of technological capacity
Legal and regulatory framework
SS: information asymmetry (adverse selection, moral hazard)
1. Incorporate better hazard, exposure and vulnerability data, e.g. to differentiate between high- and low-risk clients
2. ML & AI for improved risk data analysis
2g. State makes insurance compulsory
Gov: Competitive advantage local vs international insurers
2b. Ensure product flexibility (e.g. coverage choice, contract duration, time point of pr. or indemn. payment, coverage top-up choice)
4-Cooperation with (international) research institutes, tech companies or (re)insurers to improve risk analysis
3c. Explore different parameters or asset characteristics with lower risk to insure (product quality, revenue, turnover, multi-crop insurance)
Legend
BARRIER (SS: supply side, DS: demand side, GOV: governmental)
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Solution from "New Data, Technology, Models" pillar (see "Overview Insurance Solutions" for number references).
Solution from "Business Models" pillar (see "Overview Insurance Solutions" for number references).

STEP 4 Completion Checklist

Use this checklist to confirm that Step 4 has produced a transparent and documented selection of insurance-based adaptation options before moving to Step 5 implementation planning.

Area	Key question	Verified
Evaluation framework	Have we defined clear evaluation criteria for insurance-based adaptation options?	☐
Stakeholder input	Have evaluation criteria been discussed or validated with relevant stakeholders?	☐
Option assessment	Have candidate insurance solutions been assessed using the agreed criteria?	☐
Barrier integration	Have implementation barriers identified in Step 3 been considered in the evaluation?	☐
Feasibility check	Have we assessed whether shortlisted options are realistic in the local institutional and legal context?	☐
Comparison of options	Have we compared options in a structured and documented way?	☐
Selection decision	Have we documented the preferred insurance-based adaptation option(s) and the justification for selection?	☐
Stakeholder validation	Have stakeholders reviewed or endorsed the selection decision?	☐
Step 5 readiness	Are selected options sufficiently defined to support implementation planning in Step 5?	☐

STEP 5: IMPLEMENTING INSURANCE-BASED ADAPTATION SOLUTIONS

Understanding RAST Step 5 "Implementing adaptation policies and actions"

After adaptation options have been selected, Step 5 focuses on turning these options into concrete actions that can be implemented in real institutional contexts.

At this stage, regions organise how selected measures will be carried out, including developing implementation plans, integrating adaptation into existing sectoral policies, securing resources, and maintaining governance and stakeholder coordination over time.

The purpose of Step 5 is not to redesign adaptation options, but to ensure that selected measures can realistically move from concept or pilot stage into operational practice. Typical outputs include implementation plans, mainstreaming arrangements within existing policies, and governance mechanisms that support coordinated and sustained action.

Skipping Step 5 can leave promising solutions unrealised, as the governance, coordination, data and policy conditions needed for implementation may not be in place.

About this step

Step 5 focuses on the implementation of selected insurance solutions for climate change adaptation in Step 4. It explores the conditions, processes, and practical actions required to move from design considering the options from the portfolio of solutions all the way to implementation, including governance arrangements, enabling conditions, data availability, and lessons learned from the SOTERIA case studies.

Objective

The objective of Step 5 is to focus on what is required to put selected insurance solutions in Step 4 into practice. This includes identifying and addressing what structural constraints prevent the adoption of the selected solutions including strengthening enabling governance and policy conditions, improving supporting elements such as data sharing and coordination mechanisms reflecting on real implementation experiences from case studies. The aim is to help authorities and relevant stakeholders to understand how insurance solutions can move from concept to action within real institutional, legal, and local contexts.

RAST alignment

This step aligns with the RAST Step 5 Implementing adaptation policies and actions which focuses on putting adaptation policies and actions into practice. It covers four main elements: developing adaptation strategies and plans (RAST 5.1); mainstreaming adaptation into existing plans and sectors (RAST 5.2); securing funding or financing for implementation (RAST 5.3); and maintaining governance and stakeholder engagement during implementation (RAST 5.4). This Manual addresses Step 5 from a practical insurance-implementation perspective, rather than by following each RAST substep one-to-one. It focuses on the governance, policy, data, and process conditions needed to implement insurance solutions for climate adaptation. Funding and financing is acknowledged as an important condition for implementation, but it is not covered as a dedicated single substep in this Manual.

- **Substep 5.1 (RAST 5.2 and 5.4)**: This substep focuses on the structural constraints that must be addressed before innovative insurance solutions can be implemented beyond pilot projects. It identifies barriers such as coordination gaps, limited enabling governance, insufficient integration of insurance into adaptation policy, and constraints on accessing and using climate risk and loss data.
    - Main output: a diagnosis of structural implementation constraints (governance/coordination/policy integration/data access) that block moving beyond pilots.
- **Substep 5.2 (RAST 5.2 and 5.4)**: Building on the structural constraints identified in 5.1, this substep translates them into practical recommendations for public authorities. The emphasis is on improving the institutional and policy environment (strengthening coordination, clarifying roles, improving data use and creating stable frameworks for cooperation with insurers) so that selected solutions can actually be implemented.
    - Main output : a package of implementation recommendations (roles, coordination, policy embedding, cooperation with insurers, data-use improvements, affordability principles).
- **Substep 5.3 (RAST 5.4 and 5.2):** This substep shows what “implementation” looks like in practice, drawing on SOTERIA case-study experiences. Rather than presenting fully implemented products, it highlights the concrete steps taken beyond design (feasibility testing, stakeholder coordination, data work, and navigating governance and regulatory constraints)to give realistic insight into how regions can progress from ideas to early action.
    - Main output: a practical implementation pathway narrative.
- **Substep 5.4 (RAST 5.2 and 5.4):** This substep focuses on the Regional Data Hub content and highlights data sharing and cooperation as key enablers for sustained implementation.
    - Main output : a Regional data-sharing plan to support the selected insurance solution.

How SOTERIA tools contribute to RAST Step 5

RAST Step 5 element	What it means (Mission level)	SOTERIA tools / content
Develop implementation pathways	Organise how selected adaptation options will be implemented	Implementation playbooks from case studies
Mainstream adaptation	Integrate adaptation into policies, governance, and planning	Policy briefs on enabling frameworks
Address structural constraints	Identify governance, legal, and data barriers	Structural-barriers analysis (Substep 5.1)
Strengthen enabling conditions	Improve coordination, roles, and cooperation with insurers	Policy recommendations (Substep 5.2)
Maintain governance & stakeholder coordination	Ensure long-term coordination during implementation	CoP experiences and case-study processes
Improve data systems for implementation	Ensure access to risk and loss data	Regional Data Hub guidance & examples

5.1. Structural constraints affecting implementation

About:
This substep looks at the main obstacles that make it difficult to put innovative insurance solutions for climate adaptation into practice. It builds on the previous analysis of legal and institutional contexts in each of the countries of the case studies (Step 1.2), but moves one step further by focusing on what actually blocks implementation on the ground. In particular, it examines problems related to governance, coordination between institutions, the role of insurance in adaptation policies, and access to climate risk and loss data. The aim is to highlight the structural constraints at the implementation scale that need to be addressed before insurance solutions can realistically be used by public authorities.

RAST alignment
Supports RAST Step 5.2 (Mainstreaming – integrating adaptation into existing plans) and RAST Step 5.4 (Maintaining supporting governance for implementation).

Substep inputs
- [POLICY BRIEF] Barriers that hinder the implementation of innovative insurance solutions

Linked deliverables and other materials
- [D4.3] Policy Brief Series on policy enabling framework

5.1.1. Identifying and removing barriers to implement Innovative Insurance Solutions for climate adaptation (POLICY BRIEF)

Author: Mar Fabregat (BC3)

Executive Summary

The successful deployment of innovative insurance solutions (IIS) for climate adaptation depends heavily on the complex legal and institutional environment, not just technical design. Building on the Map the Context analysis (Section 1.2 of the Manual), this section moves beyond describing the context to identifying critical barriers that hinder IIS development and outlining policy recommendations for action. Despite existing European and national frameworks, significant structural constraints remain that limit the scaling of insurance-based adaptation approaches.

The primary obstacles identified are fragmented governance, characterized by split responsibilities and poor coordination across institutions; limited legal integration, where insurance regulations lack a focus on resilience and adaptation strategies rarely define a clear role for financial instruments; and restricted access to essential climate risk and loss data due to strict confidentiality rules and lacking binding frameworks.

Regional Data Hubs are highlighted as a practical response to overcome these data-sharing challenges through improved interoperability and governance structuring. Ultimately, addressing these structural constraints in governance, policy integration, and data availability is essential to transition from pilot initiatives to scalable, embedded solutions that effectively support long-term climate resilience.

Introduction

The development of innovative insurance solutions for climate adaptation does not depend solely on technical design or market interest. As shown in the Map the Context section, insurance operates within a complex legal and institutional environment shaped by European frameworks and national and regional legislation and context. While this environment provides an essential foundation, it also presents a number of constraints that limit the effective deployment and scaling of insurance-based approaches to climate adaptation.

Building on the contextual analysis of enabling legal and institutional frameworks, this document shifts the focus from description to action. Its purpose is to identify the main legal and institutional barriers that hinder the development and implementation of innovative insurance solutions for climate adaptation, and to outline policy recommendations that can help overcome these barriers.

By doing so, the analytical frame proposed in this document aims to support authorities and policymakers in moving from context-setting to implementation. It provides a structured basis for strengthening enabling frameworks and translating innovative insurance concepts into functional solutions that support climate adaptation on the ground.

Key legal and institutional barriers

Despite the existence of European and national frameworks that support climate adaptation, several legal and institutional barriers continue to limit the development and implementation of innovative insurance solutions. These barriers mainly relate to governance coordination, the legal integration of insurance into adaptation policy, and access to climate risk and loss data. Figure 21 shows the three barriers:

1.- Fragmented governance and coordination gaps: Responsibilities for climate adaptation, disaster risk management, and insurance are often distributed across different institutions and governance levels, with limited coordination. This fragmentation leads to unclear roles, weak cooperation between public authorities and insurers, and difficulties in integrating insurance tools into adaptation planning. Capacity and resource constraints at regional and local levels further limit the ability to engage in innovative insurance approaches.

2.- Limited legal integration of insurance into adaptation policy: Insurance regulation remains largely focused on financial stability and consumer protection, with little emphasis on prevention or long-term resilience. At the same time, climate adaptation strategies rarely define a clear role for insurance or financial instruments. This separation reinforces a reactive use of insurance and limits incentives for innovative, preventive, or nature-based insurance solutions.

3.- Barriers to data sharing: The development of climate adaptation insurance is constrained by limited access to shared climate risk and loss data. In many contexts, there are no binding frameworks to support data exchange between insurers and public authorities. Strict data protection and confidentiality rules further restrict data use, reducing the capacity to develop evidence-based insurance solutions and informed adaptation policies.

Figure 22: Main barriers for implementation of IIS

Box 3.- Regional Data Hubs as a way to overcome data-sharing barriers

Limited access to shared and usable climate risk and loss data is a key barrier to climate adaptation and insurance development. Data is often fragmented across institutions, stored in incompatible formats, and subject to legal and confidentiality constraints, which limits its use for planning and decision-making.

Regional Data Hubs offer a practical response to this challenge by providing a structured way to connect existing data sources, clarify access and governance arrangements, and improve interoperability between public authorities and insurers. Within SOTERIA, several pilot regions took concrete steps in this direction by testing data-sharing approaches and improving coordination, while the Norwegian Knowledge Bank illustrates how long-term public–private cooperation can enable access to granular loss data under a clear legal framework.

Further details on Regional Data Hubs, including SOTERIA examples and recommendations, are presented in Section 5.4 of this Manual.

Conclusions

Finally, the implementation of innovative insurance solutions for climate adaptation depends not only on product design, but on the surrounding governance, legal, and data environment. Fragmented responsibilities, limited policy integration, and restricted access to risk and loss data remain key structural constraints. Therefore, addressing these barriers is essential to move from pilot initiatives to scalable and embedded solutions that effectively support long-term climate resilience.

5.2. Strengthening enabling conditions for implementation

About

This substep focuses on the policy, legal, and governance conditions that need to be in place for insurance solutions to be implemented in practice. It builds on the barriers identified in the previous substep and translates them into concrete recommendations that support implementation. The emphasis is on strengthening coordination, improving the use and sharing of data, creating stable frameworks for cooperation with insurers, and ensuring that affordability, access, and justice are addressed as core conditions for implementation. Rather than designing new insurance products, this substep focuses on improving the institutional and policy environment so that selected insurance solutions can be actually deployed and contribute to resilient and just outcomes.

RAST alignment

Supports RAST Step 5.2 (Mainstreaming – integrating adaptation into existing plans) and RAST Step 5.4 (Maintaining supporting governance for implementation).

Substep inputs

- [POLICY BRIEF] Strengthening policy and governance conditions for implementation.
- [POLICY BRIEF] Ensuring and implementing just resilience insurance solutions.

Linked deliverables and other materials

- [D4.3] Policy Briefing Series on policy enabling framework.
- [D4.1] Policy Recommendations for Affordable and Just Insurance Solutions.

5.2.1. Policy recommendations and enabling governance frameworks (POLICY BRIEF)

Author: Mar Fabregat (BC3)

Executive Summary

The successful implementation of innovative insurance solutions for climate adaptation depends on the institutional, regulatory, and governance conditions in which they operate. Beyond product design, effective deployment requires coordinated governance, clear legal recognition of insurance as an adaptation instrument, reliable climate risk data systems, and stable frameworks for public–private cooperation. This section outlines key policy and institutional actions that can strengthen these enabling conditions and facilitate the transition from selected insurance concepts to operational and scalable solutions.

Introduction

As shown throughout this Manual, insurance solutions can contribute to climate adaptation in multiple ways, including by incentivising prevention, reducing financial vulnerability, and supporting long-term resilience-building investments. However, identifying a suitable insurance product does not in itself guarantee its effective deployment. The insurance sector operates within complex legal, institutional, and governance frameworks that shape what is feasible in practice, how responsibilities are allocated, and how climate risks are managed across different levels of authority.

Implementation therefore requires more than technical feasibility or market interest. It depends on institutional alignment, regulatory clarity, and the existence of governance mechanisms capable of integrating insurance into broader adaptation strategies. The following recommendations focus on strengthening these enabling conditions in a way that supports practical, long-term implementation.

Recommendations

The focus now shifts from selecting suitable insurance solutions to understanding what is required to make them work in practice. Throughout the previous steps, this Manual has explored risks, stakeholder engagement, data needs, and different insurance solutions. However, moving from design to implementation requires specific policy and governance decisions. The following recommendations highlight practical actions that public authorities and relevant actors should take into account to create a supportive environment for implementing innovative insurance solutions for climate adaptation.

- **Strengthen coordination and integrate insurance into climate adaptation governance:** Stronger coordination between climate adaptation, civil protection, and insurance authorities is essential to reduce fragmentation and enable consistent action across governance levels. Regular and structured dialogue between public authorities and insurers can help align objectives, build trust, and support joint planning. Climate adaptation strategies should explicitly recognise insurance as a preventive and financial tool, not only as a post-disaster compensation mechanism, and integrate insurance-related information, such as coverage levels and loss data, into planning and decision-making.
- **Improve access, use and sharing of climate risk data:** Innovative insurance solutions rely on reliable and accessible climate risk and loss data. Public authorities should support interoperable data systems that combine climate projections, exposure information, and loss data. Clear legal and institutional arrangements are needed to facilitate data sharing while ensuring compliance with data protection and confidentiality requirements. Improved data access can enhance risk assessment, support prevention, and enable more evidence-based adaptation policies.
- **Create legal conditions that support innovation and public–Private Cooperation:** Legal and regulatory frameworks should enable stable and transparent cooperation between public authorities and insurers. Clear rules, shared responsibilities, and long-term cooperation arrangements can reduce uncertainty and encourage private investment in prevention and resilience. In addition, regulatory environments should allow for the testing, piloting, and scaling of innovative insurance products that address protection gaps and support climate adaptation objectives.

Conclusions

In this regard, Innovative insurance solutions for climate adaptation can only be implemented effectively if legal and institutional barriers are addressed. Improving coordination across governance levels, strengthening the integration of insurance into adaptation policies, enhancing access to climate risk data, and enabling stable public–private cooperation are key to

creating an environment in which insurance can support prevention, resilience, and long-term adaptation.

5.2.2. Policy recommendations to ensure affordable and just implementation of insurance solutions (POLICY BRIEF)

Authors: Kamelia Georgieva, Milena Nikolova (BES), Oihana Luque, Elena Lopez Gunn (ICA), Mar Fabregat and Gabriela Alonso (BC3)

Executive Summary

This policy brief shows that insurance can only support climate adaptation in practice if affordability, access and fairness are treated as core conditions for implementation. Evidence from the SOTERIA case studies demonstrates that low insurance uptake is mainly driven by structural barriers such as affordability constraints, limited trust, information asymmetries and governance gaps, rather than by a lack of awareness of climate risks. If these barriers are not addressed, insurance-based adaptation risks widening protection gaps and reinforcing existing vulnerabilities. The recommendations presented here translate these findings into concrete policy actions to help public authorities implement insurance solutions that are affordable, inclusive and aligned with the objectives of just and long-term climate resilience.

Introduction

Across Europe, insurance is increasingly recognised as a potential mechanism to enable climate adaptation. However, the SOTERIA experience shows that identifying or designing an innovative insurance solution is not sufficient to ensure its implementation or uptake. In many contexts, affordability constraints, uneven willingness to pay and limited trust in insurance systems prevent solutions from being used by households, farmers, SMEs and local authorities most exposed to climate risks.

These challenges are closely linked to policy and governance conditions. When affordability and access are treated as market outcomes rather than policy objectives, insurance mechanisms can unintentionally increase protection gaps or lock vulnerable groups into high-risk situations. In line with the EU Adaptation Strategy, the European Climate Risk Assessment and the EEA's framing of just resilience, this section translates findings from SOTERIA case studies into concrete policy recommendations that help ensure insurance solutions are implemented in ways that are fair, inclusive and supportive of long-term adaptation.

Recommendations

The following recommendations focus on what public authorities can do to ensure that insurance solutions are affordable, accessible and fair in practice. They are based on insights and lessons from the SOTERIA case studies and aim to support implementation by addressing barriers related to affordability, trust, information and governance.

- **Embed affordability and access as core objectives of insurance-based adaptation:** Public authorities should explicitly recognise insurance affordability as a policy goal.

Targeted affordability mechanisms such as premium subsidies, vouchers or social tariffs can support low-income households, small-scale farmers and micro-enterprises exposed to high climate risks. Solidarity-based and mutualised schemes can help stabilize premiums for essential assets, while safeguards in high-risk areas should ensure that risk-based pricing is accompanied by adaptation support, prevention incentives or relocation options rather than insurance retreat.

- **Strengthen trust, transparency and accountability in insurance systems:** Trust is a key condition for implementation and uptake. Policymakers can use public procurement and public–private partnerships to demand transparent, affordable and reliable insurance solutions for public assets and vulnerable communities. Clear, standardised and understandable information on coverage, exclusions and claims processes, timely claims settlement and strong regulatory supervision and consumer protection are essential to improve confidence and ensure that insurance contributes to socially accepted and durable adaptation outcomes.

- **Reduce information asymmetries through data sharing and risk communication:** Information gaps undermine both insurance uptake and effective adaptation planning. Public–private data-sharing frameworks can improve access to climate risk and loss data while respecting data protection requirements. At the same time, investment in local and regional risk communication tools and capacity-building for municipalities is needed to translate technical data into usable knowledge and support informed insurance decisions.

- **Integrate participation and co-design into insurance governance:** Willingness to pay and perceptions of fairness are strongly shaped by governance arrangements. Institutionalising participatory and co-design processes that involve vulnerable groups, farmers, SMEs, civil society and local authorities can improve the relevance and legitimacy of insurance solutions. Recognise diverse and affected communities as knowledge-holders, integrating lived experience of risk, affordability constraints and recovery challenges into insurance design. Moreover, participation should be treated as a governance requirement, supported by adequate resources and long-term capacity-building, rather than as a one-off consultation exercise.

- **Prevent maladaptation by embedding equity safeguards in insurance design:** Insurance solutions should be aligned with prevention and long-term resilience objectives. Linking insurance incentives to preventive and resilience-building measures, such as nature-based solutions and safer building practices and climate-resilient farming that can help avoid maladaptation. Furthermore, insurance designs should avoid locking vulnerable groups into high-risk situations without realistic options for adaptation or relocation.Policymakers should also ensure coherence between insurance, social policy and adaptation planning so that financial protection translates into real recovery options and sustained well-being.

- **Strengthen multilevel governance and public–private collaboration:** Affordable and just insurance solutions require coordination across EU, national and local levels.

Insurance measures should be aligned with social policy, housing, agriculture and disaster risk management, and supported by EU instruments such as Cohesion Policy, the CAP, ESF+ and the Just Transition Fund. Public authorities can act as market shapers, using regulation, procurement and partnerships to steer insurance markets towards equitable resilience outcomes.

- **Monitor and evaluate just resilience outcomes:** Embedding justice into insurance requires systematic monitoring. Policymakers should integrate affordability and equity indicators into adaptation monitoring frameworks and track who benefits and who remains unprotected. Monitoring results should be used to adapt policies over time, ensuring continuous learning and preventing equity commitments from remaining purely rhetorical.

Conclusions

Insurance can only contribute effectively to climate adaptation if it is implemented as part of a broader social and institutional system that prioritises affordability, access and fairness. The policy recommendations presented here highlight that just resilience is not an add-on, but a foundational condition for implementation. By embedding equity safeguards, participation and multilevel coordination into insurance governance, public authorities can reduce protection gaps, avoid maladaptation and ensure that insurance solutions support climate resilience in a way that leaves no one behind.

5.3. Implementation pathways and insights from applied SOTERIA case study processes

About

This substep brings together two complementary resources to support implementation of insurance-based adaptation solutions:

- Transferable tools developed in SOTERIA (Decision tree and Playbooks) that help translate the selected option into an implementation pathway and clarify roles, sequencing, enabling conditions and typical risks.
- Case study evidence (diaries and short snapshots) showing how regions worked through real implementation constraints such as stakeholder coordination, data availability, affordability, governance and regulatory issues when moving from solution design toward early action.

RAST alignment

Supports RAST Step 5.4 (Maintaining supporting governance for implementation) and, in part, RAST Step 5.2 (Mainstreaming – integrating adaptation into existing plans), by illustrating how coordination, stakeholder engagement, and institutional arrangements influence implementation in real world contexts.

Substep inputs

- [INFOGRAPHIC] The decision-making tree: Translating barriers into strategic pathways
- [PLAYBOOK] Playbooks: operational blueprints.
- [EXAMPLE] Implementation experiences from SOTERIA case studies.

Linked deliverables and other materials

- [D3.5] Radar of Success Stories of best practice insurance solutions and financial risk transfer mechanisms.
- [D1.5] Communities of Practice Diaries.
- [TEMPLATE] Diary template (ANNEX 1.)

5.3.1. The decision-making tree: Translating barriers into pathways (INFOGRAPHIC)

Author: Oleksandr Sushchenko (UFZ)

Description

The Decision-making Tree (Figure 23) is a decision-support infographic that helps to link the barriers identified in the Step 3 to appropriate categories of intervention (step 4). It builds directly on the findings of the barrier matrix (Figure 16) and ensures that solution design is logically derived from the dominant constraints in each case rather than selected in an ad hoc manner.

The tree operationalises three analytical filters:

- First, it determines the relevant focus area – agriculture, public and private buildings, or shared/territorial resilience – thereby aligning the intervention with the institutional and

sectoral context.

- Second, it clarifies the primary objective of reform, whether improving affordability, strengthening resilience, or correcting risk perception.
- Third, it identifies barrier-specific mechanisms, such as premium subsidies, behavioural interventions, sustainable procurement, loss-data sharing, or public–private partnership models.

By guiding users through these choices, the tree turns a complex barrier landscape into a coherent strategic pathway and helps users identify which Playbook(s) are most relevant for the implementation phase.

Determination of focus area

The first level of the decision-making three distinguishes between two primary focus areas: agriculture and buildings (public and private). This differentiation is not merely thematic but structural. Each of these domains operates under distinct institutional arrangements, financial logics, regulatory environments, and stakeholder constellations, which fundamentally shape the design of insurance and resilience mechanisms.

In the agricultural domain, risk exposure is typically linked to yield volatility, drought, frost, and other weather-related shocks. Insurance models often rely on parametric triggers, crop-loss assessments, and public subsidy schemes. Farmers' liquidity constraints, climate volatility, and policy frameworks such as state aid rules strongly influence product design. As a result, affordability mechanisms and public–private partnerships frequently become central components of the solution architecture.

In contrast, buildings – particularly municipal assets – are embedded in procurement systems, public budgeting cycles, and asset management frameworks. Here, the key leverage points may lie in sustainable public procurement, resilience-linked deductibles, and integration of climate-risk criteria into tendering procedures. The institutional capacity of municipalities, regulatory compliance, and long-term asset planning become decisive factors. Transferring agricultural subsidy-based models directly into such contexts would neglect these governance-specific constraints.

By distinguishing between these focus areas at the outset, the decision-making tree ensures sectoral and institutional coherence. It prevents the inappropriate transfer of models across domains without adjustment and establishes a structured foundation for selecting intervention mechanisms that are consistent with the specific risk landscape, governance environment, and financial architecture of each context.

Identification of core feature

The second level of the decision tree clarifies the dominant intervention objective (feature) by distinguishing whether the primary goal is resilience enhancement, affordability improvement, or correction of risk perception and evaluation. This determination follows directly from the barrier profile identified in the Insurance Barrier Matrix (Figure 16)

- Where financial constraints and premium volatility prevail, affordability mechanisms become central.
- Where low insurance uptake is driven by limited preventive action, resilience-enhancing incentives and risk-reduction measures are prioritised.
- Where behavioural biases, mistrust, or misperceptions dominate, interventions focus on improving transparency, communication, and risk understanding.

By aligning the intervention objective with the most binding constraint, this step ensures strategic coherence and avoids addressing secondary symptoms rather than core barriers.

Barrier-specific mechanism selection

The third level in the decision tree proposes targeted intervention mechanisms that translate the defined objective into concrete policy and market instruments. These include:

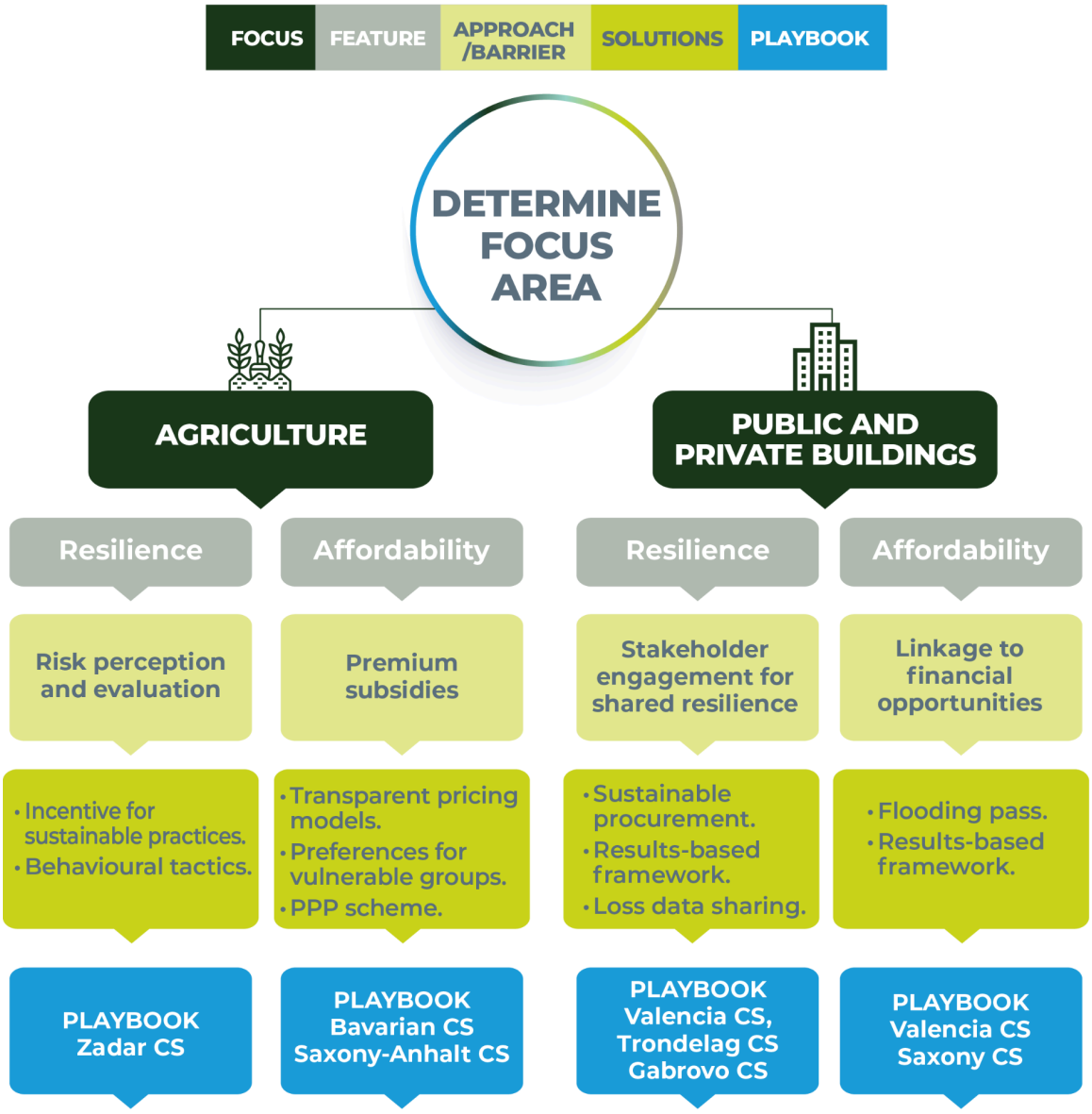
- Stakeholder engagement for shared resilience,
- Premium subsidies,
- Linkage to financial opportunities such as insurance–bank integration, sustainable procurement models, results-based frameworks, structured loss-data sharing, behavioural tactics, transparent pricing approaches, and public–private partnership (PPP) schemes.
- Risk perception and evaluation.

Each mechanism corresponds to a specific type of barrier identified in the diagnostic phase and reflects a distinct leverage point within the risk-governance system.

Through this structured progression, the decision-making tree functions as an analytical bridge between empirical barrier identification and solution architecture. It ensures that the selected intervention logic directly responds to the dominant constraint rather than applying generic innovation models. Nevertheless, the tree remains a strategic tool. It defines the direction and category of intervention but does not provide detailed implementation steps.

Concrete operationalisation for a specific case or context – roles of actors, sequencing of actions, governance arrangements, and monitoring structures – is delivered through constructing a dedicated Playbook based on the barriers analysis and structured translation provided by the decision tree as the examples show in the below section.

Figure 23: Decision-Making Tree for Innovative Climate Insurance Solutions



5.3.2 Dedicated Playbooks as operational architectures (PLAYBOOK)

Playbooks

Author: Oleksandr Sushchenko (UFZ)

Description

The "Playbooks" serve as a bridge between strategic intent and on-the-ground reality. These structured implementation models translate the general pathways defined by the Decision-Making Tree into concrete, operational blueprints tailored to specific regional and sectoral contexts. By detailing necessary institutional roles, financial structures, and governance arrangements, Playbooks ensure that climate insurance solutions are not just theoretically sound but practically deployable.

Drawing on SOTERIA case studies, these Playbooks demonstrate how differing barrier profiles necessitate distinct intervention logics. For instance, in agricultural contexts facing high affordability barriers and volatility, such as Bavaria and Saxony-Anhalt, the response is a financial one: a scalable Public–Private Partnership model that links conditional premium subsidies directly to verified adaptation measures. Conversely, where the challenge lies in managing public assets, as seen in Trøndelag, the focus shifts from finance to governance. There, the Playbook establishes Sustainable Public Procurement rules, structurally embedding resilience incentives into government contracting.

The framework further adapts to behavioral challenges in regions like Zadar and Gabrovo, where mistrust hinders action; here, Playbooks prioritize simplified products and communication strategies to overcome cognitive barriers. Finally, in complex, fragmented environments like Valencia, the approach becomes systemic, aligning insurance mechanisms with broader land-use planning and ESG frameworks to build resilience across the entire territorial structure. In summary, these Playbooks show that effective implementation requires moving beyond generic solutions to develop context-sensitive architectures for change.

Insights from the playbooks

Affordability and Volatility Barriers: Public–Private Subsidy Model

In agricultural contexts characterised by premium unaffordability and increasing climate-loss volatility, the Bavaria and Saxony-Anhalt Playbook introduces a Public – Private Subsidy-Backed Agricultural Insurance model (see **Playbook Bavaria and SA**). The model is designed to stabilise insurance markets while preserving incentives for risk reduction and adaptation.

Public authorities assume the role of finance architects by structuring and partially subsidising the scheme. Insurers recalibrate pricing based on improved climate datasets and enhanced risk modelling. Farmers receive conditional subsidies that are linked to verified adaptation and prevention measures, thereby aligning financial support with behavioural change. At the same time, data providers enhance the spatial granularity of drought and frost indicators to improve

actuarial precision, while behavioural partners address misperception and trust barriers through targeted communication and engagement strategies.

The model aligns with the “Affordability, Premium Subsidy, PPP” branch of the decision-making tree (Figure 2**3**). It simultaneously addresses financial constraints, data limitations, and behavioural barriers identified in Figure 16. The resulting structure constitutes a scalable public–private partnership framework that enhances affordability while reinforcing incentives for proactive climate adaptation.

Governance and Procurement Barriers: Sustainable Public Procurement

Where barriers concern the weak integration of climate risk into public procurement processes, the Trøndelag Playbook provides a governance-driven solution (see **Playbook Trøndelag**). Rather than focusing on premium subsidies or market correction, the model targets institutional design and contractual structures as the primary leverage points.

The model embeds climate-risk criteria directly into tender procedures, ensuring that resilience considerations become a formal component of insurance contracting. It introduces resilience-linked deductibles to incentivise preventive measures, develops shared procurement templates to standardise climate-risk integration, promotes joint learning across municipalities to strengthen institutional capacity, and aligns procurement practices with national climate governance frameworks.

This approach corresponds to the “Sustainable procurement, Shared resilience” branch of the decision-making tree (Figure 23). It demonstrates that in public-asset contexts, the key intervention mechanism is not financial subsidy but the reform of contractual design and procurement rules, thereby embedding resilience incentives structurally within public governance systems.

Behavioural and Trust Barriers: Communication and Incentive-Based Models

In regions where mistrust, product complexity, and low risk awareness constitute the dominant barriers – such as in **Zadar and Gabrovo** – the corresponding Playbooks prioritise behavioural and communication-based interventions. Rather than focusing primarily on financial restructuring, these models address cognitive and informational constraints that hinder insurance uptake.

The proposed measures include behaviourally informed communication strategies designed to improve risk understanding and trust; simplified parametric product designs that reduce complexity and increase transparency; risk-based premium discounts linked to verified mitigation actions; and structured data-sharing ecosystems that enhance credibility and reduce information asymmetry between insurers and policyholders.

These approaches correspond to the “Behavioural tactics, Incentives for sustainable practices” branch of the decision-making tree (**Figure 23**) and directly respond to the behavioural barriers identified in **Figure 16**. By targeting perception, trust, and cognitive overload, the Playbooks aim to correct decision biases and foster proactive engagement with climate risk management instruments.

Systemic and Structural Barriers: Results-Based and Shared Resilience Models

Where governance fragmentation, data gaps, and systemic coordination failures constitute the primary constraints, the **Valencia Playbook** advances a structurally integrated approach to resilience governance. Instead of targeting individual policyholders or isolated market mechanisms, the model focuses on systemic alignment across institutions, data infrastructures, and financing frameworks.

The proposed measures include the development of shared resilience indicators to establish measurable and comparable performance benchmarks; the integration of insurance mechanisms with ESG frameworks and land-use planning processes to ensure policy coherence; the mobilisation of blended finance instruments to align public and private capital; and the alignment of ecosystem-based adaptation strategies with insurance and risk-transfer mechanisms.

This approach operationalises the “Results-based framework, Loss data sharing” pathway in **Figure 23**. By embedding climate insurance within broader governance, financial, and planning systems, the Valencia Playbook addresses structural coordination failures and strengthens territorial resilience through institutional integration rather than isolated product innovation.

5.3.2. The process and results of implementation within SOTERIA (EXAMPLE)

Authors: Oihana Luque, Jose Acosta and Elena Lopez Gunn (ICA)

Executive Summary

In SOTERIA, each of the eight case study regions used a structured **diary** to document progress through three phases. The diaries were designed to reflect how practitioners describe challenges and decisions in real settings, while still allowing comparison across regions. Across the case studies, diaries served three purposes: (i) tracking progress, (ii) supporting reflection by capturing key decision points and adaptations, and (iii) providing an evidence base for cross-case learning and synthesis.

The case studies offer practical insights into how innovative insurance solutions can move from concept toward real-world application. Although SOTERIA did not reach full implementation of the proposed solutions, the case studies show what implementation looks like in practice at early and intermediate stages—highlighting the actions, interactions, constraints, and enabling conditions that shape progress. Rather than focusing on final products, this section draws on case study experiences such as stakeholder coordination, feasibility testing under regulatory and market conditions, strengthening the evidence base and data use, improving cooperation between public authorities and insurers, and integrating insurance considerations into existing governance or procurement processes.

Trøndelag Diary

Authors: County Governor of Trøndelag, Eli Sandberg and Berit Time (SINTEF)

PHASE 1 (AUTUMN 2023)
1. The challenge
What to include: What problem was your council dealing with? Dig out the original problem definition in the report or business case, and rewrite this in a conversational style.
The following is a text produced by the County Governor of Trøndelag, translated by SINTEF. In Norway, warming is faster than anywhere else on the globe, with a temperature increase of approx. 1.2 degrees since 1900. In Trøndelag, climate change will lead to the need to adapt to heavy rainfall and increased stormwater; changes in flood conditions and flood sizes; landslides and floods, as well as sea level rise and storm surges. There is a need for more knowledge, as well as better management systems and methods for mapping vulnerability. About 60% of the municipalities in Trøndelag have made or are in the process of conducting climate vulnerability analysis. Historical data on previous climate-related events

is an important knowledge base in the work on climate vulnerability analysis, but access to historical data is insufficient. In Norway, we have the best overview of floods and landslides, while there is little data on other events, e.g. wind, storm surge and drought. Access to loss data from the insurance industry is an important part of the knowledge base, but access to such data is currently limited. The work on climate change adaptation requires an interdisciplinary and sector-wide approach. This means that there must be an increased focus on which measures are best for achieving the goals for climate change adaptation. Experience from Trøndelag is that the municipalities must choose an interdisciplinary approach and organisation. There is a need for the municipalities, which are in the driver's seat in the work on climate change adaptation, to work systematically with climate change adaptation and to integrate consideration of climate change adaptation in all their plans, activities and management documents. Few Norwegian municipalities today have requirements for procurement that include climate change – both emission reduction and climate change adaptation. The same applies to tender requirements - where only a small number of municipalities set requirements in the field of climate change. Most of the municipalities in Trøndelag are small and medium-sized municipalities (only 4 out of 38 have more than 20,000 inhabitants). Lack of resources is clearly the most important challenge for the work on climate change adaptation according to the municipalities, followed by a lack of overall thinking/prioritization and a lack of interdisciplinary organisation. There is also a large turnover of professionals in the municipalities, which means that there is no continuity in the work. In addition, a lack of administrative anchoring, a lack of the right expertise, a lack of political anchoring and unclear roles of responsibility are mentioned.

2. The people

What to include: Introduce the people involved in the project, and their role in it. This may include counselors, council staff, insurance company, volunteers, and/or an advisory group.

Network Climate change adaptation Trøndelag

The county governor of Trøndelag and Trondheim municipality established *Network Climate change adaptation Trøndelag* (NKT) in 2017, with the aim of assisting the 38 municipalities in the county in their work with climate change adaptation.

A partner group was created to support NKT's work. The partners are from the state administration (The Norwegian Water Resources and Energy directorate, the Norwegian Environment Agency and the Norwegian Mapping Authority), three units at the County Governor (emergency preparedness and planning, environment/climate and agriculture), The Norwegian Association of Local and Regional Authorities, research (The Geological Survey of Norway, SINTEF and Norwegian University of Science and Technology), Trøndelag county authority, and Trondheim municipality, the largest municipality in the region, and from the business side, The Confederation of Norwegian Enterprise (NHO).

NKT has 1-2 annual meetings in the partner group and these meetings have developed into a valuable meeting place for important stakeholders in the county. There is a need to have such a regional group for competence development, experience sharing and project development and collaboration.

SINTEF

SINTEF is combining a wide range of technological disciplines and social sciences for creating technology for a better society. The institutes are Community, Industry, Digital, Ocean, Energy Research and Manufacturing. SINTEF is located in 12 Norwegian cities, and in Denmark and Belgium. SINTEF has more than 100 laboratories. The SINTEF Community is promoting sustainable development of buildings, infrastructure and mobility to develop future solutions for the built environment. SINTEF Community's business areas are research and development, research-based consultation, knowledge dissemination, and product documentation and certification.

The SINTEF community does multidisciplinary research on the topics climate change adaptation, future transport systems, architecture and built area development, energy and zero-emissions solutions, building material, constructions, water and zero-emissions building and construction sites.

On the topic climate change adaptation the SINTEF Community addresses our future development of systems within the built environment that will be able to withstand the stresses imposed by progressive climate change. The aim is to boost knowledge and develop new innovations for the climate change adaptation of buildings, built areas and infrastructure. Our **ZEB Laboratory** has instrumented stormwater management systems and hybrid ventilation for temperature regulation. It is an arena where new and innovative materials and solutions can be tested in interaction with people.

The SINTEF Community hosted the research centre ***Klima 2050*** from 2015 to 2023. Klima 2050 focused on climate change adaptation of buildings and infrastructure. The aim was to reduce societal risk linked to climate change, increased rainfall, and flooding in the built environment. SINTEF Community works in several research projects with the insurance industry, where insurance loss data on address level are used for risk analysis and criteria for rewarding climate change adaptation in non-life insurance products are being developed. SINTEF Community also works with systems for measurement and follow-up of climate change adaptation work in municipalities and businesses.

County Governor of Trøndelag

The County Governor of Trøndelag is the state's representative in Trøndelag county and is responsible for monitoring the decisions, objectives and guidelines set out by the Storting and government. In addition, the County Governor provides an important link between municipalities and central government authorities.

Gjensidige

Gjensidige offers a range of insurance products for private and commercial customers across Norway, Denmark, Sweden, and the Baltic countries. Additionally, in Norway, we offer pension and savings plans. Through more than 200 years of history, Gjensidige has made sure to create security for our customers by safeguarding life, health and assets in a sustainable manner.

Climate Risk Advisory

Legal and financial advisory services in insurance, climate risk, disaster management, and land use planning. The insights stem from extensive involvement in policy, business, and scientific research projects, including work aligned with EU Green Deal and Taxonomy regulations, with an emphasis on practical implementation.

Kommunal Landspensjonskasse gjensidig forsikringsselskap

KLP Skadeforsikring is the insurance arm of Kommunal Landspensjonskasse (KLP), Norway's largest pension company. We provide non-life insurance to local governments, public and private companies, and individuals. KLP is owned by Norwegian municipalities, health enterprises and other public enterprises.

Mitigrate

Mitigrate's integrated flood risk management tools empower insurers and policyholders to take proactive measures to prevent claims, safeguarding properties from potential flood damage and keeping your head above water.

PHASE 2 (SPRING/ SUMMER 2024)

3. The journey

What to include: What steps did you take to solve the problem? What other options were investigated – and why weren't they selected?

Regarding the thematic meeting on Climate change and procurement and insurance, 29.02.24

The purpose of the project SOTERIA is to increase the municipalities' competence in climate change adaptation and in purchasing insurance - so that society and the municipalities become more climate change adapted and that damages and costs are reduced.

Background: Climate change adaptation network Trøndelag (38 municipalities) has had 13 thematic meetings with a wide range of focus areas within climate change adaptation, since its beginning. The work with the network is about more than "technical solutions", e.g. the focus on preventing floods and landslides.

In collaboration with SOTERIA, a thematic meeting was held on 29/02/24 with a focus on climate change adaptation and the purchase of insurance. This is a topic that is new and rather immature for most professionals, both in the municipalities and in the insurance industry.
In the work to raise the municipalities' level of knowledge in climate change the network wanted to bring in a new focus area for the municipality. We also saw the possibility of bringing in a new target group in the network, namely those who work with finance, procurement and insurance in the municipalities. In addition, to create opportunities for increased cross-sectoral cooperation in the future between those who traditionally work with climate change adaptation (climate advisors, planners, technical staff, etc.) and professionals within finance, procurement and insurance with little experience in the field of climate change.

4. The discovery

What to include: How did you develop the preferred option? Did you adapt a process that had worked well in other situations, or did you need to identify new technology or methods?

Before the thematic meeting, we assumed the following:

1. The work with climate change adaptation and finance, procurement and insurance is a new professional area, for both climate professionals and the finance sections.

Those who traditionally work with climate and climate change:

- have little knowledge of finances/procurement/insurance
- have little professional contact with those who work with finance, procurement and insurance

Those who traditionally work with finance, procurement and insurance

- Some have considered setting climate requirements for procurement, but then reduced the requirements. They have requirements for reduction of greenhouse gas emissions, but not climate change adaptation

- Most have little knowledge of the subject area of combining climate change adaptation with finance, procurement and insurance, and little experience from such work.

5. The solution

What to include: Talk about the preferred option – what does it involve?

1. It is important to involve finance, procurement and insurance professionals in the work on climate change adaptation. To use their tools (purchasing requirements, good incentive structures on insurance schemes, products and services, insurance brokerage, etc.) can increase safety and security for the municipalities and provide financial benefits.

2. It is important that those who traditionally work with climate and climate change adaptation gain more insight into finance, procurement and insurance and how they can use their instruments in the work on climate change adaptation.

3. The work to stimulate the municipalities to increase focus on the technical field of climate change adaptation and finance, procurement and insurance must continue. To develop good templates, proposals for criteria and give examples of strategies and measures are relevant to incentivise the climate change adaptation work in smaller municipalities.

4. An important part of the work is to identify drivers and barriers, or what it is that can contribute to progress and increased quality in the work with climate change adaptation and the interception with finance, procurement and insurance. It is also interesting to uncover what are the biggest obstacles to success in this work.

5. Climate change and the work with climate change adaptation require new ways of working in many sectors in society, also in the municipalities. There is a great need to work more cross-sectoral and more interdisciplinary. Today, there are high walls between the various sectors in the public sector, and little cooperation across management levels.

6. New thematic meetings. Through the Soteria project, a new thematic was held during late autumn 2024. Eventually, it became relevant to create more targeted meetings with more pointed content, aimed at specific professionals.
Examples:

- Meeting for those who work with procurement and procurement strategy in the municipalities. How to deal with new legal requirements?
- A thematic meeting on climate risk in the municipalities, and which data is used and how to use insurance loss data

- A thematic meeting on how a green insurance product for municipalities should be designed.

PHASE 3 (WINTER 2025)

6. The implementation

What to include: How was your solution implemented? Did everything go as planned, or did you have to make some changes along the way? How long did it take?

Through the winter of 2025, we learned more about how Norwegian municipalities purchase insurance and how municipalities, insurance brokers and insurance companies. As learnt in the Phase 1 the topic of climate adaptation in procurement is immature, but slowly we also started exploring how to mature the interaction and cooperation between these players. A second open thematic meeting about procurement of insurance was arranged and new players were involved. We also arranged two workshops, one in Oslo and one in Trondheim where special players both from insurance and public sector were invited. The aim was to explore how climate risk and damage prevention can be integrated into public procurement of non-life insurance.

Today, there are three main players in the property insurance market for municipalities and county authorities: Gjensidige, KLP, and Protector Forsikring ASA. Municipalities often insure their entire building portfolio, and pricing is based on average risk assessments. The largest buildings receive the most attention in risk assessments, and high deductibles serve as an incentive for both damage prevention and reduced insurance costs.

But how can climate risk take a larger role in the procurement of non-life insurance?

But we learned that we have some good examples that can show the way.

Measures to prevent climate-related damages to commercial and private buildings are rewarded by Gjensidige. Several actors have now also taken steps towards municipalities:

- KLP offers lower deductibles for documented damage-preventive measures and includes stormwater risk in pricing.
- KLP's politician dashboard provides an overview of maintenance status for municipal buildings.
- Söderberg & Partners has weighted price and quality equally in tenders – where climate and damage prevention are included as quality criteria.
- Møre og Romsdal County holds regular meetings with school principals to strengthen attitudes towards maintenance and damage prevention.
- Several municipalities have, partly through a national climate grant scheme, hired climate/environmental advisors in their procurement departments.

The most surprising thing about the workshops was how clearly the various participants expressed that they greatly appreciated meeting in a neutral setting, both municipalities and insurance actors, and discussing the possibilities for solutions to prioritize and intensify the work to reduce climate risk and prevent better. In this way, for example, EU projects and other knowledge-building projects that involve various actors are particularly important.

Findings or key principles to follow as we learnt:
Cooperation is Key: For climate risk to play a larger role in insurance procurement, municipalities and the insurance industry must work more closely together. This involves:

- Knowledge sharing – on both risk and procurement
- Joint development of requirements for damage prevention and sustainability
- Training and capacity building across sectors
- Market dialogue and shared meeting arenas

What Can Be Required in Practice? Municipalities can require insurance companies and/or brokers to provide:

- Environmental certification and sustainable practices
- Coverage that includes upgrading to newer environmental standards when rebuilding after damage
- Climate adaptation as a topic in dialogue between insurer and broker
- Sharing of knowledge and insights on climate risk and preventive measures

Insurance companies can require municipalities to have:

- Systems for managing climate vulnerability and risk
- Documented preventive measures
- Risk assessments and systematic use of an implemented facility management system
- Annual participation in dialogue meetings and training

SINTEF has been responsible in SOTERIA for the work on data sharing. As a final Local Open Day SINTEF and the County Governor of Trøndelag arranged an event on December 2.nd about Risk analysis in spatial planning - sharing of data and tools with more than 60 participants.

7. The results

What to include: Explain how the preferred option solved the problem. Be as specific as you can here. If possible, use hard data.

An Immature Topic: Climate adaptation requirements in procurement – and especially in insurance procurement – is a little-studied topic that we have begun exploring in the Trøndelag case study. Through four different regional and national events leading up to

climate adaptation and damage prevention in municipal insurance procurement we have started paving the way.

With *Climate Adaptation Network Trøndelag* as a main arena, the events have been focusing on how municipalities can prioritise climate risk and adaptation in procurement processes in general and specifically on insurance procurement. We have engaged more than one hundred participants from municipalities, insurance companies, brokers, and others in dialogue about climate risk and procurement of insurance.
While the project was underway, an interesting legislative change occurred in Norway that may affect the extent and speed at which climate risk prevention and reduction becomes part of the insurance purchasing process.

Since 2024, public procurement in Norway has been required to weight climate and environmental considerations by at least 30% (§ 7-9 of the Procurement Regulations). In this context, “climate considerations” refer to greenhouse gas emissions, not climate adaptation. But we believe damage prevention should be considered an environmental measure – and thus part of sustainable procurement.Preventing climate-related damages reduces both resource use and greenhouse gas emissions associated with rebuilding, and should therefore be seen as an important element from a sustainability perspective. The work that was done in the Trøndelag case study can provide a very good basis for developing a unified definitions of “sustainable insurance.”
The growing impacts of climate change highlight the urgency of this topic, and we expect significant developments ahead. There is clear potential for benefits – for both municipalities and insurers – that has yet to be realised.

Zadar Diary

Author: Paul Eberlein (G&Co)

PHASE 1 (AUTUMN 2023)
1. The challenge
What to include: What problem was your council dealing with? Dig out the original problem definition in the report or business case, and rewrite this in a conversational style.
Zadar County (14.02.2024): Challenge: People do not buy much insurance in Zadar, farmers were not interested in the workshop they organized (only 5-10 farmers), even though the supply side was there (two insurance companies and MoA and the Agency). Initially, Zadar County thought the issue would be on the side of the insurer (agents not being aggressive enough or not interested enough to talk with farmers). But since the workshop they don't think so anymore. Larger farmers do have insurance, but they are not the majority of the farmers (only around 10 %). Especially small scale farmers are uninsured, but do not seem much interested. Goal: Zadar county is trying to cover as much land with irrigation systems funded by EU funds. Zadar county signed an agreement with the farmers before construction, making sure they will put in the effort to make the solution work. Not all farmers pay the county for the water once the systems have been set up. Through public procurement they hire a company who does the maintenance of the irrigation systems each year, paid for with the money farmers pay for the water. Croatia Osiguranje (29.02.2024): The (crop) insurance industry is facing major challenges: the weather is changing, winters are getting warmer, which means that the coverage period for spring frost, for example, has to be adapted to the changing conditions. Loss ratios in crop insurance are generally not good, as there are many possible perils that can affect the harvest. Unprecedented severe (hail) storms last year led to high claims. The crop portfolio is not profitable, so prices have to be raised and deductibles increased. But insurers also feel a responsibility to farmers. Some competitors in the market don't care about profitability. There is uncertainty about the outcome of the season, and it is difficult to plan and protect the technical result. This makes it difficult to develop an underwriting or business strategy. Livestock also faces problems such as outbreaks of African swine flu and avian influenza. There are also technological challenges, such as digitalisation to handle their own data for better strategy making. It's easier to deal with larger customers, who usually understand the insurance business, but it's more difficult to deal with small and medium-sized

customers (especially fruit growers who insure against spring frost and do not want to accept high deductibles).

There are also some regulatory challenges: The paying agency sometimes does not pay the subsidy to CO on time, which creates cash flow problems for them. They have recently raised the issue with the insurance association. The government premium subsidy itself is very necessary, without it many farmers would not be able to buy insurance, they say. But the government doesn't encourage farmers to take out insurance because it subsidises them too much in other ways. There is talk of setting up a national mutual fund, but the CO fears that no one will buy private insurance. They think that insuring assets as a condition for receiving subsidies could be a solution with multiple benefits.

Genillard & Co:
In Croatia, only 7 to 8 percent of farmers are currently insuring their business, compromising around 40 to 50 percent of the agricultural area used. Especially small-scale farmers are at risk in case of a natural disaster as these farmers often do not have the financial means to balance out a significant loss; however, few of them consider insurance to increase their resilience and rather rely on the government to step in. As climate change advances, the frequency and severity of extreme weather events and natural hazards is increasing, leading to a higher number of events such as heavy hailstorms, as well as more damages claimed by farmers. To better protect the people engaged in and relying on agriculture, it is imperative to close this insurance gap. For this purpose, we first have to identify the various reasons why farmers choose not to insure their business, as well as other external barriers such as challenges in the regulatory framework for example. Afterwards, we aim to develop a suitable solution to approach these issues. In the end, we want to be able to propose an insurance product or financial instrument that can improve the situation in the relevant case study region.

2. The people

What to include: Introduce the people involved in the project, and their role in it. This may include counselors, council staff, insurance company, volunteers, and/or an advisory group.

Zadar County:
Department for agriculture, fishery & EU funds: 7 colleagues in total, 2 of them working on the irrigation project. The head of section: agriculture, fisheries and rural development, and the senior professional associate share their tasks (also Soteria related).

Croatia Osiguranje:
In the SOTERIA project the Head of non-life, the Product manager of property insurance, and the team lead property & agro were involved.

Genillard & Co:

Genillard & Co is the lead of the Croatia case study. For this purpose, we are working with various stakeholders involved in the insurance and agricultural sector. Croatia Osiguranje (department non-life: agro and property) is providing insight into the Croatian agricultural insurance market while Zadar county (Administrative Department for Agriculture, Fisheries and EU Funds) is supporting with information on regional aspects and initiatives as well as contact to farmers. Furthermore, we have started talks with AGRRA (Agency for Rural Development of Zadar County) and the Croatian Chamber of Agriculture to get a better understanding of the overall situation and possibilities for change.

PHASE 2 (SPRING/ SUMMER 2024)

3. The journey

What to include: What steps did you take to solve the problem? What other options were investigated – and why weren't they selected?

In February 2024, we sent out a questionnaire to Croatian farmers asking about their views on climate change and natural hazards as well as their experience and thoughts on agricultural / crop insurance. The survey was sent out via the Croatian Chamber of Agriculture; using their contact base, we were able to receive around 1000 answers over the course of a month.

Our project partner Behavior Smart handled the preliminary and later the detailed analysis of responses, contributing their knowledge on behavioral science. The results showed that while most farmers had already experienced damage from natural hazards and see increasing trends in severity as well as frequency of events, most still do not have agricultural insurance. One of the most frequently stated reasons is that the price is perceived as too high and that there is a lack of suitable insurance products on offer.

Together with our local partners, we discussed the questionnaire results, insights gained and where we can approach the issues at hand. We will most likely focus on the design / further development of an insurance product; the issuing of official recommendations to relevant stakeholders could also be an option.

We are behind on our schedule towards developing an insurance solution for the case study since the questionnaire analysis has taken longer than previously expected due to the high number of answers.

Update summer 2025:

In the beginning of March 2025, Zadar County, together with our contact from the Chamber of Agriculture, hosted the Climate Resilience Dialogue. One topic of the CRD was the planned implementation of mutual funds for agricultural cooperatives. The implementation of these funds is anchored in the CAP and therefore not part of the SOTERIA project. There is also no option for us to join this initiative. In April, we had a follow-up meeting with Zadar County and the Chamber of Agriculture to discuss the outcomes and the summary of the CRD. Due to strongly reduced resources with our local partners at the time, and difficulties to motivate farmers to engage, there was a short pause in communication.

4. The discovery

What to include: How did you develop the preferred option? Did you adapt a process that had worked well in other situations, or did you need to identify new technology or methods?

As no clear solution for this CS could be identified through talks with our stakeholders, we decided to ask the Task Force on IIS led by UFZ for help. The first meeting took place on June 3 with Paul Eberlein (G&Co), Oleksandr Sushchenko (UFZ), and Kamelia Georgieva and Milena Nikolova (BehaviourSmart). Follow-up meetings were held on June 23 and July 24. BeS explained their idea on how they would approach the issue from a behavioural perspective.

Regarding the points below: Talks were held with stakeholders but they did not lead to clear ideas on what to test/implement. There was not high interest in testing something new or to really increase the insurance uptake. Also, as mentioned above, there was a short pause in communication (status 07.08.2025).
Discussions with stakeholders (planned):

- Croatia Osiguranje: actuarial, technical & legal aspects, feasibility on their side
- Zadar County: perceived needs from farmers, risk data, government's involvement
- Croatian Chamber of Agriculture: farmers' needs and views on proposed products

Workshop to work out a solution together (planned):

- Bring all views to the table, look for common ground as well as individual barriers
- Draft a first product design agreed on by different stakeholders

5. The solution

What to include: Talk about the preferred option – what does it involve?

The current plan is to send out questionnaires again to Croatian farmers. Ideally, we want to send out two/three different questionnaires within one survey (maybe also via different distributors, if possible). The questionnaires shall be assigned randomly to the farmers, so that not everyone receives the same questionnaire. Through this, we want to find out how the farmers react to different distributors and what different stakeholders (insurers, cooperatives, government) could do to change farmers' attitude towards insurance which eventually should lead to an increased insurance uptake. **Update 29.12.2025** The second questionnaire was sent out in October 2025, again via our contact in the Chamber of Agriculture. It is currently still open for answers.
PHASE 3 (WINTER 2025)
6. The implementation
What to include: How was your solution implemented? Did everything go as planned, or did you have to make some changes along the way? How long did it take?
After the CRD that was held in Croatia in March 2025, we had meetings with the Task Force, in which we discussed the plan for a second survey. This was also discussed with our local partners and we agreed to send out a second survey via the Chamber of Agriculture again. So, Behaviour Smart started to create three different surveys that would be then sent out in one link. After clicking on the link, one of the three surveys is assigned randomly to the respondent. Some weeks after the link was sent out, we still only had two answers, therefore, we decided to make some changes in the description of the survey and send it out again in the beginning of December, as we were told this would be a better time to expect more answers. In mid-December we now had more than 200 answers and the survey is still open. In January, Behaviour Smart will analyze the responses and we will use them to create some type of guidance on what could be tested theoretically (with more time and resources), similar to what we are doing for Bavaria
7. The results
What to include: Explain how the preferred option solved the problem. Be as specific as you can here. If possible, use hard data.
There are no results yet, as we did not achieve what we initially aimed for. Together with our partner Behaviour Smart, we will use the answers from the survey to create policy

recommendations and guidance and explain how an innovative insurance solution could look like for this case. It could in future be tested with more time and resources.

West Athens Diary

Author: Dimitris Dimitriadis (ASDA)

PHASE 1 (AUTUMN 2023)
1. The challenge
What to include: What problem was your council dealing with? Dig out the original problem definition in the report or business case, and rewrite this in a conversational style.
"The Association for the Development of West Athens (ASDA), representing nine municipalities (Agia Varvara, Agioi Anargyroi-Kamatero, Aigaleo, Ilion, Korydallos, Peristeri, Petroupoli, Fyli, and Haidari), is confronting a dual challenge centered on climate vulnerability and financial resilience. The primary problem is the acute exposure of this urban area to climate change impacts, including heatwaves, droughts, urban flooding, and peri-urban wildfires. This risk is exacerbated by the region's specific socio-economic and structural vulnerabilities: high energy poverty, dense urban fabric with large concrete buildings, and a population suffering from significant poverty and social inequalities. Major floods in 2014 and subsequent events highlighted the region's fragility and the immense financial cost of recovery. The secondary, interconnected problem is the critical gap in affordable insurance solutions for natural disasters, and this gap applies for businesses, citizens and municipalities. The historical model of state compensation for damages is becoming legally and fiscally unsustainable. The recent Greek Law 5116/2024 is signaling a big shift: ● For businesses with an annual revenue over €2 million, natural disaster insurance is now mandatory, ending state compensation for them and signaling a broader shift towards private insurance responsibility ● For individuals, the law introduces incentives such as ENFIA (Uniform Real Estate Ownership Tax)[22], tax reductions for insured residential properties, further extending responsibility to citizens.

[22]Annual property tax paid by property owners in Greece.

- Municipalities, meanwhile, are expected to play a coordinating role within this evolving framework.

However, despite this legislative progress, there remains a significant gap in the implementation of accessible, coordinated insurance solutions within a unified national strategy. At the same time, municipalities face a separate legal obligation under the National Climate Law 4936/2022 to develop Municipal Emissions Reduction Plans (DSME), which most currently lack, underscoring the urgent need for integrated public–private cooperation and strengthened local capacity

ASDA's challenge within SOTERIA is to address this protection gap by developing innovative, affordable insurance-related solutions to enhance the region's climate resilience, thereby moving from a reactive (post-disaster compensation) to a proactive (pre-emptive risk management) model."

2. The people

What to include: Introduce the people involved in the project, and their role in it. This may include counselors, council staff, insurance company, volunteers, and/or an advisory group.

The case study involves a multi-stakeholder ecosystem centered on West Athens:

- Lead Organization: The Association for the Development of West Athens (ASDA). ASDA is the mandated body representing the nine municipalities, with a 20-year history in regional development, urban planning, and environmental sustainability.
- Beneficiaries: The nine municipalities of West Athens and their constituents. This is a Functional Urban Area (FUA) with chronic problems of poverty and marginalization, where approximately 3.9% of the population lives in extreme poverty.
- Scientific Partner: The National Centre for Scientific Research "Demokritos" (NCSRD), providing scientific expertise and climate data.
- Insurance Sector Partner: The Hellenic Association of Insurance Companies (HAIC). Initially, Ethniki Asfallistiki was an advisor, but HAIC became the crucial collaborative partner from August 2024, providing industry insight and data.
- Government Entities: The project interacts with national frameworks set by the Ministry of Environment and Energy (for DSME plans) and the Ministry of Climate Crisis and Civil Protection (for disaster compensation protocols).
- Future Participants: Plans are in place to engage civil society, including citizens, NGOs, and local businesses, in advisory workshops.

PHASE 2 (SPRING/ SUMMER 2024)

3. The journey

What to include: What steps did you take to solve the problem? What other options were investigated – and why weren't they selected?

Initially, 4 meetings were held with representatives of the municipalities and the region of the west part of Athens to see what exactly is in force by legislation, what are the problems and what solutions would be effective. The main conclusions or proposals as they emerged from the four meetings could be summarized by the following propositions:

- Insurance coverage for natural disasters in both the public and private sectors focuses on losses that are unpredictable from phenomena such as floods or fires and not on predictable damages that can be caused gradually in the future, from phenomena such as heat waves or snowfalls.
- Insurance coverage of both public infrastructure and private property is related to covering the consequences of climate change (e.g. fires, floods), rather than to the climate parameters themselves (such as high temperatures or heat intensity).
- There is no direct insurance coverage for damage caused by heat waves.
- Municipalities cooperate with the local insurance market to insure public works, including all types of climate risks
- Municipalities choose the cheapest insurance options for natural disaster coverage, without investing in quality.
- The municipalities of West Athens that are most affected by the heat island phenomenon and heat waves are Aigaleo, Peristeri, and Chaidari due to the lack of vegetation and the highly populated areas.
- It is proposed to strengthen inter-municipal cooperation as well as cooperation between the public and private insurance sectors.
- It is proposed that insurance use data and modeling for different events through a single risk hub with the aim of visualizing the portfolio, for understanding vulnerable groups.
- It is proposed to emphasize the prevention of the consequences of phenomena such as heat waves, through nature-based solutions and citizen information

Then, in June 2024 ASDA was in trouble because Ethniki was not actively participating in the program. Specifically, Ethniki Asfalistiki's limited availability to engage consistently in the coordination activities made it difficult to identify mutually convenient times for meetings within the planned communities of practice. So, there were contacts at the offices of the Hellenic Association of Insurance Companies, which showed great interest in the program. They showed great interest immediately. The change from Ethniki to HAIC caused a delay in the initial planning, but in the end, this turned out to be a positive thing.

It didn't affect the quality of our results and actually helped us draw better final conclusions about the critical need for integrated cooperation among all insurance companies.

From August 2024, HAIC (Hellenic Organization of Insurance Companies) is one of the collaborators of the project. It will participate in workshops for recording, collecting, suggesting and we believe that will be of great help in finding the insurance solutions we are after.

During that period also, the need for civil society to participate as advisory groups (citizens, NGOs, businesses) with proposals for finding solutions was highlighted. While we're still planning to hold those workshops in the near future, we have started collecting feedback. Citizen and vulnerable group experiences regarding insurance coverage have been conveyed indirectly through representatives of the municipalities and the HAIC insurers, who are in daily contact with these groups."

4. The discovery

What to include: How did you develop the preferred option? Did you adapt a process that had worked well in other situations, or did you need to identify new technology or methods?

"The proposed option was to examine potential impacts of heatwaves and how the insurance sector could be a potential contributor to the adaptation efforts in the FUA.
The ASDA's case focuses on insurance innovation for the adaptation of the municipalities of West Athens, also considering that heatwaves is a persisting and emerging EU challenge which will have devastating effects over the next years. Being clearly aware that heatwaves is not a priority hazard for the insurance sector, we proceeded with the proposed priority hazard for the following reasons:

- It is a hazard of high interest in the EU, 95% of the fatalities associated with weather and climate-related extremes recorded in Europe between 1980 and 2023 were linked to heatwaves Although health insurance is not a issue covered within SOTERIA project, according to the EUCRA considers increase in mean temperature and heatwaves is becoming increasingly common, exposing a large share of the population to heat stress, particularly in southern and western Europe.
- According to SWISS-RE extreme heat poses a growing threat to the insurance industry, with property, specialty and L&H business most exposed. It increases the risk of electrical outages and wildfire risk, and can damage and cause disruption to transport, water and energy infrastructure, thus driving up property and specialty claims. Extreme heat can put additional stress on healthcare systems. Liability

exposures may also rise as employers and institutions face legal risks for failing to mitigate heat-related harms.

Before selecting heatwaves, we did carry out a general assessment of risks and the necessity of finding solutions, specifically for Greece and West Athens. This assessment was based on existing statistical data and indicators provided by our partners at DEMOKRITOS.

5. The solution

What to include: Talk about the preferred option – what does it involve?

ASDA and NCSRD identified several priority axes linked to the WA Integrated Urban Intervention Plan that strives for a sustainable local economy and society. The examined list is the following :

- Insurance products for the property of municipalities in terms of climate change.
- Detailed risk assessment in West Athens considering data scarcity, and vulnerability in regard to insurance coverage rates, including for municipal infrastructure and extreme weather events covered.
- Promote the active and collaborative sharing of risk, hazard and impact data across stakeholders though the standardisation of metadata and the format of granular data that can be more efficiently and transparently shared across stakeholders productively.

The preferred option is not a single product but a multi-faceted strategy to integrate insurance innovation into climate adaptation. The work, conducted in Winter 2025 in collaboration with HAIC, focused on two main directions:

Direction 1: In-Depth Risk Assessment. A comprehensive effort was launched to understand the heatwave risk:

- Data Collection: Gathering high-resolution climate data from NCSRD, CORDEX, and the Ministry of Environment. Collecting municipal heatwave emergency plans and insured loss data for Attica from HAIC.
- Impact Analysis: Assessing the impact of Urban Heat Island effects on critical infrastructure (energy grid, transportation, water systems, buildings, digital infrastructure) and municipal services (increased social care demand, stress on green spaces, delays for outdoor workers).
- Risk Quantification: Based on existing statistical data and predictive indicators, the risk assessment has been completed. It can be combined with the 2023 study, "Adaptation to Climate Change—Challenges and Prospects for the Greek Economy

Direction 2: Developing Concrete Insurance Solutions

Through stakeholder discussions with HAIC and Civil Protection agencies, several potential insurance products were identified. We also discussed the financial feasibility of these new products. Since they don't yet exist in Greece, a key proposal is that compensation wouldn't be based on damage, but on temperature indices. For example, a payout would be triggered

The identified products include :

when Celsius degrees exceed a specific, pre-set limit.Operational Loss Insurance for Outdoor Workers: Covering businesses for losses when heatwave laws mandate work stoppages.

- Project Delay & Quality Insurance for Contractors: Covering delays and quality issues in municipal construction projects caused by heatwaves (e.g., asphalt paving, roadworks).
- Municipal Asset Insurance: Expanding municipal insurance portfolios to specifically include heatwave damage to assets like water reservoirs, parks, and roads that support green infrastructure.
- Electricity Grid Failure Insurance: Addressing business and household losses from blackouts and appliance damage caused by grid overload during heatwaves.

The overarching solution involves creating a new framework for data sharing and standardized risk assessment to enable these innovative products, ultimately aiming to make West Athens more resilient by using insurance as a proactive tool for climate adaptation.

PHASE 3 (WINTER 2025)

6. The implementation

What to include: How was your solution implemented? Did everything go as planned, or did you have to make some changes along the way? How long did it take?

There were two most important reasons why we decided to focus the study of West Athen's case study, on finding insurance solutions that would cover losses and damage related to the heat wave.

The first reason is that, based on the study carried out within the framework of the program, heat waves are a priority risk, responsible for 95% of weather-related deaths in Europe and causing knock-on effects on health, infrastructure and energy systems. On the one hand, they can be linked to the outbreak of fires that have been increasing and have painful consequences in recent years and on the other hand, they could be linked to

tangible civil liability risks (e.g. for businesses, public services) and economic risks. The above, in combination with the statistical data showing a rise in temperature and discomfort in West Athens, which can be associated with densely populated conditions or a lack of greenery, which is mainly found in areas inhabited by "vulnerable groups".
The second reason is that despite the current situation above, there were no insurance products directly related to the compensation of damage to public or private property from high temperatures. Through the research carried out within the framework of the SOTERIA program, there was a perception that the main problem identified regarding the lack of corresponding insurance products can be justified by the difficulty of directly linking the cause of material damage to the rise in temperature.
Due to the radical lack of corresponding products, it was difficult to meet the schedule for the creation and implementation of an insurance product that could be immediately placed on the market. One reason for this situation is that the public finds it difficult to support the purchase of such a product. To solve the above problem, two solutions are currently being implemented.

The first solution is related to the proposal by the ASDA team for two possible insurance products that are being discussed for possible preparation or implementation with the HAIC. The first insurance product proposed is to add the exceeding of a specific temperature limit as a possible cause to an existing insurance product for compensation for property damage caused by fire. The second solution was the preparation, pricing and precise terms of an insurance product, for damage to private property with compensation terms, linked to specific parameters. The key parameter, in this case, could be the exceeding of a temperature limit that will have been
The second solution is that given the lack of direct insurance solutions for heat waves, a risk analysis product could be designed through the collaboration of HAIC insurers and engineers and representatives of municipalities with whom ASDA collaborates. A detailed assessment of current climate-related risks could be carried out for the identification of the main insurable risks foreseen related to ASDA. The main goal would ultimately be a prediction of the future risk trend.

7. The results

What to include: Explain how the preferred option solved the problem. Be as specific as you can here. If possible, use hard data.

A key outcome of the program is that the significant insurance gap that exists regarding insurance coverage for damage to public or private property caused by high temperatures and heat waves was identified. A very basic finding was that in order to implement a corresponding product, both insurers and the public will need to be informed so that the

existing market can absorb it. An important conclusion was the need to focus on solutions that support prevention.
Regarding the implementation of specific insurance solutions, there were problems that were presented in the above question. The research showed that a possible insurance product could be based on: a. the addition of temperature increase, as a cause of fire, to an already existing insurance product or b. the preparation and pricing of a new insurance product. that would be based on parametric insurance. whereby compensation would be paid if the temperature exceeds a predetermined limit. It is currently being discussed whether one of the above solutions could be prepared or implemented.
Despite the difficulties encountered, the case study created the conditions to prepare, implement and price an insurance product related to damage to public and private property caused by heat waves in West Athens.

Update February 2026

A. **November-December 2025 :** Based on the consideration of the difficulty in creating and piloting insurance contracts directly related to heat waves, there was a discussion between the members of the program from ASDA, Demokritos, HAIC and HDI. The main topic of the discussion was about the next actions that could be taken in order to complete the program with a proposal for insurance solutions that respond to the real climate challenges faced by the Municipalities of West Athens. The original target was to assess the impact of Heat Waves in the area of the 9 municipalities of ASDA. Target was also to examine potential insurance solutions available or seek new innovative insurance solutions. After discussions with HAIC it was evident that there are currently no insurance solutions available to cover Heat Waves. Still the Heat Waves are caused by Climate change and they are resulting in consequences like Floods, Heavy Rain, Wildfires, Hail, etc. Such consequences that cause direct Physical Loss/ Damage to Municipal Assets are indeed possible to be insured and there are insurance products available.

B. **January 2026** : Based on the concerns for the completion of the case study, different proposals were discussed and studied. For example, the case of testing a parametric insurance contract was proposed. This solution, and based on the insurance partners of the program, was difficult to implement because there is no direct connection between high temperatures and damage to critical public infrastructure and private property. Based on the concerns, it was proposed by the insurers and especially by Dionysios Matsas, working at HDI, that there should be a change in the case study from heat waves to existing risks. He therefore proposed an indicative mapping of risks in some public infrastructures of great importance for nine municipalities and the drafting of an action plan based on this mapping. This proposal was discussed with the responsible for the program, during the in-person meeting in Brussels and the implementation began immediately.So the decision from ASDA was to focus on these Risks and proceed with the Risk Mapping analysis in the area of the 9 municipalities in order to assess the risks and

exposure.

C. **February 2026:** Initially, ASDA contacted the nine municipalities and requested specific data for the city hall buildings and two schools selected by the municipalities based on criteria such as size of the school complex, number of children, level of education and age of the building. The data requested were the coordinates and address, construction material, and square meters per floor. Based on this process, official documents that included these data were collected and filed in tables. These tables were sent to Dionysios Matsas and passed to a special program with the aim of risk analysis from priority climate hazards for each of these buildings in Excel format.
D. **March**: This will provide with the predominant risks and will determine the imminent ones i.e. setting priorities depending on possibility and exposure. Also a general risk analysis on Municipal level will be delivered, covering whole areas and concentrating on high risk zones per region. Based on the above, an action plan will be drawn up. Also a draft/ indicative insurance policy wording would be provided as a specimen/ sample of how an insurance policy could look like.

Conclusions

The SOTERIA case studies show that moving from innovative insurance ideas to implementation is complex and often constrained by factors beyond technical design. While no insurance products were implemented, the project generated practical lessons on the conditions required for implementation, the types of actions that can be taken before market deployment, and the importance of governance, data, and stakeholder alignment.

5.4. Design and implementation of a Regional Data Hub

About

This substep focuses on the concrete actions taken within SOTERIA to improve the organisation, sharing, and use of climate risk and loss data as part of the implementation process. Although no fully operational Regional Data Hub was formally established, several pilot regions actively worked on data-related solutions, testing arrangements, improving coordination, and connecting existing data sources. These actions represent early but tangible implementation steps, showing how data practices can be put in place in real institutional contexts to support adaptation planning and insurance-related decisions.

RAST alignment

Supports RAST Step 5.2 (Mainstreaming – integrating adaptation into existing plans) by strengthening the practical data basis needed to integrate risk and adaptation considerations across sectors and planning processes, and RAST Step 5.4 (Maintaining supporting governance for implementation) by reinforcing coordination, data-sharing practices, and ongoing cooperation between public authorities and insurers during implementation.

Substep inputs

- [GUIDE] Guidance on improving data sharing through Regional Data Hub.
- [EXAMPLE] Regional experiences of Regional Data Hub initiatives in SOTERIA Case Studies.
- [GUIDE] Recommendations for the development of regional or national data hubs.
- [INFOGRAPHIC] Considerations for the development of Regional and National Data Hubs.

Linked deliverables and other materials

- [D1.3] Recommendations for regional data integration into the Risk Data Hub and vice versa.

5.4.1. Strengthening data sharing through Regional Data Hubs (GUIDE)

Author: Mia Ebeltoft (CRA)

Executive Summary

Across SOTERIA, several pilot regions worked on improving how climate risk and loss data are organised, shared, and used in practice. While no fully operational Regional Data Hub was formally established, concrete steps were taken to address data fragmentation, test data-sharing arrangements, and improve coordination between public authorities and other actors. These experiences show how Regional Data Hubs can act as an enabler for climate adaptation planning and for future insurance-related actions.

Introduction

Throughout the project, access to reliable and usable climate risk and loss data emerged as a recurring challenge for regions working on adaptation and insurance solutions. Public authorities

and other stakeholders often hold relevant data, but it is spread across different institutions, platforms, and formats, making it difficult to use in a coordinated way.

In response, SOTERIA pilots explored some ways to improve data coordination and sharing at regional and local level. Rather than creating new systems, the focus was on better connecting existing data sources, clarifying roles and responsibilities, and exploring how data could be shared and used in a more structured and usable way at regional or municipal level.

Box 4.- Benefits of creating a Regional Risk Data Hub

Creating a Regional Data hub presents a number of key challenges in current practices like fragmented data, limited access to insurance loss data, coverage gaps and technical and institutional barriers. Despite these barriers, the analysis highlights clear opportunities and benefits. A Risk data hub can:

- enable municipalities to carry out risk and vulnerability assessments (RVAs) with higher accuracy and detail,
- provide evidence for budget prioritization and long-term investment in adaptation,
- build institutional trust between insurers and public authorities,
- encouraging systematic data sharing and
- align local action with broader frameworks such as the Sendai Framework for DRR, the Paris agreement, EU Adaptation Strategy, EU Climate Law, the EU flood directive, the EU taxonomy and GDPR.

What is a Regional Data Hub?

A Regional Data Hub offers a practical way to overcome the fragmentation, inconsistency, and limited accessibility of climate risk and loss data. It brings together hazard, exposure, vulnerability, and loss information, including granular insurance data where available, into a harmonised and legally compliant system that local and regional authorities can actually use.

By integrating data from public institutions and insurers, a Regional Data Hub helps municipalities build a clearer picture of where risks concentrate, how damages evolve over time, and which areas or infrastructures require priority attention. This supports more robust risk and vulnerability assessments, more targeted adaptation planning, and stronger evidence bases for funding and investment decisions.

Beyond its technical function, a Regional Data Hub can also improve coordination across departments and institutions, reduce reliance on isolated datasets, and create a trusted setting for ongoing data sharing between public and private actors.

Conclusions

The SOTERIA experience shows that developing a Regional Data Hub is an incremental process that depends on local context, existing systems, and institutional capacity. Even without

fully implemented hubs, the actions taken in the pilot regions demonstrate the value of improving data coordination as a concrete step towards more effective climate adaptation and better-informed insurance-related decisions.

5.4.2. Examples on Regional Data Hubs (EXAMPLE)

Author: Mia Ebeltoft (CRA)

Executive Summary

This section presents concrete examples related to the development of Regional Data Hubs, drawing on experiences from within the SOTERIA project and one external reference case. While no fully operational Regional Data Hub has been established, the examples show how regions have taken practical steps to improve data coordination, interoperability, and governance around climate risk and loss data. Together, these experiences illustrate how Regional Data Hubs can gradually emerge through incremental actions, stakeholder dialogue, and the connection of existing data systems, rather than through the creation of entirely new infrastructures.

Introduction

Across Europe, a wide range of data platforms already exist to support the assessment of climate and disaster risks. Large reinsurance companies such as Munich Re and Swiss Re maintain extensive databases on economic and insured losses, which are primarily used to support risk modelling, pricing, and portfolio management. In parallel, advances in open-source tools and modelling approaches, such as OASIS LFM and CLIMADA, have broadened access to climate risk analysis beyond the insurance sector, with initiatives supported by EIOPA helping bridge climate science and insurance practice.

Despite these developments, SOTERIA did not fully establish operational Regional Data Hubs that systematically collect, integrate, and share climate-related risk and loss data at the regional level for public decision-making. The time span of the project was probably too short since for example learning from the Norwegian experience a Regional data hub would take around 3 to 5 years to fully mature and more so if it is also formalised legally. However we were able to describe and test its potential implementation in terms of the concrete actions to be identified or taken to achieve this. Across several SOTERIA pilot regions, stakeholders worked on improving data availability, interoperability, and coordination between institutions, laying important groundwork for future Regional Data Hubs even if these were not fully established during the project timeframe.

In this context, the Norwegian Knowledge Bank (KB) is used as a reference case. Although it was not developed within SOTERIA, it illustrates how long-term cooperation between public authorities and the insurance sector can lead to the creation of a functioning data hub and informed the approach taken in several SOTERIA pilots.

Examples from SOTERIA pilots

Regional Data Hubs can build on existing European and open-source initiatives, such as the Global Earthquake Model (GEM), the Risk Modelling Steering Group (RMSG), or the EU Risk

Data Hub, to improve access to shared risk data, tools, and methodologies for disaster risk management. To do so, interoperability with existing regional or municipal GIS platforms is essential.

Across SOTERIA pilot regions, municipalities already use different GIS tools adapted to their size, needs, and capacities. However, these systems rarely include detailed damage and loss data, particularly at a granular level. Limited resources, fragmented responsibilities across departments, and the absence of common standards make it difficult to collect, harmonise, and use data consistently. Where access to insurance loss data is possible, additional effort is needed to integrate and standardise this information. Despite these challenges, web-based GIS platforms provide a strong foundation for improving risk analysis, coordination, and decision-making, and represent an important first step towards future Regional Data Hubs.

Valencia region

During the local workshops of the Valencian case study, particularly those held with regional and municipal public authorities, it became clear that all institutions already hold relevant climate-related, risk, loss, and asset data, but that these data are dispersed across multiple platforms, institutions, and levels of governance. The main challenge identified is therefore not the lack of data, but fragmentation and limited interoperability, which hinders a systemic understanding of cascading risks and constrains the translation of information into effective prevention, planning, and insurance solutions.

In parallel, dedicated meetings were held with the Consorcio de Compensación de Seguros (CCS) to better understand the data it holds on insured assets and estimated damages by region; within the project framework, the CCS shared loss data for the Valencia region to enable the Generalitat Valenciana (GVA) to assess what information already exists and explore future integration options.

As the CCS already maintains a public loss database, the next steps focus on assessing how the Cartographic Viewer of the Generalitat can link to the CCS website and ensure interoperability between systems, building on existing platforms in the Valencian Community rather than creating a single regional data hub. There was strong consensus across all levels of authority that improving data sharing and interoperability, across insurance loss data, climate data, asset information, and local knowledge, is a critical enabler of resilience and insurance innovation, as integrated data systems support a shift from reactive disaster management toward preventive, risk-informed decision-making; this dialogue, initiated during the project, will continue between regional and national authorities

Gabrovo municipality

The municipality of Gabrovo is increasingly exposed to climate-related risks such as flash floods, flooding, storms, droughts, electricity disruptions, and the spread of invasive species affecting forests and agricultural land. In response, several workshops were organised to strengthen cooperation both within the municipality and with external stakeholders.

Through SOTERIA questionnaires and stakeholder engagement, the municipality improved its understanding of existing data and data needs, involving representatives from all municipal

departments as well as relevant external actors. While relevant data exists, it is not yet sufficiently systematised or aligned with regional needs. As a result, Gabrovo agreed to start developing a data hub at the municipal level, beginning with a detailed digital terrain model that allows access to address-level data. This is considered a key step to support better investment and planning decisions.

There is broad agreement on the long-term goal of scaling this work into a regional data hub, and securing funding is considered achievable. To the best of current knowledge, this represents the first initiative of its kind in Bulgaria, offering valuable lessons for other municipalities and for future regional replication.

West Athens region

The West Athens (WA) region is a functional urban area within the Attica Metropolitan Area, comprising several municipalities and facing long-standing challenges related to poverty, social inequality, and marginalisation. Neither the region nor its municipalities have yet adopted a climate adaptation strategy aligned with the EU Climate Law.

Risk data is available for several climate-related hazards, including heavy rainfall, snowfall, forest fires, earthquakes, air pollution, and soil contamination. While this information allows for basic vulnerability mapping, it remains insufficiently detailed to fully capture local climate risks. These challenges are compounded by fragmented urban planning, including extensive areas of “illegal” construction, which increase exposure to hazards such as urban flooding and peri-urban wildfires. Flood protection in West Athens is among the weakest in the metropolitan area, and the lack of open space further limits adaptation options in the context of heatwaves, drought, and air pollution.

Although statistical data can be accessed through the Hellenic Statistical Authority, data sharing across municipalities is very limited, and many local authorities lack the technical capacity to carry out comprehensive risk assessments. Within SOTERIA, key actors identified as potential hosts or coordinators of a Regional Data Hub include the Association for the Development of West Athens (ASDA), the Attica Regional Authority, and the National Observatory of Athens (NOA), with insurance companies and the Hellenic Association of Insurance Companies considered relevant partners. Given the diversity of stakeholders and vulnerabilities involved, any Regional Data Hub for West Athens would need a flexible structure that can interact with multiple actors, including vulnerable groups and neighbouring communities.

The Norwegian Knowledge Bank: a reference process for Regional Data Hubs

The Norwegian Knowledge Bank (Kunnskapsbanken) is a national data hub established in 2020 to support climate adaptation and disaster risk reduction through systematic sharing of climate risk and insurance loss data. While it is not part of the SOTERIA project, it provides a useful reference for regions exploring similar approaches.

The Knowledge Bank was developed through a long-term, multi-stakeholder process involving insurance companies, the national insurance and banking association (Finance Norway), ministries, national agencies, supervisory authorities, and representatives of municipalities and counties. The process was initiated by the insurance sector and later anchored institutionally

within the Norwegian Directorate for Civil Protection (DSB), which led to the formal establishment of the platform.

A key feature of the Knowledge Bank is that it allows municipalities and relevant public authorities to access granular insurance loss data at asset level, alongside public climate and hazard data, under a clear legal and governance framework. This has enabled local authorities to improve risk assessments, prioritise preventive measures, and integrate climate risk considerations more systematically into spatial planning and infrastructure management.

The Norwegian experience highlights that establishing a Regional or National Data Hub is not primarily a technical matter, but a governance process that requires trust, clear roles, legal clarity, and sustained collaboration over time.

An infographic illustrating the timeline and key steps of the Norwegian Knowledge Bank process is available via an external link.

Figure 24: Timeline of the Norwegian process leading up to the knowledge bank


TIMELINE: NORWEGIAN PROCESS LEADING UP TO THE KNOWLEDGE BANK
2010-2012
INCEPTION AND STRATEGIC DIALOGUE
• Resilience Dialogue: Finance Norway (FN), The Norwegian insurance association, initiates dialogue with local communities (LC) and water utilities regarding climate risk and Disaster Risk Reduction (DRR).
• Strategic Anchoring: The mandate, process, and projects were anchored with the board of Finance Norway starting in 2010 and continuing through the entire period. This board consists of the CEOs from the 10 largest non-life insurance companies, ensuring the process was integrated into the leadership of all member companies from day one.
• Informal Forum: A dialogue platform is established with six national public agencies and national federations representing local communities.
• Objective: To identify common challenges for climate risk and DRR, and enhancing risk visualization through data sharing.
2012-2015
PILOTING AND POLICY ACTION
• Pilot Project (PP): FN launches a project with 10 municipalities to test the value of insurance loss data at the asset level.
• Regulatory Push: FN and various federations entered into dialogue with the Ministry of Climate and Environment to push for a government-appointed legal commission.
• Government Commission: A commission is appointed by the Government with a mandate to solve and regulate urban flood resilience due to climate change. The Pilot Project was successfully incorporated into the national White Paper.
2015-2017
CONSOLIDATION AND CONSENSUS
• Naturfareforum: This national public forum is created as the National Sendai Platform for stakeholder coordination.
• Management Agreements: Frameworks for the PP project's progression and data storage protocols are established.
• Platform Development Dialogue: Ongoing dialogue is maintained with municipalities and national agencies, including the Directorate for Civil Protection (DSB), regarding the development of a common platform for utilizing insured loss data.
• International Recognition: The dialogue and Public-Private Partnership (PPP) led to invitations to international forums such as the OECD, UNDRR (United Nations Office for Disaster Risk Reduction), and the European Commission (DG CLIMA and DG ECHO).
2017-2020
DEVELOPMENT AND INAUGURATION
• KB Funding: The Directorate for Civil Protection (DSB) requests funding to create the Knowledge Bank (KB), in collaboration with the National Flood Agency (NVE) and the Norwegian Public Roads Administration.
• Formal Agreement: DSB and Finance Norway sign a formal collaboration agreement for the project's development.
• Inauguration: The Knowledge Bank is officially inaugurated in November 2020.
2020-2021
LEGAL FRAMEWORK
• New Regulations: Legislation comes into effect allowing DSB to collect, utilize, and share asset-level insurance loss data with local communities, NVE, and regional governors.
• Expansion: The data sharing process, now fully integrated into the operations of all insurance companies, continues to serve as a model for international climate resilience efforts.

Conclusions

The experiences from the SOTERIA pilots show that, while fully operational Regional Data Hubs were not established, important groundwork for their development has been laid. Across different regional contexts, the project helped clarify data needs, identify institutional and technical gaps, and initiate cooperation between public authorities, insurers, and other key stakeholders. These processes are a necessary part of implementation, as access to reliable and shared risk and loss data is a prerequisite for informed decision-making and for the future development of innovative insurance solutions. In this sense, the Regional Data Hub work within SOTERIA demonstrates how implementation often begins with coordination, data alignment, and governance arrangements, rather than with fully deployed technical systems.

5.4.3. Recommendations for development of regional or national data hub (GUIDE)

Author: Mia Ebeltoft (CRA)

Executive Summary

Regional Data Hubs can support climate adaptation and disaster risk reduction by improving access to shared and usable climate risk and loss data. This section presents key recommendations for developing regional or national data hubs, based on lessons from the SOTERIA pilots and the Norwegian Knowledge Bank. The focus is on governance, technical design, regulatory conditions, and capacity building, highlighting Regional Data Hubs as enabling infrastructures that help address data fragmentation and support effective implementation processes.

Introduction

Here we provide a series of recommendations for the development and the implementation of Regional Data Hubs based on our experience with the SOTERIA case studies and the existing Norwegian Knowledge Bank which operates at national level. These Regional or National Data hubs integrate climate-related risk and loss data. Such hubs can facilitate the coherence between climate change adaptation (CCA) and disaster risk reduction (DRR) policy areas. By providing structured, harmonized, and accessible data, these Regional Data Hubs enable local and regional governments to make better-informed decisions, enhance resilience, and reduce vulnerabilities to climate change and disasters.

The recommendations aim to be a practical guidance for policymakers, practitioners, and insurers to establish a Regional Data Hub that connects fragmented data into integrated systems. By doing so, it becomes not only technical platforms but also governance mechanisms that strengthen coherence between CCA and DRR, bridge gaps between public and private actors, and help regions across Europe prepare for the escalating risks of climate change.

The recommendation builds on findings from the SOTERIA project, particularly lessons learned from mainly three pilot regions (Valencia, Gabrovo, and West Athens) and from Norway's

national Knowledge Bank. By combining case study evidence, literature review and expert consultation, this deliverable identifies mechanisms, barriers, and enablers for the creation of regional data hubs that can bridge institutional gaps between government agencies, municipalities, and the insurance sector.

Recommendations for implementing a Regional Data Hub

The experience gathered through the SOTERIA pilots shows that developing a Regional Data Hub is not only a technical exercise, but a governance process that requires clear roles, trust between actors, and enabling policy conditions. The following recommendations focus on the main elements that need to be in place to move from fragmented data practices toward an operational and usable data hub that can effectively support climate adaptation and risk management at regional and local levels.

Strategic and policy recommendations

A Regional Data Hub should be embedded in a clear policy framework that supports closer alignment between climate change adaptation and disaster risk reduction. At EU and national levels, existing strategies and initiatives already provide a mandate for improved data sharing and risk-informed decision-making. These frameworks should be translated into practical guidance that clarifies objectives, roles, and responsibilities for establishing and governing a data hub.

Political commitment is essential throughout the process. Lessons from the pilots show that leadership by a public institution with a clear mandate helps reduce buy in, address fragmentation and ensure continuity. Early and structured dialogue with key actors, including public authorities, insurers, research institutions, and civil society, is critical to identify data needs, barriers, and opportunities. In particular, access to more granular loss and damage data, including insurance data where available, is necessary to support asset-level planning and effective adaptation measures.

Technical and operational recommendations

Findings from SOTERIA show that regions and municipalities may need to follow different pathways when developing a Regional Data Hub. In some cases, this may involve building on existing data platforms, in others, starting with a municipality-level data hub or working toward a national system may be more appropriate. Before defining the technical and operational setup, a number of key questions need to be addressed:

- Who needs which types of data, at what level, and for what purpose?
- Who currently holds the data, and under what conditions can it be shared?
- How will data be collected, stored, shared, and disseminated, using raw or standardised formats?
- Should the hub include future climate projections, and should data be open-source, access-restricted, or a combination of both?

The architecture, design and practical implementation of the Regional Data Hub will largely depend on the answer to the above questions, including size and complexity of the region and municipalities, and use of geo-informatic-systems (GIS). The Hub should have a flexible structure enabling it to scale up enlarging/include add-on data being collected, processed and

disseminated. It needs to identify the ability of external computer systems or software to exchange and make use of information (interoperability). Ontologies as those developed in Soteria (*see Step 2 for details in this Manual*) can help structure and organise data effectively, and testing data and functionalities is essential to ensure they meet the needs of the regions and municipalities.

Regulatory framework and guidelines

The regulatory framework has been identified as one of the main barriers to data sharing, as municipalities consistently highlight the need for granular, asset-level data. At the same time, existing data protection requirements, particularly under GDPR, limit how such data can be shared and used. This points to the need for new legal and organisational solutions that allow data sharing while remaining fully compliant with data protection rules.

Establishing a permanent Regional Data Hub would likely require a dedicated regulatory or legal base and mandate, granting the hub a clear legal mandate to collect, compile, store, and share climate-related risk and loss data. The experience from Norway, where new rules were introduced to enable the sharing of granular insurance data through the Knowledge Bank, offers a useful reference for potential replication in other European countries.

National authorities should therefore provide clear guidelines on how regional and local authorities can cooperate, coordinate, and integrate climate change adaptation (CCA) and disaster risk reduction (DRR) data. This should include a roadmap for setting up a Regional Data Hub and for linking it with other external data sources, such as climate projections and nature-based solutions (NbS). Throughout this process, particular attention must be given to the sensitivity of insurance data and the need to balance public value with commercial confidentiality.

Capacity building and partnership actions

Successful Regional Data Hubs depend on people and institutions being able to use and trust the data. Capacity-building efforts should therefore be closely linked to user needs and developed together with participating actors. Local and regional authorities should be involved from an early stage to define priorities, responsibilities, and expected benefits.

Building trust between public institutions, insurers, and other stakeholders is a gradual process that requires transparent communication, regular interaction, and clear governance arrangements. Over time, new routines, skills, and resources are needed to ensure that data are not only collected, but actively used to support planning, investment decisions, and long-term resilience.

Conclusions and Outlook for the future

European tools and platforms such as the EU Risk Data Hub and CLIMADA are still not weel known and therefore often underused by regional and local authorities in climate change adaptation (CCA) and disaster risk reduction (DRR). There is clear potential to better integrate these resources EU and international level scale platforms into national and regional data hubs, improving the quality of risk assessments and helping authorities better understand exposure, for example by distinguishing between pluvial and fluvial flood risks.

Regional and local hubs as well as national data hubs should be designed to remain flexible and able to incorporate new types of data, including ecological and nature-related risk information

that is becoming increasingly relevant through frameworks such as the EU Taxonomy and CSRD. At the same time, well-structured and reliable loss and damage/impact data can help unlock both public and private investment in adaptation and risk reduction. In this context, cohesion policy can play an important role in directing funding and fostering cooperation between regions facing similar climate risks.

5.4.4. Considerations for the development of Regional and National Data Hubs (INFOGRAPHIC)

Author: Mia Ebeltoft (CRA)

Executive summary

Based on SOTERIA pilot experiences, this infographic illustrates the essential elements for developing regional data hubs to support climate adaptation and insurance decision-making. It visualizes the entire data cycle, from hazard events and loss recording to analysis and practical use by local authorities. The graphic highlights the critical integration of insurance and public data while addressing practical challenges such as governance, access rights, and institutional capacity. It frames hub development as an incremental governance process, rather than a purely technical task, requiring strategic choices regarding data integration.

Considerations for the development of the hub

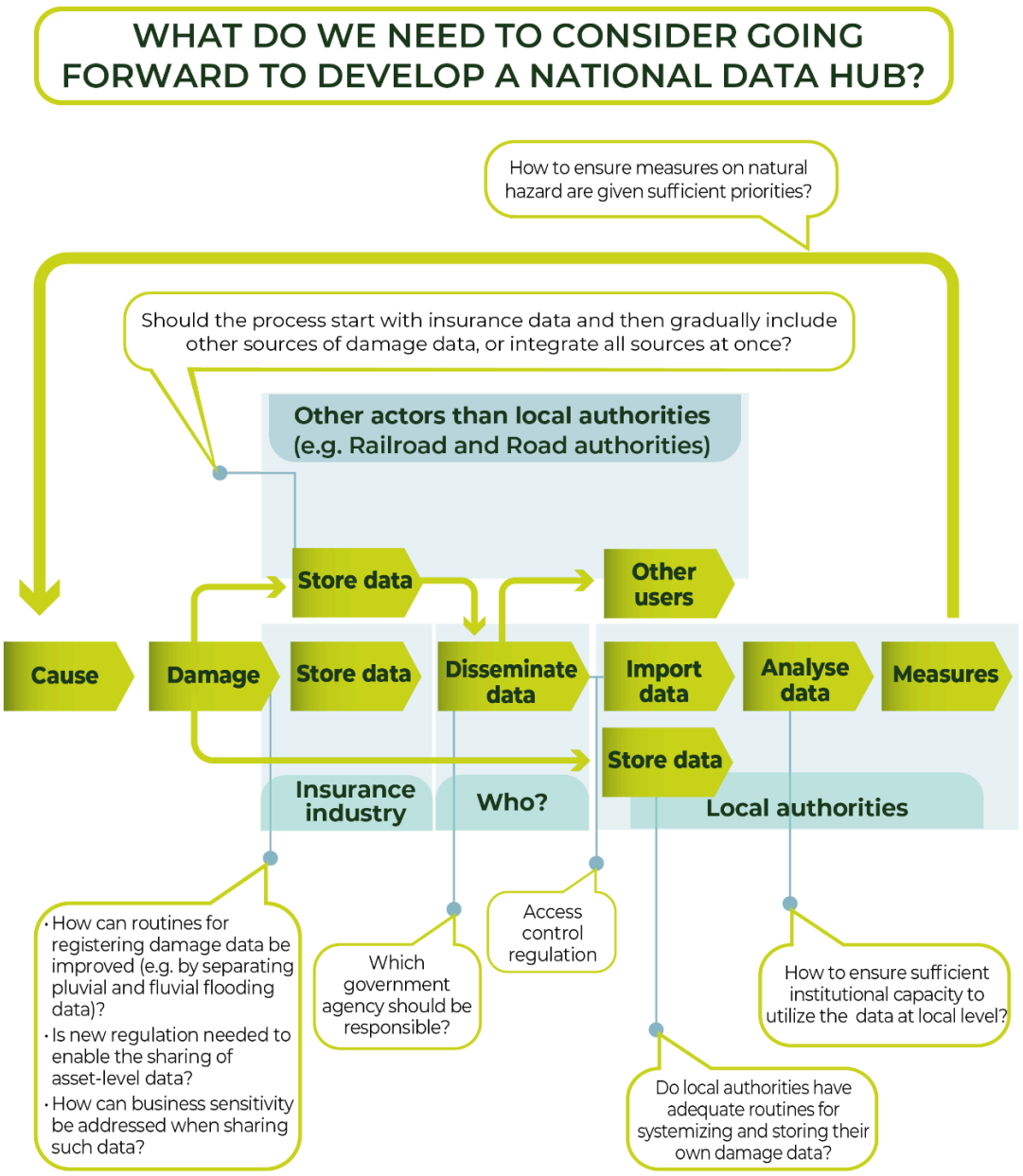
This infographic illustrates the key elements that need to be considered when developing a regional or national data hub to support climate adaptation and insurance-related decision-making. It reflects the practical questions, actors, and data flows identified through the SOTERIA pilot experiences and highlights how damage and risk data move from initial recording to analysis and use in concrete adaptation measures.

The graphic shows the full data cycle, from the causes of climate-related hazards and resulting loss and damages, through data collection, storage, sharing, and analysis, to the use of information by local authorities and other actors. It highlights the central role of insurance loss data, alongside data held by public authorities and infrastructure managers, and illustrates how different users interact with the data at different stages.

In this sense, the infographic focuses on the implementation challenges that arise in practice. These include questions around data governance, access rights, institutional responsibilities, data sensitivity, and the capacity of local authorities to systematically collect, store, and use climate risk loss and damage data. It also raises strategic choices faced by regions, such as whether to start with insurance data and expand gradually, or to integrate multiple data sources from the outset.

By visualising these interactions and decision points, the infographic complements the guidance and case study examples presented in Step 5.4. It helps practitioners understand that developing a Regional Data Hub is not only a technical task, but an incremental governance and coordination process that unfolds alongside adaptation planning and implementation.

Figure 25: Essential elements for developing regional data hubs



STEP 5 Completion Checklist

Use this checklist to confirm that your region is ready to move selected insurance-based adaptation solutions into implementation within the SOTERIA methodology.

Area	Key question	Verified
Implementation planning	Do we have a clear implementation pathway for selected insurance solutions?	☐
Governance readiness	Are roles and responsibilities for implementation clearly defined?	☐
Policy integration	Are insurance solutions linked to existing adaptation or DRR policies?	☐
Structural constraints	Have key governance, legal, or coordination barriers been identified?	☐
Enabling conditions	Have recommendations been developed to address these barriers?	☐
Stakeholder coordination	Are public authorities, insurers, and stakeholders engaged for implementation?	☐
Data availability	Do we have access to the climate risk and loss data needed for implementation?	☐
Data sharing arrangements	Are mechanisms in place to share data across institutions?	☐
Case-study learning	Have lessons from SOTERIA case studies been reviewed and adapted to our context?	☐
Implementation feasibility	Are selected solutions feasible under current institutional and legal conditions?	☐

STEP 6: MONITORING, EVALUATION, AND LEARNING (MEL)

Step 6 (Monitoring, evaluation and learning) is not developed as a full step in this Manual, because the SOTERIA project timeline did not allow completion of a full monitoring cycle. Step 6 will be progressively populated and expanded through the SOTERIA Platform; meanwhile, several SOTERIA process outputs (e.g., case-study diaries and the indicator reflections developed in Valencia) can already be used as practical building blocks to support monitoring, evaluation and learning.

ANNEXES

ANNEX 1 Light Story Map template (TEMPLATE)

Authors: Kamelia Georgieva (BES) and Elena Lopez Gunn (ICA)

Executive Summary

The Story Map supports pilot regions in gathering and structuring information to test innovative insurance solutions for climate adaptation. It serves as both a questionnaire and a participatory framework to understand regional risks, adaptation needs, and insurance opportunities. The Story Map consists of five main parts and is intended to evolve throughout the project's implementation.

Part 1 — General

Objective: Capture a general overview of the case study, key actors, and overall context.

- Case Study Name:
- Country / Region Type (Urban, Rural, Agricultural):
- Key Economic Sectors:
- Main Partner (Case Study Owner):
- Other Project Partners:
- Key External Stakeholders:
- Geographical Scale (Community / Local / Regional):
- Short Description:
    - Specific Focus of Case Study: *Provide a short description of the story behind this case*
    - Situation Before the Project: *Highlight the starting point and the main challenges*
    - Projection of Insured Assets: *Describe the project interventions and observations*
    - Proposed Protective Measures / Interventions: *and the final results*
    - Key Insights & Conclusions *(insurability, policy implications):*

Part 2 — Risk Analysis

Objective: Describe the climate-related risks, exposure, and adaptation context of the region.

- Bio-geographical Region:
- EU Cohesion Classification (Red / Orange / Yellow):
- Main Hazards: *Refer to the UNDRR 'Hazard Definition and Classification Review: Technical Report' as a guideline*

(https://www.undrr.org/publication/hazard-definition-and-classification-review-technical-report).

- Climate Change Adaptation Challenges:
- Meteorological Data (current and projected):
- Hazard Modelling (methods, tools, data):
- Risk Characterization (urban vs rural context):
- Local Adaptation Strategies:
- Past Experience with Climate Hazards: *Personal experience (type of events), experience with damage in immediate community/ network or experience with damage in geographic area) and experience with damage on private property (citizens or business) or public property/ infrastructure*
- Perceived Risk (citizens, businesses, authorities):
- Actors Bearing Costs / Investments:
- Vulnerable Groups:
- Climate-Induced Losses & Insurance Coverage:
- Protection Gap & Financial Mechanisms:
- Drivers of the Protection Gap *(e.g., capacity, coverage availability, affordability)*:

Part 3 — Supply and Demand Analysis

Objective: Assess the insurance landscape, demand trends, and relevant policy environment.

- Existing Insurance Portfolios: Specify covered sectors (households, industry, agriculture, etc.).
- Damage Assessment (current and projected):
- Policy & Regulatory Context: *National-level policy or regulatory factors enabling/ hindering climate change adaptation and risk of losses (disaster risk reduction) (e.g. Floods or Droughts Management, Climate Adaptation, Agriculture policy etc.)*
- Roles & Responsibilities in Disaster Risk Management (state, regional, municipal):
- Barriers & Enablers (institutional or policy-related) affecting insurance affordability and access:
- Demand for Insurance Solutions (public and private sectors):
- Budgets and Incentives for Insurance Penetration *(The amount of national / regional allocated budget to increase the penetration of insurance, and in what formats (e.g. subsidies, tax incentives):*
- Insurance Market Overview (percentage insured, coverage types):
- Reasons for Buying Insurance (key decision drivers):
- Reasons for Not Buying Insurance (barriers, market availability, prior experience) (*have they ever been insured in the past and if yes, what made them drop out; are relevant insurance options available on the market?:*
- Decision Journey Map (key decision points):

Part 4 — Data

Objective: Identify data sources, accessibility, and gaps related to insurance and risk management.

- Existing Data on Losses and Compensation:

- Availability and Accessibility of Disaster Damage Data: O*wners, storage locations, access rights:*
- Barriers to Data Sharing (objective and subjective):
- Data Gaps (uncollected or missing data and reasons):

Part 5 — Innovative Insurance Solutions

Objective: Describe innovative insurance models and assess their potential impacts and scalability.

- Insurance Penetration Level (EIOPA Scale):
- Identified Needs and Barriers:
- Types of Innovative Insurance Solutions:
- Potential Barriers (Technical, Policy, Governance):
- Short-Term Ambitions / Key Performance Indicators (KPIs):
- Medium-Term (5-Year) and Long-Term (10-Year) Impacts:
- Continuation Plans / Future Funding:
- Insurance Partners:
- Upscaling & Replication Potential:
- Community Engagement (affordability, inclusiveness, just transition):

Methods for Data Capturing

- Workshops and Surveys: Tools for stakeholder engagement and regional data collection.
- Case Study Characterization Interview Templates.
- Data Mapping Template.

ANNEX 2. CoP template description (TEMPLATE)

Authors: Oihana Luque (ICA)

CASE STUDY	
GEOGRAPHICAL SCOPE	
KEY STAKEHOLDERS	

STAKEHOLDER INVOLVEMENT	☐ High ☐ Moderate ☐ Low ☐ Varies (please explain) _____
STAKEHOLDER CONTRIBUTION	☐ Contribution for the specification of technical characteristics ☐ Consideration of expectations of end-users throughout the solution design and development ☐ Convincing end-users and stakeholders about the benefits from the implementation ☐ Increase of communication and dissemination of the results ☐ Other (please explain) _____
PARTICIPATION How often do these CoPs meet or engage with members?	☐ Weekly ☐ Bi-weekly ☐ Monthly ☐ Ad-hoc ☐ Other (please specify) _____
GOAL & AMBITION	
INNOVATIVE INSURANCE SOLUTION DEVELOPED	
HOW THE COP WORKS? Formal decision making and/or only information. What is discussed ?	
KEY CHALLENGES	

ANNEX 3. Dossier of the CRD blogs (DOSSIER)

The dossier has been extracted from the dedicated Climate Resilience Dialogues webpage developed by Empower Insight and Global Infrastructure Basel Foundation.

Regional CRD meeting in Gabrovo - Regional Climate Resilience Dialogues in Gabrovo: Insurance, Risk Data & Urban Adaptation

Authors: P. Dikova (DZI), N. Dimitrov (Gabrovo Municipality), M. Ebeltoft (CRA), K. Georgieva (BES), V. He (GIB), M. Ivanova (Gabrovo Municipality) & A. Radstake (GIB)

Date: 12 November 2024

Introduction

SOTERIA's Regional Climate Resilience Dialogues (CRDs) bring together local stakeholders to discuss climate-related risks and the role of insurance in enhancing resilience. Based on the European Commission's model, the dialogues address topics such as the climate protection gap, insurance coverage, public-private collaboration, and risk data.

The regional CRD in Gabrovo, Bulgaria was held on November 21, 2024. Around 30 participants, including the Mayor, municipal departments, regional authorities, utility providers, insurers, academics, and project partners explored local climate risks, insurance behavior, and tools like the Risk Data Hub through expert presentations and group discussions.

Current Status of the Climate Protection Gap

The case study of Gabrovo focuses on exploring additional and new financial avenues (including innovative insurance-related solutions) for the protection and restoration of urban areas and forest areas of Gabrovo to conserve its environmental services, including its buffering and absorption capacity in extreme weather events. The forest ecosystem is widely distributed in the pre-Balkan areas where Gabrovo is situated. The case study aims to create scalable solutions to support the adaptation to climate change in the urban areas of the municipality and the conservation and restoration of the Gabrovo natural flora, fauna, and biodiversity.

How does climate change affect Gabrovo, Bulgaria?

1. Extreme weather events

Over the last decade, the city's residents have witnessed extreme weather events including

- Unusual strong gale-force winds and heavy rainfall, oftentimes accompanied by hailstorms, leading to localized flooding and damages by the winds on the infrastructure.
- Short-term intense snowfall during late autumn and winter months disrupting the normal rhythm of life.

2. Invasive species

Climate change has facilitated the migration of invasive species, such as the "борова процесионка" – Thaumetopoea pityocampa, which is a moth species belonging to the family Thaumetopoeidae, into Gabrovo's ecosystem. In recent years, the Department of Forestry has come to witness its migration from the south of the mountain range to the area of Gabrovo, which is not native to the area.

Despite climate change challenges, including floods and other extreme weather events, there is a lack of interest in climate insurance and of prerequisites and motivation for citizens and employers to insure their private homes and for employers to insure their businesses, especially for industrial enterprises. Businesses are usually insured, or only to some extent. Investments in preventing the factors leading to the aforementioned meteorological events are thus accompanied by low insurance coverage.

Establishing a regional data hub – Learning from the Norwegian Case

A regional data hub in Norway serves as a best practice in public-private cooperation within the insurance sector. It was developed through dialogues between insurers and public authorities to improve understanding of climate-related risks, strengthen disaster prevention, and reduce losses through a shared data platform, the Knowledge Bank.

The Norwegian Knowledge Bank: Origins

The idea of the Knowledge Bank emerged from challenges where insurance companies and municipalities in Norway disagreed on the risk and magnitude of climate-related hazards, due to a lack of loss data and vulnerability analysis, blind investments in city infrastructure, and a lack of insurance loss data at the asset level.

The public-private dialogues led to an agreement that insurers, cities, municipalities, and national authorities need to compile loss data from different stakeholders, adopt a coordinated approach to decision-making at both, national and local levels, and cooperate in monitoring and reporting under UN agreements.

Pilot project

Between 2010 and 2015, Finance Norway, insurers and municipalities launched a public-private pilot project to share insurance data on the causes of damage (hazards), economic losses, business interruption (indirect economic costs), and hazard occurrence. This pilot project led to new insights into emerging risks, an improved understanding of the risks of climate change, a knowledge base for existing infrastructure and reinvestment, and enhanced risk and vulnerability assessments.

Inclusion in national regulation

From 2017 to 2020, the Civil Protection Directorate (DSB) in Norway worked toward establishing a public-private Knowledge Bank to collect and store loss data at the asset level and make the data available for assessment processes. The National Civil Protection Act now gives DSB the legal right to collect, use, and share insurance loss data at the asset level with municipalities, the National Flood Agency, and regional governors. Other stakeholders can access insurance loss data at the municipality level.

Potential Insurance Solutions for better protection in Gabrovo, Bulgaria- How does behavioural analysis explain the lack of insurance coverage?

Stakeholders were presented with survey findings on barriers to insurance uptake in Gabrovo. While many acknowledged the growing frequency and intensity of climate hazards, only 43% insured their assets due to these risks. In contrast, 36% cited high premiums or a belief that losses were unlikely.

Behavioral analysis explains this gap through psychological and contextual factors. People are

influenced by peer behavior, underestimate personal risk, and are deterred by financial concerns. Cognitive biases, such as poor future planning, present bias, fear of losses, and avoidance of complex issues, further reduce motivation to insure.

To shift behavior, clear and accessible information about climate risks is essential. Cooperation among local authorities, national agencies, and insurers is key. This includes sharing scientific forecasts, real-life risk examples, location-specific models, and financial scenarios to help people make informed decisions.

Which factors explain the low insurance penetration in Gabrovo, Bulgaria?

Findings from the European Climate Resilience Dialogues highlighted key factors behind the climate protection gap. On the demand side, barriers include low risk awareness, limited access to disaster risk data, lack of regional expertise, unaffordable insurance, and low trust in insurers. On the supply side, challenges include insufficient data for risk modeling, reduced eligibility, and rising insurance costs.

In Bulgaria, the insurance penetration level is currently very low, yet the country faces a high risk of flooding. The municipality of Gabrovo is divided into several risk zones on a scale of 1-4. Additionally, Bulgaria lacks mandatory property insurance (excluding the cases of credits and grants).

The majority of homeowners in our country do not have property insurance. Less than 10% of property owners in the country have property insurance with the risk of natural disasters included, and in most cases, they also do not voluntarily insure their property. The largest percentage of “Fire and natural disaster” insurance was purchased as an integral part of mortgage loans granted for the purpose of purchasing real estate.

Key reasons for low coverage:

1. Perceived low risk: Many believe adverse events are unlikely to affect them. It turns out that very few people fear natural disasters before they happen. According to insurance experts, usually after a catastrophic event, there is a euphoric increase in purchased property insurance policies, which then quickly subsides.
2. Perceived financial constraints: Insurance is considered unaffordable by many.
3. Distrust of insurers: Concerns about inadequate compensation in case of an insured event discourage policy adoption.

What actions will be undertaken to increase the protection gap in Gabrovo?

To mitigate climate risks and reduce the climate protection gap, Gabrovo should conduct climate risk assessments in the region, continue to adopt climate measures (e.g., nature-based solutions, supportive policies, technological measures, and raise awareness to promote behavioral changes), and develop innovative insurance solutions focusing on risk-based premiums, incentivizing the implementation of risk reduction measures, clear and transparent conditions, and simplified procedures for the payment of benefits.

The NET Zero City Contract of Gabrovo – Envisaged Nature-based Solutions for Adaptation

Gabrovo is one of 100 EU cities aiming for climate neutrality by 2030 and the only Bulgarian

pilot city in the Net Zero Cities (NZC) platform. It is currently under evaluation for the European Commission's Climate City Label. Gabrovo is actively implementing measures to cut emissions and adapt to climate change, participating in various adaptation projects. The SOTERIA project supports the city in developing innovative climate solutions through expert collaboration.

Key takeaways

1. To make informed decisions about insurance, relevant information on climate hazards and loss data should be collected and shared. Greater emphasis should be placed on science-based information, such as modeling and risk maps, rather than relying solely on empirical evidence.
2. Gabrovo should prioritize implementing innovative measures to improve insurance-related decisions. These initiatives must cater to the needs of both businesses and individuals (such as property insurance) while fostering greater awareness and understanding of climate-related risks, and insurance. Educating the public on how insurance works and its vital role in helping individuals and businesses manage climate change risks is crucial.
3. Maintaining and strengthening the collaboration between insurance providers, businesses (particularly in the industrial sector), and municipalities is essential. Public investments in climate change adaptation remain highly relevant and can significantly enhance resilience. Gabrovo, as a frontrunner among Bulgarian cities in this domain, has an opportunity to set an example by fostering innovative partnerships and

Keywords

Climate Resilience Dialogues, Climate Protection Gap, Risk Hub, Behavioural Analysis, Industrial Entreprises, Net Zero Cities, Nature-based Solutions.

Regional Climate resilience dialogue in Norway- Municipal Climate Change Adaptation Networks building Climate Resilience through Municipal Climate Change Adaptation Networks

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Date: 11 December 2024

Introduction

Climate change has caused substantial damage and increasingly irreversible losses to many vulnerable groups and regions worldwide. Municipalities are on the front line of addressing these devastating impacts and face an increasing urgency to improve their ability to manage such challenges [1]. As key actors in society's climate change adaptation efforts, municipalities play a crucial role, especially in urban planning [2]. However, there is a widening gap between the need for adaptive solutions and their actual implementation [3]. Additionally, severe knowledge gaps and insufficient resources exacerbate this adaptive deficit [4].

To bridge this gap, the EU-funded Horizon SOTERIA project has initiated regional climate resilience dialogues across six European regions.

These efforts aim to foster a community network that promotes open discussions, transparent communication, and collaboration among stakeholders affected by climate change. Since 2023, the SOTERIA project has collaborated with the Network Climate Change Adaptation Trøndelag to engage municipalities – particularly procurement managers – to incorporate climate change risks into their purchasing process of non-life insurance. This article highlights Norway's extensive journey in building climate change adaptation networks, offering valuable insights for the SOTERIA case regions and beyond.

Networks as soft risk mitigation strategies

An increasing number of research on climate change adaptation in municipalities emphasises networks' potential to drive transitions toward a more precautionary approach to mitigate climate change-related risks. These networks can take various forms: formal or informal, transnational, national, regional, or municipal. Most importantly, they bring together stakeholders who endure upcoming risks to share experiences, knowledge, challenges and ideas [5,6]. Such collaboration can help stakeholders to overcome some resource barriers (human, financial and knowledge-related), and help municipalities fight the pervasive 'silo mentality' problem [7,8].

Interactive dialogues and open communication within networks can also spark innovative solutions and tailor standardised approaches to local contexts [6,9]. Through content-focused networking across organisational boundaries, municipalities can learn from experts and experiences from their peers. This helps build their administrative and knowledge capacity for climate change adaptation, and identify specific actions to pursue, including the design and implementation of policy measures [6,10,11].

To unleash the transformative potential, it is essential to create an environment of trust among participants. This fosters a sense of alliance and ownership of proposed solutions, encouraging members to apply their network-derived insights within their respective organisations. It is also recommended to bring in external expertise, divide the participants into smaller working groups [8,11], and use context-sensitive decision-making to ensure local conditions are considered under regional or national frameworks [12].

Climate change adaptation networks in Norway: The IFront Climate Change Adaptation Network

Established in 2015, the climate change adaptation network IFront was coordinated by the Norwegian Environment Agency on behalf of the Ministry of Climate and Environment [13]. It comprises 13 cities from different regions of Norway. The network aims to create an arena for the exchange of experience, knowledge development, and skills enhancement. The goal was that best practice examples and experiences from the participatory city municipalities would contribute to strengthening climate change adaptation in a wider range of Norwegian municipalities [14].

An evaluation of this municipal network after four years revealed that it successfully contributed to raising awareness among the participants and enriched their knowledge about climate change adaptation. Yet the diffusion of these practices within municipalities depended on anchoring in the political leadership. The evaluation also pointed out that other directorates should have been more involved to amplify the network's impact [15].

Network for Climate Change Adaptation Trøndelag

In 2017, the Network Climate Change Adaptation Trøndelag was launched to increase multi-stakeholder cooperation and knowledge sharing to protect buildings and infrastructure from the impacts of climate change. This network includes 36 municipalities, research organisations, and national government bodies (e.g. the Norwegian Environment Agency, Norwegian Water Resources and Energy Directorate, and Norwegian Mapping Authority), and private sector representatives [16].

An assessment of the Trøndelag network concluded that the variety of its involved partners and their expertise significantly contributed to the network's success, leading to a range of joint activities focused on experimenting with and implementing climate change adaptation measures. Inspired by this initiative, several counties have since established similar climate change adaptation networks to harness these benefits [17,18].

A National Network for Climate Change Adaptation

Building on the success of these municipal and regional efforts, the Norwegian Association of Local and Regional Authorities (KS) – representing all municipalities in Norway – established a national network for climate change adaptation in 2022. This initiative places particular emphasis on risk and vulnerability assessments [19].

By investing in climate change adaptation networks, Norway exemplifies how municipalities can overcome common barriers, foster collaboration, and build resilience. These efforts, supported by various stakeholders, provide valuable lessons for regions worldwide facing the growing challenges of climate change.

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Regional Climate Resilience Dialogue in West Athens: Insurance Challenges and Opportunities in Climate Adaptation

Authors: Vivian He (GIB)

Date: 18 December 2024

Introduction

The regional Climate Resilience Dialogue, which took place in West Athens on 18 December 2024, brought together stakeholders from diverse sectors to address critical challenges related to insurance for climate resilience. Association for the Development of West Athens (ASDA) hosted the Climate Resilience Dialogues as one of the key activities of local stakeholder engagement. Participants included representatives from the Hellenic Association of Insurance Companies (HAIC), HDI Global Insurance Company, the Municipality of Aigaleo, the National Center for Scientific Research “Demokritos,” and the Global Infrastructure Basel Foundation (GIB).

The dialogue focused on identifying challenges, proposing solutions, and exploring collaborative pathways to advance sustainable insurance and resilience strategies. This article provides a recap of the event, highlighting key insights and discussions on climate insurance and resilience.

Challenges Highlighted

For Insurers:

- Gradual and Undefined Events: Insurers face difficulty underwriting and pricing for gradual climate-related effects, such as soil erosion or long-term heatwaves, as these events lack clear definitions and measurable impacts.
- Data Availability: Accurate modeling and risk assessment are hindered by inadequate data on certain climate events and their preventative measures.
- Foreseeability of Events: Insurance products typically exclude foreseeable events or gradual climate change impacts, focusing instead on sudden and accidental occurrences.

For Municipalities:

- Mandatory Insurance Gaps: Emerging perils like heatwaves are not included in mandatory insurance requirements, exposing municipalities to significant risks.
- Public Procurement Constraints: Municipalities in Athens are legally required to select the cheapest insurance offers, often compromising quality and long-term resilience.
- Insuring Nature-Based Solutions (NbS): The integration of NbS interventions into

insurance frameworks remains uncertain, posing challenges for municipalities investing in green and grey infrastructure.

Proposed Solutions

- Establishing a Working Group: A collaborative effort involving insurers, municipalities, and policymakers to create standardized guidelines and address gaps in insurance solutions for climate adaptation.
- Policy Recommendations: ASDA and HAIC may jointly propose recommendations to the central government, focusing on enhancing insurance coverage and resilience strategies at a legislative level.

Insights from Discussions

Collaboration between public and private entities, particularly through Public-Private Partnerships (PPPs), has proven effective in insuring municipal infrastructure during construction phases. However, a significant gap exists in the operational phase, leaving critical infrastructure uninsured after its transfer to public ownership. To address these vulnerabilities, comprehensive risk registers are essential. These registers would enable municipalities to assess potential risks, model scenarios, and determine insurability, providing a foundational tool for both insurers and public stakeholders.

Climate hazards such as heatwaves present growing challenges, particularly in regions like West Athens. Heatwaves can trigger cascading events, including wildfires and flooding, yet their insurability remains limited due to the difficulties in quantifying immediate impacts. The Urban Heat Island (UHI) effect further exacerbates these challenges in densely populated areas with limited vegetation. Proposed adaptations include expanding green spaces, implementing early warning systems, and enhancing carbon mitigation efforts to mitigate the adverse effects on urban environments.

Technological advancements in data and digital solutions, such as GIS mapping and digital twins, offer promising tools for simulating climate event scenarios. These technologies can help municipalities and insurers visualize risks and better prepare for potential disasters. However, significant data gaps remain, and accurate data collection is critical. Insurers rely heavily on precise modeling to assess financial losses and design tailored products, particularly for vulnerable communities that are disproportionately affected by climate hazards.

Post-Meeting Feedback

Participants emphasized the importance of focusing discussions on problem-solving rather than reiterating known challenges. Shorter, more action-oriented meetings with minimal introductory content were recommended to enhance productivity.

Regional Climate Resilient Dialogue in Zadar- Resilient Agriculture through Insurance and Policy Innovation: A Regional Perspective from Croatia

Author: Jelena Marinković (Zadar County)

Date: 6 March 2025

Introduction

SOTERIA's Regional Climate Resilience Dialogues (CRD) aim to unite and facilitate dialogue among diverse local stakeholders to share perspectives on climate-related disasters impacting their region and explore the potential contributions of the insurance industry. Inspired by the European Commission's Climate Resilience Dialogues, these sessions address key topics such as the climate protection gap, insurance coverage, public-private collaboration, risk assessment, barriers and enablers and preliminary findings from the case study.

On March 6, 2025, SOTERIA's associated partner Zadar County in Croatia hosted regional Climate Resilience Dialogue together with Croatian Chamber of Agriculture at the newly opened Agricultural and Educational Center of Zadar County in Zemunik Donji. The CRD focused on presenting the results of the SOTERIA project to farmers and to point out possible solutions for ensuring agricultural production that are adapted to climate change.

Stakeholders

Approximately 25 stakeholders participated in the CRD, including the Department for Agriculture, Fisheries and EU funds of Zadar County, Croatia Osiguranje (associated partner in the project), Croatian Chamber of Agriculture, Vereinigte Hagel VH insurance, AGRRA- Zadar County Rural Development Agency, University of Zadar, Local action groups LAG Mareta and LAG Laura. Additional attendees included local stakeholders: OPG Šimunov, OPG Čavlin, OPG Marino Jurjević, OPG Lukić Bojana, OPG Neven Jurjević and representatives of cooperatives such as Agricultural Service Cooperative Krupa, AGRO-LIŠANE Cooperative for agriculture and Association of vine growers and vine production "NADIN".

Main topics of discussion

After the introduction by the Head of the Department for Agriculture, Fisheries and EU funds of Zadar County, to the regional CRD in Zadar, the dialogues covered three topics:

- informing farmers about agricultural production insurance contracting models in order to reduce economic losses caused by adverse climatic conditions, and for the purpose of preserving their crops.
- changes in the Strategic plan of the Common Agricultural Policy 2023-2027 in the coming period.
- opportunities in agriculture through innovations.
- The Croatian Chamber of Agriculture had presentations about above mentioned topics involving stakeholders into discussions.

Agricultural production insurance

The SOTERIA project is funded by the European Union, dedicated to advancing insurance solutions for climate change adaptation across diverse European regions and communities.

Given that farmers are losing income due to climate change, SOTERIA project seeks to see why there is a lack of interest on the part of insurance companies to create new insurance models, given that the climate is changing and agriculture has become unpredictable. On the other hand, each region has its own specificities and there is serious fear and resistance among farmers to insure their production and livestock under the current dominant insurance models, which very often do not cover damages, which is why farmers very often give up production.

Croatian Chamber of Agriculture in collaboration with SOTERIA partners, collected around 1000 opinions of farmers through a questionnaire. The survey results show that the majority of agricultural farms (81%) in Zadar County are smaller farms with an area of up to 20 ha. The main threats related to climate disasters were detected by processing the questionnaire, and in the area of Zadar County drought and heat waves are main threats. Of the total number of respondents, 76% do not insure their plantations.

The majority of agricultural farms in Zadar County have an agricultural area of around 6000 farms, but most farmers do not have crop insurance. The most common reasons for purchasing an insurance policy in agriculture are that the farmer has already experienced some major loss in his production and because they realized that this way they could protect their business. The main reasons why farmers do not take an insurance policy are: insurance policies are too expensive and insurance policies are not adapted to their needs.

Detected problems

Livestock farmers from the Zadar County area pointed out that one of the biggest problems are wolves and the damage caused by wolf attacks on livestock and properties. Numerous livestock farmers are suffering from these increasingly frequent attacks and the lack of solutions, as well as the inability to adequately secure their livestock. They sell them because they cannot defend them from the wolves. Insurance premiums are also very low for wolf attacks. Mrs. Radić mentioned that the Croatian Chamber of Agriculture has two representatives in the 'Wild Animals committee', which is actively working within the Ministry of Environmental Protection of the Republic of Croatia and is actively advocating for this problem to be solved. We are aware of the fact that wolf damage creates major problems for farmers and no insurance covers this loss. The Croatian Chamber of Agriculture are trying to find ways to mitigate these damages and ensure the viability of agriculture in these areas.

One of the Zadar county's local cooperatives, AGRO-LIŠANE Cooperative for agriculture, that cultivates vegetables, melons and watermelons, root and tuberous vegetables (total production on 216 ha), has not yet insured its production because they have not had any serious problems so far. For them, the greatest potential risk is spring frost and hail, and they emphasize that they would be insured if the damage coverage ratios were increased, because the current insurance is not very generous.

Conclusions

Farmers are convinced that they would insure their crops and livestock more if insurance companies would put on the market different insurance models more quickly, which follow the increasingly strong climate changes, and they should also have policies for individual regions that have their own specific production problems.

Changes in the Strategic Plan of the Common Agricultural Policy of the Republic of Croatia (2023–2027)

The possibilities of existing measures from the Strategic Plan of the Common Agricultural Policy of the Republic of Croatia (2023–2027) that finance the risks of agricultural production are presented, and these measures are:

- Measure 17.1.1. Insurance of crops, animals and plants
- Measure 76.01. Insurance of agricultural production
- Measure 73.02. Investments in the renewal of agricultural potential
- Mutual Funds

Measure 17.1.1. Insurance of crops, animals and plants

Within the Rural Development Programme of the Republic of Croatia for the period 2014-2020, through the type of operation 17.1.1. “Insurance of crops, animals and plants”, support was awarded for co-financing the insurance premium (in the amount of 70%) for insurance policies covering losses exceeding 20% of the average annual agricultural production for the following risks: adverse climatic conditions (hail, frost, fire, drought, flood, etc.) and animal diseases.

Measure 76.01. Insurance of agricultural production

The representative explained the intervention 76.01. Insurance of agricultural production. Damages resulting from natural disasters, animal diseases, plant diseases or environmental pollution have a significant impact on farmers’ incomes. The intervention allows for the allocation of support for contracting agricultural production insurance so that farmers can more easily overcome disruptions in the production cycle due to climatic disasters or animal diseases, which are risks for which insurance can be contracted in the territory of the Republic of Croatia.

Measure 73.02. Investments in the renewal of agricultural potential

Measure 73.02. Investments – Restoration of agricultural potential aims to restore agricultural potential damaged by natural disasters and catastrophic events and thus ensure the sustainability of agricultural production and a source of income for the population of rural areas, thereby preventing the decline of agricultural farms, emigration from rural areas and enabling the continuation of agricultural activities.

The workshop participants were engaged by the discussion of the proposed changes to the Strategic Plan for the Common Agricultural Policy of the Republic of Croatia (2023-2027), particularly the establishment of Mutual Funds aimed at developing new support mechanisms to more effectively address and finance agricultural damages. While we presented the conditions for these mutual funds and sought participants’ input on potential improvements, interest in the topic was limited. Instead, participants expressed a greater concern for practical solutions to reduce wolf attacks on their livestock and emphasized the need for adequate insurance coverage for such incidents, as the current insurance policies do not sufficiently address this issue.

Proposal for the Mutual fund:

1. Producer organizations/ agricultural cooperatives/ farmers’ associations

- be accredited by the competent ministry in accordance with the provisions of national legislation for a maximum of 3 years
- must adopt a statute or legal act establishing the rules and regulations governing the

mutual fund in accordance with the provisions of national legislation (if they already have a statute, they must adapt it to the provisions relating to the mutual fund before applying for accreditation)
- must follow a transparent policy regarding payments and disbursements from the fund
- must have an initial share capital
- must keep the accounting and assets of the mutual fund separate from other PO/PZ activities
- must ensure clear rules on the allocation of responsibility for possible debts incurred
- define sanctions in case of negligence by farmers.

Eligible costs under this intervention refer to the administrative costs of establishing mutual funds, which may include, among other things, fund management costs, staff costs, overhead costs and other administrative costs spread over a maximum of three years (according to the descending principle that we will determine in the Rulebook). The intensity of support for the administrative costs of establishing mutual funds is up to 70% of the amount of eligible costs.

2. Beneficiaries – members of producer organizations/agricultural cooperatives/farmers' associations

Requirement for Mutual Fund Users:

- must be an active farmer
- must be a beneficiary of direct payments in a given year
- must be a member of the farmers' association that established the mutual fund
- must pay the agreed amount of contribution to the mutual fund.

The basic eligibility conditions for the payment of compensation from the mutual fund will be prescribed by a legal act of the association of farmers that manages the mutual fund. The intensity of support for the financial contribution to the mutual fund from the EAFRD is up to 20% of the total annual contribution of the members of the mutual fund and other legally acquired assets of the mutual fund, but the total contribution from the funds and state support must not exceed 70% of the total eligible costs.

All of the above interventions aim to help farmers and mitigate disasters caused by various agricultural disasters.

Regional Climate Resilience Dialogue: Bavaria and Saxony-Anhalt: Role of parametric insurance in closing climate insurance gap in agriculture.

Authors: Paul Eberlein (G&Co.), Oleksandr Sushchenko (UFZ)

Date: 26 May 2025

Participants: Gesamtverband der Versicherer (GDV), Swiss Re, Allianz Agrar, Helmholtz-Zentrum für Umweltforschung (UFZ), Genillard & Co. GmbH., Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten (StMELF).

Strategic Framing and Research Imperative

Climate Resilience Dialogue (CRD) in Bavaria and Saxony-Anhalt, held under the auspices of Genilliard & Co. as part of the SOTERIA project, served as a high-level platform for policy and research engagement. It brought together public authorities, agricultural stakeholders, and representatives from the insurance sector across both regions. The dialogue was structured around a critical examination of structural and behavioral drivers, budgetary frameworks, affordability challenges, and emerging innovations in climate insurance design.

Mechanisms for Enhancing Public Budget Allocation Toward Insurance Penetration

The dialogue emphasized that integrating insurance solutions into comprehensive climate adaptation strategies is critical to driving widespread adoption. In Bavaria, the existing multi-peril insurance scheme – supported jointly by the EU and the federal state, provides financial support to farmers through premium subsidies. However, these incentives are currently decoupled from proactive resilience-building efforts. That is, while the scheme helps reduce the cost burden of insurance, it does not support or require the implementation of on-farm risk reduction or adaptation measures. (STMELF, 2025).

Participants proposed several recommendations to improve the effectiveness of public expenditure in supporting climate resilience. A key recommendation focused on introducing conditional subsidies, granted only upon the verifiable implementation of climate adaptation practices by farmers. This approach could be modeled on the points-based evaluation system used in Lower Saxony (Germany), which ties financial support to concrete, measurable adaptation efforts at the farm level (KLARA, 2022). The second recommendation calls for the exploration of European funding instruments to support the establishment of pilot programs for innovative risk-transfer models, with a particular emphasis on leveraging Pillar II of the Common Agricultural Policy (CAP), which focuses on rural development and climate resilience. Pillar II is preferred over Pillar I in this context to avoid potential negative feedback from farmers, as Pillar I payments are more closely linked to direct income support. Redirecting or attaching conditions to Pillar I funds could be perceived as a threat to farmers' financial stability and provoke resistance, whereas Pillar II offers more flexibility for targeted, incentive-based interventions (EP, 2023). Importantly, such pilot programs should also be aligned with the EU Taxonomy prerequisites, ensuring compliance with sustainability and climate adaptation objectives at the EU level. (EC, 2021).

Despite these proposals, structural barriers – including administrative burden and limited stakeholder awareness – are dampening the effectiveness of current public allocations.

Constraints and Catalysts for Achieving Affordable Climate Insurance

The dialogue highlighted a complex set of challenges undermining both the economic viability and social acceptability of climate insurance solutions. A primary concern is the growing volatility of extreme weather patterns, which has significantly reduced the predictive accuracy of conventional climate models. This decline in predictability has, in turn, led to heightened actuarial uncertainty and premium volatility, making insurance offerings less stable and more expensive. One contributing factor is the shifting behavior of jet streams, which is driving more frequent and intense extreme weather events across Europe and beyond. (Lee J., et al., 2024)

Key risk domains – particularly drought and spring frost – remain significantly underinsured.

Drought poses a major threat across Central and Southern Europe, yet existing models have not adequately captured the full extent or evolving nature of this risk under current and projected climate conditions. This modelling gap hampers effective risk pricing and limits the development of tailored insurance products capable of addressing the increasing severity and frequency of drought events (JRC, 2024).

The dialogue identified several key innovations and policy instruments as pathways to enhancing the affordability of climate insurance services. These include the expansion of parametric insurance, the development of public-private financing models, and the improvement of data quality and granularity to enable more accurate risk assessment and pricing. The dialogue emphasized the growing importance of parametric insurance for drought, particularly when supported by transparent trigger thresholds that enhance both operational clarity and claims processing efficiency. Parametric insurance was recognized as increasingly mainstream and is expected to see further expansion across the sector. In parallel, the deployment of public-private co-financing frameworks was identified as a promising approach to reduce premium costs for high-risk yet climate-adaptive agricultural producers.

Improving data granularity, especially through enhancements in the accuracy and resolution of datasets provided by the German Weather Service (DWD), was seen as a key step in mitigating basis risk and strengthening consumer trust. Despite acknowledged precision limitations, DWD data remains highly trusted by farmers. Nevertheless, a persistent epistemic trade-off between the simplicity of insurance products and the actuarial precision required for effective risk pricing continues to limit market scalability.

Institutional Capacities and Technical Infrastructure Required for Regional Uptake

To enable the regional-scale implementation of climate insurance instruments, the following priority needs must be addressed:

- Dedicated technical assistance to support the implementation and monitoring of adaptation actions that qualify for insurance-linked incentives. The Lower Saxony model, which ties support to verified adaptation measures, serves as a strong reference framework.
- Regulatory harmonization to clearly define the legal mandates and responsibilities of

municipalities in negotiating, implementing, and managing insurance contracts.

- Investment in municipal administrative capacity, particularly in the areas of risk appraisal, claims management, and stakeholder coordination. Accurate risk assessment is critical, and premium subsidies alone are insufficient without robust local implementation structures.
- Transnational harmonization of state aid frameworks to prevent distortions in production incentives and insurance access across EU member states, ensuring a level playing field for farmers throughout the Union.

It was also confirmed that insurance offerings should be aligned with capital investments in climate-resilient agricultural infrastructure, including irrigation systems, hail protection nets, and agroforestry. Notably, agroforestry was highlighted as a particularly underutilized opportunity, offering substantial potential for both risk reduction and long-term resilience.

Frontier Innovations and Best Practices in Climate Insurance Architecture

The Climate Resilience Dialogue (CRD) highlighted several cutting-edge approaches and emerging design principles that are shaping the future of climate risk insurance:

- Adoption of parametric insurance models, particularly in the drought insurance market, where objective meteorological indicators (e.g., rainfall thresholds) serve as transparent and efficient disbursement triggers.
- Development of results-based insurance mechanisms that reward measurable resilience outcomes. The Lower Saxony model, which links support to proven adaptation practices, was noted as a strong foundation for such conditional frameworks.
- Integration of behavioral insights into insurance product design, acknowledging the roles of social learning, peer influence, and cognitive heuristics in shaping farmers' decision-making. These behavioral dynamics are critical, as farmers often influence one another and form demand collectively.
- Exploration of hybrid insurance schemes that incorporate ecosystem service valuations and introduce disincentives for environmentally harmful practices, such as the cultivation of former peatlands. These models aim to align insurance incentives with broader sustainability goals.

There was a consistent emphasis on the co-creation of insurance products in collaboration with end users, to ensure greater contextual relevance, user comprehension, and adoption. Engaging farmers directly in the design process was seen as essential to building trust and tailoring solutions to real-world needs.

Conclusion and Steps Forward

There was a consistent emphasis on the co-creation of insurance products in collaboration with end users to ensure greater contextual relevance, user comprehension, and adoption. Engaging farmers directly in the design process was seen as essential to building trust and tailoring solutions to real-world needs. In this context, several insurance companies expressed their readiness to continue the dialogue through a structured Community of Practice, aimed at

fostering ongoing exchange, mutual learning, and the collaborative development of scalable, farmer-centered insurance solutions.

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Regional Climate Resilience Dialogue in Saxony- Flood Prevention in Saxony: From Isolated Preparedness to Shared Resilience – A Holistic Case Study Approach in Saxony

Authors: Dr. Sebastian Golz (TU Dresden) and Sina Rühland (UFZ)

Date: 19 June 2025

Introduction

As flood risks increase in severity and frequency, particularly in Saxony, we are confronted not only with physical challenges but also with societal and behavioral ones. At the intersection of policy, insurance, and individual responsibility lies a critical question: how can we close the protection gap in private flood prevention? Our current work addresses this question through a multi-faceted case study based in Saxony. This blog post outlines our ongoing activities regarding the climate resilience dialogues (CRD). Rather than organizing a single large-scale event to bring all stakeholders together, we deliberately chose a decentralized strategy. By hosting a series of smaller, localized meetings and events, we can capture the diverse perspectives and lived experiences of those affected. This approach allows us to closely examine the decision-making processes behind private flood protection measures—an essential step toward designing more effective and inclusive adaptation strategies.

Why Shared Resilience?

Inspired by EIOPA's concept originally developed for pandemics, shared resilience emphasizes that no single sector can tackle climate-related risks alone. Households, insurers, governments—each must contribute. The concept is based on four key principles: Sharing costs & responsibilities, central coordination, mitigation and adaptation and the fact, that insurance von only cover a part of the economic costs occurring. In Saxony, where some regions have been flooded up to 18 times in the past two decades, the urgency to act is undeniable. Despite this, private insurance uptake remains low, and adaptation measures are often insufficient. Behavioral theory helps explain this disconnect. While financial constraints do play a role, studies show that perception, trust, experience, and emotion are just as critical. Hopelessness, mistrust in institutions, or even denial can prevent individuals from acting—even when objective risks are high. This insight guides our approach: effective flood prevention requires not just subsidies or checklists but personal engagement, tailored communication, and trusted networks.

Activities outside of the Project

In Saxony, the Flood Competence Center plays a key role in bridging the gap between science, policy, and citizens. By actively engaging with municipalities and residents, it facilitates communication on flood risks and promotes the use of the flood certificate as a tool for individualized protection planning. The center also organizes regular conferences that focus on flood damage prevention and showcase technical solutions for building-level protection. Complementing these efforts, the State of Saxony provides accessible flood risk and heavy rainfall maps, equipping the public with vital information to better understand and manage their exposure to natural hazards.

Our Activities: a decentralized CRD approach to involve the most important stakeholders

1. Information Campaigns with Local Partners

Together with the Consumer Association of Saxony, we launch a targeted flood awareness

campaign focused on areas with high flood vulnerability, high ownership rates and low insurance coverage. Using publicly available data, we identified priority regions and will hold our first public event in Meißen. These events aim to provide clear and accessible information on risks and insurance. We'd also like to foster dialogue with residents to understand their experiences, wishes and needs. Rather than simply convincing people, we strive to empower them to make an informed decision themselves.

2. Improving the Flood Certificate Process

The flood certificate program is a valuable tool that includes on-site consultations, risk assessments, and adaptation plans. However, only about 10% of the recommended measures are implemented. To better understand the strengths and potential improvement, we conducted an interview with Dr. Golz (University of Dresden) – one of the initiators of the flood certificate. He highlighted key barriers: The lack of coordination support, financial limitations and technical complexity of the protection measures for the buildings. His recommendation included raising funding ceilings, enhance public communication and to create regional networks of certified craftsmen to extend the support for citizens. They will not only receive advise on what to implement, but also where to ask for it to ensure proper quality of the protective measures. We also developed an evaluation tool for the university of Dresden to enhance experience exchange with the customers of the flood certificate. This will help to monitor and improve the communication and the overall process of the certificate.

3. Empirical Research on Decision Factors

Why do some households adapt, while others don't? We're exploring this through regression analysis using data from the Green-SÖP. Our focus is on the role of climate change skepticism in shaping the decision process regarding flood prevention. If values and beliefs significantly impact risk behavior, communication strategies must be tailored to those attitudes.

Looking Ahead: A Collective Effort

Flood risk is more than a technical issue—it's a social challenge. The gap we face is one of perception, participation, and trust. If we want to build a more resilient Saxony, we need shared responsibility: and we need informed, proactive citizens to move from isolated preparedness to shared resilience.

About Dr. Sebastian Golz: With the start of his civil engineering studies at the Dresden University of Technology (TU Dresden) – focusing on structural engineering – Dr. Golz dedicated himself extensively to the topic of flood-resilient construction. Following the completion of his doctoral dissertation in this field, he joined HTW Dresden in 2018, where he now leads the teaching module on climate-adaptive building. As one of the initiators of the Flood Preparedness Certificate, he has been involved in the project from the very beginning. We sincerely thank Dr. Golz for the pleasant collaboration and his valuable insights into the details of the Flood Preparedness Certificate.

About Sina Rühland: Sina Rühland from the Helmholtz-Zentrum für Umweltforschung (UFZ) team for SOTERIA holds a Master's degree in Economics with a focus on environmental sustainability. Her primary interest in the SOTERIA project lies at the intersection of psychology,

ecology, and economics. By analyzing the decision-making processes of private households, she identifies key factors that incentivize improved private flood preparedness, thereby helping to reduce the existing protection gap. Building on these insights, she develops targeted measures and policy recommendations that engage all relevant stakeholders in the process—aligned with EIOPA's Shared Resilience approach.

About the Consumer Association of Saxony: The Consumer Association of Saxony (Verbraucherzentrale Sachsen) is an independent, non-profit organization primarily funded by public sources. Its mission is to inform, advise, and support consumers on matters of private consumption. With 13 advisory centers across Saxony, a consultation hotline, and online services, it provides expert guidance to over half a million people each year. In addition to individual counseling, it contributes to broader consumer protection by pursuing legal violations, representing consumer interests in politics, informing the public through media, organizing campaigns and exhibitions, and collaborating with schools and educational institutions.

Regional Climate Resilience Dialogue in Valencia- Building a Common Framework for Shared Resilience

Authors: Marina Torres (GVA), Gabriela Alonso (BC3)

Date: 5 June 2025

Introduction

On June 5th, 2025, a total of 52 stakeholders (60% women and 40% men), gathered at the Regional Ministry for the Environment, Infrastructure, and Territory in Valencia, Spain, to participate in a Climate Resilience Dialogue (CRD), and discuss the SOTERIA's Valencian pilot case study: the Marjal dels Moros wetland.

This CRD emerged from a series of sectoral workshops held throughout 2024 with key stakeholders linked to the Marjal dels Moros—such as representatives from agriculture, industry, local government, and NGOs. These workshops, facilitated by the Regional Ministry for the Environment of the Valencian Community under the SOTERIA project, aimed to explore sector-specific perspectives on the wetland in the context of climate change. A shared priority quickly emerged: the conservation and restoration of the Marjal as a strategic asset for building climate resilience.

Marjal dels Moros is a wetland located 30 km north of the city of Valencia, between the municipalities of Sagunt and Puçol. It covers an area of 620 hectares and is protected under several conservation designations, including its recognition as a Protected Wetland and its integration into the Natura 2000 Network as a Site of Community Importance (SCI) and a Special Protection Area for Birds (SPA). In 2015, it was also declared a Special Area of Conservation (SAC). Its protection not only helps mitigate climate risks but also plays a key role in managing the challenges associated with the energy transition.

Objectives

The main objective of the CRD was to co-develop a shared resilience framework. During the workshop, participants prioritized a set of resilience indicators selected from the EU Taxonomy and Spain's National Adaptation Plan. These indicators serve as the foundation of a practical, measurable framework that integrates sectoral contributions and aligns with local, national, and European adaptation strategies.

Shared resilience framework

This shared resilience framework will be directly linked to the ongoing update of the 2018 Marjal dels Moros Management Plan (Plan Director), which is currently being revised. The prioritized indicators from the CRD will guide the development of restoration and conservation activities within the updated Plan, helping to establish clear priorities and measurable outcomes. The goal is for the Plan to become a strategic tool capable of attracting diversified funding—including private sector contributions—while strengthening public-private collaboration and enhancing climate resilience at the local level.

Additionally, the Insurance Compensation Consortium (Consorcio de Compensación de Seguros, CCS) presented the critical role of the insurance sector in climate adaptation, emphasizing its function in responding to extreme weather events and the advantages of

Spain's solidarity-based insurance system. Finally, the CCS highlighted the value of loss data it manages as a resource to support evidence-based decision-making and more effective climate planning.

Key takeaways

- Climate adaptation is an urgent and high priority in the Valencian Region, given its high vulnerability to climate change impacts. International, European, national and regional frameworks are aligned to enable a coordinated response.
- Coastal wetlands such as the Marjal dels Moros are recognised as effective nature-based solutions to reduce risks and protect the environment, the economy and public health.
- Climate adaptation is not only necessary but also cost-effective. The PVIECC 2030 will be the main tool to coordinate regional action, while the involvement of municipalities, supported by dedicated funding, is essential to advance climate resilience.
- The CCS provides coverage for extreme events, facilitating recovery and providing valuable data for risk planning. The Spanish insurance system, with mandatory coverage for extraordinary events, maximises mutualisation, maintains affordable rates and centralises damage data, supporting risk management and climate adaptation.
- The increase in extreme weather events threatens the financial sustainability of the insurance system, making complementary strategies essential. Ecosystem restoration, such as the restoration of wetlands, offers a cost-effective and sustainable way to reduce long- term climate risks. Coastal wetlands like the Marjal dels Moros are crucial natural infrastructures.
- The Marjal dels Moros Master Plan (2018) is a living document currently being updated and revised. The original plan established a comprehensive vision for restoration, with 36 actions across nine areas and an investment of over €8 million. The update proposes a model of adaptive governance and innovative financing to integrate participatory investment among stakeholders. The updated plan will consider the indicators prioritized in the workshop.
- Adaptation must be locally grounded and participatory, involving regional stakeholders and aligning indicators with national and local priorities. The active participation of local stakeholders, citizens, businesses and public administrations is essential for the conservation of the wetlands, integrating technical knowledge, hydrogeological models and an assessment of their social and ecological benefits.
- There is a need to strengthen coordination, explore innovative financing tools and align national policies with local implementation for effective adaptation. Resilience must be built collaboratively, involving public, private and civil society actors from design through to implementation.

ANNEX 4. Questionnaire to Identify needs for climate-related risk and loss data (TEMPLATE)

Authors: Oihana Luque (ICA)

Purpose

As part of the European Horizon project SOTERIA, this questionnaire aims to gather insights from public authorities and key stakeholders regarding the collection, access, and use of climate-related risk and loss data.

This questionnaire explores your existing use of climate-related data, the gaps or challenges you face, and the functionalities you require in a user-friendly software platform for accessing and analyzing this data.

Context

Loss data is crucial for identifying areas vulnerable to and exposed to climate risks, enabling the planning and implementation of adaptation measures. For instance, Norway's Knowledge Bank has allowed municipalities to pinpoint highly vulnerable areas, supporting informed decisions on adaptation strategies. By understanding the costs of damages, countries can prioritize investments in risk reduction measures and risk transfer mechanisms, contributing to building climate resilience.

There are various types of risk and damage data, some of which come from insurers who record and analyze damages. **This information is not only vital for local decision-making but also supports international frameworks** such as the Paris Agreement and the Sendai Framework for Disaster Risk Reduction. The OECD highlights the importance of public-private collaboration in collecting and making available data on assets, vulnerabilities, and past losses. Consistent post-disaster loss assessments and the harmonization of data at national, regional, and international levels are essential for effectively managing disaster risks.

Job title :	Main functions :	Organization

1. Current use of climate-related risk data

This section focuses on how you currently use climate-related risk and loss data in your work. We aim to understand the types of data you rely on, the specific purposes for which you use it, and any barriers you face in accessing, analyzing, or utilizing it. The insights gathered here will help us tailor the data hub to meet the real-world needs of stakeholders at various levels.

1. Do you work with climate risk and loss data?

- Yes
- No (If you select "No", it is not necessary to continue with the questionnaire.

2. What types of climate-related risk and loss data do you currently use in your work?(e.g., flood data, storms, economic damages, etc.)

3. What is the purpose of using this data? (e.g., policy formulation, risk assessment, disaster response, urban planning, etc.)

4. How often do you use climate risk-related data?
- Daily
- Weekly
- Monthly
- Occasionally

5. At what administrative level do you primarily focus on?
   - Asset level (infrastructure or properties)
   - Municipal
   - Regional
   - National
   - Global

6. What types of areas do you primarily work in?
   - Coastal areas
   - Urban areas
   - Rural or agricultural areas
   - Mountainous areas
   - Forest areas
   - Other: specify

7. What data sources and platforms do you use to access and visualize climate risk and loss information?

2. Data Needs

This section focuses on identifying barriers and the need for additional data, as well as understanding what would be useful to meet legal objectives.

8. What challenges or barriers do you face when accessing, interpreting, or using this

data?

- Formatting issues (e.g., compatibility problems, unreadable formats)
- Technical limitations (e.g., software compatibility)
- Licensing and regulatory restrictions
- Political restrictions: How do existing policies influence the ability to use these data?
- Trust and perception: Are there subjective barriers, such as concerns about data reliability or sources?
- Other. (please specify)

9. Would you need additional data to comply with your legal obligations?
    - Yes
    - No (If you select "No", you can proceed to the next section.)
10. Are there specific data you need for particular geographic areas (e.g., certain municipalities or regions)? If so, what type of data is needed, and for which areas?
11. Do you need more detailed data (e.g., at a finer geographic scale, such as community, neighborhood, or asset level)? If so, what type of data and what level of detail is required?
12. Do you need projected data, such as long-term climate scenarios? If so, what specific data do you need and what time scale is required?
13. Do you find the data from insurers useful on the following aspects?
    - Cause of damage (e.g., type of hazard like storm, earthquake)
    - Natural damage (e.g., river floods, landslides)
    - Water-related damage (e.g., flash floods, sewage backups)
    - Economic losses (e.g., compensation paid to policyholders)
    - Business impacts (e.g., indirect economic costs due to interruptions)
    - Date, time, and location of the damage

3. Need for a centralized climate Risk Data Platform

This section aims to understand the usefulness of developing a single platform or integrating climate risk data into an existing platform, similar to Norway's Knowledge Bank. This platform would provide local authorities and other relevant stakeholders with access to crucial climate risk data, including:

- *Database: Information on climate events, losses, and vulnerabilities.*
- *Interactive visualization: Maps and charts to identify vulnerable areas.*
- *Assessment tools: Analysis to help prioritize adaptation investments.*

- *Educational resources: Reports and case studies on adaptation strategies.*
- *Continuous updates: Regularly updated data*

14. Do you think it would be useful to have a single platform for various climate risk data? Do you already use or know of a similar platform?
15. Below is a list of suggested functionalities. What are your thoughts on these?
    - Do you think a tool that displays aggregated loss data by hazard type would be useful? If so, what types of hazards would be most relevant to include?
    - Would it be useful to have a platform that provides quick access to relevant public datasets for climate risk assessment, organized by hazard type? (e.g., tables or cards with quick access links)

Potential Interface features	
Loss Data Visualization ● Feature: Display loss data per hazard type (adjusted to 2015 Euro values). ● Functionality: ○ Filter by region, year, and hazard type. ○ Aggregated loss data with regional breakdown. ● Download: Option to download filtered data in CSV/Excel. ● Visual Suggestion: Interactive map and bar charts for loss data comparison.	**Public Datasets for Risk Assessment** ● Feature: List of public datasets organized by hazard type. ● Functionality: ○ Links to dataset sources. ○ Brief descriptions of each dataset and relevance for risk assessment. ● Visual Suggestion: Table or cards with quick-access links.

Do you have any additional suggestions, comments, or specific needs related to the use of climate-related risk and loss data that you'd like to share?

- Full EU dataset tables
- Full SOTERIA Ontology property lists
- Technical demo (Plotly Dash + Neo4j details)
- Detailed risk guidelines

ANNEX 5. Catalogue of weather and climate insurance solutions (CATALOGUE)

Examples of insurance solutions that can support climate change adaptation, with reference to those listed in the “Overview of insurance solutions” infographic (dated: Feb 2026).

Linked to D3.5, D3.2 and 3.1

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
001	https://www.allianzagrar.de/files/mmagrar/content/dokumente_formulare/Flyer%20Trockenheit.pdf	Trockenheitsversicherung, Ernteschutz Vario	Data use	Agro	TRL9 (deployment)
002	https://gvf.de/die-wetterversicherung/, Münchener & Magdeburger Agrar AG - CYA International Consulting	CYA XLab	Data use	Agro	TRL7 (deployment)
003	Arbol Insurance Services | Low Temperature solutions	Low Temperature insurance	Data use	Agro	TRL2 (research)
004	NA, personal communication	Meteorological data index product for olive- or grape-diseases.	Data use	Agro	TRL2 (research)
005	The Effects of Extreme Weather on Apple Quality | Scientific Reports (nature.com)	Temperature index product covering apple quality for spring frost.	Data use	Agro	TRL1 (research)
006	https://www.sciencedirect.com/science/article/pii/S0308521X23001361	Temperature - humidity index predicting dairy cow milk yield and protein content due to heat-humidity stress.	Data use	Agro	TRL1 (research)
007	https://www.researchgate.net/publication/344296587_The_optimal_drought_index_for_designing_weather_index_insurance	Farm-specific combination of different drought indices.	Data use	Agro	TRL1 (research)
008	https://www.libertymutualre.com/static/2021-05/LM+Re+Forestry+Factsheet.pdf, https://descartesunderwriting.com/wildfire/	Parametric forestry wildfire cover	Data use	Agro	TRL9 (deployment)
009	https://emergency.copernicus.eu/mapping/list-of-activations-risk-and-recovery	Risk and damage assessment data base	Data use	Non-LOB specific	TRL2 (research)
010	https://cwn-rce.ca/project/advancing-municipal-flood-management-through-effective-knowledge-curation/	Municipal Flood Management through Effective Knowledge Curation	Data use	House/ Building	TRL9 (deployment)
011	https://www.swissre.com/reinsurance/property-and-casualty/solutions/specialty-solutions/growing-a-healthy-agriculture-boo	Opti-crop Index tracker	Data use	Agro	TRL9 (deployment)

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
	k-our-agro-suite.html				
012	https://www.swissre.com/risk-knowledge/mitigating-climate-risk/natcat-2019/drought-is-insurable.html#:~:text=Swiss%20Re%27s%20Soil%20Moisture%20Deficit,rain%20fed%20agricultural%20production%20worldwide.	Soil Moisture Deficit Index Insurance	Data use	Agro	TRL9 (deployment)
013	https://www.munichre.com/en/solutions/reinsurance-property-casualty/natcatservice.html	NatCatService	Data use	Non-LOB specific	TRL9 (deployment)
014	http://connectivity-hub.placard-network.eu/?resource=false&teaser_resource=false	Connectivity Hub	Data use	House/ Building	TRL4 (development)
015	https://www.cystellar.com/#	CyStellar TerraRisk Re	Data use	House/ Building	TRL9 (deployment)
016	https://www.vestforsk.no/sites/default/files/migrate_files/vf-rapport-7-2014-testing-av-skadedata.pdf	Sharing of loss data	Data use	House/ Building	TRL9 (deployment)
017	https://www.worklimate.it/il-progetto/	Two-year national initiative	Data use	Agro	TRL9 (deployment)
018	https://www.adb.org/sites/default/files/publication/712591/sustainable-development-after-covid-19-sdg-bonds.pdf	Sustainability Bond	Financial	Infrastructure	TRL9 (deployment)
019	https://www.munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2022/media-information-2022-05-24.html https://www.swisslife.com/content/dam/com_rel/dokumente/bonds/2021/SwissLife_CH1130818847.pdf	Green bond issuing	Financial	Non-LOB specific	TRL9 (deployment)
020	https://www.reinsurancene.ws/allianz-swiss-re-place-first-legally-bound-cat-xol-reinsurance-dlt-contract-enabled-by-b3i/	Smart reinsurance contracts	Financial	House/ Building	TRL9 (deployment)
021	https://www.artemis.bm/news/nat-cat-protection-gap-widens-to-368bn-cat-resilience-bonds-needed-swiss-re/ https://journals.openedition.org/factsreports/4910	Resilience Bond Insurance	Financial	Non-LoB specific	TRL5 (development)
022	https://www.munichre.com/en/solutions/reinsurance-property-casualty/structured-prospective-solutions.html	Prospective Structured Reinsurance	Financial	Non-LOB specific	TRL9 (deployment)

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
023	https://www.allianz.com/en/press/news/commitment/sponsorship/160615-blockchain-technology-successfully-piloted.html	DLT-based cat swap	Financial	Non-LOB specific	TRL7 (deployment)
024	https://www.climatebonds.net/2013/11/zurich-insurance-allocates-1bn-green-bond-investing-mandate-goes-blackrock https://www.climatebonds.net/2014/07/zurich-insurance-says-it-will-invest-target-2bn-green-bonds-europe-us https://www.climatebonds.net/resources/reports/green-bonds-market-summary-h1-2020	Green and climate Bonds investment	Financial	Non-LOB specific	TRL9 (deployment)
025	https://www.refocuspartners.com/wp-content/uploads/2017/02/RE.bound-Program-Report-December-2015.pdf	Resilience bonds	Financial	Non-LoB specific	TRL6 (development)
026	https://www.swissrefoundation.org/what-we-do/projects/natural-hazard-and-climate-risk-management/mangroves-pay-their-way.html	Insurance cover for mangroves	Financial	Non-LOB specific	TRL7 (deployment)
027	https://www.unepfi.org/events/regional-roundtables-on-sustainable-finance-2023/ https://www.eiopa.europa.eu/sustainable-finance-roundtable-eiopa-announces-its-sustainable-finance-activities-coming-three-years-2021-12-07_en	Exchange of the best practices (ESG, innovative products, etc.)	Insurance business models	Non-LOB specific	TRL9 (deployment)
028	https://www.swissre.com/our-business/public-sector-solutions/insurance-to-protect-and-enable-nature-based-solutions.html	Construction All Risk (CAR) policy for NBS	Insurance business models	Infrastructure	TRL9 (deployment)
029	https://www.chubb.com/ca-en/business-insurance/green-building.html	Green-building restauration	Insurance business models	Non-LOB specific	TRL9 (deployment)
030	NA, personal communication with reinsurers	Sales closing date-dependent Sliding Scale premiums	Insurance Marketing & Sales methods	Agro	TRL1 (research)
031	https://pib.gov.in/PressReleasePage.aspx?PRID=1915851	Heat index insurance	Insurance Marketing & Sales methods	Agro	TRL9 (deployment)
032	https://www.gdv.de/gdv/service/musterbedingungen	Model contract	Insurance Marketing & Sales methods	Non-LoB specific	TRL6 (development)
033	NA, to be added	Experimental evidence	Insurance Marketing & Sales methods	Non-LoB specific	TRL1 (research)

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
034	https://www.verbraucherzentrale.de/wissen/geld-versicherungen/weitere-versicherungen/welche-versicherung-brauche-ich-12605	Podcasts, blogs	Insurance Marketing & Sales methods	Non-LoB specific	TRL5 (development)
035	https://www.verbraucherzentrale.de/wissen/geld-versicherungen/weitere-versicherungen/hausratversicherung-auf-den-wert-der-einrichtung-kommts-an-13889	Benchmarking, Evaluation of services	Insurance Marketing & Sales methods	Non-LoB specific	TRL5 (development)
036	Use of Sliding Scale Premiums in Subsidized Insurance Programs, The (urban.org)	Income-dependent Sliding Scale premiums	Insurance Marketing & Sales methods	Health	TRL9 (deployment)
037	NA, personal communication	Flood label	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	House/ Building	TRL5 (development)
038	NA, personal communication with (re)insurers	Multi-year contracts offer affecting price	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	Non-LOB specific	TRL7 (deployment)
039	https://www.munichre.com/us-non-life/en/solutions/reinsurance/flood.html	Affordable flood insurance designed specifically for homeowners in low-to-moderate risk areas	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	House/ Building	TRL9 (deployment)
040	NA, to be added	Criteria in the insurance contract rewarding CCA measures	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	House/ Building	TRL4 (development)
041	NA, to be added	Risk-reduction conditions in the insurance contract (e.g. maintenance calendar) with small benefits	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	House/ Building	TRL6 (development)
042	NA, to be added	Regular house inspection	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	House/ Building	TRL1 (research)
043	https://hbr.org/2017/08/how-the-insurance-industry-can-push-us-to-prepare-for-climate-change https://www.aviva.com/sustainability/our-stories/fighting-floods/	AVIVA flood-risk price differentiation, and USAA wildfire price differentiation	Insurance pricing methods and other policy terms (e.g., rates, deductibles, pay out limits)	House/ Building	TRL9 (deployment)

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
044	https://glasnost.amsterdam/en/work/green-roof/	New cover for NBS: sale of greenroofs	Insurance product types, e.g. new cover for NBS	House/ Building	TRL9 (deployment)
045	https://www.itcdiaeurope.com/featured-insurtechs/etherisc-decentralized-insurance-leveraging-blockchain/ https://www.lemonaide.co/blockchain https://www.etherisc.com/	Block-chain based crop insurance	Insurance product types, e.g. new cover for NBS	Non-LOB specific	TRL6 (development)
046	NA, to be added	New cover for NBS: sale of NBS to private property owners and businesses	Insurance product types, e.g. new cover for NBS	House/ Building	TRL4 (development)
047	NA, to be added	Coverage for restoration to eco-label	Insurance product types, e.g. new cover for NBS	House/ Building	TRL1 (research)
048	https://www.floodre.co.uk/buildbackbetter/	Affordable insurance services	Insurance product types, e.g. new cover for NBS	House/ Building	TRL9 (deployment)
049	https://www.cbd.int/financial/doc/cec-pes.pdf	PES (Payments for Environmental Services)-scheme	Insurance product types, e.g. new cover for NBS	Non-LoB specific	TRL2 (research)
050	https://corporatesolutions.swissre.com/dam/jcr:3b534611-27be-4fc1-b2dd-1e570a9d882a/FLOW-parametric-water-level-insurance.pdf https://reports.swissre.com/2019/business-report/from-risk-to-resilience/more-stories-on-resilience/other-solutions-for-resilience.html#	FLOW Insurance	Insurance product types, e.g. new cover for NBS	House/ Building	TRL9 (deployment)
051	https://corporatesolutions.swissre.com/innovative-risk-solutions/parametric-solutions/hail.html https://corporatesolutions.swissre.com/dam/jcr:34fb5129-15c8-4265-80fd-a27f739fb8f0/innovating-together-examples-innovative-risk-solutions.pdf	HAIL Damage Insurance	Insurance product types, e.g. new cover for NBS	House/ Building	TRL9 (deployment)
052	https://www.axa-research.org/en/events/coastal-resilience-and-the-role-of-nature-based-solutions	Ecosystems interruption insurance product	Insurance product types, e.g. new cover for NBS	Non-LOB specific	TRL3 (research)
053	https://www.munichre.com/content/dam/munichre/mram/content-pieces/pdfs/Resilience-Risk-Transfer.pdf/_jcr_content/renditions/original./Resilience-Risk-Transfer.pdf	Resilience Risk Transfer (RRT)	Insurance product types, e.g. new cover for NBS	Non-LOB specific	TRL9 (deployment)
054	https://www.munichre.com/en/solutions/f	Weather risk insurance	Insurance product types,	Non-LOB	TRL9 (deploy

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
	or-industry-clients/energy-weather.html		e.g. new cover for NBS	specific	ment)
055	https://www.zurich.com/en/commercial-insurance/services/climate-resilience	Zurich Resilience Solutions	Insurance product types, e.g. new cover for NBS	Non-LOB specific	TRL9 (deployment)
056	https://axaxl.com/fast-fast-forward/articles/lets-talk-climate-parametric-insurance-a-versatile-remedy-for-our-future-world	Transfer risks from atypical climate events	Insurance product types, e.g. new cover for NBS	Agro	TRL9 (deployment)
057	https://climatechampions.unfccc.int/how-innovative-insurance-solutions-are-protecting-mesoamerican-reefs-and-communities/	Mesoamerican reefs and communities protection	Insurance product types, e.g. new cover for NBS	Non-LOB specific	TRL9 (deployment)
058	https://www.dglobe.com/business/farmers-insurance-introduces-eco-rebuild; https://www.woodworkingnetwork.com/news/woodworking-industry-news/farmers-insurance-offers-homeowners-green-incentives	Eco-Rebuild Insurance Product	Insurance product types, e.g. new cover for NBS	Agro, House/ Building	TRL9 (deployment)
059	https://sustainability.travelers.com/drivers-of-sustained-value/climate-strategy#products-services	FORTIFIED Home Insurance Product	Insurance product types, e.g. new cover for NBS	Non-LOB specific	TRL9 (deployment)
060	https://www.genillard-co.com/agriculture-risk-metrics/	Agriculture Risk Metrics portal	Insurance services, e.g. supportive IT-solutions	Agro	TRL2 (research)
061	NA, personal communications	SaaS: On-line client & risk pooling service	Insurance services, e.g. supportive IT-solutions	Non-Lo B specific	TRL1 (research)
062	https://okv.de/Leistungen/	SMS extreme events alerts	Insurance services, e.g. supportive IT-solutions	House/ Building	TRL9 (deployment)
063	NA, to be added	SaaS: Visualization of CCA or NBS solutions risk-reduction potential	Insurance services, e.g. supportive IT-solutions	House/ Building	TRL5 (development)
064	NA, to be added	Tool offered by insurer to city mayor to track public investment in buildings maintenance	Insurance services, e.g. supportive IT-solutions	House/ Building	TRL2 (research)
065	https://climate-adapt.eea.europa.eu/en/metadata/case-studies/optimization-of-the-mix-of-private-and-public-funding-to-realise-climate-adaptation-measures-in-malmo/#solutions_anchor	PPP for constructing green roofs, green areas, stormwater management system	Public Private collaboration (beyond premium subsidy)	House/ Building	TRL1 (research)
066	https://www.artemis.bm/news/chinas-parametric-catastrophe-insurance-to-expan	Parametric insurance	Public Private collaboration (beyond	House/	TRL5 (develop

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
	d-to-henan-province/	sollution	premium subsidy)	Building	ment)
067	NA, to be added	Insurer's pooling	Public Private collaboration (beyond premium subsidy)	Agro	TRL9 (deploy ment)
068	https://insuresilience-solutions-fund.org	State reinsurance	Public Private collaboration (beyond premium subsidy)	Agro	TRL9 (deploy ment)
069	https://www.sintefbok.no/book/index/1259/natural_perils_insurance_and_compensation_arrangements_in_six_countries --> MdV downloaded the book, it is saved here: R:\Knowledge Management\Insurance Solutions for CCA	National Disaster Compensation Scheme	Public Private collaboration (beyond premium subsidy)	Agro	TRL9 (deploy ment)
070	https://www.sintefbok.no/book/index/1259/natural_perils_insurance_and_compensation_arrangements_in_six_countries --> MdV downloaded the book, it is saved here: R:\Knowledge Management\Insurance Solutions for CCA	Natural Perils Pool /Natural Perils Insurance Scheme	Public Private collaboration (beyond premium subsidy)	Non-LOB specific	TRL9 (deploy ment)
071	https://link.springer.com/article/10.1007/s13753-017-0140-y, https://www.aw-landesverwaltungsamt.thueringen.de/foerderung/foerderung-a-z/eler-ernteversicherungen, https://www.vkb.de/content/firmen-landwirte/landwirte/ernteversicherung-erntesch utz/bayern-police/,	Insurance Premium subsidies	Public Private collaboration (beyond premium subsidy)	House/ Building	TRL9 (deploy ment)
072	https://www.cityofvancouver.us/government/department/public-works/water-sewer-and-stormwater/stormwater-surface-water-groundwater-utility/vancouver-watersheds/	Environemntal payments	Public Private collaboration (beyond premium subsidy)	Non-LOB specific	TRL9 (deploy ment)
073	https://iowaagriculture.gov/news/signup-crop-insurance-discount-program-cover-crops-extended-jan-27	Discount Program to promote Best Practice in Agriculture (e.g. planting of cover crops).	Public Private collaboration (beyond premium subsidy)	Agro	TRL9 (deploy ment)
074	https://www.derris.eu/en/actions/	Technical assistance to SMEs	Public Private collaboration (beyond premium subsidy)	Infrastr ucture	TRL9 (deploy ment)
075	https://www.denhaag.nl/en/taxes/sewage-charges-for-users.htm	Sewage charge	Public procurement & other legacy outcomes	Infrastr ucture	TRL9 (deploy ment)
076	https://www.sciencedirect.com/science/article/pii/S0306919221001937?via%3Dih	Non-linear heat index insurance	Risk quantification methods and models	Agro	TRL1 (researc

# ID	Link to source	Name of solution (if any)	Innovation type	LOB	Status
	ub				h)
077	https://axaxl.com/-/media/axaxl/files/pdfs/about-us/corporate-responsibility/24760--axa-xl--climate-report--2023--v5.pdf?sc_lang=en&hash=966172A8B292474E3CC67AE3E3B9F9E3	ORSA and climate change scenarios	Risk quantification methods and models	Non-LOB specific	TRL9 (deployment)
078	https://www.toronto.ca/city-government/budget-finances/city-finance/investor-relations/environmental-social-governance-performance-report/	Urban ESG reporting	Risk quantification methods and models	Non-LoB specific	TRL2 (research)
079	dClimate - Aegis	Aegis	Risk quantification methods and models	House/ Building	TRL7 (deployment)

ANNEX 6. Template of the PESTEL/COM-B Matrix (TEMPLATE)

Illustration from SOTERIA

Applied to climate-risk and loss data management, the matrix highlighted that:

- **Political/Legal factors** (e.g., GDPR interpretation, confidentiality laws) and **Economic factors** (competition concerns) formed clear, tangible barriers.
- **Social factors** (trust, norms of data ownership) and **Motivation** (fear of risk vs. perceived reputation gain) were key intangible ones.
- **Technological conditions** (interoperability, anonymisation) created both constraints and enablers.
- The combination showed that policy success required both regulatory clarity and behavioural incentives for data sharing – mirroring lessons from the Norwegian Knowledge Bank and Klima 2050 research.

The matrix thus serves as a practical bridge between institutional analysis and behavioural science, supporting decision-makers in designing multi-layered solutions.

COM-B \ PESTEL Capability	Political	Economic	Social	Technological	Environmental	Legal

Knowledge & skills	●●	○○	●○	●○	●○	●●
Technical infrastructure	○○	○○	●○	●●	N/A	○○

Opportunity	Political	Economic	Social	Technological	Environmental	Legal
Regulatory environment	●●	●○	●○	●○	N/A	●●
Collaboration mechanisms	●○	●○	●○	●○	N/A	●○
Financial incentives	●○	●●	N/A	●○	N/A	●○

Motivation	Political	Economic	Social	Technological	Environmental	Legal
Awareness of benefits	●○	●●	●●	●○	●●	●○
Market pressure	●○	●○	●○	●○	●●	N/A
Reputational considerations	○○	●●	●●	○○	●●	N/A

Legend: ●● = solid
●○ = inconsistent
○○ = lacking

ANNEX 7. SOTERIA Roadmap for Regions and Local Authorities

The SOTERIA Roadmap is a practical pathway for Regions and Local Authorities that want to move quickly from identifying a real insurance need to designing and testing an Innovative Insurance Solution (IIS). It focuses on the essential steps to (1) define demand, (2) identify suitable solution types, (3) design a pilot pathway, and (4) test, monitor and improve. The Roadmap complements this Manual: it does not describe the full SOTERIA methodology or adaptation planning process, which is provided in the Replication Manual.

The graphical representation of the pathway can be found here.

A practical pathway to design and test Innovative Insurance Solutions for climate adaptation

Purpose of this roadmap

Many regions are facing repeated climate losses from floods, droughts, heatwaves and storms. Public budgets alone cannot cover these losses, and traditional insurance often does not work in high-risk areas. At the same time, insurance can be an important tool for climate adaptation when it supports prevention, reduces vulnerability and improves financial resilience.

Within the SOTERIA project, several European regions worked with insurers, financial institutions and stakeholders to explore how new types of insurance solutions could be developed and tested. Those experiences showed that regions need a clear and practical pathway to move from identifying a real insurance need to testing an innovative insurance solution in practice.

This roadmap provides that pathway. It is designed for regional and municipal actors - Regions and Local Authorities (RLAs) - who want to use insurance as a tool for adaptation and risk management. It focuses on the essential steps needed to define the demand for insurance, identify suitable insurance solution types, design a pilot and test it.

The roadmap does not explain the full SOTERIA methodology or adaptation planning process (this can be found in the SOTERIA Replication Manual) It focuses specifically on how RLAscan develop and test innovative insurance solutions.

When to use this roadmap ?

This roadmap is useful when a region or local authority faces a situation such as:

- repeated climate losses affecting households, farmers, businesses or infrastructure;
- insufficient insurance coverage or unaffordable premiums;
- interest from insurers or public authorities in developing new risk-transfer solutions;
- need to use insurance as part of adaptation strategy.

It assumes that no suitable insurance solution currently exists and that the region wants to explore and test one.

Overview of the roadmap

The roadmap follows a simple sequence derived from SOTERIA case studies:

1. Define the real insurance need.

2. Identify the type of insurance solution that could help.
3. Design how to test that solution.
4. Test it, monitor results and improve.

Each phase uses one of the SOTERIA tools:

- Story Maps: defining demand
- Radar: identifying solution types
- Playbooks: designing pilot pathways
- Diaries: monitoring and learning

This sequence allows regions to move from a climate-risk problem to a tested Innovative Insurance Solution.

Phase 1 – Define the real insurance need

(Using Story Maps)

The starting point is always the real situation of the region. Insurance innovation cannot be designed without understanding local risks, key institutions and stakeholders to involve and the RLAs socio-economic, cultural and insurance.

RLAs should begin by selecting one concrete climate-risk problem that creates significant losses. This may be urban flooding affecting small businesses, drought losses in agriculture, heat impacts on vulnerable populations, or damage to coastal infrastructure.

Using the Story Map approach developed in SOTERIA, the region analyses:

- the main hazards and their economic impacts;
- sectors and communities most affected;
- past loss patterns and future risk trends;
- existing insurance coverage and gaps;
- institutional responsibilities;
- Data landscape (which data is available and where)
- Possible insurance solutions
- barriers to insurance uptake.

This analysis should explicitly map the insurance landscape and barriers to uptake (financial, regulatory, behavioural, data-related or institutional), in order to clearly identify the protection gap.

This process often reveals why insurance is not working. Premiums may be too high in high-risk areas, insurers may lack data, stakeholders may distrust insurance, or regulatory frameworks may limit innovation.

The outcome of this phase is a clear definition of the protection gap and the specific insurance need. This ensures that insurance is used as a targeted adaptation measure rather than as a generic product.

Phase 2 – Identify the type of insurance solution

(Using the Radar of innovative insurance solutions)

Once the insurance need is clear, the next question is which type of insurance could address it.

The SOTERIA Radar compiles innovative insurance approaches identified in different regions. These include parametric insurance, public–private insurance partnerships, insurance linked to resilience investments, pooled schemes for specific sectors, and other models.

Regions compare their protection gap with these solution types and identify one or two that could realistically work in their context. This decision must consider regulatory conditions, market capacity, data availability and financial sustainability.
The aim is not to invent a new insurance product but to identify a solution type that matches the regional problem. The outcome of this phase is a decision on the type of Innovative Insurance Solution to test.

Types of Innovative Insurance Solutions available for regions

- Parametric insurance: Insurance that pays automatically when a predefined climate indicator is reached (for example rainfall level, river height or temperature), allowing fast payouts and reducing administrative costs, especially useful when losses are frequent and data are available.
- Public–private insurance schemes: Insurance systems co-designed by public authorities and insurers where governments support affordability through subsidies, reinsurance, or risk-sharing, often linked to public adaptation goals or disaster-risk strategies.
- Insurance linked to resilience investments: Insurance products that reward or require risk-reduction measures (such as flood-proofing buildings, drought-resilient farming, or ecosystem restoration) by lowering premiums or improving coverage, helping insurance become a driver of adaptation.
- Pooled insurance schemes: Insurance arrangements where risks are shared across many users or regions (for example agricultural cooperatives or municipal pools), improving affordability and stability when individual risk is too high for private insurance alone.
- Community-based or mutual insurance: Local insurance schemes managed collectively by communities or sectoral groups, often combined with public support, useful where traditional insurance markets are weak but local solidarity and shared risk management are strong.
- Blended finance insurance solutions: Insurance combined with loans, grants, or resilience funds to finance preventive investments while providing coverage, helping regions invest in adaptation while managing remaining risk.
- Data-driven insurance platforms: Insurance models supported by shared risk data systems, Earth observation, or digital monitoring tools that improve pricing accuracy and transparency, enabling new insurance products in areas previously considered uninsurable.
- Sector-specific innovative insurance: Insurance designed for specific sectors such as agriculture, tourism, infrastructure, or housing, tailored to their risk profiles and often linked to sectoral adaptation plans.

Phase 3 – Design how to test the solution
(Using Playbooks derived from SOTERIA case studies)
Choosing a solution type is only the beginning. Regions must design how to implement and test it.
Playbooks developed in SOTERIA describe and recommend an implementation pathway for 6 innovative insurance solutions that aimed to be implemented in the SOTERIA CS. They identify which stakeholders should be involved, what roles they should play, how governance

and financing can be organised, and what conditions are needed to implement the selected IIS.
RLAs should select the playbook closest to their context and adapt it. This involves defining:

- which insurer or consortium will design the product;
- how risk data will be provided;
- how premiums or incentives will be financed;
- how stakeholders will participate;
- how the pilot will be evaluated.

This phase requires coordination between public authorities, insurers, financial institutions and affected sectors. It produces a concrete plan for testing the insurance solution.
The outcome of this phase is a pilot Innovative Insurance Solution ready to be tested.

Phase 4 – Test, monitor and improve
(Using Diaries and structured monitoring)
Testing an innovative insurance solution inevitably reveals practical challenges related to stakeholder behaviour, regulatory conditions, data availability and institutional coordination. The experiences are valuable because they show what works in real conditions.
In the SOTERIA case studies, Diaries were used to document the process of designing and testing IIS. They recorded key decisions, barriers encountered, adjustments made and lessons learned, creating a structured narrative of how the solution evolved.
Regions applying the roadmap should use a similar approach to document their implementation pathway. The objective is not primarily to monitor performance indicators, but to capture the reasoning behind decisions, identify critical obstacles, and record practical insights that may well be used by other regions.
Within the Community of Practice, RLAs may also agree on a small set of shared evaluation criteria -based on commonly used adaptation indicators- to assess the IIS in a comparable way across regions (e.g. effectiveness in reducing risk, affordability, equity, behavioural incentives, and institutional feasibility).
Through this documentation, regions create replication knowledge: what steps were needed, what challenges emerged, how stakeholders cooperated, and what mistakes should be avoided. This learning allows IIS to be improved locally and adapted in other regions facing similar risks.
The outcome of this phase is not only a tested solution, but also documented experience that supports scaling and replication.

Governance and stakeholder cooperation
Developing an Innovative Insurance Solution requires cooperation between multiple actors. Regions should create a working group including public authorities, insurers, financial institutions, data providers and representatives of affected sectors.
Communities of Practice used in SOTERIA helped regions share knowledge, build trust and refine solutions through dialogue. Similar collaboration structures help ensure that insurance innovation supports adaptation objectives and stakeholder needs.

Expected results
By following this roadmap, a region should achieve:

- a clear definition of its climate-risk protection gap;

- identification of a suitable insurance solution type;
- a pilot innovative insurance scheme;
- evidence on its effectiveness and feasibility;
- knowledge that supports scaling and replication.

This process helps regions use insurance as a tool for climate adaptation and risk management.

Final remarks

Insurance alone cannot solve climate risk, but when designed around real regional needs and tested through structured collaboration, it can reduce vulnerability, incentivise prevention and strengthen resilience.

The experience of the SOTERIA project shows that regions can develop Innovative Insurance Solutions when they start from their real protection gap, learn from existing best practices and test solutions step by step.

This roadmap provides a practical pathway to do so.

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