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FARCLIMATE

DELIVERABLE D7.2

Platform Documentation

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List of acronyms

AI: Artificial Intelligence

D: Deliverable

EC: European Commission

EEA: European Environment Agency

EU: European Union

IPCC: Intergovernmental Panel on Climate Change

LAG: Local Action Group

LL: Living Lab

LLM: Large Language Model.

MIP4Adapt: EU Mission Implementation Platform

NGO: Non-Governmental Organisation

PU: Public

R&D: Research and Development

T: Task

SME: Small and Medium Enterprise

UN: United Nations

UNFCCC: United Nations Framework Convention on Climate Change

WP: Work Package

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Project information

Project full title: Moving ForwARd to achieving CLIMATE-resilient and sustainable European regional economic systems - FARCLIMATE

Acronym: FARCLIMATE

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Partner No.	Organisation Name | Acronym
1 (Coord.)	UNIVERSIDAD DE VIGO | UVIGO
2	CONTACTICA S.L. | CTA
3	C4G - CONSULTING AND TRAINING NETWORK, LDA | C4G
4	INVIABLE LIFE CYCLE THINKING S.L. | INV
5	MUNICIPIO DO FUNDAO | FUNDAO
6	GREEN GROWTH GENERATION | GGG
8	FUNDACION CENTRO DE SERVICIOS Y PROMOCION FORESTAL Y DE SU INDUSTRIA DE CASTILLA Y LEÓN | CESEFOR
9	UNIVERSIDADE NOVA DE LISBOA | UNL
10	FUNDACION PARA LA PESCA Y MARISQUEO FUNDAMAR | FUNDAMAR
11	INTERNATIONAL UNION FOR CONSERVATION OF NATURE | UICN
12	EUROPEAN NETWORK OF LIVING LABS IVZW | ENoLL
12.1	ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS | CERTH
12.2	LAUREA-AMMATTIKORKEAKOULU OY | LAU
13	UNIVERSITY OF GHENT | UGENT

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Deliverable details

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Abstract:	The present document builds upon the foundational user research and content strategy outlined in the previous deliverable (D7.1) to present the detailed design and conceptualization of the FARCLIMATE Transformation Hub platform. It describes the methodology for platform design, the structure and components of the Hub, and the integration of key features informed by co-creation with stakeholders. The document details the development of the content portfolio, narrative-driven visualization strategies, platform architecture, and wireframes for core functionalities. It also addresses the strategy for embedding AI capabilities to enhance knowledge navigation and solution exploration. This technical and conceptual groundwork supports the subsequent platform development and beta testing phases, underpinning FARCLIMATE's mission to accelerate climate adaptation action through user-centred, inspiring, and practical digital solutions.

Version	Date	Description
Draft_V0	05/09/2025	First draft
Version_V1	24/09/2025	Initial version
Version_V2	29/09/2025	Second version
Version_V3	23/09/2026	Third version of D7.2 (revised after RP2 review)

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1. Executive Summary

The present document, developed as part of **Task T7.2** within **WP7—Transformative Solutions for a Positive Climate Future** of the FARCLIMATE project, presents the detailed **design** and **conceptualization** of the FARCLIMATE Transformation Hub platform. Building upon the foundational user research and content strategy outlined previously, it translates these insights into a coherent, user-centred, and co-created digital solution designed to accelerate climate adaptation action.

Section 2 situates the Transformation Hub within the broader **objectives** of WP7, establishing its **role** as a cornerstone for delivering inspirational, practical, and accessible climate adaptation knowledge. This framing sets the stage for the following sections, guiding the platform's purpose and strategic approach.

Section 3 provides a **general description** of the Hub, detailing the content development strategy and key features conceived to address user needs, with special attention to priority sectors and thematic relevance. This builds on the **conceptual starting points** established in **Section 4**, which focuses on communities, bioregions, and climate adaptation solutions, as well as the Hub's main objectives to foster **inspiration** and **learning** among its diverse user base.

The **methodology** for **platform design** is elaborated in **Section 5**, describing the **design approach**, the extensive **knowledge sources** surveyed—including European and global platforms and research projects—and the innovative **recipe structure** that organizes adaptation solutions for consistent presentation and improved usability. This methodological foundation ensures rigor and relevance in the platform design.

Section 6 details the iterative user-centred **prototyping** and **co-creation activities** that shaped the platform's development, highlighting the curated portfolio of transformational solutions and the emerging user journey models. **Conceptualization** of the Hub continues in **Section 7**, featuring the prioritization framework for **key features**, the **visual identity** development, and the **technical architecture** alongside detailed **wireframes**, all underscoring the platform's modular and scalable design.

Finally, **Section 8** synthesizes the **conclusions** and **next steps**, linking the document's content to the ongoing implementation phase (Task T7.3).

Together, these sections form a comprehensive narrative that guides the development of the FARCLIMATE Transformation Hub as a transformative digital tool empowering local and regional actors, especially across agriculture, forestry, and fisheries sectors, to access, share, and co-create climate adaptation knowledge in a practical and engaging way. The beta version of the Transformation Hub has been released and is undergoing user testing in living labs, as described in D7.3 Platform in Production and Source Code. The Connected Action component for EU Adaptation (Task T6.5) has also been completed and integrated into the Hub, as detailed in D6.5.

This third version of the deliverable incorporates the constructive feedback received during the RP2 review process (June 2026). The external perspective provided by the RESIST project's coordinator during this review proved particularly valuable in sharpening the Hub's positioning relative to other Mission-funded initiatives (see Section 4.1) and opened a channel for direct collaboration: a joint working session with the RESIST team is scheduled for October 2026. This engagement, in turn, facilitated a dedicated working session with the EU Mission

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Adaptation to Climate Change team, scheduled for 6 October 2026. Further engagement with the wider Mission Community is planned at the Fifth Forum for the EU Mission on Adaptation to Climate Change (23-24 November 2026, Dublin).

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2. Introduction

2.1 Purpose and objectives

The **FARCLIMATE** project tackles the complex challenge of developing and scaling **climate-resilient measures**, with a strong emphasis on ensuring they are **accessible** and **comprehensible** to all. In doing so, it addresses the social, political, and economic barriers that often obstruct progress. By empowering local communities, FARCLIMATE places climate adaptation at the forefront, ensuring that transitions are guided by principles of justice and inclusivity. Based on the premise that **digital tools**, **platforms**, **content**, and **communities** can be essential for effectively developing inclusive, community-driven approaches (Sultana et al., 2024; Cattino and Reckien, 2021) to tackling wicked problems (Conklin, 2006)) in climate adaptation, the **objectives** established in **WP7 - Transformative Solutions for a Positive Climate Future** are as follows:

- **O7.1**. To build inspiring knowledge and meaningful experiences to accelerate climate adaptation action.
- **O7.2**. To provide transformative user-centred solutions for a positive climatic future.
- **O7.3**. To enhance the effectiveness of the actions and take advantage of synergies by fuelling a growing network of Connected Action for EU adaptation.

Accelerating the shift towards a climate-resilient future demands re-contextualising **existing knowledge** while generating **new narratives** that mobilise and **inspire** stakeholders to actively **engage** in the resilience journey. To address this challenge, FARCLIMATE proposes a Transformation Hub: a **user-centred** platform built on **social innovation principles** and a **co-creative design pro**cess, ensuring that content is framed effectively and solutions are communicated in ways that resonate with diverse users. The development of the Transformation Hub is the cornerstone on which WP7 pivots. This “digital artefact” - a collection of infrastructures, tools, interfaces and contents - serves as the tool through which FARCLIMATE systematises and disseminates information on climate adaptation solutions, stemming from proposals that have been conceived and developed throughout the project, as well as the extensive universe of experiences, initiatives, and prior projects in the field of climate adaptation.

The **FARCLIMATE Transformation Hub** is being developed based on a co-design process involving various stakeholders and following a user-centred approach, adhering to a co-creation scheme consisting of four main steps (Figure 1):

1. **User-led innovation**: through workshops, surveys and interviews, the main needs will be identified.
2. **Platform-design proposal**: following the explained communication approach, a design proposal will be developed for further codesign
3. **Platform development**: all technical steps to build the platform.
4. **User experience assessment**: to test the functionality of the platform under the considered objectives. Needed changes in the design or in the technical part will be accomplished to achieve all set objectives.

Deliverable **D7.1** provided the **context** within which the approach of WP7 of the FARCLIMATE project was framed, with a particular focus on the Transformation Hub. It also described the

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activities carried out in Task **T.7.1**: **User research and content strategy development** (**step 1** of Figure 1), which took place between October 2023 and September 2024. In addition to documentary research aimed at characterising the climate adaptation ecosystem, this first phase of user research addressed two key aspects for defining the content strategy:

- The **analysis** of how different **user archetypes** interacted with and experienced the main adaptation platforms.
- The **analysis** of **users' perceptions** of the relevance of case study content and its usefulness in supporting decision-making.

Deliverable **D7.2** built upon the findings of Task 7.1 by translating the user insights and content strategy into a first design proposal for the FARCLIMATE Transformation Hub (**step 2** of Figure 1). The aim of this deliverable is to describe the **methodology** for **platform design** and outline the **structure**, **features**, and **visualisation strategies** of the platform, ensuring that the conceptual framework could be transformed into a tangible and user-centred digital solution. This third version, submitted after the RP2 review, incorporates the feedback received during that process, as detailed throughout the relevant sections below.

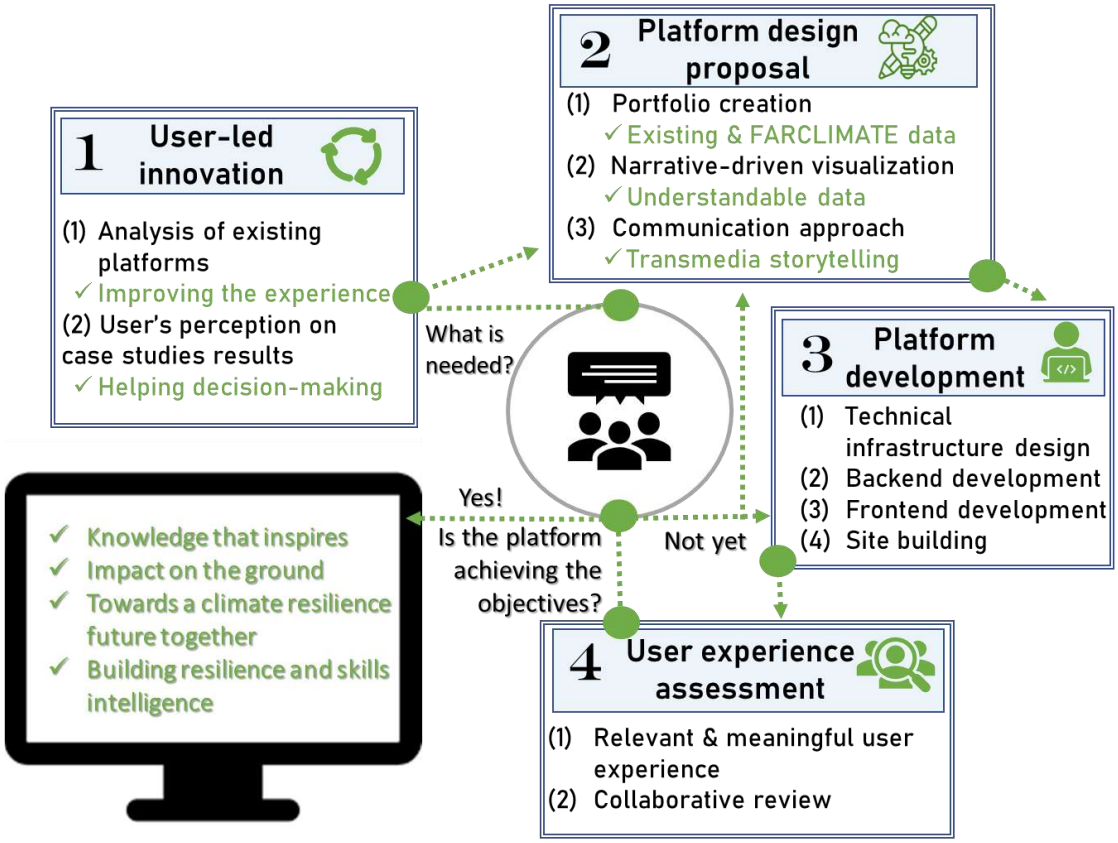


Figure 1. Key steps in the creation process of the FARCLIMATE Transformation Hub.

2.2 Summary of insights from user research review of existing platforms

The user research conducted under Task 7.1 of the FARCLIMATE project provided an in-depth analysis of existing climate adaptation knowledge platforms, focusing on their strengths,

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weaknesses, and user experiences. This research aimed to **bridge the gap** between available **climate adaptation information** and the **actual needs of primary users**, particularly those at local and regional levels engaged in implementing practical solutions.

The review highlighted that many current platforms, such as Climate-ADAPT, tend to emphasize broad, policy-oriented information targeting governmental decision-makers, which limits their direct utility for other crucial stakeholders like local communities, economic agents, and civil society organisations. Users reported difficulties finding tailored, sector-specific, and territorially relevant content that supports practical decision-making.

Interviews revealed that users often perceived existing platforms as overly technical, complex, and lacking in engagement and visual appeal. Language barriers and navigation challenges, such as unclear categorization and insufficient search tools, further reduced accessibility. While case studies were regarded as valuable, these are often concentrated in sectors like water management and urban planning, with notable underrepresentation of critical sectors such as agriculture, fisheries, and forestry—sectors that are a priority focus in FARCLIMATE.

The research underscored the importance of incorporating local experiential knowledge alongside scientific data, with users valuing narratives that reflect real-world challenges and solutions. The study also pointed to the need for diverse content types, including practical toolkits, graphical abstracts, videos, and inspirational storytelling, to enhance user engagement and learning.

3. General description of the Transformation Hub

3.1 Content development strategy and key features

The definition of the **content strategy** for the FARCLIMATE Transformation Hub was addressed in **D7.1**, where the **strategic framework** and **key features** of the platform were identified based on comprehensive user research. D7.1 developed the content strategy grounded in strategic guidelines and essential functionalities that shape the Hub's design and user experience.

The strategic framework of the Transformation Hub is founded on core design principles: a **user-centred** and **co-design** approach ensures active user involvement throughout all project phases, prioritizing primary users to address gaps detected in existing climate adaptation platforms; an agile process enables iterative validation and adaptability to user needs; and a preference for open source solutions and interoperability maximizes connectivity with other projects and knowledge bases.

Conceptually, the Transformation Hub is designed as a collective action ladder that serves three main generic functions: acting as a repository of climate adaptation content, providing basic tools for access and consultation, and enabling fundamental features for user interaction, dialogue, project design, and decision-making. D7.1 also systematised a dataset characterising the climate adaptation ecosystem, including entities, adaptation solutions (products), and processes such as European-funded projects. This open-access dataset adheres to FAIR principles (Findable, Accessible, Interoperable, and Reusable) and supports both **platform development** (**T7.3**) and **visualization** activities (**T6.5**- **Connected Action for EU Adaptation**).

Leveraging insights from analysis of existing platforms, particularly Climate-ADAPT, D7.1 highlighted an uneven sectoral distribution of adaptation case studies, with a priority to

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incorporate more examples from underrepresented sectors such as agriculture, marine and fisheries, and forestry—all key focuses of FARCLIMATE.

Key features identified for the Transformation Hub include presenting **good practices** (successful and unsuccessful case studies), **toolkits** and toolboxes, **visual content** such as graphical abstracts and infographics, effective access to cited resources, contact information for case study leads, directories of relevant organisations, and inclusion of local knowledge. The Hub's content is structured and navigable by geographical and sectoral categorizations, supported by keyword search and mapping tools to facilitate user discovery and engagement. This foundational work described in D7.1 establishes the conceptual and operational basis upon which the present report builds, advancing the platform design stage through prototyping and stakeholder co-creation activities.

3.2 Components of the Hub

The Transformation Hub content is designed around the premise that users highly value practical **climate adaptation solutions**, with a priority on those already implemented in various contexts. These solutions will be made accessible through the Hub in multiple formats to accommodate diverse user preferences. Additionally, the platform will enable users to create personalized databases of resources they identify as relevant and useful.

A central feature of the Hub will be the **Connected Action for EU Adaptation** (Task **T6.5**), which will provide a visualization of the European climate adaptation ecosystem. This visualization will focus on key actors fundamental to users, including providers of data and tools, technical assistance, and financial support. The representation will purposefully limit inclusion to maintain relevance and usability, excluding expansive lists of local policymakers and project partners that may overwhelm the user experience.

Supporting content types will include an **introductory section on climate adaptation** that offers pathways to explore key concepts such as hazards and impacts. This section will also contextualize the Hub's objectives and its focus on specific sectors within FARCLIMATE's scope.

To support **capacity building**, the Hub will curate existing e-learning courses, webinars, and toolkits developed by various entities, directing users to these resources rather than producing original training materials. This curated collection will address evident user interest in skills development critical for climate adaptation.

Recognizing the importance of **inspiring leadership**, particularly **women's** leadership in climate action, the Hub will highlight a selection of two to three **inspiring stories** featuring women protagonists actively shaping adaptation efforts. These narratives will serve to motivate users and underscore the social dimension of climate resilience.

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4. Starting point for design

4.1 Communities, Bioregions and solutions for climate adaptation



Figure 2. Conceptual outline of the starting point for design of the Transformation Hub.

The conceptualisation of the Transformation Hub is anchored in three key starting points: the **bioregion**, its associated **community**, and the climate adaptation **solutions** that emerge within these contexts. The bioregion represents the spatial scale at which ecological, economic, and governance systems converge, particularly where economic activities are closely tied to ecosystem functions. This bioregional scale offers a meaningful geographic and functional framework for the Hub's focus. The opportunity of bioregional thinking is to create what Ilya Prigogine called 'islands of coherence' amid a 'sea of chaos'. Coherence emerges when the activities of a landscape, its people, its local knowledges and its politics overlap to the benefit of all. That is especially true in a world where climate resilience will often be best understood and delivered by local citizens rather than central governments.

Communities associated with these bioregions constitute the primary source of key users and the target audience for the Transformation Hub. The **primary target audience** includes individuals responsible at local and regional levels within public institutions, economic sectors, or community organisations, often representing civil society interests. **Secondary users** encompass unorganised citizens and technical or political representatives from public institutions operating at regional, state, or European levels. Scientists play a variable role within this framework depending on the nature of their knowledge generation. Some scientists primarily support public policymaking and are thus considered secondary users, while others actively participate in territorial alliances and projects that develop context-specific adaptation solutions, collaborating closely with local actors and therefore considered primary users.

This precise characterisation of primary and secondary users, grounded in the extensive interview-based user research conducted under Task T7.1 (D7.1), is a distinctive feature of the Transformation Hub's design. Rather than assuming a generic climate adaptation audience, FARCLIMATE has explicitly defined who its primary users are and tailored content, language, and functionalities accordingly translating scientific knowledge on climate adaptation into information that is genuinely comprehensible, accessible, and usable for territory-led actors. This user-centred specificity differentiates the Hub from other Mission-funded initiatives with

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a broader or different audience focus, such as the RESIST project's prototype (https://sadl-kuleuven.github.io/resist/#/home), which is primarily oriented towards regional innovation ecosystems and market-scaling actors rather than the local implementers targeted by FARCLIMATE. It should also be noted that Connected Action for EU Adaptation (Task T6.5), integrated within the Hub, addresses a distinct audience -stakeholders interested in the EU Mission's project ecosystem itself- and is described in detail in D6.5.

The Hub's sectoral focus prioritises **agriculture**, **forestry**, and **fisheries**, which are the three key sectors in which the FARCLIMATE project is centred, recognising these sectors as critical to climate adaptation efforts at the bioregional scale.

4.2 Main objectives: inspiration and learning

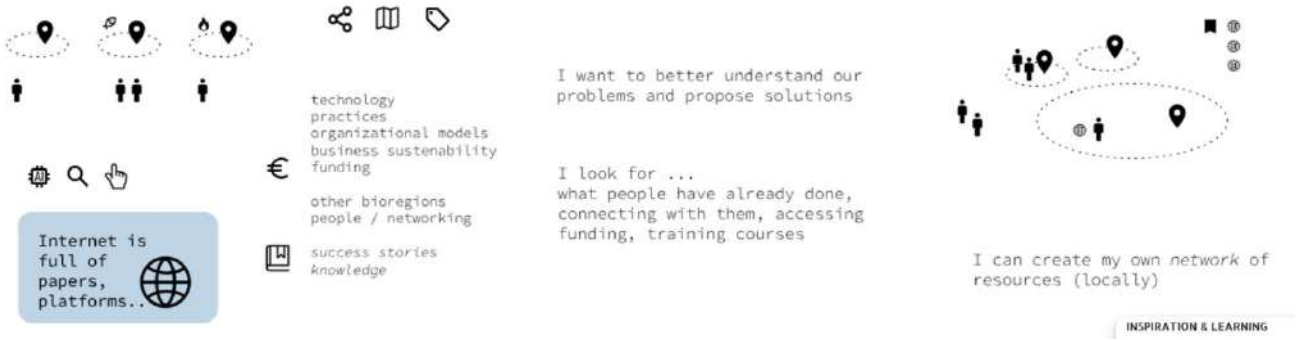


Figure 3. Graphic outline of the process of inspiration and learning through the Transformation Hub.

The Transformation Hub aims primarily to foster climate adaptation actions by ensuring that knowledge effectively reaches those working on the ground—the decision-makers and actors driving adaptation processes. To this end, the Hub will make existing knowledge about climate adaptation widely accessible, focusing especially on practical solutions that can serve as inspiring and relevant references. These will be presented in formats that are both understandable and engaging to the platform's diverse user base.

Past experiences with community engagement approaches in similar projects and platforms have shown limited success. For instance, **social network-based approaches** such as those implemented on the weADAPT platform often resulted in **inactive** or **minimally active** communities, sustained chiefly by project-driven posts rather than ongoing user interaction. Examples include the AGORA project, which hosts a minimal number of members and contributions, and the KE4CAP project's adaptation knowledge community (Climate Change Adaptation Knowledge Platforms Community of Practice), noted for its inactivity despite its initial membership. Thematic communities on weADAPT exhibited varied engagement levels, with dominant participation mostly in training-oriented groups.

Drawing on these lessons, the Transformation Hub explicitly rejects becoming merely another repository overloaded with irrelevant or seldom-accessed information. Instead, it will develop targeted strategies to promote **meaningful engagement** and **sustained learning** that motivates users to implement climate adaptation solutions.

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5. Methodology for platform design

5.1 Design approach and working process

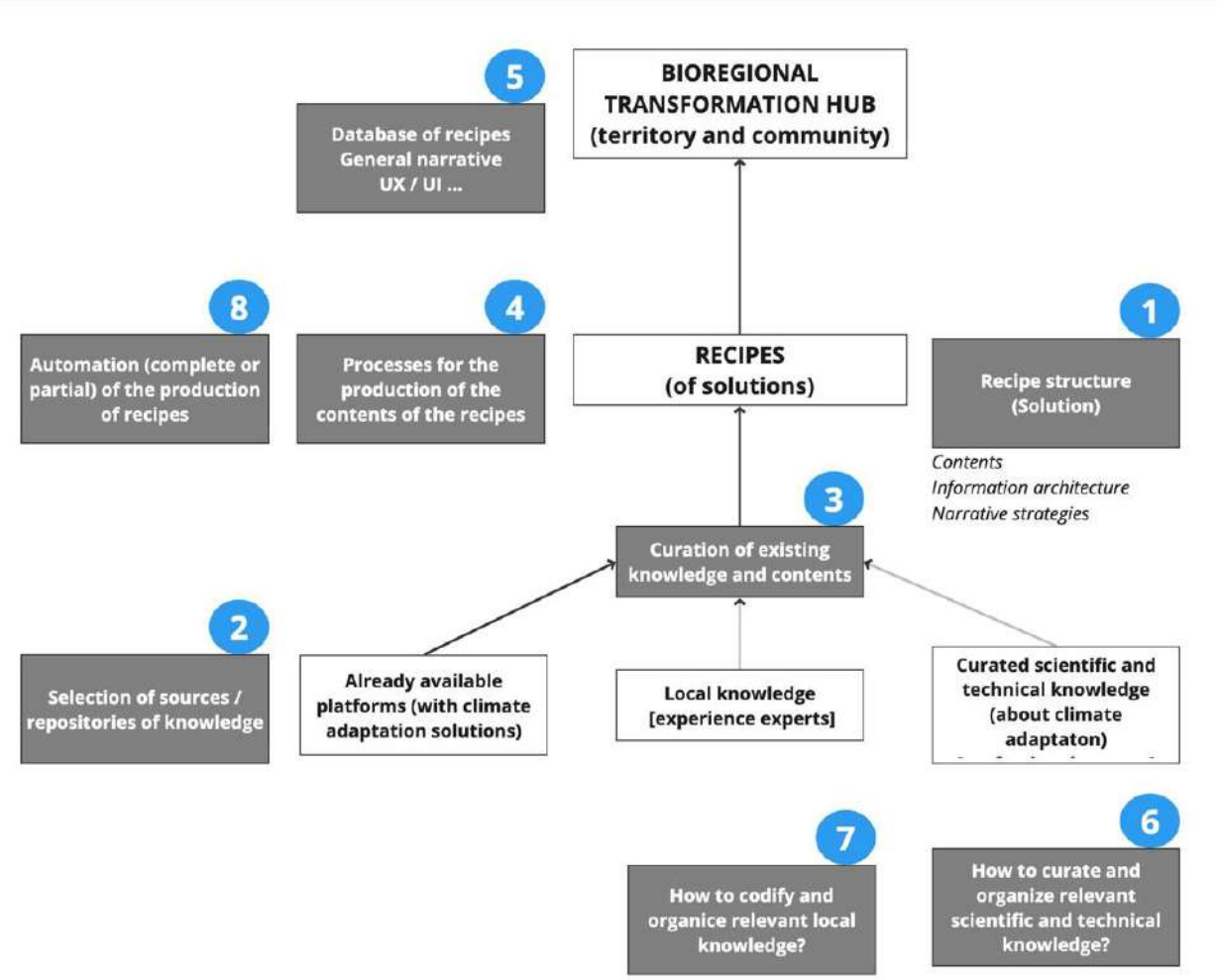


Figure 4. Components (white box) and processes (blue box) of the recipe design. The sequence of the work is indicated in blue.

The **approach** to designing climate adaptation solutions within FARCLIMATE is metaphorically likened to the process of **cooking**. Just as cooking a dish involves adapting a **recipe** to available local **ingredients** and specific tastes, developing effective adaptation solutions requires contextualising valuable existing knowledge—expressed as "recipes"—to local realities. This metaphor underscores the importance of identifying which information is essential to ensure that inspiration and learning drawn from previous adaptation "recipes" are genuinely useful. It entails recognising the key ingredients—core components and conditions—that must be considered in adapting and customising solutions. Only by understanding these fundamental elements can stakeholders collaboratively create their own tailored "recipes" for successful climate adaptation in their territories. The recipe design process is summarized in Figure 4.

The diagram illustrates the initial set of hypotheses regarding processes, functionalities, and their associated components for the Transformation Hub. It serves as a blueprint for

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exploration, design, piloting, and assessment. The numbered items indicate the sequence in which the hypotheses should be addressed during prototyping and user validation.

Building upon an in-**depth analysis** of various **sources** of **climate adaptation solutions** described in the following **section 5.2**, a preliminary **"recipe" structure** was proposed (detailed in **section 5.3**). This structure was discussed and refined during the **co-design** workshop (**section 6.4.1**). The description of the climate adaptation solutions included in the Hub's portfolio was adapted to this structure to form the database that users will explore and analyse on the platform.

Although the original plan was to develop a sequence of "paper" and functional prototypes to be tested by users, the complexity of the Hub—considering the diversity of its components, functionalities, and information sources—indicated from early phases that it would be more appropriate to approach the design process as an exploration of options. This exploration involved multiple iterative cycles of divergence and convergence related to sources of information, knowledge search and production functionalities, and the publication of selected or "recombined" knowledge.

Gradually, some options were discarded or put on hold for various reasons, including lack of user interest, technical difficulties, or the need to prioritize objectives within available timelines (section 7.1). For example, the option to create a social network was ruled out based on lessons learned from previous platforms and users' lack of interest. Consequently, by May 2025, a first "real" prototype version was achieved, which not only showcased possibilities but also made concrete decisions regarding which functionalities to offer. This prototype served as the foundation for the co-design activities described in section 6.4. Finally, an improved version has been developed (September 2025) as the outcome of Task 7.2.

5.2 Knowledge sources

The knowledge sources relevant for the design of the Transformation Hub include a wide array of **platforms**, **research projects**, and **scientific** outputs that provide data, tools, case studies, and innovative practices in the field of climate adaptation. These sources, ranging from global and European platforms to national-level case studies and EU-funded projects, serve as essential references to ensure that the Transformation Hub builds upon existing resources, avoids duplication, and supports knowledge integration for stakeholders. The main sources reviewed are described below.

5.2.1. Platforms

Main global and European climate adaptation platforms

Climate-ADAPT

https://climate-adapt.eea.europa.eu/en

Launched in 2012 as a partnership between the European Commission and the European Environment Agency (EEA). It is the main European platform providing data, information, tools, and case studies to support climate change adaptation across Europe. It helps users access and share data on climate impacts, vulnerabilities, adaptation strategies, and good practices.

MIP4Adapt

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https://climate-adapt.eea.europa.eu/en/mission/the-mission/about-mip4adapt

Part of the Climate-ADAPT platform, developed under a contract that began in 2023. It incorporates Case Studies and adds Adaptation Stories (concise and accessible) and Success Stories (available as PDFs for some countries). It supports the EU Mission on Adaptation.

Climate Innovation Window (CIW)

https://climateinnovationwindow.eu/

A platform dedicated to innovations addressing climate change challenges. It connects climate adaptation innovators, end-users, and investors to facilitate the development and adoption of innovative solutions.

weADAPT

https://weadapt.org/

A collaborative platform focused on climate change adaptation issues. Designed for practitioners, researchers, and policymakers to access credible, high-quality information and to network and share experiences related to adaptation.

RESIST

https://resist-project.eu/ | Prototype: https://sadl-kuleuven.github.io/resist/#/home

An EU Mission-funded project supporting 12 European regions in testing and scaling climate adaptation solutions. Its interactive prototype —a metadata repository with a map-based Graphical User Interface— documents over 100 solutions, searchable by hazard, solution type, and implementation status, offering a useful point of reference for benchmarking solution documentation approaches (see Section 4.1).

National-level climate adaptation case studies across Europe

The catalogue of national climate adaptation case studies available in Europe is presented in table 1:

Table 1. Country-wise catalogue of climate adaptation case studies websites.

Country	Case study catalogue website
Austria	https://www.klimawandelanpassung.at/praxis/kwa-anpassungsnetzwerk/good-practice-beispiele
Belgium	https://www.adapt2climate.be/case-studies/?lang=en
Croatia	https://prilagodba-klimi.hr/primjeri-dobre-prakse/
Czechia	https://www.adapterraawards.cz/en/Databaze
Denmark	https://klimatilpasning.dk/kommuner-og-forsyning/loesninger
Finland	https://www.climateguide.fi/adaptation-measures-in-finland
France	https://www.adaptation-changement-climatique.gouv.fr/dossiers-thematiques
Germany	https://www.klivoportal.de/SiteGlobals/Forms/Suche/EN/Steckbriefsuche_Formular.html?nn=1980018 https://zentrum-klimaanpassung.de/wissen-klimaanpassung/praxisbeispiele https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/werkzeuge-der-anpassung/tatenbank

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Greece	https://adaptivegreecehub.gr/kales-praktikes/
Ireland	https://www.epa.ie/our-services/research/epa-funded-research/epa-funded-projects/research-climate-data-table-dev/
Italy	https://climadat.isprambiente.it/buone-pratiche/
Nether-lands	https://klimaatadaptatienederland.nl/en/examples/
Norway	https://www.miljodirektoratet.no/ansvarsomrader/klima/for-myndigheter/klimatilpasning/prosjektarkiv/
Poland	https://klimada2.ios.gov.pl/pokaz-dobre-praktyki/
Slovakia	https://www.klima-adapt.sk/priklady-z-praxe https://www.sazp.sk/zivotne-prostredie/starostlivost-o-krajinu/zelena-infrastruktura/adaptacne-a-mitigacne-opatrenia https://www.sazp.sk/zivotne-prostredie/starostlivost-o-krajinu/zelena-infrastruktura/adaptacne-strategie-a-akcne-plany-na-zmenu-klimy https://odolnesidliska.sk/wp-content/uploads/2021/03/Katalog-AM-opatreni.indd-slabe-rozlisenie_FINAL_FINAL.pdf
Spain	https://adaptecca.es/en/casos-practicos
Sweden	https://www.klimatanpassning.se/exempel

Other major global platforms of interest in climate adaptation

Climate Change Adaptation Information Platform (A-PLAT)

https://adaptation-platform.nies.go.jp/en/index.html

Launched in 2016 by the Japanese government, A-PLAT uses an "easy-to-understand" approach, covering basic concepts and showcasing national, local, private sector, and citizen adaptation. Private sector case studies are categorized as "Climate Risk Management," "Adaptation Business," and "TCFD Initiatives." The platform offers an Adaptation database equivalent to case studies, searchable by region and sector.

Climate Adaptation Platform (CAP)

https://climateadaptationplatform.com/

Developed in New Zealand, CAP offers a case studies section with some post-format publications in three categories: sea level rise impact, funding, and management. The site appears not to be regularly updated.

Climate Adaptation Knowledge Exchange (CAKE)

https://www.cakex.org/

Launched in July 2010 and managed by EcoAdapt, a US non-profit, CAKE is a community-oriented platform open to contributions. It features a large collection of case studies, primarily from the US and the Americas, classified by phase, sector, scale, region, habitat, and climate impacts.

Climate Change Adaptation Resource Center (ARC-X)

https://www.epa.gov/arc-x/case-studies-climate-change-adaptation

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Led by the EPA, ARC-X is an interactive resource for local governments. It hosts case studies that can be sorted by area of interest, region, level of government, and keywords.

Global Center on Adaptation (GCA)

https://gca.org/

GCA is an international organisation founded in 2018 in the Netherlands. Active worldwide (except the Americas), its website provides reports and toolkits but does not showcase case studies as adaptation "solutions."

UNDP Climate Change Adaptation

https://www.adaptation-undp.org/

UNDP's portal for climate change adaptation, featuring stories (not structured as case studies) and a project explorer map that can be filtered by region, thematic area, and climate hazard.

Nature for Climate Adaptation Initiative

https://ncai.iisd.org/

A capacity-building initiative for civil society, led by IISD (Canada) with partners such as GIZ and IUCN. Offers an e-learning course and valuable resources, including six detailed case studies.

National Adaptation Plan (NAP) Global Network

https://napglobalnetwork.org/

Platform of a network founded after COP20, focused on developing countries. Shares reports and resources for advancing national-level planning.

Climate Change Knowledge Portal (CCKP)

https://climateknowledgeportal.worldbank.org/

The WBG's climate information hub, providing data and tools explored by country and watershed.

ClimateWatch

https://www.climatewatchdata.org/

A platform managed by the World Resources Institute, offering open climate data and visualizations. Users can analyse and compare NDCs globally.

NDC Partnership's Knowledge Portal

https://ndcpartnership.org/knowledge-portal

This portal, launched in 2016 at COP22, supports NDC promotion. Its relevant climate adaptation content is limited.

Climate Adaptation & Mitigation Impact Area Platform – CGIAR

https://www.cgiar.org/research/cgiar-portfolio/climate-adaptation-mitigation/platform/

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The CGIAR portal consolidates its climate research efforts and resources, but does not explicitly present case study "solutions."

UNFCCC's Adaptation Exchange

https://unfccc.int/news/join-the-adaptation-exchange

Presented as an interactive platform, but currently only links to a minimally active Facebook page.

Global and Regional Adaptation Support Platform (ci:grasp 2.0)

https://www.pik-potsdam.de/cigrasp-2/index.html

Appears to be under review for updates. Funded by IKI-GIZ, ci:grasp provides robust climate data, impacts, and adaptation options at multiple scales.

Connecting Nature Enterprise Platform

https://naturebasedenterprise.com/

A marketplace connecting buyers with nature-based solution suppliers for design, delivery, and monitoring. Managed by Horizon Nua as a Horizon 2020 project spin-out, it remains active despite project closure in 2022.

5.2.2. Research projects and processes

Another relevant source of knowledge is the results from research projects and processes. A targeted search for relevant projects in the field of climate adaptation was conducted, with special attention to the European context. A thorough analysis was performed of the **46 projects** that constitute the **Mission Projects Catalogue** (CINEA et al., 2025). Although this catalogue provides a comprehensive compilation and relevant information about the projects, some inconsistencies in the presentation of information were detected; for example, the FARCLIMATE project appears classified under "Water management." The complete list of projects, including a brief description to identify their focus and their corresponding websites, is detailed in **Annex 1**. The review of projects from this catalogue has been complemented with projects such as CARMINE[1], which, although not part of the catalogue, address climate adaptation in the European context.

Among the reviewed projects, it is worth highlighting the compilation of **tools** from the first four EU Climate Adaptation Mission projects: ARSINOE, IMPETUS, REGILIENCE, and TransformAr (Figure 5). Additionally, **funding** and **training** opportunities are detailed on the REGILIENCE website. Regarding IMPETUS, the project features demonstration sites in 7 of Europe's 11 biogeographical regions. Particularly noteworthy developments include the **IMPETUS Marketplace**, which aggregates all project results and provides curated selections tailored to stakeholders' roles, and the **Semantic Context Broker Tool**, launched in December 2022 as deliverable 2.2 (Onrubia & Corchero, 2022). deliverable 2.2). In the TransformAr project, the focus on **Key Community Systems (KCS)** and categories is central, along with deliverable 3.2: **Catalogue tool** designed to identify the **best available solutions** (Khamis et al., 2022).

[1] Climate-Resilient Development Pathways in Metropolitan Regions of Europe - CARMINE project https://www.carmine-project.eu/.

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Figure 5. Projects of special relevance for the design of the Transformation Hub.

Another notable project is RESIST[2], which aims to reduce the time-to-market and risk for at least **100 new climate change adaptation solution**s from providers across Europe, offering coaching, business support, and potential regional markets to scale their solutions. RESIST has since progressed considerably beyond its early-stage documentation: as reported in Deliverable D1.13 (June 2025), its metadata repository and interactive Graphical User Interface —the RESIST prototype— now document over 100 climate adaptation solutions across all 12 RESIST regions, with structured filtering by hazard, solution type, ecosystem services, and implementation status. A working session with the RESIST project coordinator, scheduled for October 2026, will provide an opportunity to further explore synergies between both tools

Regions4Climate (R4C) similarly documents its adaptation innovations through a Common Innovation Framework & Solutions Portfolio, covering cross-sectoral solutions —combining social, technological, digital, business, governance, and environmental approaches— co-developed and tested across its 12 partner regions. Unlike RESIST's interactive repository, R4C's portfolio is currently presented as a structured deliverable rather than a navigable online tool, but it remains a valuable reference for benchmarking solution documentation approaches relevant to FARCLIMATE's own recipe-based structure.

Finally, a complementary search was conducted of reports and scientific articles describing climate adaptation solutions. This included recent publications and assessments that provide a broad and up-to-date perspective on effective adaptation strategies, supporting evidence-based decision making and policy development.

5.3 The Recipe

The recipe structure for presenting climate adaptation solutions in the Transformation Hub is based on the framework used by the Climate-ADAPT case studies, adapted and enhanced according to insights gained from user research.

[2] RESIST project https://resist-project.eu/

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Selection and content criteria

Following Climate-ADAPT's eligibility criteria, solutions incorporated must be implemented or in the process of implementation and provide clear contact information. In the FARCLIMATE Hub, there is further consideration to include "proposed" solutions that may not yet have been tested. Priority is given to solutions operating at local and sub-national scales.

Quality of content is paramount; complete descriptions of the adaptation process are preferred, including analyses of cost-benefit or cost-effectiveness, stakeholder participation, defined reference climate scenarios, relevant legal and institutional frameworks, and evidence of co-benefits surpassing adaptation alone, such as contributions to sustainable development and transformative adaptation approaches. Particular emphasis is placed on initiatives funded by the EU, given their documented and transparent evaluations, though national, sub-national, and local initiatives offering useful insights are also valued.

Nomenclature and typology

Adaptation solutions are classified using the **Key Type Measures typology** (Leitner et al., 2021; Leitner et al., 2020), which clusters adaptation options into categories such as governance and institutional policies, economic and financial strategies, physical and technological solutions, nature-based and ecosystem approaches, and knowledge and behavioural change efforts including public awareness and training. **Annex 2** presents the classification list based on the Key Type Measures typology.

Structure Scheme

Each solution recipe organizes information along the following dimensions:

- Sector (Agriculture, Fishing, Forestry)
- Geographical scope (territorial scale and area of intervention)
- Hazards/Climate impacts/Challenges (e.g., extreme temperatures, sea-level rise, storms)
- Type of solution/Adaptation option/Key measure (categories as above)

Summary Section

Each recipe summarizes the following:

- Title
- Proposing or implementing agent/stakeholder
- Date of implementation
- Brief description (with multimedia support such as images or videos)
- Economic data
- Reference information including contact, websites, and other sources
- Keywords for search and categorization

Solution Description Section

The core descriptive content includes:

- Context: location and characteristics, challenges, policy and legal background
- Objectives of the intervention

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- Solutions implemented: detailed description of "what" and "how," potentially subdividing "how" into implementation phases and timeline
- Success and limiting factors
- Benefits observed
- Lessons learnt
- Transferability potential to other contexts
- Related Sustainable Development Goals (SDGs)

The recipe structure has been practically applied and validated using three example case studies selected for prototyping and user validation:

- **Fisheries**: Control of ciguatera poisoning in the Canary Islands, Spain
- **Agriculture**: Temporary flood water storage in agricultural areas in the Middle Tisza river basin, Hungary
- **Forestry**: Decision support for forest owners choosing climate-adapted tree species in Hesse, Germany

These recipes were fully developed using comprehensive information available from Climate-ADAPT, supplementing the information when necessary (**Annex 3**).

5.4 Strategy for AI integration

Artificial intelligence is becoming an indispensable resource for digital platforms that aim to support decision-making in complex domains such as climate change adaptation. When the Transformation Hub was initially proposed in 2022, AI-powered tools were still limited in terms of accessibility, cost, and reliability. However, in the last two years, advances in large language models (LLMs), natural language processing, and machine learning have significantly lowered the barrier to their adoption, making them both affordable and practical for general use. Including AI functionalities in the Hub can now provide users with more dynamic, personalized, and efficient access to information and with tools for content creation, enhancing their ability to navigate, analyse and recombine knowledge and solutions tailored to geographic areas with specific economic, environmental and sociopolitical attributes.

The integration of AI within the Transformation Hub is fully aligned with relevant European policies, particularly those promoting digital innovation, sustainable transitions, and ethical AI use. By adopting AI tools, the Hub supports the objectives of the European Green Deal and the Digital Europe Programme, fostering data-driven solutions that enhance climate adaptation and resilience. Furthermore, the deployment follows the principles set out in the EU Artificial Intelligence Act, ensuring transparency, accountability, and human oversight in all processes. This alignment confirms that the Hub not only advances technological innovation but also adheres to the EU's commitment to sustainability, inclusiveness, and responsible digital transformation.

Our strategy for integrating AI into the Hub focuses on embedding intelligent functionalities into existing and planned features, rather than presenting AI as a separate component. In this way, AI will serve as an enabler that streamlines processes such as information retrieval, classification of resources, and generation of tailored solution pathways. For example, AI can help automate data processing and synthesis from diverse knowledge repositories, or semi-automate user interactions by offering context-aware recommendations, summaries, and

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comparative analyses. This approach ensures that AI powers specific tasks where it can clearly add value, while maintaining transparency and user control over final decisions.

By adopting this integrated approach, the Transformation Hub will position itself at the forefront of digital innovation for climate adaptation. Users will benefit from a platform that not only hosts a rich repository of knowledge but also actively assists them in transforming data into actionable insights. This will allow stakeholders—from local practitioners to policymakers—to more effectively explore adaptation strategies and identify best practices suited to different contexts, strengthening the Hub's role as a catalyst for knowledge-driven transformation.

5.5 Narrative-driven visualizations and prototyping with the user community



Figure 6. Images of the co-creation activities - Workshop held in Soria, May 2025.

Within the Transformation Hub conceptualisation process, **narrative-driven visualisation** played a central role in bridging the gap between complex data and user-centred decision-making. During the portfolio creation (Section 6.1) and the definition of the user journey (Section 6.2), the methodology of data-driven storytelling was applied. This methodological approach combined narrative design patterns with storytelling techniques to generate compelling stories supported by data. Its main objective was to explore how information could be presented in a way that makes data both understandable and actionable for the target audience.

The collected data was analysed to identify patterns, insights, and decision-relevant elements. Based on these results, alternative forms of data visualisation were explored to construct a powerful narrative that could optimise the decision-making process of end users. Particular attention was given to matching visualisation strategies with the essential content elements required to communicate solutions effectively. This ensured that the platform could convey not only information, but also context, relevance, and actionable pathways for stakeholders. As part of this design-driven process, **7 visualisation prototypes** (Section 6.3) were developed. These prototypes served as **exploratory tools**, allowing the project team and the user community to assess different narrative and visualisation approaches. Building on these

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prototypes, **co-creation activities** (Section 6.4) were organised, where representatives of the user community directly interacted with the visual concepts, providing valuable feedback, preferences, and refinement suggestions. This participatory step was essential to align the communicative strategies with real user needs and expectations.

The insights generated through these prototyping and co-creation activities ultimately informed the selection of **features** for **implementation** (Task **T7.3**). In this way, narrative-driven visualisation was not only a method for communicating data, but also a creative and participatory process contributing directly to the integral conceptualisation of the Transformation Hub, which is presented in detail in Section 7.

5.6 Drawing skills and inspiring stories

While the exploration and analysis of solutions, together with the visualisation of Connected Action for EU adaptation (Task T6.5), represented central elements of the Hub, the platform was complemented with two additional sections considered essential to support an integrated approach: Inspiring Stories and Skills. The design of these two components was carried out with the objective of **enriching** the **user experience** and reinforcing the transformative dimension of the Hub.

For the **Inspiring Stories** section, a transmedia storytelling approach was explored to illustrate how the adverse effects of climate change could be prevented. In particular, the development drew on the narrative framework of *Toward a Climate-resilient Future Together*, situating storytelling to engage audiences in a more immersive way. A core narrative element highlighted the central role of women's leadership in climate action, resulting in the concept of **Women shaping climate action** being placed at the heart of this section. These inspiring narratives were designed not only to communicate concrete examples of climate resilience, but also to empower users by connecting them with relatable experiences, voices, and pathways of change.

In parallel, the **Skills** section was designed to foster capacity building and support practical learning, conceived not as a competing training offer but as a discovery and signposting mechanism. Rather than developing training activities that could divert attention from the dedicated FARCLIMATE Training Online Platform (D4.2, https://training.farclimate-project.eu/), this section provides Hub users with an overview of the most relevant capacity-building resources available across the adaptation landscape. The FARCLIMATE training platform is featured as a flagship resource within this section, complemented by selected material from initiatives such as weADAPT, Adaptation AGORA, and other trusted sources. By design, the Skills section is intended to help drive traffic towards the FARCLIMATE training offer rather than compete with it. Existing e-learning courses, webinars, and toolkits were curated and organised together with the training materials developed in WP4, and embedded into the navigation design under the approach **How you can build your skills**. This structure aimed to provide users with clear entry points to strengthen their competencies, encouraging both professional development and personal empowerment in climate adaptation practices

Together, these two components extended the scope of the Hub beyond data exploration and solution analysis, embedding **human narratives** and **practical learning** into the platform, and thereby contributing to the overall mission of FARCLIMATE.

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6. User-centred design development and prototyping

6.1 Curated portfolio of transformational solutions

The curation process to develop the **portfolio** of climate adaptation solutions begins with a detailed analysis of what constitutes a **climate adaptation solution**, grounded in scientific rigor and the potential for practical application, as extensively described in the diverse knowledge sources reviewed in depth (see Section 5.2). In the broad and varied literature, terms such as solution, option, action, initiative, or process are sometimes used with subtle nuances but generally refer to measures aimed at reducing vulnerability to climate change impacts.

For the design and development work of the Transformation Hub, a solution is considered as follows:

- Applicable at a **bioregional scale** (whether already tested or validated in specific cases), explicitly excluding global geoengineering.
- Addresses a climate adaptation challenge related specifically to economic activities such as **fisheries**, **agriculture**, or **forestry**, excluding other sectors.
- Comprises a **combination** of **actions** and **strategies** that enable the "**resolution**" of the problem. This spectrum ranges from actions that build adaptive capacity (such as knowledge creation, information sharing, and supportive institutional frameworks) or establish management systems and enabling mechanisms (e.g., improved land management planning, insurance mechanisms) to adaptation actions implemented on the ground (e.g., physical or ecosystem-based measures).

The documentation analysis of solutions includes **146** solutions integrated in **Climate ADAPT**, **210** from **Climate Innovation Window Europe**, descriptions from **17 national platforms** (all European), as well as **562** solutions from **Network Nature** (global), **115** from **A-PLAT** (Japan), and **545** from **CAKE** (US & Americas). Additionally, solutions from the **Impetus project** (**35** in Europe), the approach of the future **RESIST project's** catalogue (100 in Europe), and other documentary sources such as the **20** nature-based solutions from Ihobe (2024) have been considered and analysed. In the realm of scientific publications, the work by Chiriacò et al. (2025) represents an interesting example of how a scientific team "constructs" solution recipes. Although there is a top-down bias, starting from the review of public policy documents, the process of building the solution involves contacting local actors for six case studies. Ultimately, they arrive at a catalogue of 60 solutions related to land use, including 22 solutions within the FARCLIMATE sectors (15 in agriculture, and 7 in forestry). While the "recipe" may be somewhat dense to digest, it includes some very interesting aspects such as synergies and trade-offs, as well as suitability factors.

Though there is a broad range of sources and documentation available, in most cases the information presented **does not meet user expectations** in terms of **applicable knowledge**; for example, almost none of the sources describe or mention associated costs, or at least provide approximate investment scales, a fundamental aspect in decision-making regarding local viability. Moreover, a bias identified as the "success compliance syndrome" is common when presenting research project results, making it difficult to identify what did not work—highly valuable lessons for other experiences—as descriptions tend to focus on how results fulfilled expected outcomes and "lessons learned" are generally broad. Furthermore, given the limited

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lifespan of project executions, many links become inactive after project completion, making it impossible to access the related information and documentation over time.

From the analysis of how information on solutions is presented across different sources (platforms, projects, scientific papers, and other documentation), it became evident that there is a pressing need to establish **semantic bridges** that enable both the systematic organisation and, in a later stage, the automated processing of knowledge. The terminology used to describe solutions varies widely, often with overlapping meanings and subtle nuances, which creates challenges for consistent integration into a coherent portfolio.

As mentioned earlier, the concept of a solution appears under multiple labels—such as *solution, innovation, case study, demonstrator, measure*, or *use case*—while contextual descriptors vary widely across sources, including terms like *hazard, issue, challenge category, target*, or *impact*. Different ways to express scale are found in labels such as *scale, territory*, or *area of intervention*. Classification terms include *type, typology*, or *category of adaptation solution*, and actors are referenced as *agent, actor*, or *stakeholder*. For implementation analysis, descriptors such as barriers, lessons learnt, and success factors sometimes appear, along with additional elements like adaptation approach, adaptation phase, habitat, type of exploitation, TRL level, and SDGs. What remained consistently absent were economic data—particularly cost estimates and scales of investment—despite being a critical dimension for decision-making regarding local viability. As previously discussed, this limitation considerably reduces the usability of existing repositories for stakeholders seeking to assess feasibility or compare options.

To synthesise this diversity and clarify terminology, a **semantic framework** was proposed (Table 2), which organises and maps these key concepts, synonyms, and gaps in the available information.

Table 2. Semantic framework for climate adaptation solution concepts and attributes.

Conceptual Category	Synonyms / Variants	Comments / Missing Elements
Solution Concept	Solution, Innovation, Case Study, Demonstrator, Measure, Use Case	Broad terms with some nuance; need for harmonisation
Hazard / Impact Context	Hazard, Issue, Challenge Category, Target, Impact	Expresses climate risks or challenges addressed
Scale / Territorial Scope	Scale, Territory, Area of Intervention	Geographic or bioregional levels
Solution Classification	Type, Typology, Category of Adaptation Solution	Differentiates solution kinds or approaches
Stakeholders / Actors	Agent, Actor, Stakeholder	Entities involved in implementation or governance
Implementation Analysis	Barriers, Lessons Learnt, Success Factors	Important for understanding feasibility and outcomes

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Conceptual Category	Synonyms / Variants	Comments / Missing Elements
Additional Attributes	Adaptation Approach, Adaptation Phase, Habitat, Type of Exploitation, TRL Level, SDGs	Fragmented presence; enriches understanding
Economic Data	Cost, Investment Scale	Mostly absent; critical gap for decision-making

Regarding the treatment of economic data specifically, it is important to clarify FARCLIMATE's approach: no cost or investment information has been introduced into the recipes beyond what was already present, however fragmentarily, within the original Climate-ADAPT case studies. In many instances, cost-related details appeared scattered across different sections of a case study rather than in a dedicated field; AI-assisted processing was used to identify and consolidate this information into the recipe's dedicated economic data section, with each output subsequently reviewed by the team to verify its accuracy against the source. Where no cost information was available in the source material, this is transparently indicated in the recipe as unavailable, rather than inferred.

The consolidation of the curated portfolio therefore required not only aggregating solutions from the wide range of datasets and publications but also addressing this semantic heterogeneity through a harmonised framework. This effort laid the groundwork for the systematic inclusion of transformational solutions in the Hub, while opening the path towards the development of semantic and computational tools that can standardise, compare, and connect disparate information sources to better meet user expectations.

It should be noted that, additionally, the climate adaptation solutions designed within the framework of the project will be integrated into the platform implementation.

In order to generate a first operational prototype with real content, the initial implementation of the curated portfolio was carried out using case studies sourced primarily from the Climate-ADAPT platform. Given the absence of a public API, the data was scraped and processed through a semi-structured extraction schema built with the Python library crawl4ai. Programmatic methods and AI-based text analysis were then applied to enrich the raw material with additional information such as geolocation coordinates, time references, and Spanish translations. The resulting outputs were consolidated into a single JSON file and uploaded to the ORAMA cloud search engine, enabling interactive exploration of the database. It is important to clarify the intent behind this dataset: the beta phase of the Hub was not conceived to offer a comprehensive catalogue of adaptation solutions, but rather to validate a methodological approach to processing and presenting knowledge -materialised in the recipe structure (Section 6.1)- and to build a documentary base sufficient for meaningful user testing. Climate-ADAPT was selected as the primary source for this initial phase due to its scientific rigour and institutional standing, and its 146 integrated solutions were fully incorporated into the Hub's dataset. However, this source proved to have very limited coverage of the fisheries sector, one of FARCLIMATE's three priority sectors. To ensure fisheries could also be represented for testing purposes, 2 additional solutions were manually processed from the CAKE platform, bringing the total dataset to 142 entries. The intention going forward is for this

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dataset to grow substantially through the knowledge generated within the project itself, particularly the adaptation solutions developed and implemented by the FARCLIMATE Living Labs (see Section 8). As new solutions are incorporated -whether through partner contributions at co-design events such as the La Rochelle session or through periodic review of Climate-ADAPT and complementary sources- a lightweight curation workflow combining automated scraping with targeted manual review will be maintained, so as to minimise the ongoing human effort required to keep the portfolio current.

6.2 User journey

Following the curation process, the next step was to define the **user journey** within the Hub. This journey structures how users interact with the platform through distinct phases: Search, Analysis, Production, and Publication/Communication. Curation itself is not part of the user journey, as it is a preliminary activity performed by the Hub's creators who provide users with a collection of pre-selected, curated information; this curation occurs beforehand by selecting and integrating relevant platforms to feed the Hub, allowing users to engage directly with validated and organised content.

The user journey framework serves to clearly define **interaction phases** and associated **functionalities** within each phase. This enables the prioritisation of features for development—some functionalities are targeted for implementation within the current project, while others are identified as part of a future backlog to be potentially addressed in subsequent initiatives.

During the prototyping phase and co-design activities with users, the user journey framework was refined and structured into three main stages to better represent typical user interactions: **Search & Explore**, **Analysis & Assessment**, and **Information Management & Collaboration**.

6.3 Conceptualisation and visualisation prototypes for user exploration

As described in the methodology overview (Section 5.5), a series of prototypes were developed to support user exploration and engagement. These prototypes played a key role in feeding the co-design activities outlined in Section 6.4.

The seven prototypes developed are synthesised below, including a brief description of their approach or the questions they aim to explore, as well as a visual representation.

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Multimedia summaries

What if written articles could be transformed into other media formats such as podcasts or videos, where someone explains the content?

Would this approach be effective, and could it be automated?

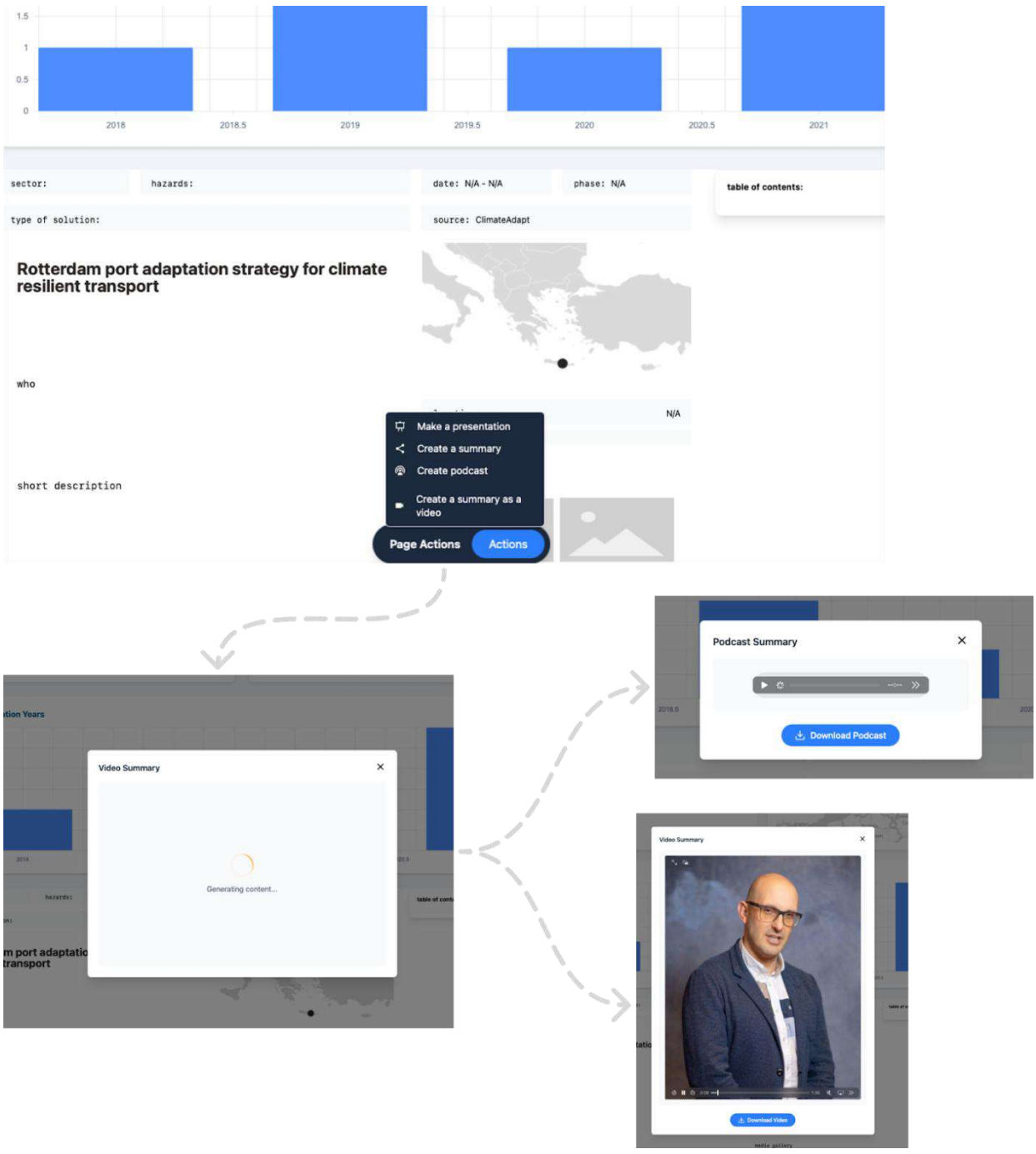


Figure 7. Visual representation of the Multimedia summaries prototype.

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Live reporting

What if projects were not only documented upon completion, but reporting occurred as a live, ongoing process throughout the project's life cycle?

This concept is explored through a compact interface where project authors publish content grouped by different milestones. Followers of the project can then post comments and stay continuously updated on its progress.

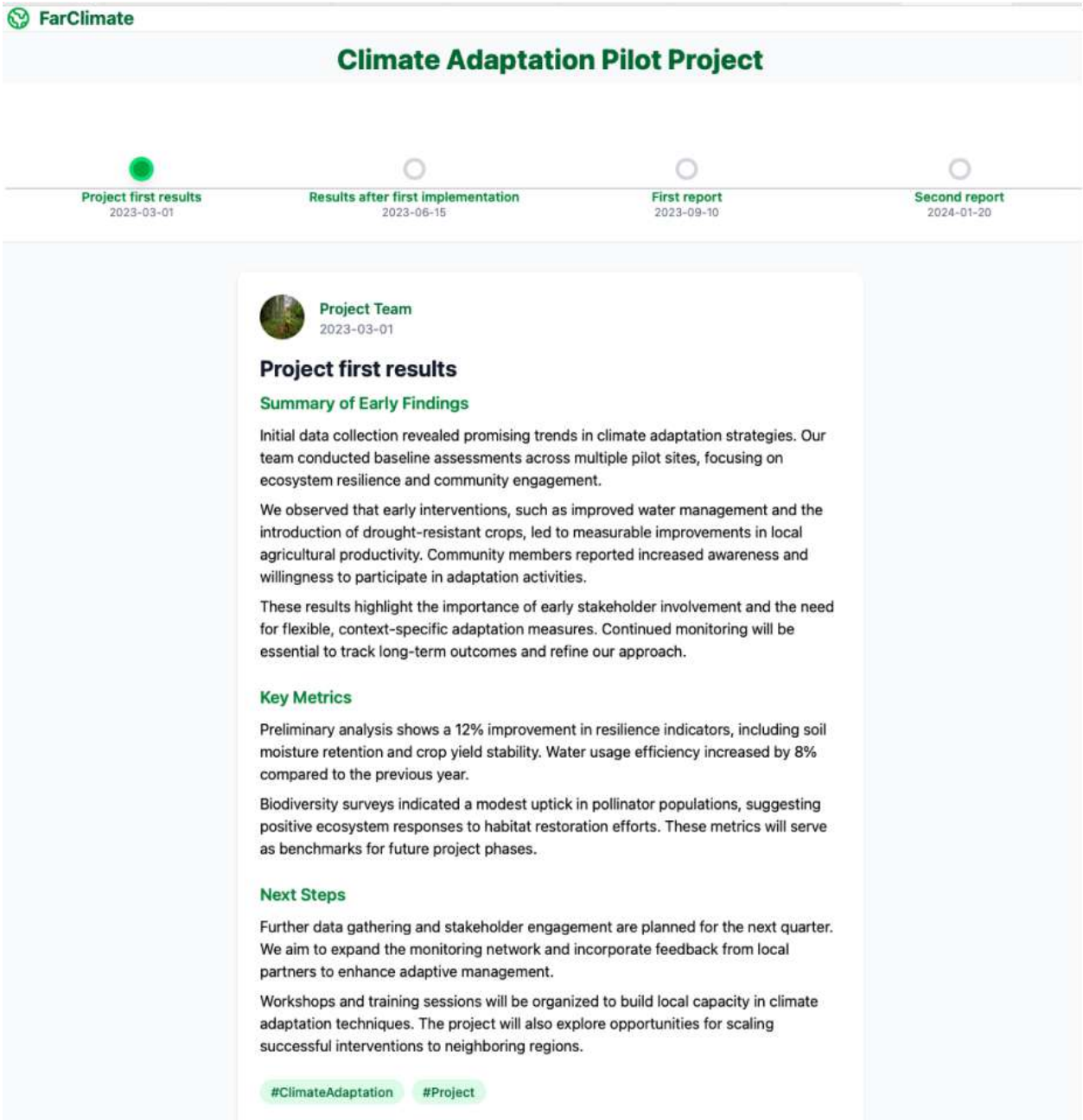


Figure 8. Visual representation of the Live reporting prototype.

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Nodes

In this prototype, we explore a non-linear, node-based interface where navigating the content generates a variety of views and reports displayed simultaneously on the screen.

Users can pan across the entire dataset using zoom controls and navigate both vertically and horizontally.

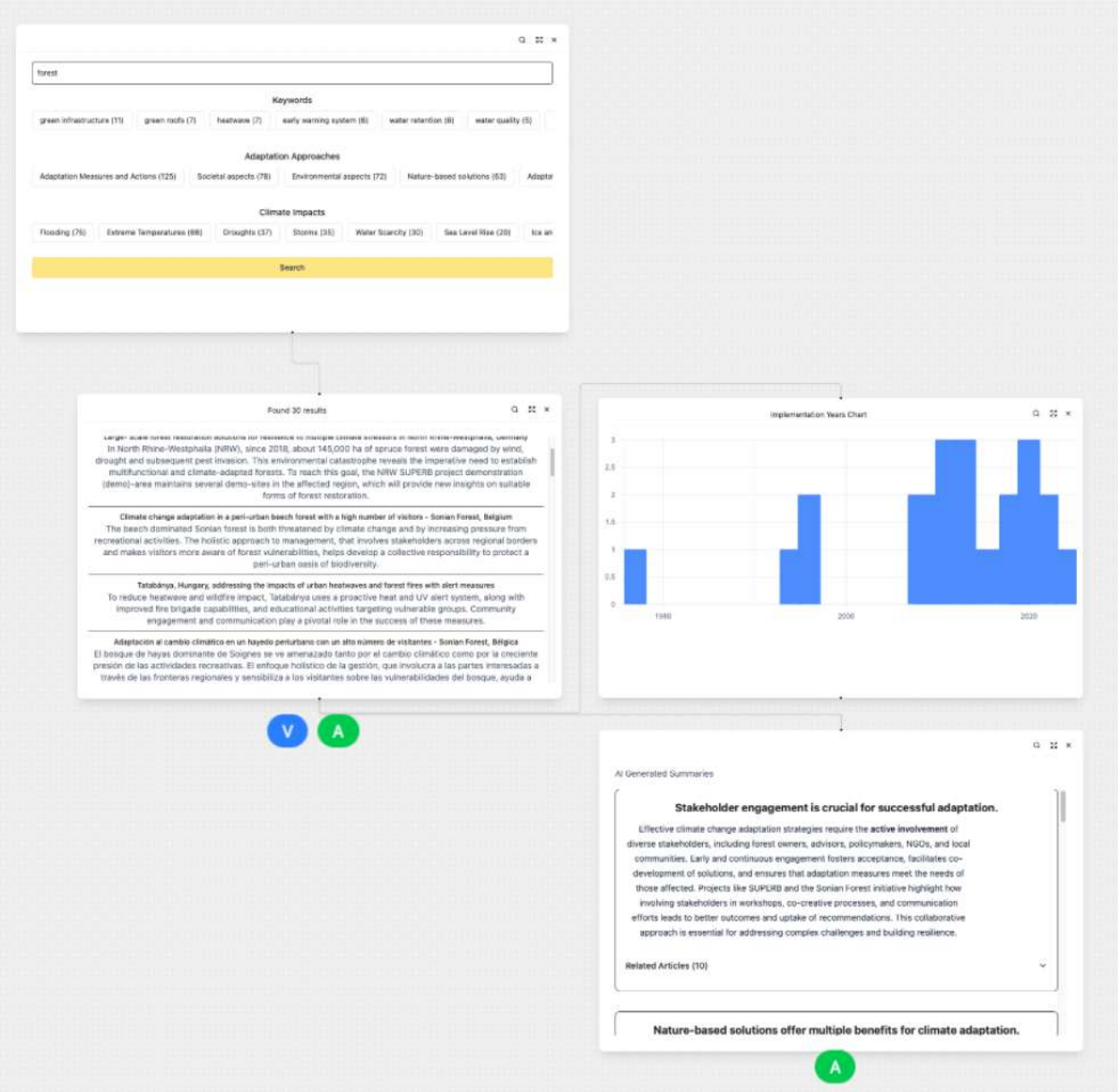


Figure 9. Visual representation of the Nodes prototype.

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Instagram

What if the experience of reading and browsing through each part of your solutions felt more like scrolling through Instagram rather than reading scientific publications?

This idea is explored through a mobile prototype featuring an interface that prioritises images and videos to create a more engaging and intuitive experience.

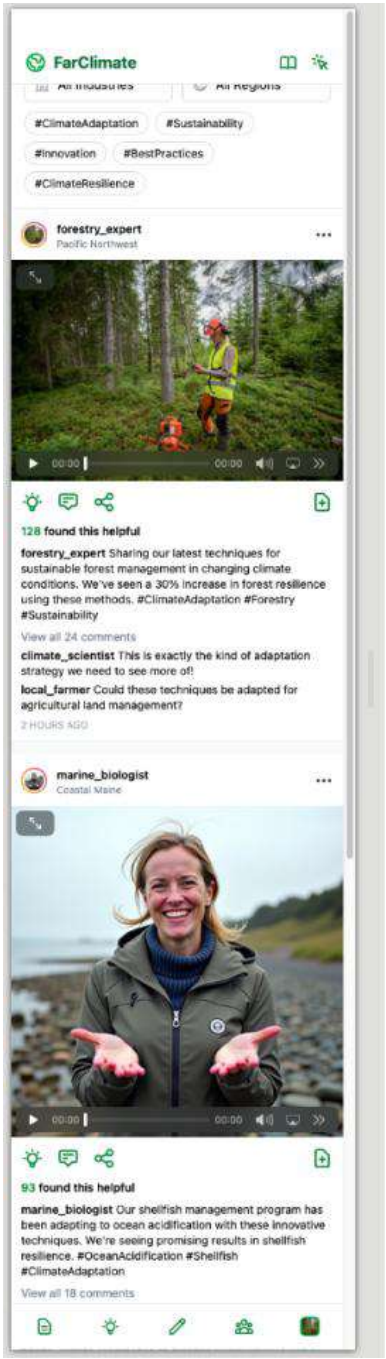


Figure 10. Visual representation of the Instragram prototype.

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Forum

Climate adaptation platforms sometimes feel like spaces where communication is one-directional.

With this interface, we imagine a social space for debating solutions, functioning similarly to a forum.

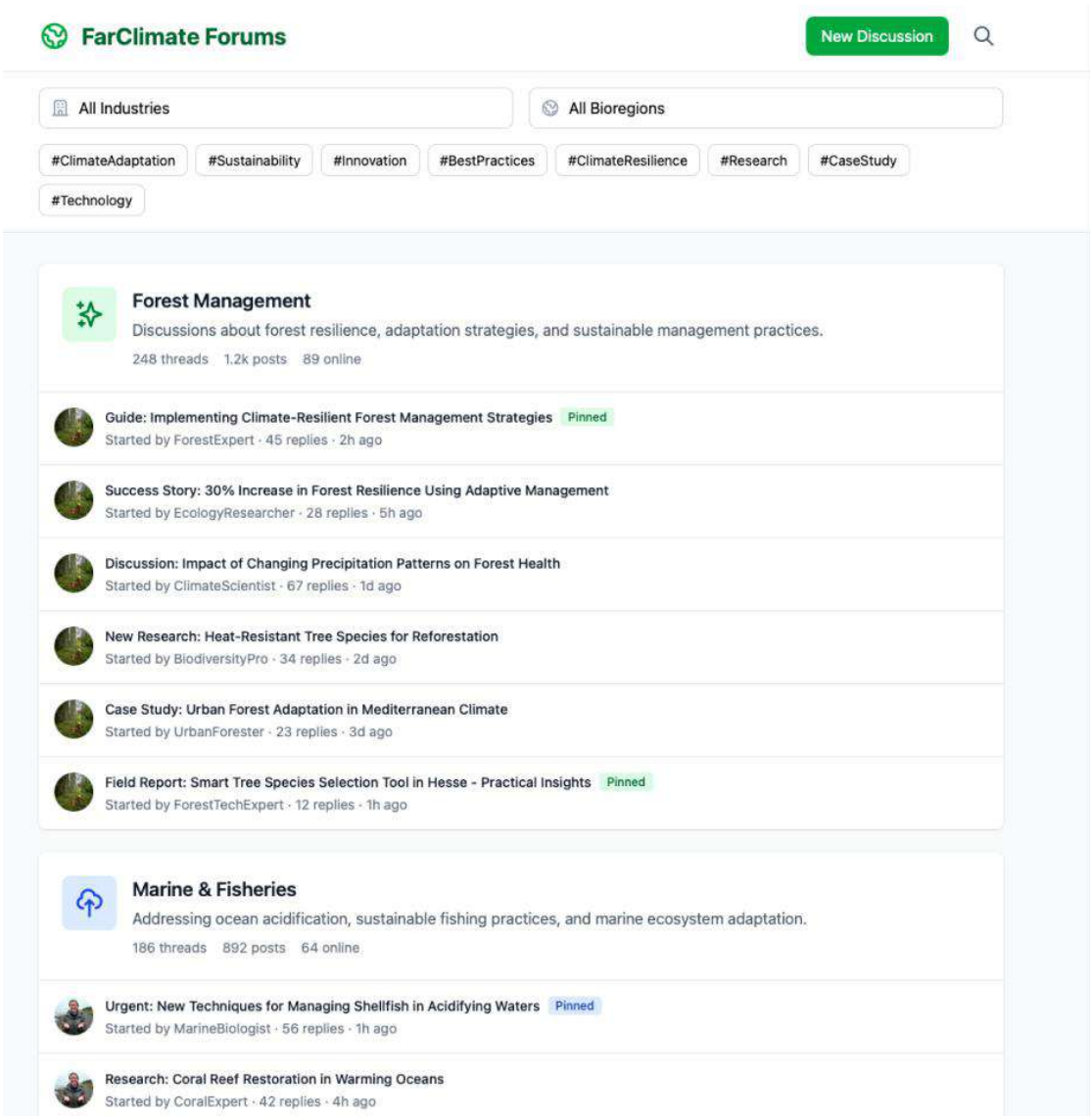


Figure 11. Visual representation of the Forum prototype.

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Geographical view

A classic geographical view is provided, where each solution is represented by the location or locations where it has been implemented.

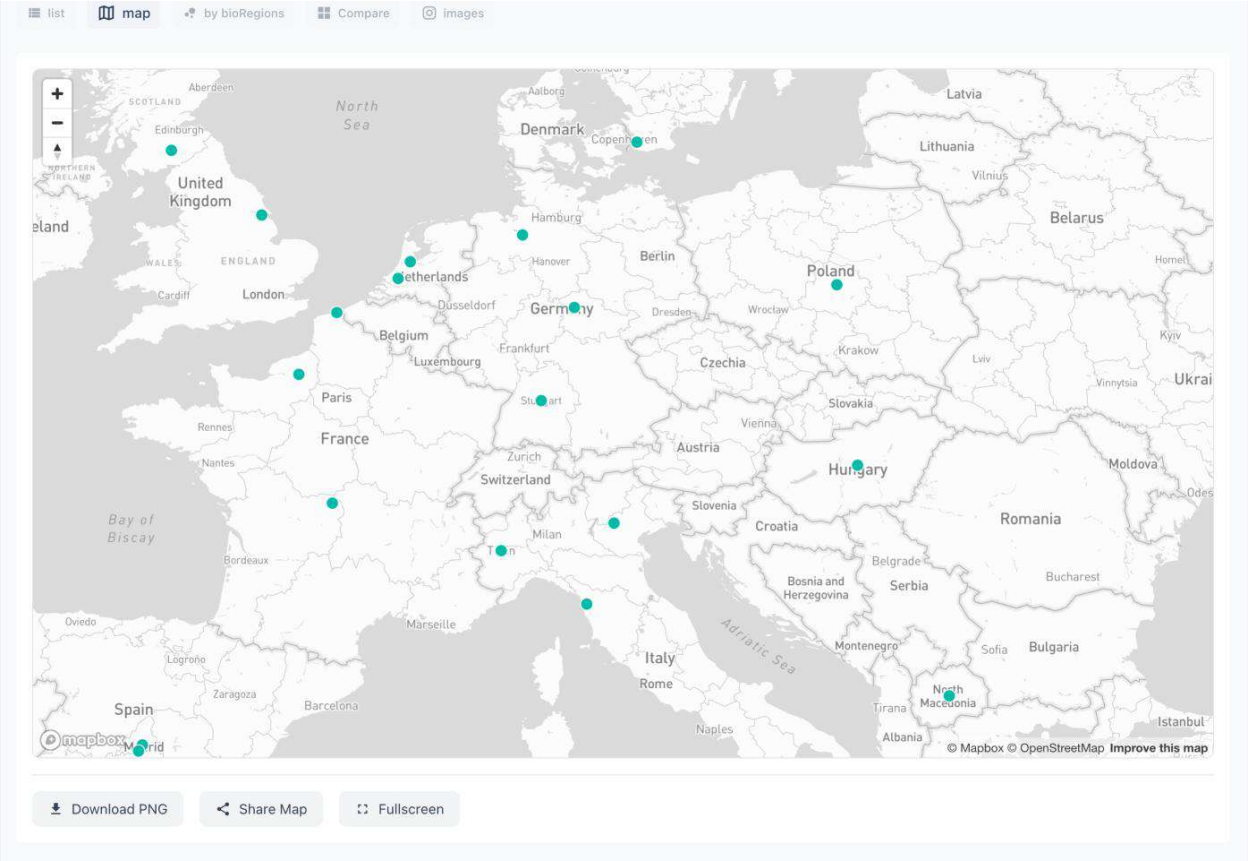


Figure 12. Visual representation of the Geographical view prototype.

Side-by-side comparison

This view allows users to compare multiple results based on a selected feature, which the system attempts to automatically extract from the various solutions. For example, a user may want to determine whether a project was developed independently or in collaboration with a network of stakeholders.

The AI system searches each solution for content related to the chosen feature and generates a brief summary. These summaries can then be compared across different solutions. This feature enables the exploration of a catalogue of solutions described in unstructured formats as if they were structured data.

While this approach has limitations—if no information related to the selected feature exists, no results will be shown—it still provides a quick way to display specific information drawn from multiple documents.

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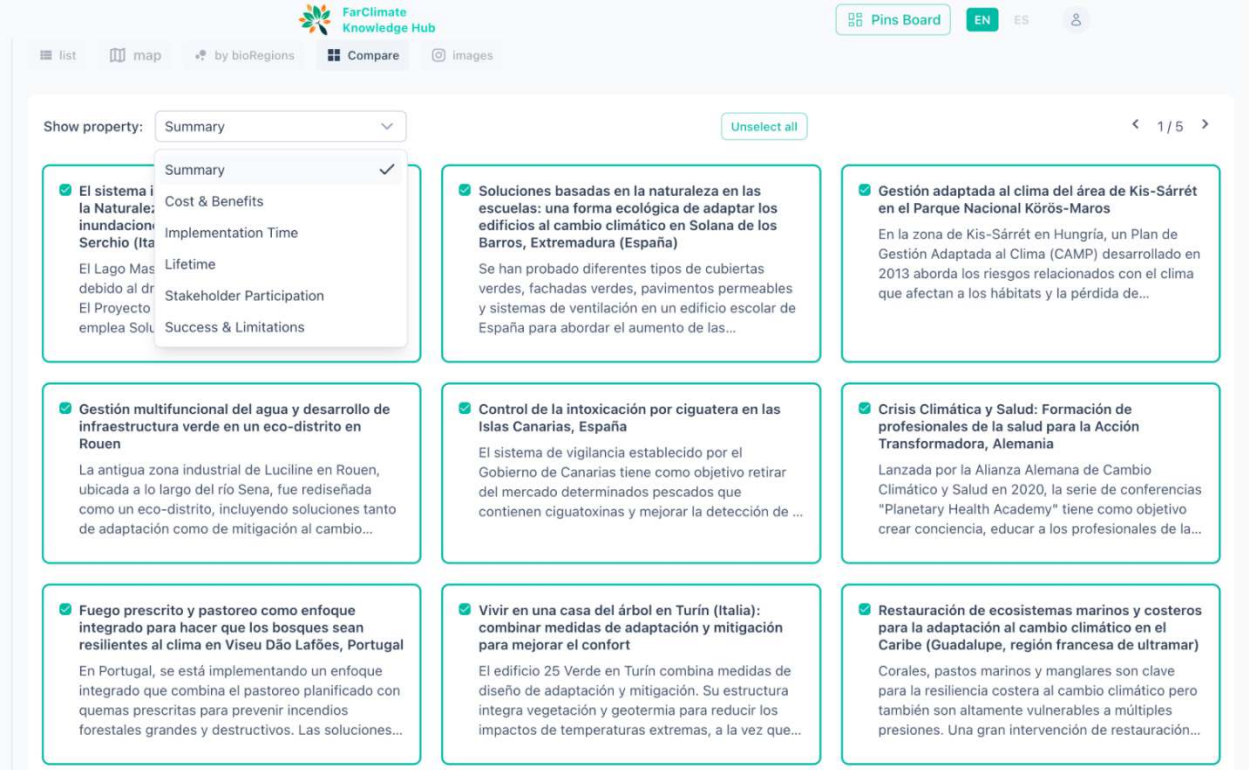


Figure 13. Visual representation of the Side-by-side comparison prototype.

6.4 Co-creation activities

A first co-design workshop was conducted in May 2025 to engage primary users in the early stages of the FARCLIMATE platform development. Following this workshop, a series of semi-structured interviews were held with key users to delve deeper into the key features identified during the initial session. These activities aimed to gather detailed user feedback and insights to refine and prioritise the platform's functionalities in alignment with user needs and expectations.

6.4.1. Co-design workshop

The **co-design workshop** took place in Soria on May 13, 2025, as part of the consortium meeting, with the participation of 19 attendees. After a brief presentation outlining the objectives and approach of the Transformation Hub, a discussion was held regarding the relevance of the adaptation solution **"recipe" ingredients**. All were considered appropriate, and their **relative importance** was assessed through an **interactive exercise** using the Mentimeter tool. The results of this exercise are presented in **Annex 4**.

Following this, a **co-design activity** was conducted based on the previously developed prototypes. The exercise aimed to explore how users could better understand search results and interact with solution data. Participants worked in groups to address the following:

1. **How might the exploration and presentation of a solution be improved?** For example, through alternative formats such as videos or podcasts. Additionally, how to explore and analyse a set of solutions resulting from a search, such as summaries or graphical

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analyses. Groups were asked to draw their ideal interface, highlighting features and components they would find useful (10 minutes).

2. **What would users do with the search results?** The discussion considered possibilities for saving searches—whether users would want to store them for personal use, and what information they would want to save. The potential for generating shareable formats was also discussed, including the importance and usefulness of sharing information with others, possibly in different formats tailored to different audiences. Groups discussed these questions collectively (10 minutes).
3. **Collective reflection and sharing**. Each group then presented their conclusions and design ideas in a final plenary session (15 minutes).

The outcomes and key findings from the co-design workshop are systematically presented in **Annex 5**.

6.4.2. User insights and validation activities

Building on the outcomes of the co-design workshop, a first **functional prototype** of the FARCLIMATE Transformation Hub was developed to deepen understanding of user interests and the relevance of various features. This prototype targeted representative users from the primary audience across the three sectors covered by the FARCLIMATE project: forestry, fisheries, and agriculture.

During June and July 2025, a total of four **semi-structured interviews** were conducted with key stakeholders representing archetypal users: a local government technician (forestry sector), two managers from a Fishing Local Action Group (fisheries sector), and a president of an agricultural cooperative (agriculture sector). The interviewees included three women and one man.

The interview guide was structured into three main blocks:

Block 1: Context

1.1 Project context

1.2 Objective and context of the digital artefact ("Transformation Hub"): explained as a tool to support the search for climate adaptation solutions by providing inspirational information, primarily solutions from other contexts addressing similar challenges. The first prototype incorporated content from Climate ADAPT and focused on the three sectors, with acknowledgment of these current limitations and their potential resolution in future versions. It was semi-functional at this stage.

1.3 Use case: participants were asked to recall instances where they needed inspiration or information from projects related to their challenges or, if none came to mind, to imagine a similar situation. This scenario served as a thread throughout the interview.

Block 2: Search Interface

2.1 Customisation of the user journey: preferences were explored regarding whether the user would want to provide specific information about their problem or context to guide the search, versus directly searching without prior input. Advantages, disadvantages, and the importance of enabling both options were discussed.

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2.2 Filters: participants reviewed the filter screen, reflecting on suggested possible actions. Although filters did not produce immediate results in the prototype, their intended function was explained. Users were asked how they would continue a search for this project and which filters seemed most relevant or missing.

2.3 Result views: a brief walkthrough of the different visualisation modes was presented. Participants identified which elements were striking or useful in the context of seeking information, focusing on functionalities that allow analysis of search results (e.g., year-based graphs, key points extracted from multiple solutions, maps) and references (contacts, bibliography). Suggestions for additional features were solicited.

Block 3: Saving, Sharing, and Transforming Information

3.1 Initial exploration: participants considered what they typically do when they find useful information—how they save it, share it, and apply it.

3.2 Prototype validation: the implemented model for saving and transforming information was demonstrated. Participants were invited to suggest additional functionalities or imagine features that could facilitate their work within this context.

These interviews provided valuable user insights and validation, supporting the iterative refinement of the Hub's features and usability to better meet the needs and expectations of the target audience.

Key findings from the interviews, which were crucial for the conceptualization of the Hub, are summarised below:

- Users prioritize access to **contextually relevant** climate adaptation solutions that relate to **challenges and environments similar to their own**. They value case studies that help assess the transferability and applicability of solutions.
- The **search interface** should allow for an initial **broad search with options to refine** results using filters such as bioregion, project type, budget distinctions, and risk categories. Users prefer not to have overly restrictive early input requirements.
- In **results viewing**, providing clear context for solutions (problem addressed, initial conditions, outcomes) enhances understanding. **Visual aids** like maps and representative images increase trust and engagement with the content.
- Features enabling **comparison** across multiple solutions, **AI-generated summaries** for quick insight extraction, and **accessible contact** information are appreciated by users for efficient information processing.
- Users typically **save and share** information in formats that are **easy to digest** and adaptable for various audiences, including non-specialists. Visual formats such as videos or slide decks are especially valued. The prototype's saving and sharing model aligns with real-world workflows but further attention is needed to facilitate well-managed digital exchanges during collaborative or in-person discussions.
- **Language accessibility** and **content reliability** are key concerns, with many users relying on national sources due to language barriers, highlighting the need for multilingual support.
- **Speed** and **trustworthy information** are particularly critical in sectors like forestry where timely decisions are essential.

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7. Conceptualization of the Transformation Hub

7.1 Prioritization framework: key features and functionalities

The outcomes of the co-design activities provided the basis for outlining a comprehensive set of features, shaping a functional framework that guides their characterization. This groundwork enables the application of prioritization criteria, ensuring a systematic approach to evaluating and ultimately selecting the most relevant functionalities to be integrated into the Transformation Hub.

7.1.1. Features description

Table 3 presents the complete list of features proposed during the co-design process, along with a brief description of their characteristics.

Table 3. List and description of features to be assessed for the Transformation Hub.

Feature	Description
Access to Climate-ADAPT solutions database	Enables access to the Climate-ADAPT solutions database, with AI-powered translation of entries into the Transformation Hub's recipe format.
Access to other platforms with climate adaptation solutions	Enables integration of climate adaptation solutions from external platforms, expanding the range of practices accessible within the Transformation Hub.
Access to technical and scientific sources (journals, reports ...) about climate adaptation	Provides direct access to a curated collection of scientific journals, technical reports, and research databases focused on climate adaptation
Access to local knowledge about climate adaptation	Enables access to community-driven knowledge on climate adaptation, integrating local experiences and practices to complement scientific information for more holistic and context-specific solutions
AI-based Interactive Search	Offers an AI-powered interactive search combining vector similarity and traditional text search methods, enabling precise and flexible queries across the adaptation knowledge base
Smart filtering	Uses AI-powered algorithms to enable dynamic and intuitive filtering of climate adaptation data, allowing users to easily narrow down results by relevant criteria for faster, context-aware discovery of solutions and information.
AI-based search customized by user profiles	Allows users to describe their profile and needs, then uses AI vector search and analysis to recommend tailored climate adaptation case studies, enhancing relevance and personalization in knowledge discovery.

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Feature	Description
Geographic view of results	Displays climate adaptation solutions on an interactive map according to their geographic location, helping users visualize spatial distribution
Text / image display of results	Display the list of solutions prioritizing text/summary/ or images
Ecoregional results	Groups solutions by bioregion to reflect ecological and geographical contexts for targeted adaptation.
AI-enhanced comparisons [Smart, Adaptive]	Allows users to select comparison criteria, then AI finds and compares relevant information across solutions for smart, adaptive analysis.
Get insights	Uses AI to rapidly extract and summarize key insights from multiple solutions for quick understanding.
Chat with the results	Allows users to ask AI questions about selected results and get conversational, context-aware answers.
Mindmap	Visualizes concepts and connections as an interactive mindmap for easy exploration of relationships and ideas.
Node-based interface	Provides a visual, node-based interface for intuitive manipulation and organization of adaptation solutions.
Multi-layered solution view	Displays each solution at multiple zoom levels, from title to full detail, for flexible browsing and in-depth exploration.
Re-arrange solutions to fit recipe	Transforms a solution's content into the structured format of the Transformation Hub recipe for clear and consistent presentation.
User identity	Manages user profiles and authentication to personalize access and experience within the platform.
Login to save	Registered users can sign in and save boards on the server, with full sign-up and sign-in flows.
Create boards	Allows users to create and save multiple boards to organize and manage their content.
Save content to board	Enables saving full solutions or solution segments to user boards for easy access and organization.
Add annotations to saved content	Allows users to add notes and comments to saved content for personalized insights and collaboration.
Explore and analyse saved content with AI	Uses AI to provide insights and a chat interface for interactive exploration of saved solutions.

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Feature	Description
Share "project" read-only	Creates public read-only views of saved content for easy sharing and collaboration.
Share "project" collaborative	Enables shared projects with editing rights for multiple users to collaborate in real time.
Federate	Allows organizations to run independent instances, curate content, publish resources, and link content across partner platforms.
Download media	Allows users to download output resources such as images and presentations for offline use.
Podcast	Converts articles into audio podcasts.
Video	Generates AI talking head videos that explain one or more solutions with realistic avatars and narration.
Include AI generated images	Creates synthetic images for solutions lacking high-quality visuals to enhance appeal.
Presentation template	Exports saved images and charts as a PowerPoint presentation template.
Posts "Instagram style"	Displays content in a visually rich, scrollable format similar to social media posts.
Forum	Provides a space where organizations share progress, announcements, and get feedback on solutions.
Logbook / timeline	Offers an interface to document and track projects in real-time while in progress.
Recipe building	AI-assisted creation of solutions using curated and user-added external and local knowledge.
Voice-Activated information navigation	Allows voice prompts to offer hands-free access to additional information anytime the user requests it.
AI-Assisted language translation for communication	Provides real-time AI translation during voice or text interactions to enable seamless multilingual communication.
Multilingual interface	Displays content in the user's preferred language using AI-powered translation for seamless multilingual experience.

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7.1.2. Functional framework

The features were characterized by considering the **User Journey phases**—Search & Explore, Analysis & Assessment, and Information Management & Collaboration—where they are applied and identified. Their **functional domains** and **categories** were defined accordingly, based on the specifications detailed in Table 4.

Table 4. Functional domains and categories for the characterization of the Transformation Hub features.

Functional domains	Categories
Knowledge sources	Climate adaptation database
Knowledge management	Smart search
Knowledge management	Display formats
Knowledge management	Smart analysis
Knowledge management	Content curation
Knowledge management	Content creation
Community	User management
Community	Community interaction
User interfaces	Conversational interface
User interfaces	Graphic, interactive interface
User interfaces	Voice user interface
User interfaces	AI-based language translation

7.1.3. Features characterisation

The classification criteria established in the functional framework were applied to all previously identified features to adequately characterize their role within the Hub.

An example of this characterisation applied to specific features is presented in Table 5.

The complete list of **characterised features** is provided in **Annex 6**.

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Table 5. Example of the application of classification criteria to the evaluated features.

Feature	User journey	Category
Access to Climate-ADAPT solutions database	Search & Explore	Climate adaptation database
Access to other platforms with climate adaptation solutions	Search & Explore	Climate adaptation database
Access to technical and scientific sources (journals, reports ...) about climate adaptation	Search & Explore	Climate adaptation database
Access to local knowledge about climate adaptation	Search & Explore	Climate adaptation database
AI-based Interactive Search	Search & Explore	Smart search Conversational interface
Smart filtering	Search & Explore	Smart search Conversational interface
AI-based search customized by user profiles	Search & Explore	Smart search Conversational interface User management
Geographic view of results	Analysis & Assess...	Display formats

7.1.4. Functionality selection criteria and decision matrix for feature integration

After characterising and analysing the features, a prioritization framework was established, defining criteria at two levels. First, three **primary selection criteria** were set (Table 6): **User Interest**, reflecting the level of demand, enthusiasm, or expressed need from interviewed users; **Technical Feasibility**, considering the complexity of development and availability of technology and skills; and **Resource Cost**, estimating the financial, human, and time resources required.

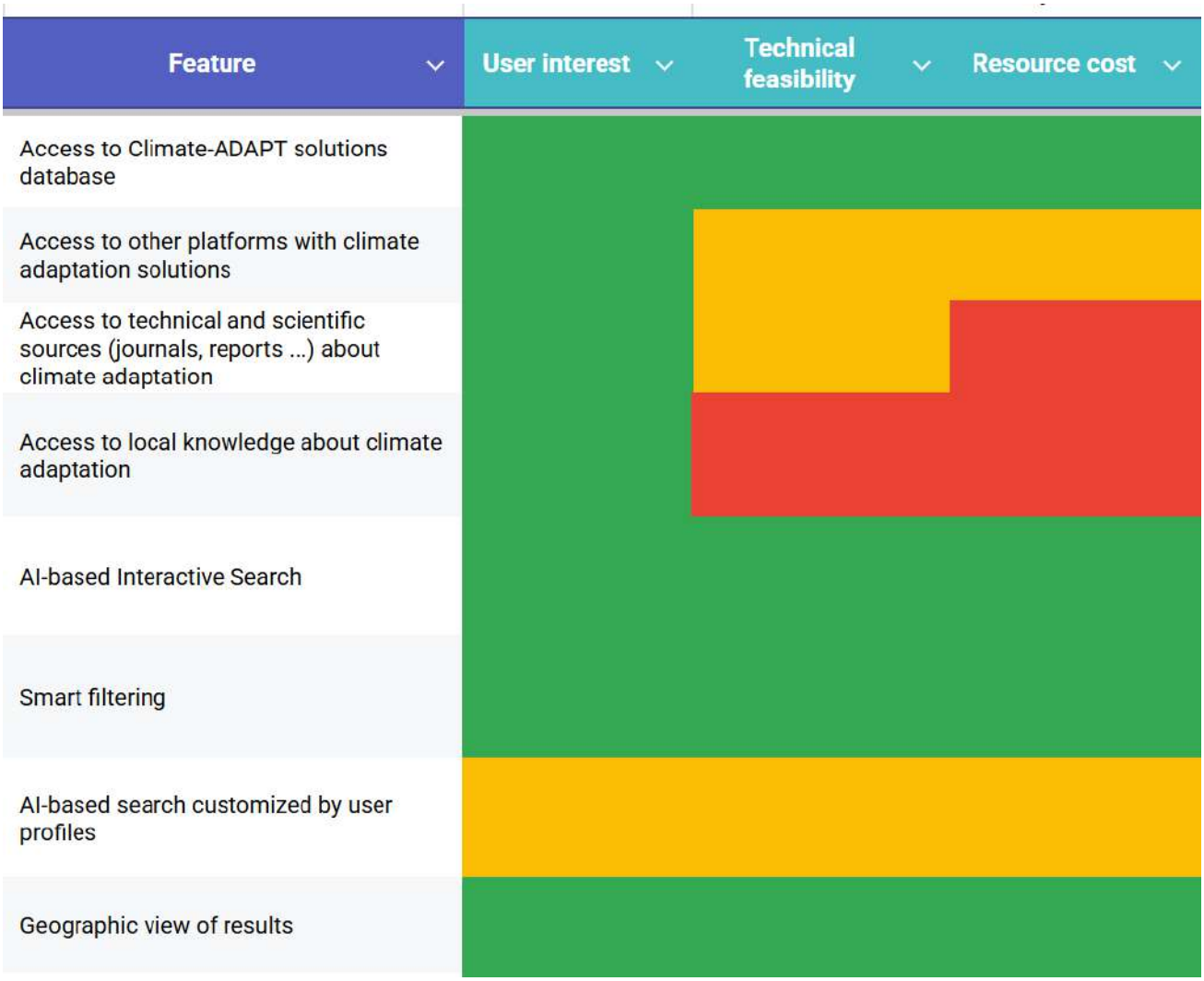
These criteria were applied with a traffic-light system in the **decision matrix for feature integration** to guide decisions on which features to implement or discard. Table 7 presents an example of this criteria application in the decision matrix.

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Table 6. Primary criteria for feature selection.

Criterion	Description
User interest	Level of demand, enthusiasm, or expressed need from interviewed users
Technical Feasibility	Complexity of development, availability of technology and skills
Resource Cost	Estimated financial, human, and time resources required

Table 7. Example of the application of classification criteria to the evaluated features.



Based on these results, a second evaluation phase was designed using **secondary criteria** (Table 8): **Strategic Alignment**, assessing contribution to the core objectives and long-term vision of the Hub; **Impact Potential**, considering the expected benefits for climate adaptation users and systems; and **Scalability**, evaluating ease of scaling or adapting the functionality to

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other contexts. This phase aimed to identify features that, despite lacking immediate user interest, technical feasibility, or having high costs, might be worth considering for **future implementation**.

Table 8. Secondary criteria for feature selection.

Criterion	Description
Strategic Alignment	Degree to which the functionality contributes to the core objectives and long-term vision of the Hub
Impact Potential	Expected benefit for climate adaptation users and systems once implemented
Scalability	Ease of scaling or adapting the functionality to other contexts

The decision matrix, showing the selection decision for each feature (implement, defer, or discard), is provided in **Annex 7**.

7.2 Visual identity definition

The visual identity of the Transformation Hub serves as a coherent foundation that communicates its values, ensuring clear recognition and reflecting its core purpose across every interaction. Here follows the visual identity definition developed for the Transformation Hub, capturing the essential elements that shape its image and guide its communication strategy moving forward.

Challenge

Create a global identity that is aligned with the project's objectives, building all its elements under the same umbrella and with the same purpose.

Design Principles

The design principles serve as a guide to shape this identity, not only for current products but also for possible future products. They must align with the objectives and the users' needs.

- Adaptability: All solutions must be adjusted to the context.
- Clarity: All information displayed must be clear and transparent.
- Trust and rigour: Content must be reliable, verified, and well-substantiated. Transform science into clear data.
- Scalability: All solutions must have a future vision and the capability to scale.
- Collaboration and Participation: All content must be prepared to involve different stakeholders.

7.2.1. Colour palette

The colour palette is designed to be versatile, conveying clarity and trust in daily communication while adapting to scenarios that require managing a wide variety of tones to visualize complex data.

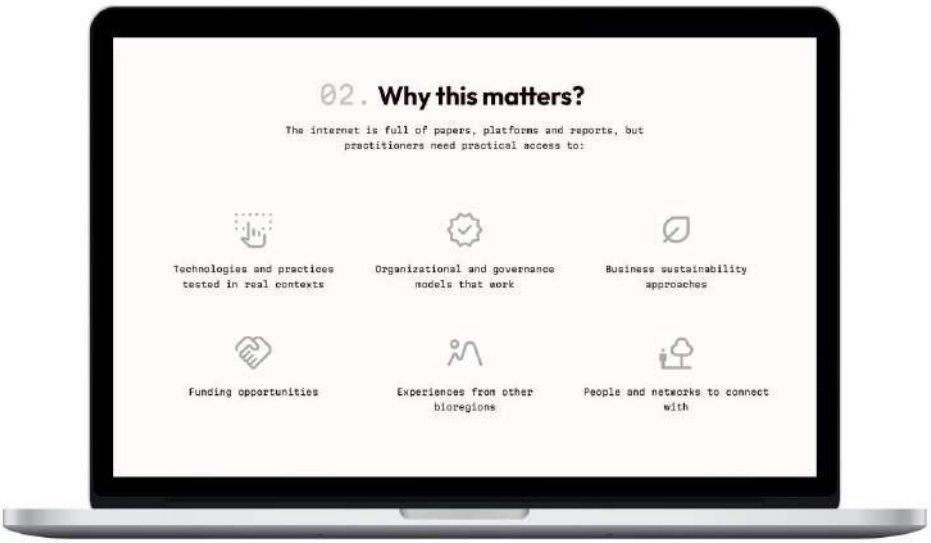
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Neutral Colours

Backgrounds and typography.

Used for backgrounds and typography that help make the information accessible.





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Accent Colours

Main colours.

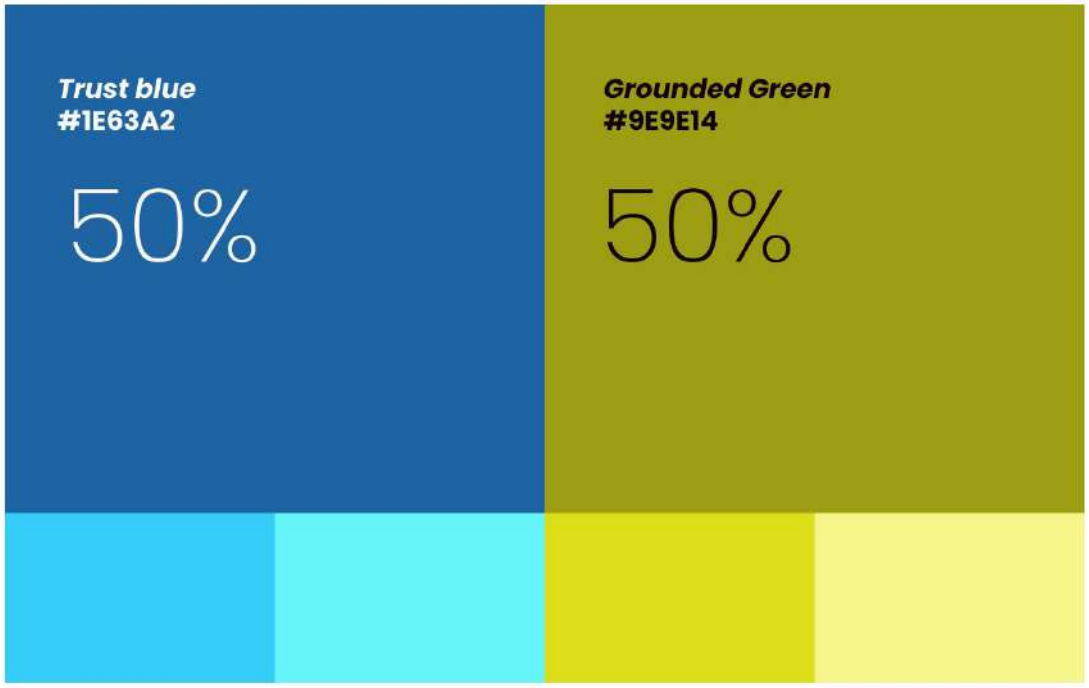
Trust Blue

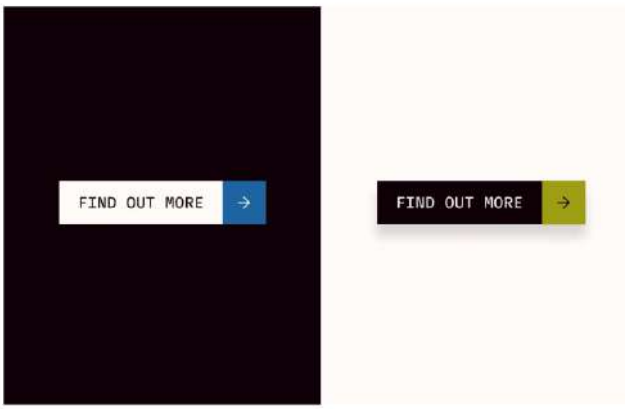
Trust, clarity, and scientific rigor.

Grounded Green

Scientific rigor, seriousness, connected with the earth.

These main colours are applied as calls to action. Depending on content and context, Trust Blue or Living Green is used.





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Rainbow Colours

Secondary colours.

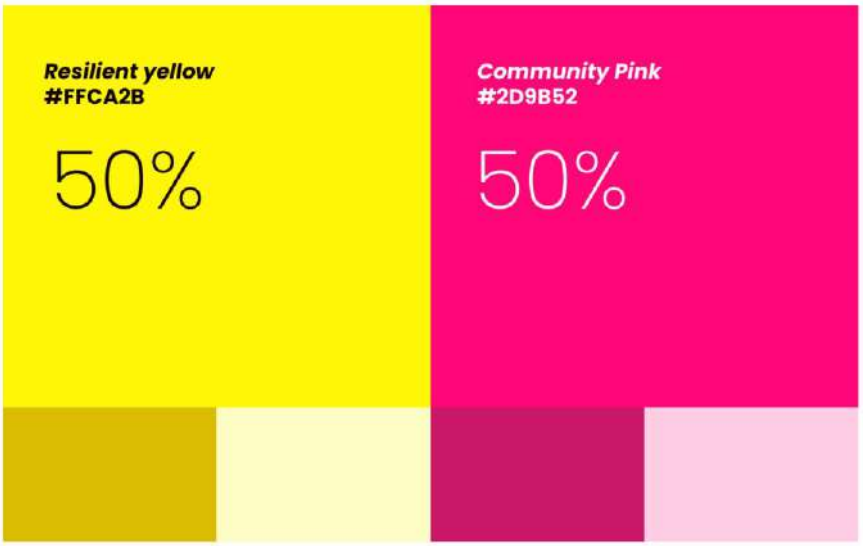
Resilient Yellow

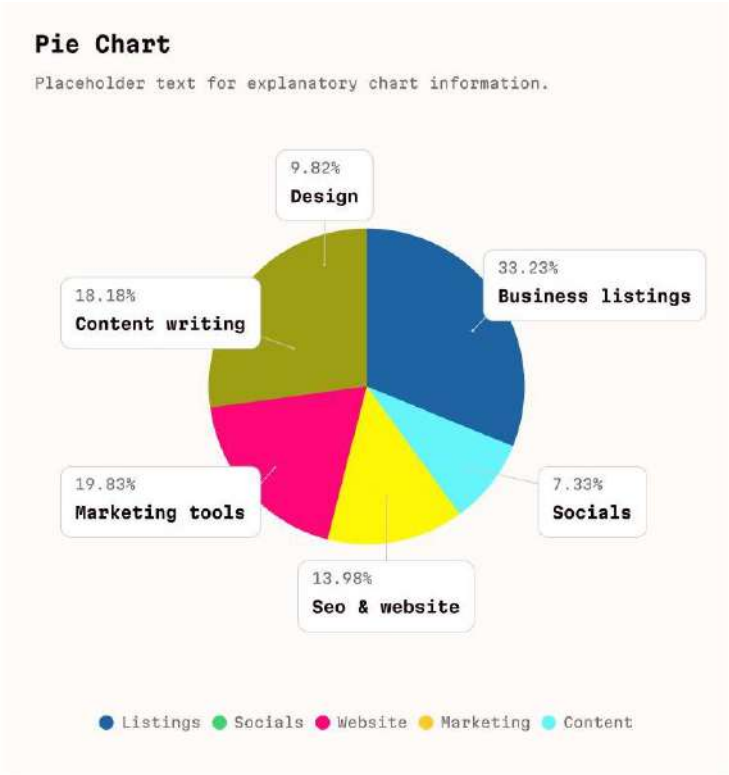
Optimism, adaptation, and future.

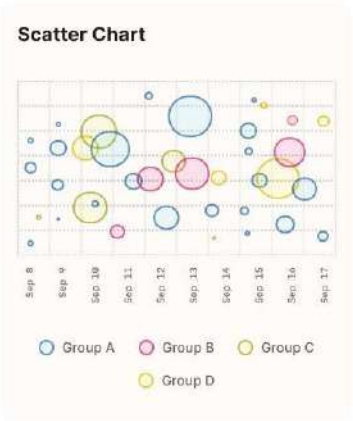
Community Pink

Social dimension of collaboration and community.

Used mainly together to display data charts.







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7.2.2. Image

Images are the first point of connection with the audience. Beyond aesthetics, their true value appears when combined with illustrations and graphics, creating a more complete and effective visual language.

Illustration

Scientific illustration is a language of its own that expresses the interior of objects, processes, or phenomena in ways that photography or direct observation cannot. It conveys depth of field and detailed precision, making complex topics accessible and understandable.

Scientific illustration provides:

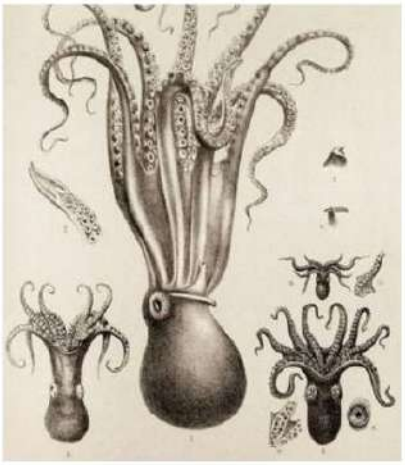
- Simplification of the invisible.
- A perfect resource for qualitative representation.
- Conceptual understanding.
- A display of rigor by linking to old books and scientific publications.







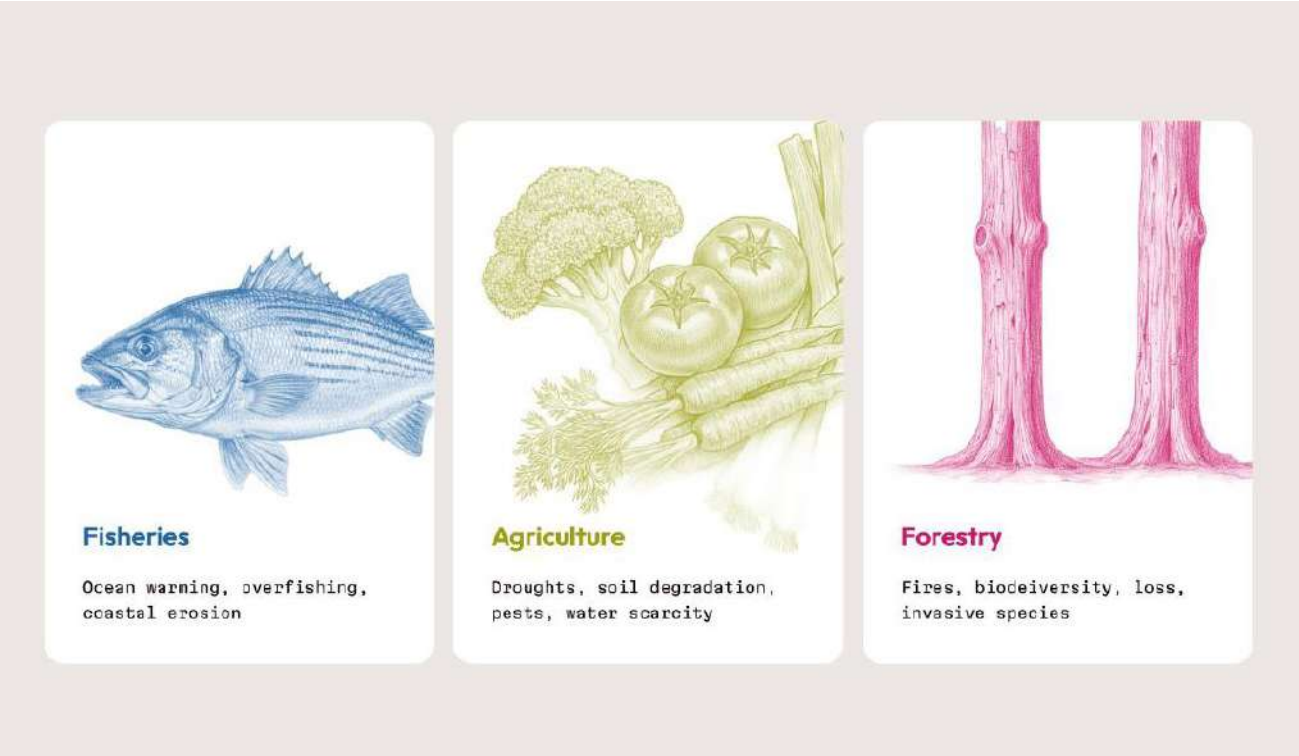




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Application examples

This resource is used not only to give the identity scientific rigor and credibility but also to serve as a more recognizable and personalized element of the brand identity.



Images

Images are the first point of connection with the audience. Beyond aesthetics, their true value emerges when combined with illustrations and graphics, creating a more complete and effective visual language.

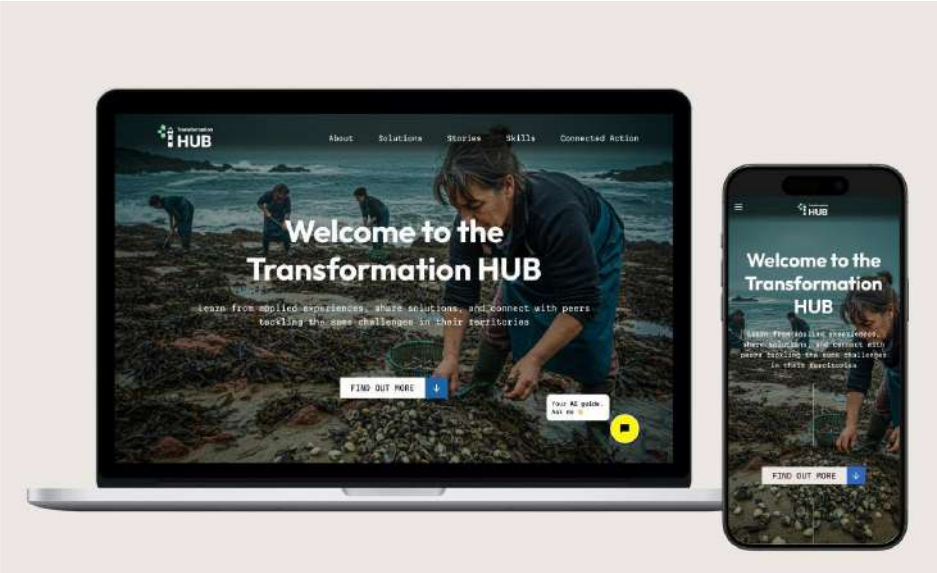
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Application examples

Images, in turn, place information in a recognizable context. They provide context and empathy by showing impacts or benefits in a tangible way. They offer an emotional and human connection.

Images will be used as a fundamental element to give future digital products a sense of closeness, mostly as module backgrounds.



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Graphics

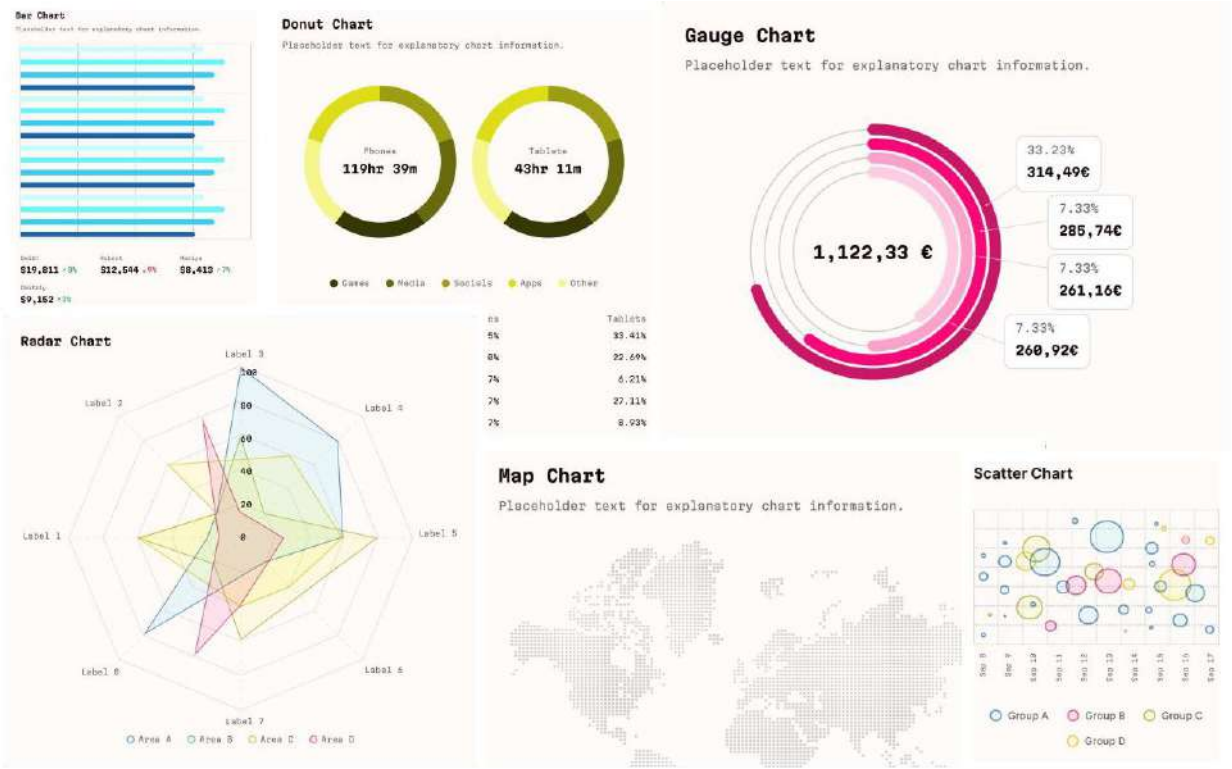
Using graphics helps present detailed and quantitative information. It also aids clarity in visualizing trends.



Application examples

Combining illustrations with graphs and images enhances the perception of scientific rigor.

Graphs help present detailed and quantitative information. They provide clarity in visualizing trends.



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7.2.3. Typography

Typography is a fundamental pillar that directly influences the aesthetic of an identity. It must be legible and provide standardization throughout all constructed materials to seek credibility in the developed products.

Sans-serif Typography

Heading typeface

Its clean, modern design makes it more readable on screens, making it a popular choice for headings.



Serif Typography

Body typeface

The serifs help the reading of long texts such as articles or papers and help generate an aesthetic with scientific rigor.



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Application examples



7.2.4. Post-beta refinement: naming and usability

Following the release of the Transformation Hub beta in June 2026, the FARCLIMATE team dedicated July and August 2026 to reviewing the visual identity and improving usability based on early internal testing. One key finding from this review was that the name "Transformation Hub" was not easily recognisable and did not clearly convey an association with climate adaptation to first-time users. To address this, the team decided to complement the Transformation Hub with the name "Adaptarium", intended to be more immediately recognisable and evocative of its adaptation focus.

These naming and usability improvements will be presented for feedback in upcoming engagement spaces, including interviews with the Hub's target audience as well as discussions at the Fifth Forum for the EU Mission on Adaptation to Climate Change (23-24 November 2026, Dublin) with other Mission audiences. The insights gathered, together with their reflection in the Hub's final version, will be documented in D7.4 Lessons Learned from User Experience Evaluation

7.3 Platform architecture and wireframes

The technical architecture of the platform is organised into several key components to ensure seamless operation and advanced functionality. At the core is the complete data processing pipeline, which encompasses scripts for web scraping and connections to APIs of existing data sources. This pipeline manages the extraction, preprocessing, and storage of data within the primary database. The preprocessing stage includes code that cleans and reshapes incoming articles and, when needed, interacts with AI providers to assist in data processing tasks.

Built upon this database is an advanced search engine that supports both traditional search algorithms and modern vector search capabilities, providing enhanced retrieval performance. Access to the database is facilitated via a dedicated API, which serves as the communication bridge between the backend and the frontend interface.

Separately, a second database manages user-related information, including preferences, accounts, and other essential data necessary for standard platform operations. Additionally, a

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distinct backend infrastructure handles AI-driven tasks initiated by users, such as text summarization, chat functions, and mind map generation, leveraging a set of specialized prompts.

Finally, the frontend comprises all interface elements and the necessary code to interact with the backend API, delivering an integrated and user-friendly experience. The platform technical architecture is summarized in Figure 14. This modular architecture supports the robust functionality required by the Transformation Hub, while enabling scalability and efficient management of data and user interactions.

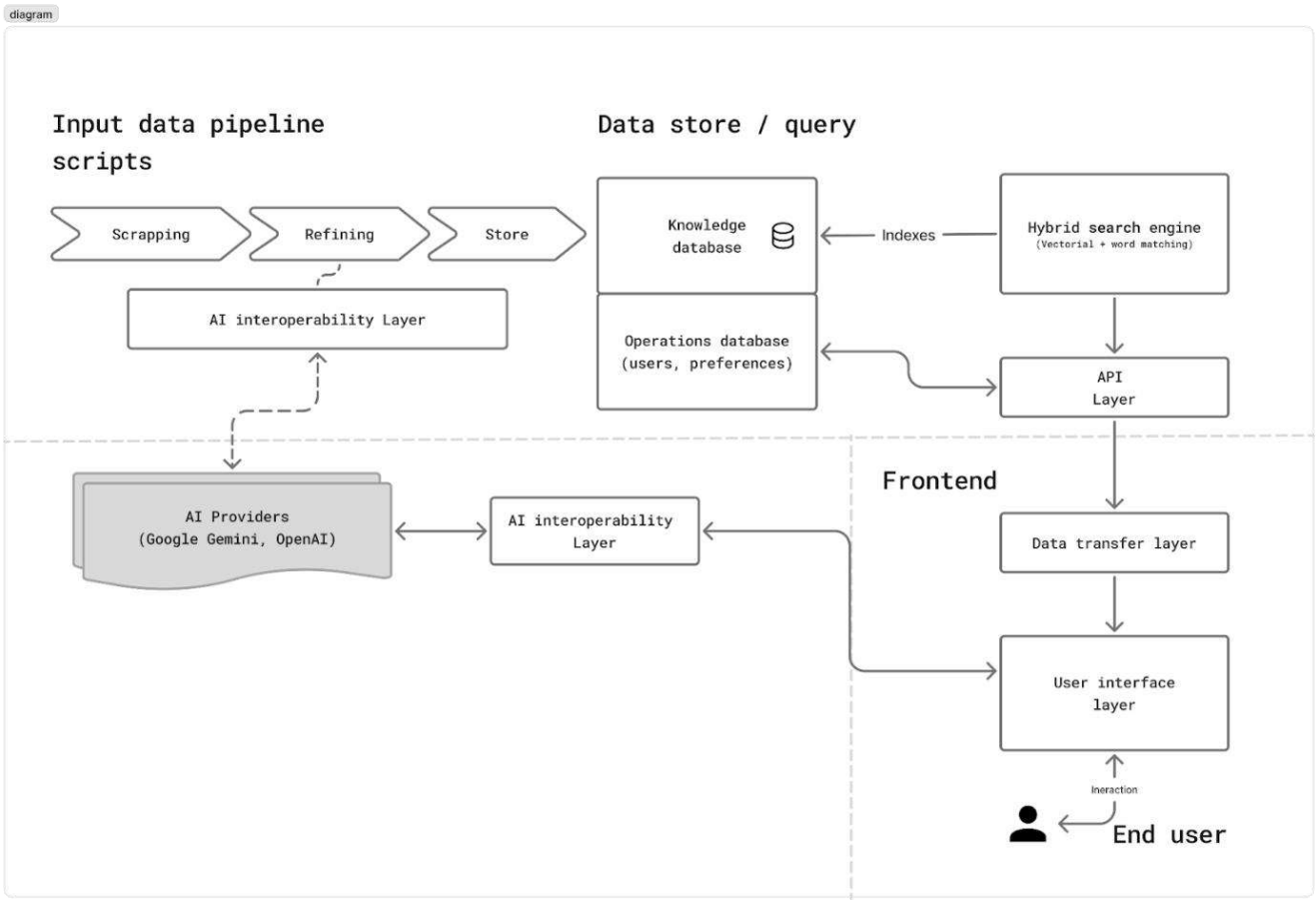


Figure 14. Summary diagram of the platform's technical architecture, illustrating the main components and their interactions.

Once the technical architecture was defined, the next step involved the detailed design of wireframes for the various features of the Transformation Hub. These wireframes serve as visual guides for the development process. Their implementation is being carried out in Task 7.3, with the objective of producing a beta version of the platform. This beta will be the first to be tested and validated through user engagement in the living labs, specifically in Task 2.4

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Inspiration tool screens

Intro

This screen represents the starting point of the process. It features a brief explanatory text and provides the option to directly access results related to one of the three industries addressed in the project. Additionally, it allows users to enter a text string for custom searches.

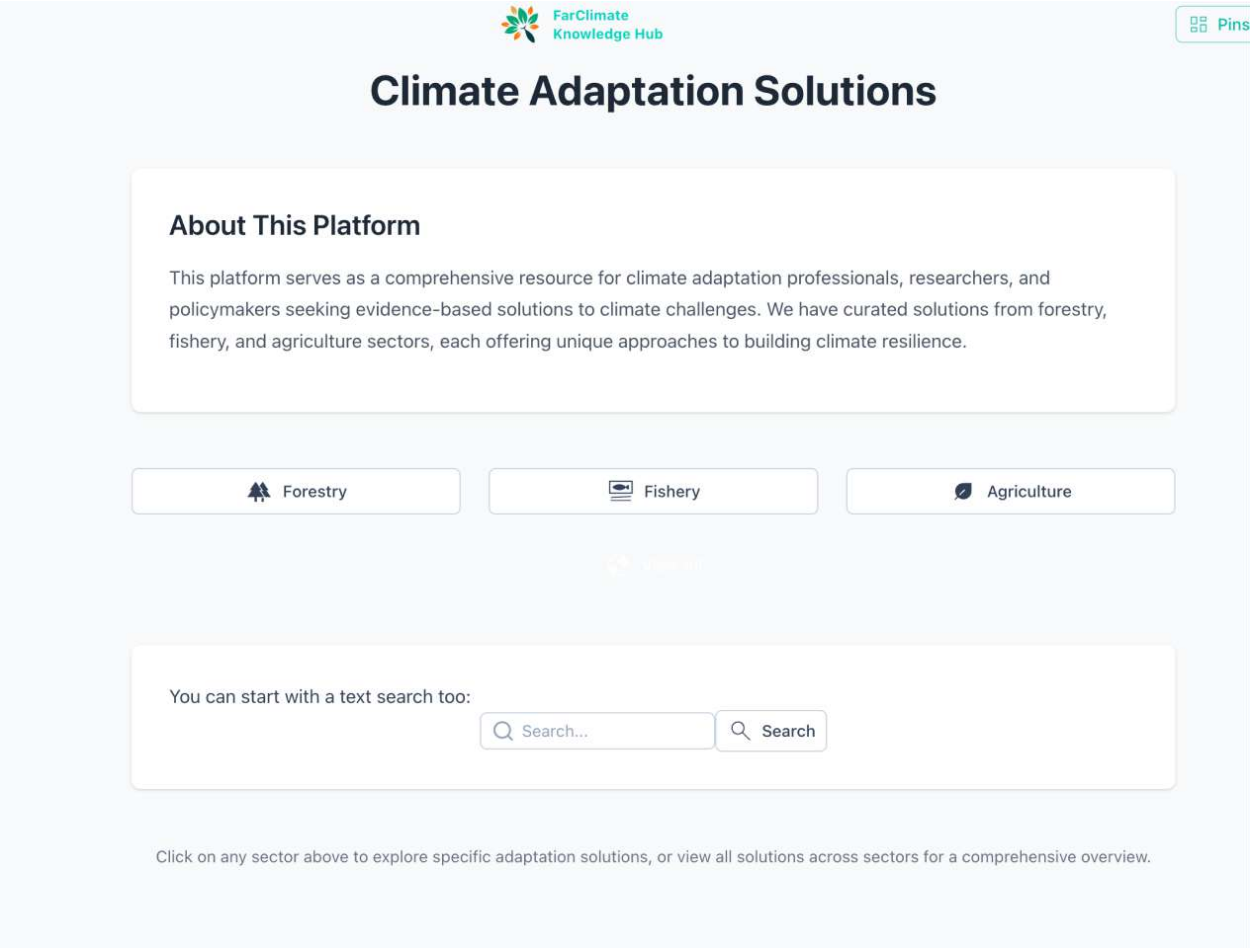


Figure 15. Inspiration Tool introductory screen with industry selection and search input options.

Explore

This is the application's exploration screen, divided into two main sections.

On the left, various filter controls also serve as a visualization of the collection, allowing users to see how many documents belong to a specific sector or risk type. Users can enable or disable different filters as needed.

The right side displays a list of solutions matching the current search criteria and filters. This listing goes beyond simple titles and can be presented in different formats depending on the user's exploration preferences.

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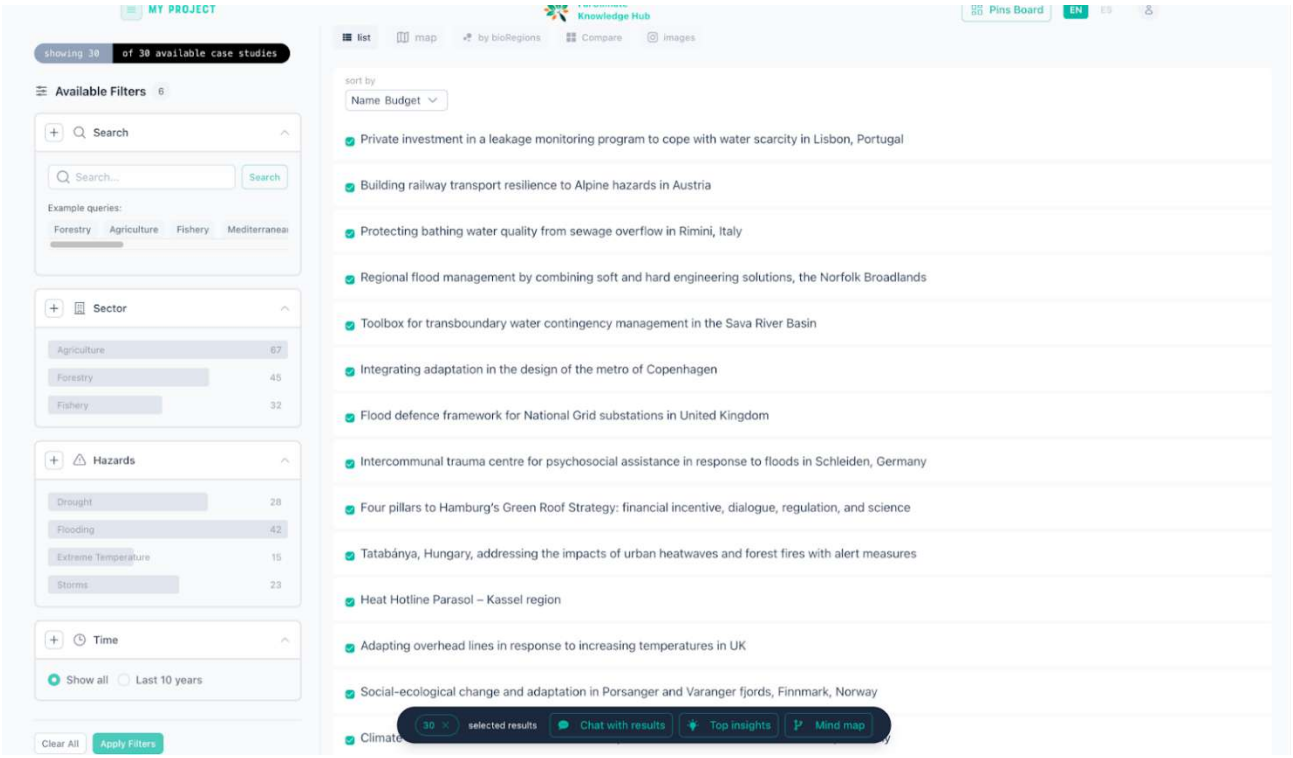


Figure 16. Inspiration Tool exploration screen with dynamic filtering and solution display options.

Select options

In addition to the various views, this section, called Transformations, allows users to select a set of results and perform actions such as generating a comprehensive summary, creating a mind-map view, or querying the selected results using free text.

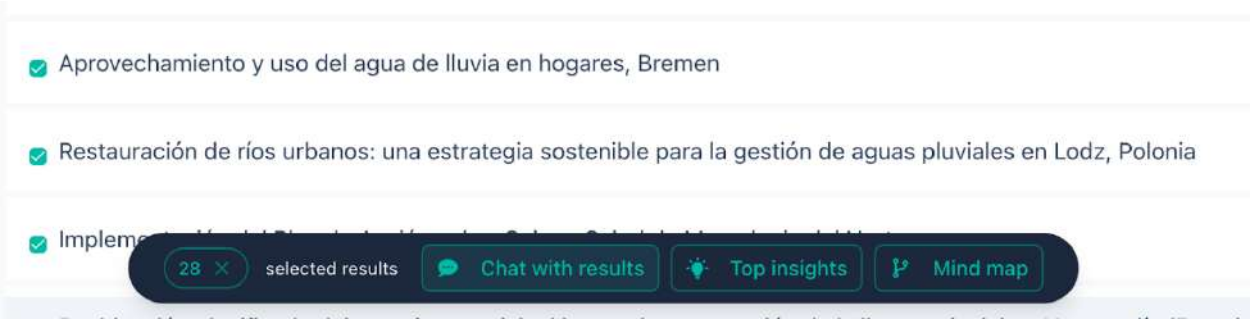


Figure 17. Transformations section with options for summarization, mind mapping, and free-text querying of selected results.

View

Geographical view

This classic geographical view displays each solution according to the location(s) where it has been implemented, providing spatial context for the data.

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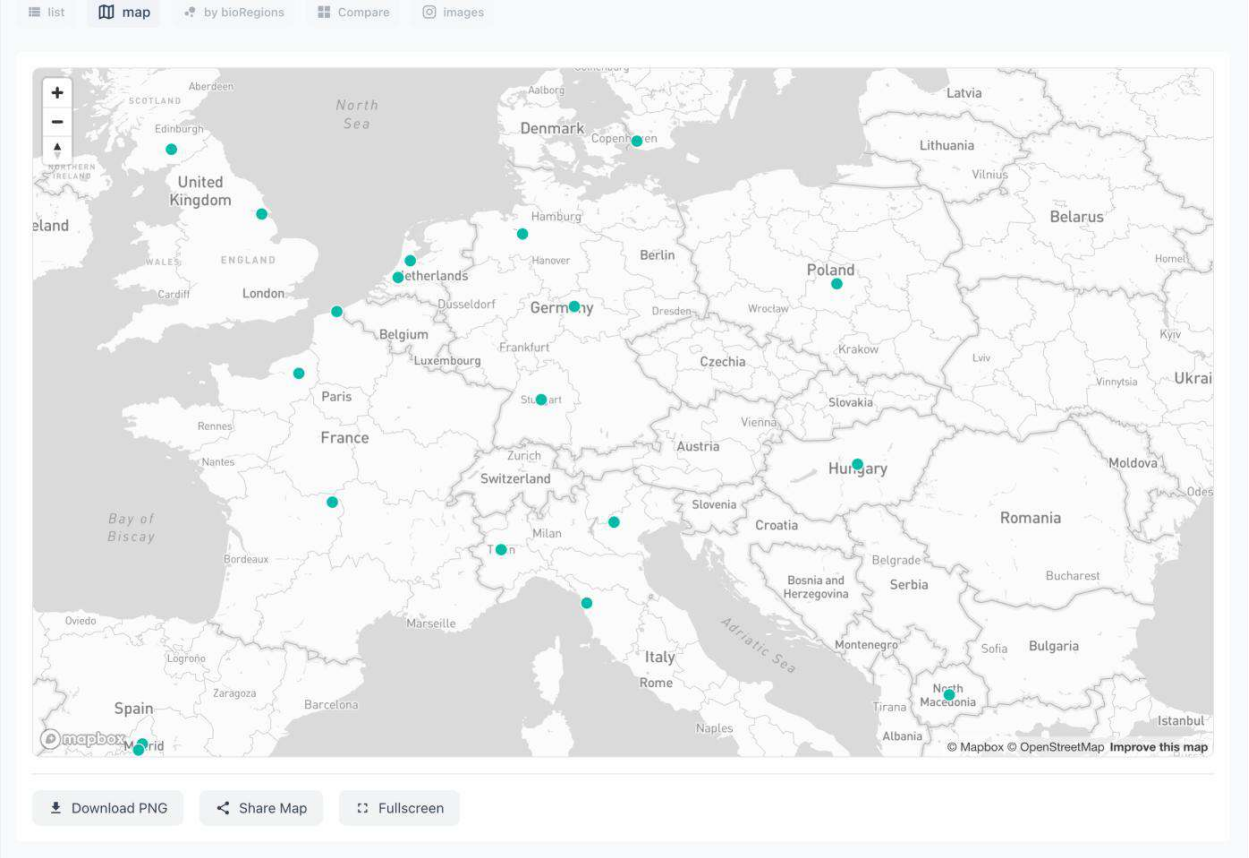


Figure 18. Geographical view illustrating solution implementation locations.

Side-by-side comparison

This view allows users to compare multiple results based on a selected feature. The system attempts to automatically extract these features from the various solutions. For example, a user may want to determine whether a project was developed independently or in collaboration with a network of stakeholders.

The AI system analyses each solution to find all content related to the chosen feature and generates a brief summary for each. This enables comparison of summaries across different documents. This feature facilitates exploration of a catalogue of solutions originally described in an unstructured way, treating them as if they contained structured data. There are limitations, however; if no information related to the selected feature is found, the comparison will display no results. Despite this, it provides a convenient and quick way to extract and display specific information across multiple documents.

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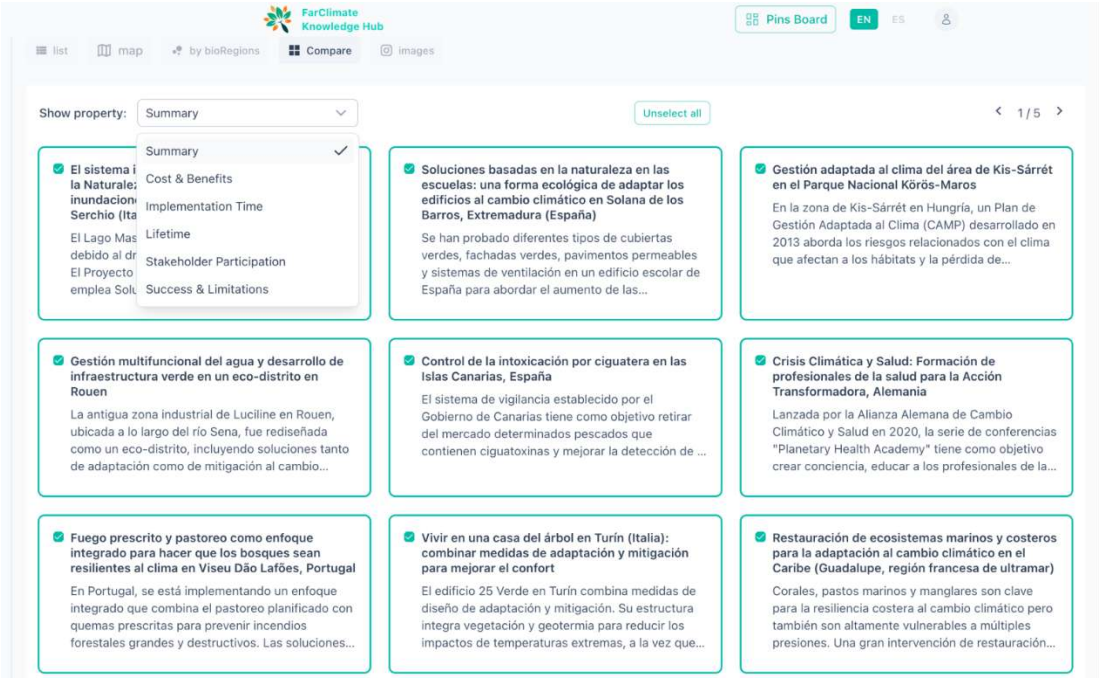


Figure 19. Side-by-side comparison view enabling feature-based analysis of multiple solutions.

Image-based view

This view emphasizes imagery, drawing inspiration from Instagram-style navigation. It displays a large project image along with its title and a portion of the introduction.

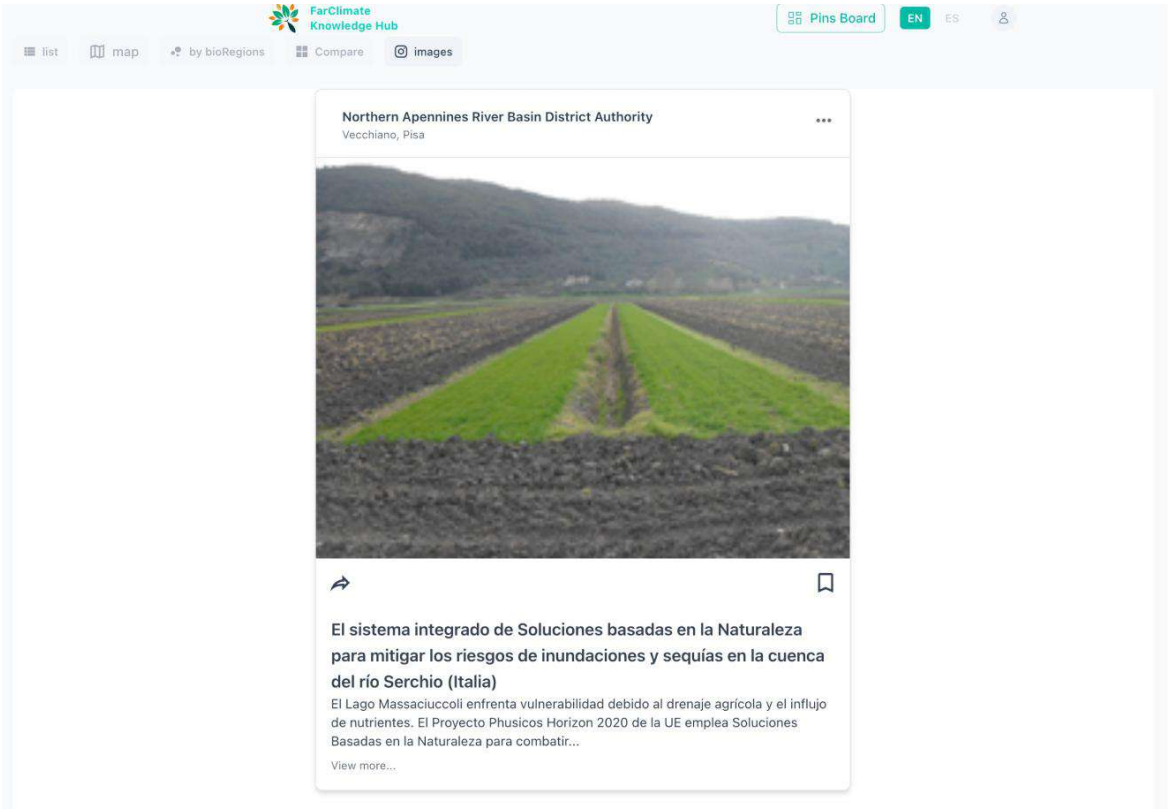


Figure 20. Image-based view showcasing projects with prominent visuals and introductory text.

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Cluster

Geographically close locations can experience very different climatic conditions, meaning projects may be developed in distinctly different contexts. Therefore, a traditional geographical view does not always provide complete insight. To address this, a range of clustering algorithms are applied based on various features. For example, projects can be grouped not by their exact geographic coordinates but by their climatic region.

This results in a map-like visualization where points represent clusters defined by variables other than latitude and longitude.

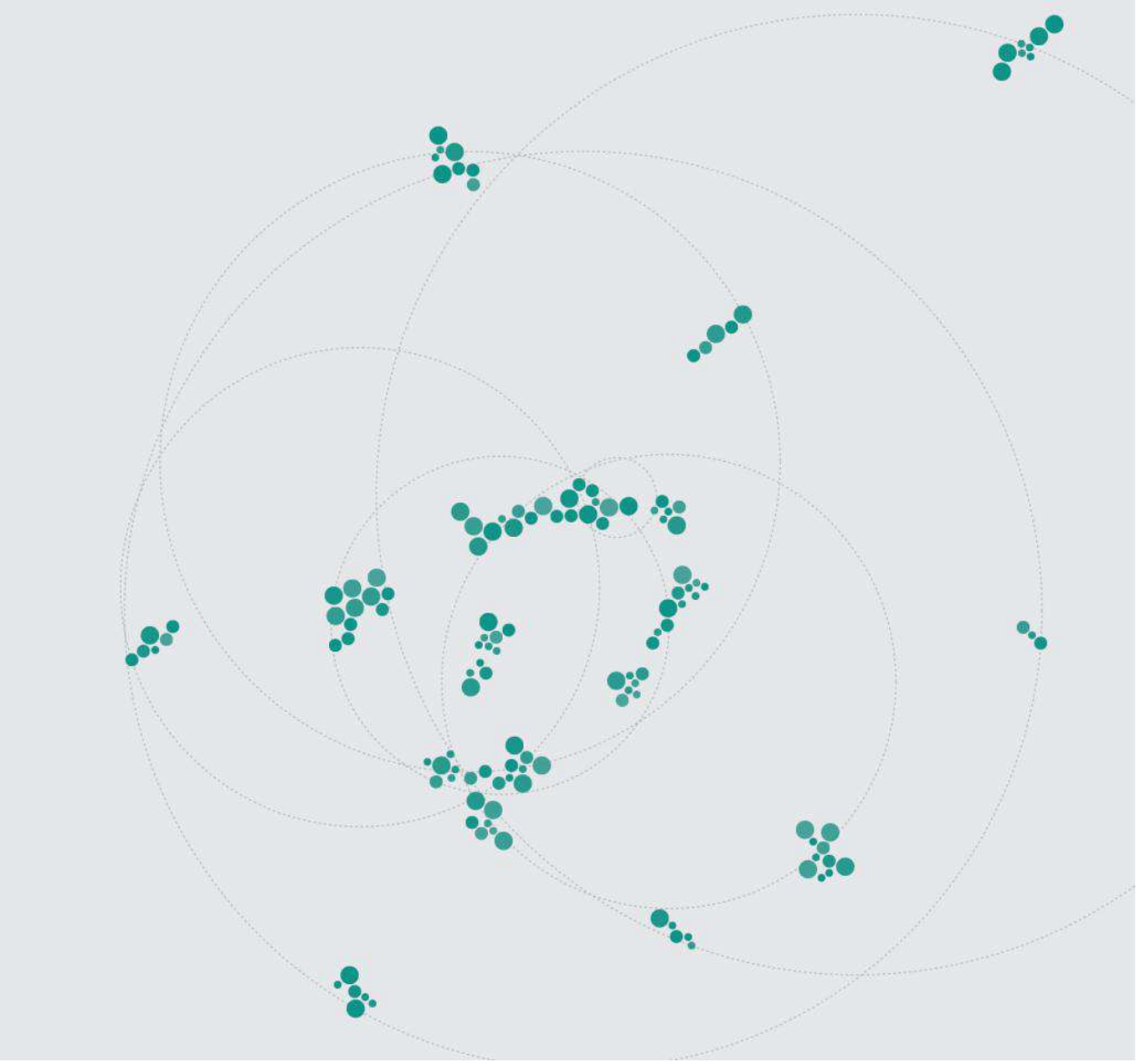


Figure 21. Cluster view grouping projects by climatic and contextual similarity.

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Transformation views

Chatbot

While the interface offers various exploration methods, user testing revealed that some users prefer to run their own queries across the results. The chatbot interface is designed in a ChatGPT-style format. Besides providing AI-generated responses, it also offers direct links to the articles referenced during the conversation. To assist users in getting started, a set of suggested questions is provided.



Figure 22. Chatbot interfaces enabling conversational queries with linked article references.

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Main Insights

Another valuable feature is the extraction of main ideas from a set of solutions. When filters or searches yield a large number of results, reviewing each one to find relevant information can be overwhelming. This interface links each main idea to the articles where it is discussed, allowing users to quickly identify key points. Additionally, users can select and read any of the referenced articles directly.

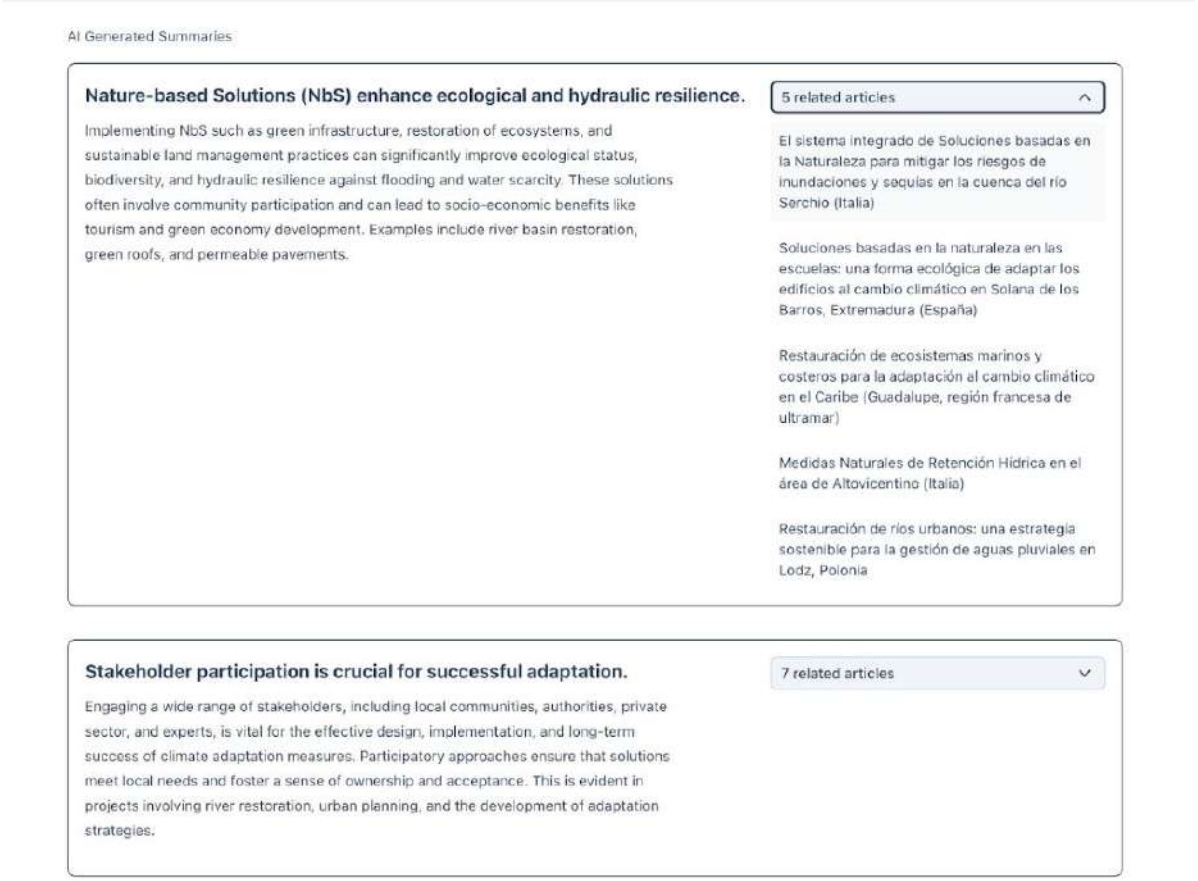


Figure 23. Main Insights interface displaying key ideas linked to source articles.

Mind Map

Alongside the traditional text-based results interface, this Mind Map-style view offers a quick, high-level overview of the concepts covered across the selected solutions. Users can explore the relationships between ideas visually and select any solution to read in depth if desired.

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Figure 24. Mind Map interface providing a conceptual overview of selected solutions with detailed access options.

Read a single solution

Summary View

To focus on a specific solution, several review options are available. This initial summary view highlights key information such as main features, sectors, risks, stakeholders, financial data, contact personnel, reference websites, a brief description, and available images.

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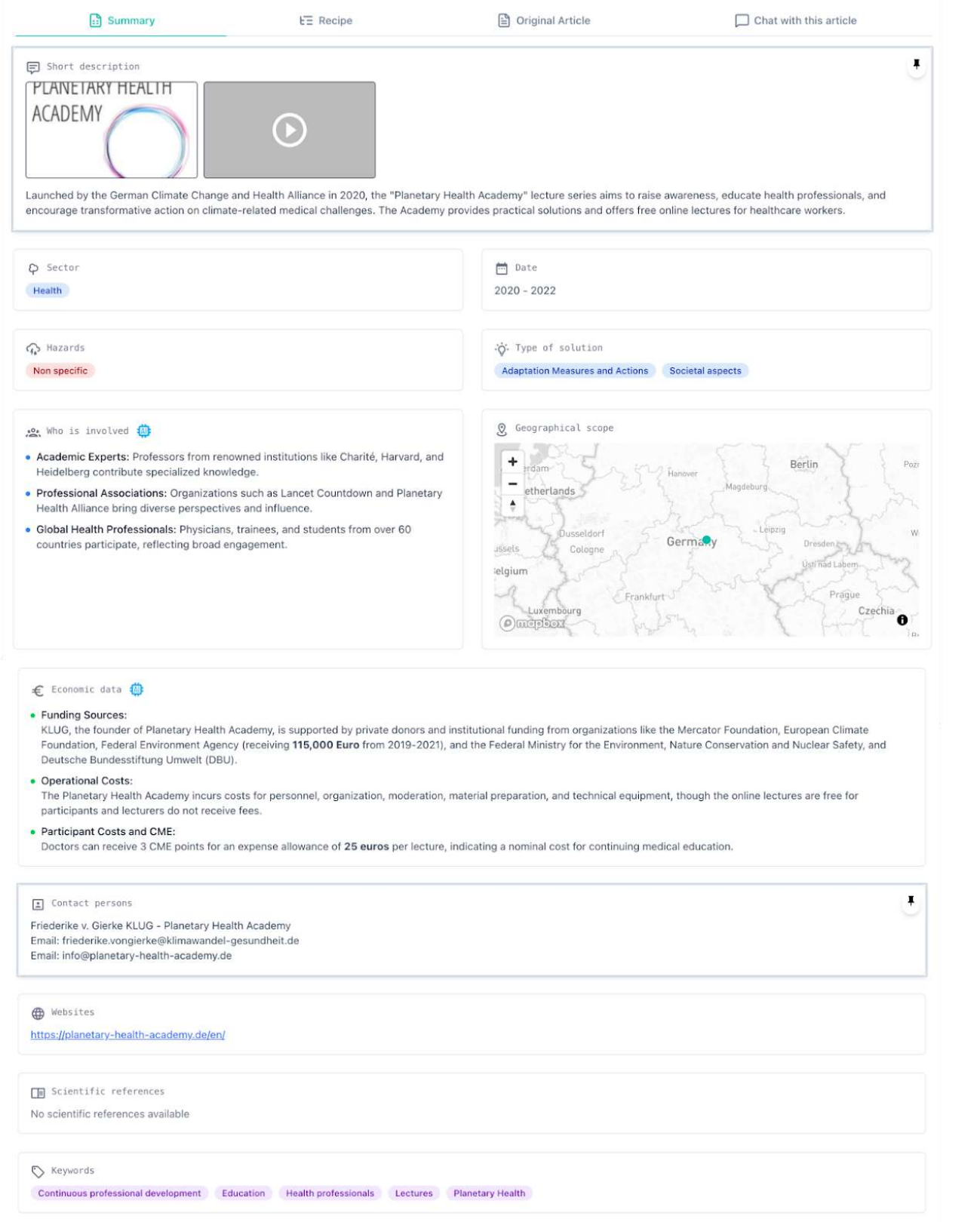


Figure 25. Summary view presenting key details of a selected solution.

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Recipe view

One key outcome of this project is the development of a document structure that better matches the type of content users seek, called a recipe. In the recipe view, articles are restructured to align with this standardized recipe format. AI models are used to identify which parts of the original article correspond to each section in the recipe structure. Sections that do not exist are left blank, while existing ones are placed in their respective placeholders. This approach provides a consistent and uniform viewing experience across all articles, regardless of their source.

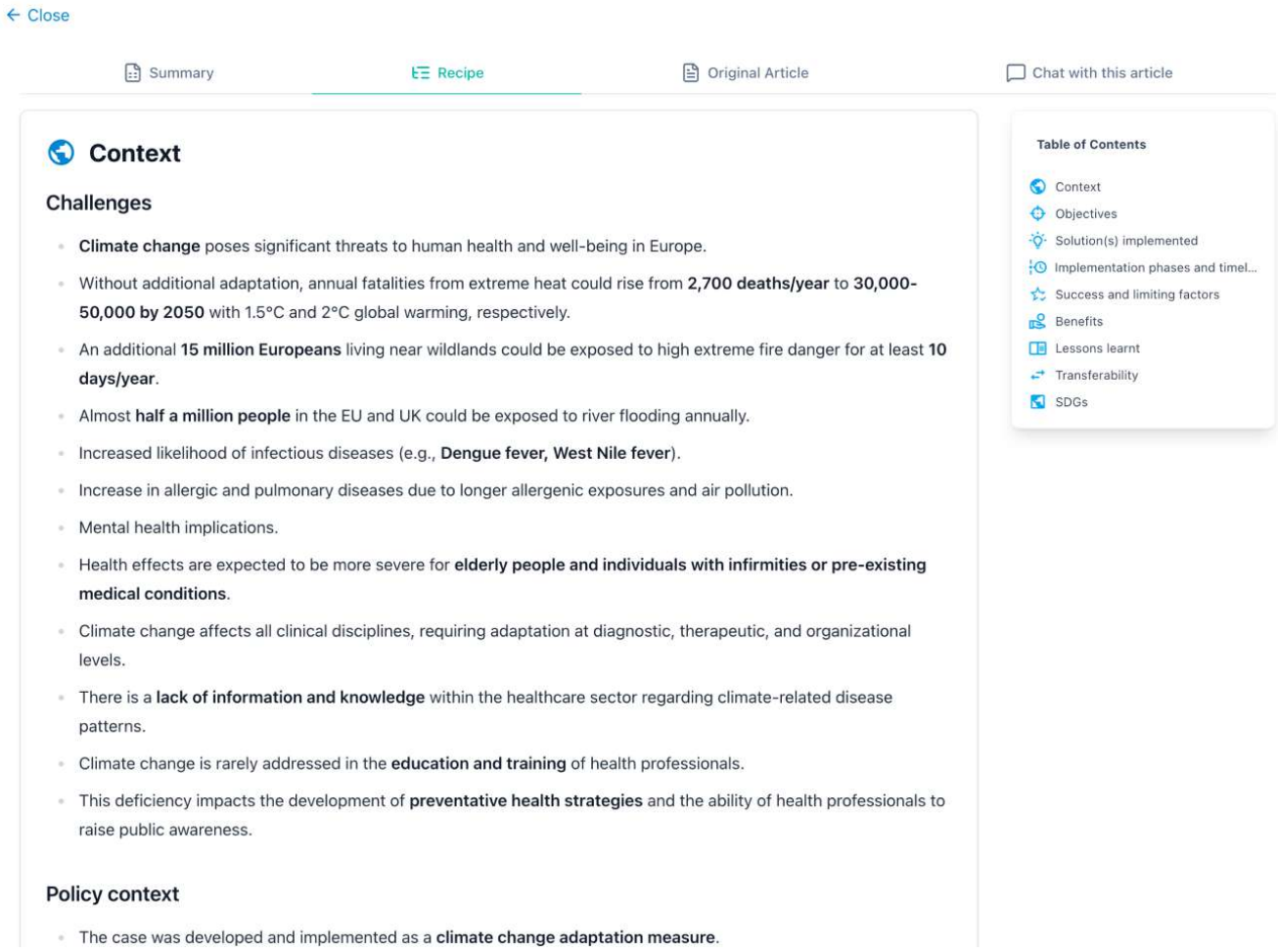


Figure 26. Recipe view presenting articles in a standardized, structured format using AI-assisted content mapping.

Original view

This view displays the article exactly as it was originally published, preserving its original format and structure.

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Case Studies

Climate Crisis and Health: Education of health professionals for Transformative Action, Germany

Share Download Preparing download © David Steinhart *Launched by the German Climate Change and Health Alliance in 2020, the "Planetary Health Academy" lecture series aims to raise awareness, educate health professionals, and encourage transformative action on climate-related medical challenges. The Academy provides practical solutions and offers free online lectures for healthcare workers.* The health sector plays a central role in communicating, preventing and following up on the effects of the climate and environmental crisis. Therefore, the inclusion of the topic of climate crisis and health in education, training for students and trainees and continuing education (continuous professional development, CPD) for all health professions must be ensured as a fundamental educational background in universities and educational institutions. To contribute to this, the German Climate Change and Health Alliance (KLUG e.V.) founded the first "Planetary Health Academy" lecture series in summer 2020 under the education project Climate crisis and Health: Education for Transformative Action, funded by the German Environmental Agency (UBA), the German Federal Environmental Foundation (Deutsche Bundesstiftung Umwelt - DBU) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. The Planetary Health Academy is a free online lecture series focussing on transformative action in addition to scientific foundations and transdisciplinary perspectives on Planetary Health. Planetary Health focuses on man-made issues such as global heating (climate crisis), the loss of biodiversity, pollution, and change of land use. It tries to find solutions to these problems that can help both humans and the environment thrive. The Planetary Health Academy is aimed at all interested parties from the healthcare sector including physicians, trainees, students and employees of all health professions. Over the semesters, the lectures provide theorical background but also more specific knowledge such as clinical content, with particular emphasis on the connection between various medical disciplines and planetary health.

Case Study Description

Policy context of the adaptation measure Objectives of the adaptation measure Adaptation Options Implemented In This Case

Additional Details

Stakeholder participation Success and limiting factors

Reference Information

Case Study Description

Challenges

Figure 27. Original view showing the unaltered article in its published format.

Chat view

Similar to the chat interface used for exploring multiple solutions, this view presents a chatbot designed specifically for in-depth interaction with a single article.

Curate Information

Board

In addition to various elements visible in the interface—such as images, solutions, or blocks for each solution—each item includes an icon for saving it. Saved elements are accessible through a separate interface called the "Board."

This board acts as a central information repository where users can store relevant content to support the creation of their own solutions in the future. The stored information can also be used for sharing or for generating multimedia content like presentations or images.

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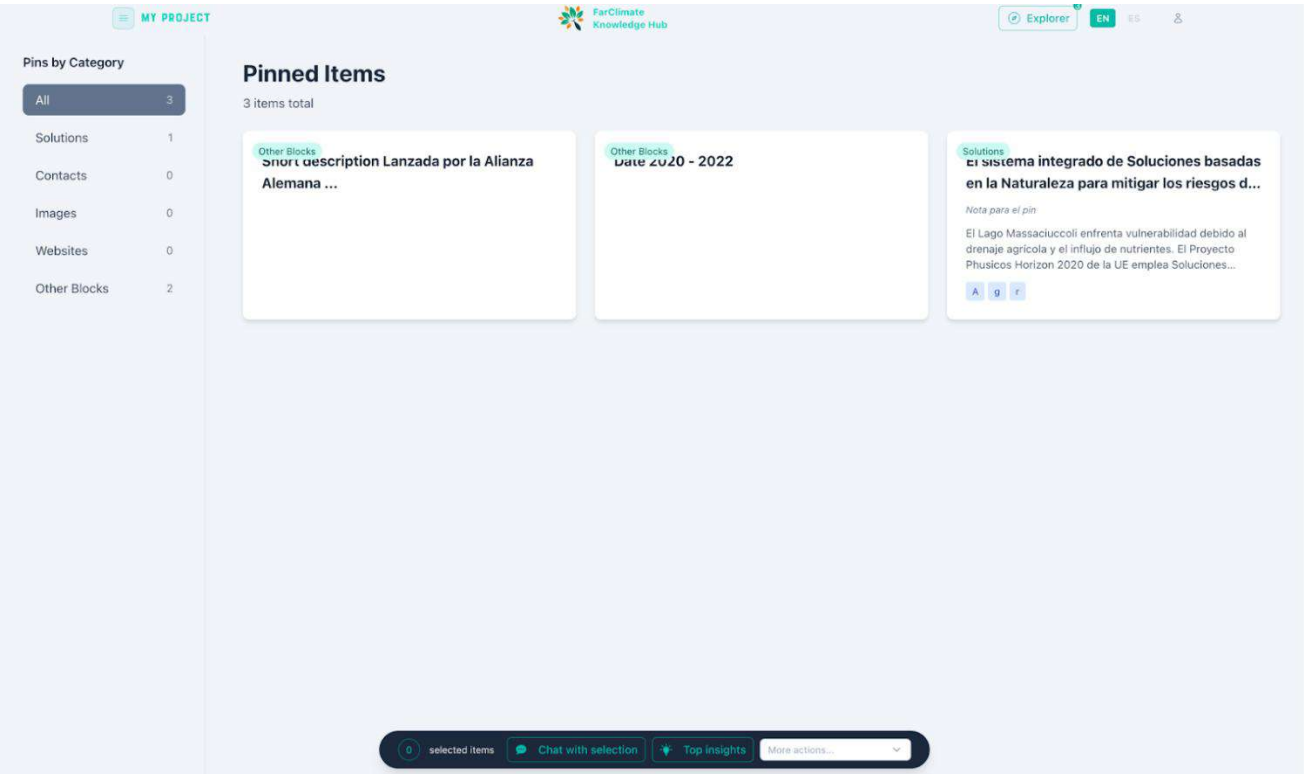


Figure 28. Curate Information board serving as a repository for saved elements and multimedia content creation.

Transformations / Outputs

Following the same pattern as the exploration screen, users can select elements and apply various transformations to them. Beyond the existing options such as "explore features," "summaries," and "chatbot conversations," a new set of operations called "outputs" is introduced. These outputs generate content tailored for communication initiatives or collaborative workflows, enhancing the versatility of the platform.

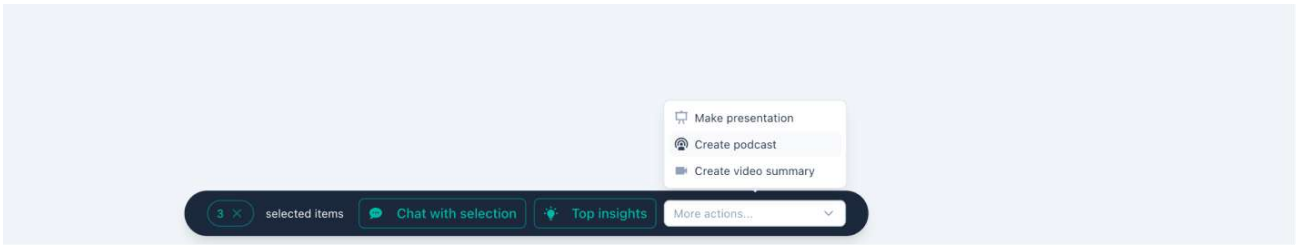


Figure 29. Transformations and outputs interface enabling advanced content generation for communication and collaboration.

Sharing

The sharing functionality allows users to generate a read-only version of a project that can be distributed via a link. Recipients accessing the project through this link view a restricted version where editing is not possible, but certain basic actions remain available. These include downloading the content or cloning the project into their own folder, if they are registered on the platform. This feature ensures the safeguarding of original contributions while enabling wider circulation and reuse of materials across different user groups.

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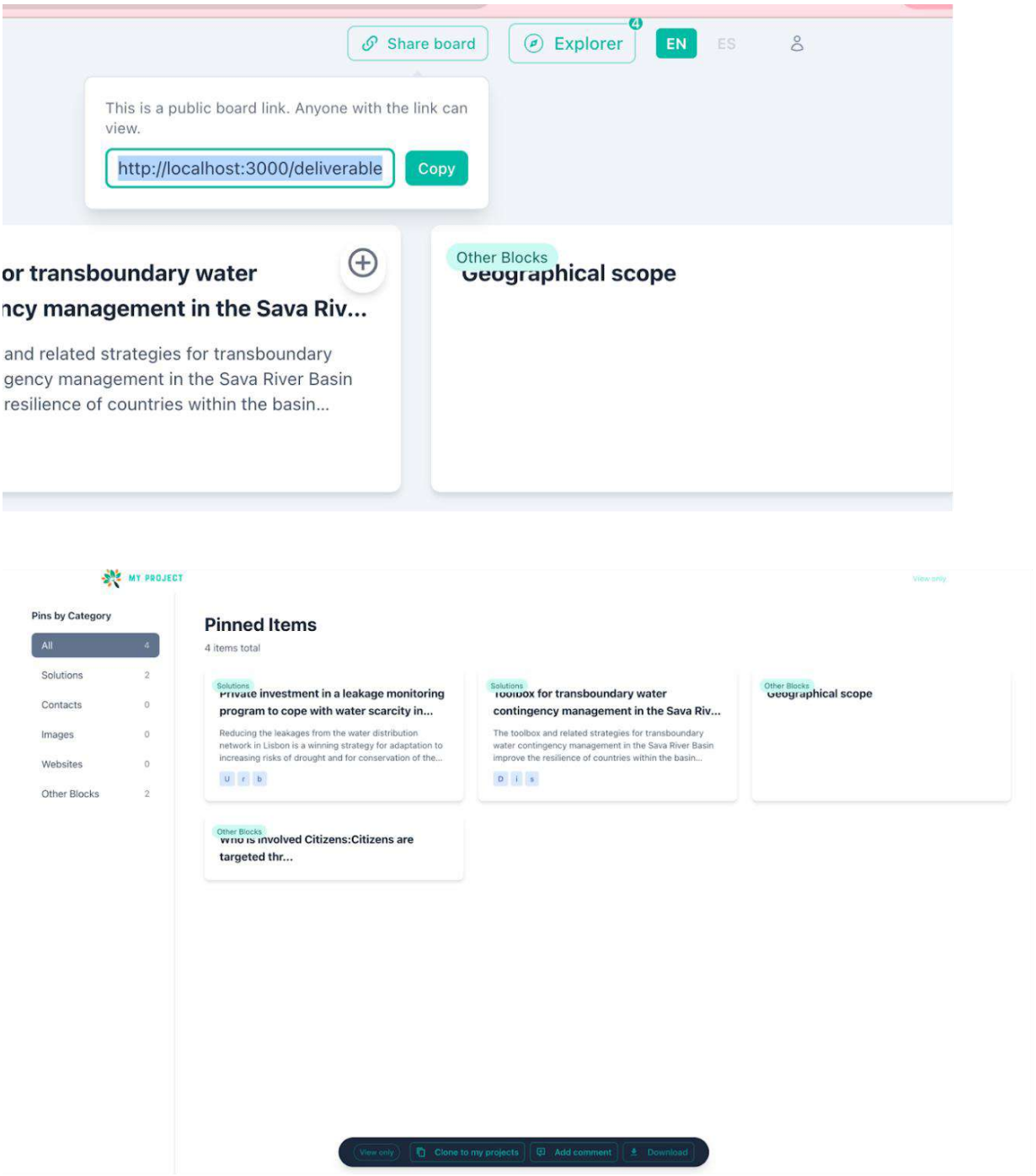
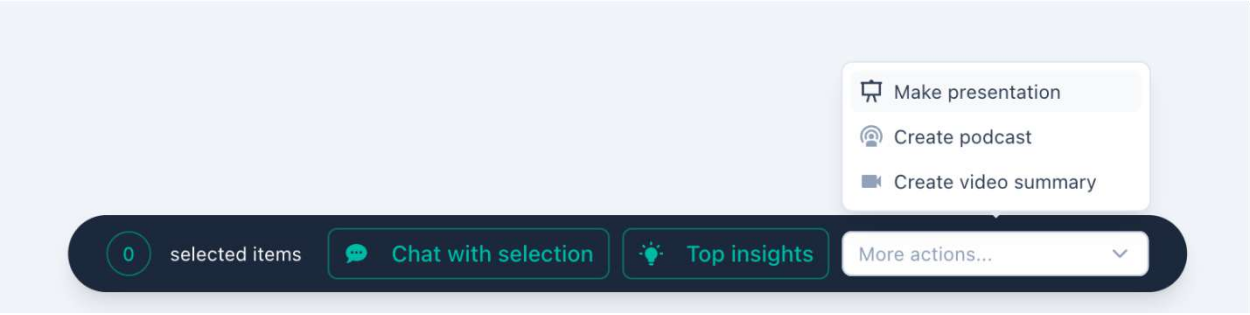


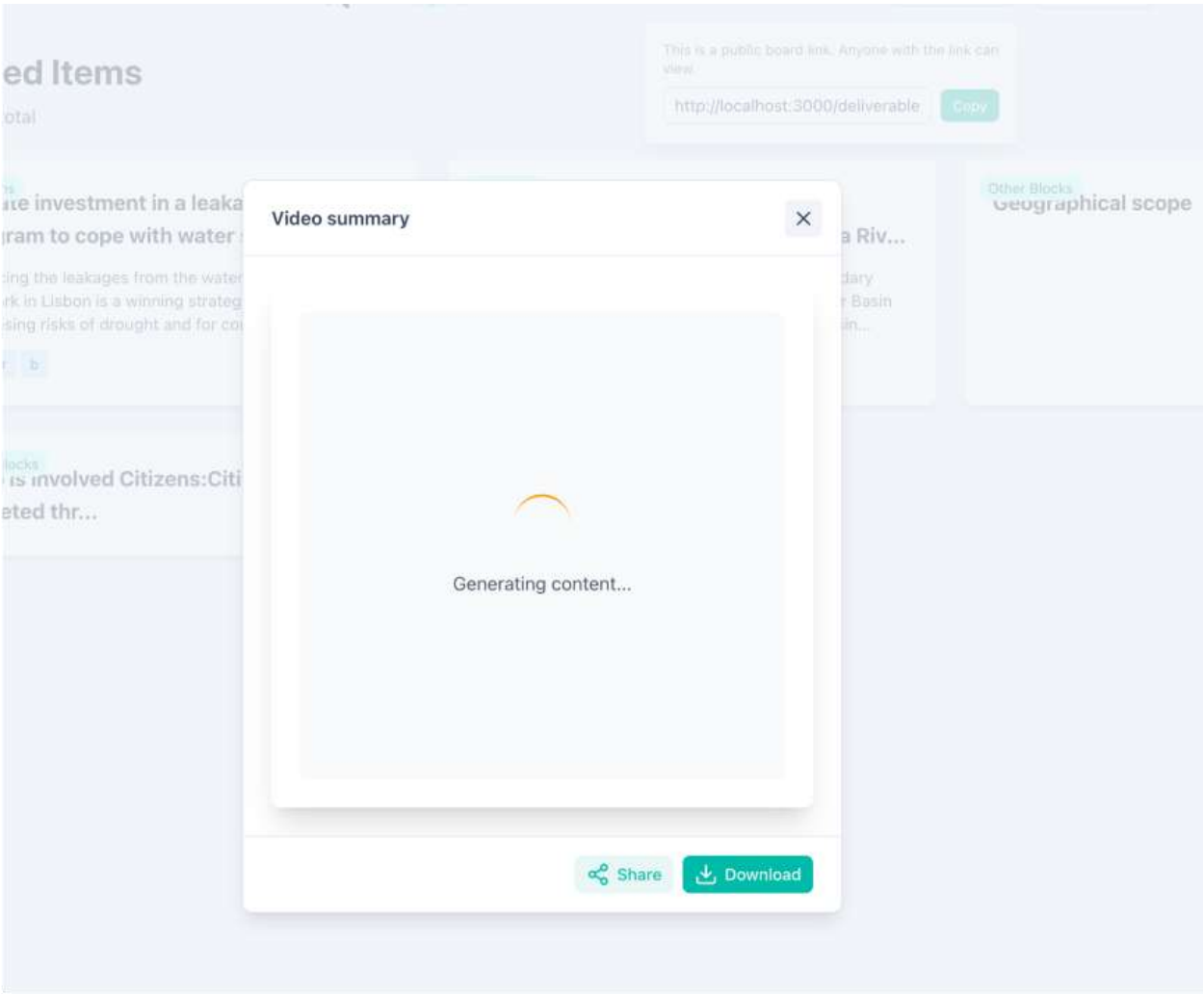
Figure 30. Sharing functionality.

Transmedia / content creation

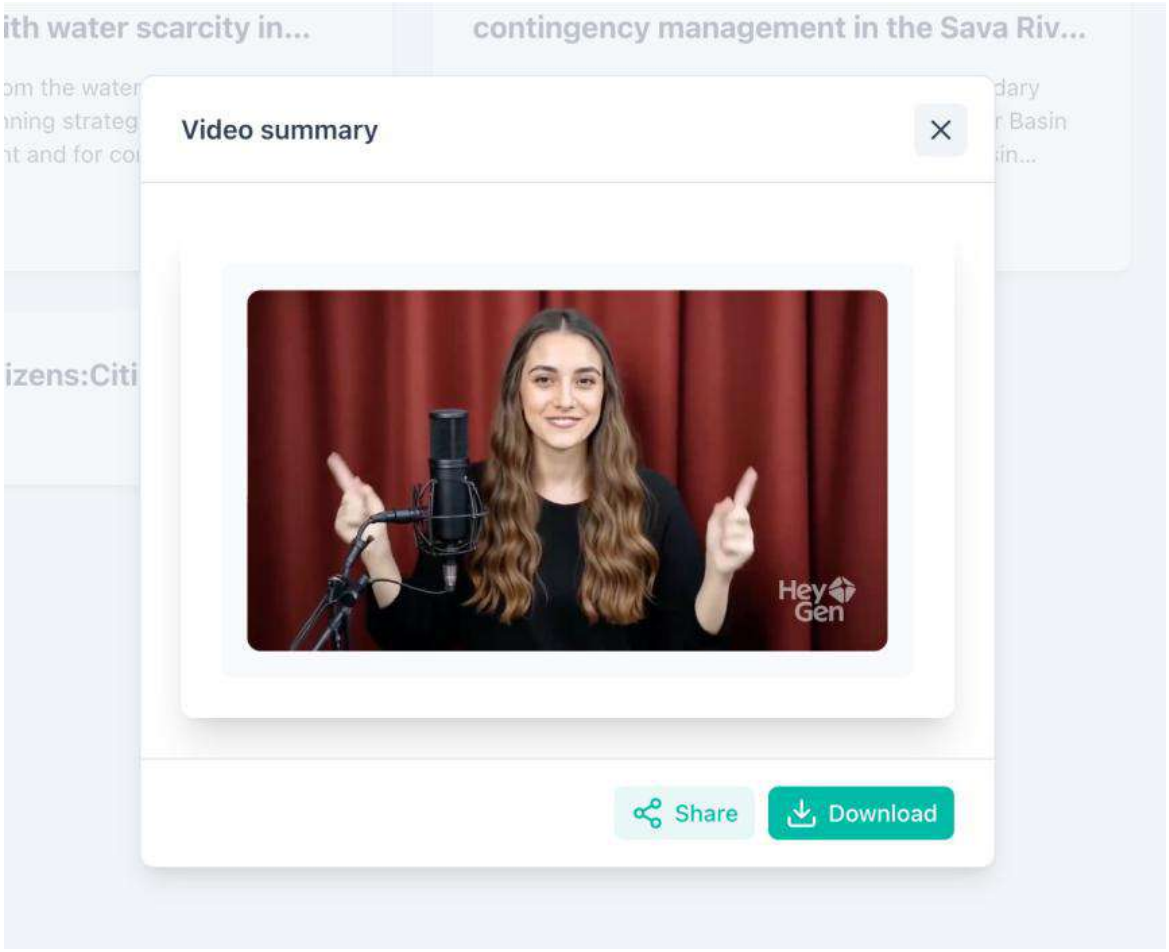
The transmedia functionality explores alternative formats for presenting articles and insights beyond plain text. As a first step, the interface offers options to generate short videos featuring a talking-head presentation or to create a podcast. This additional layer of content supports broader knowledge dissemination, enabling materials to be adapted for diverse audiences and contexts, including community outreach, presentations, and social media engagement.

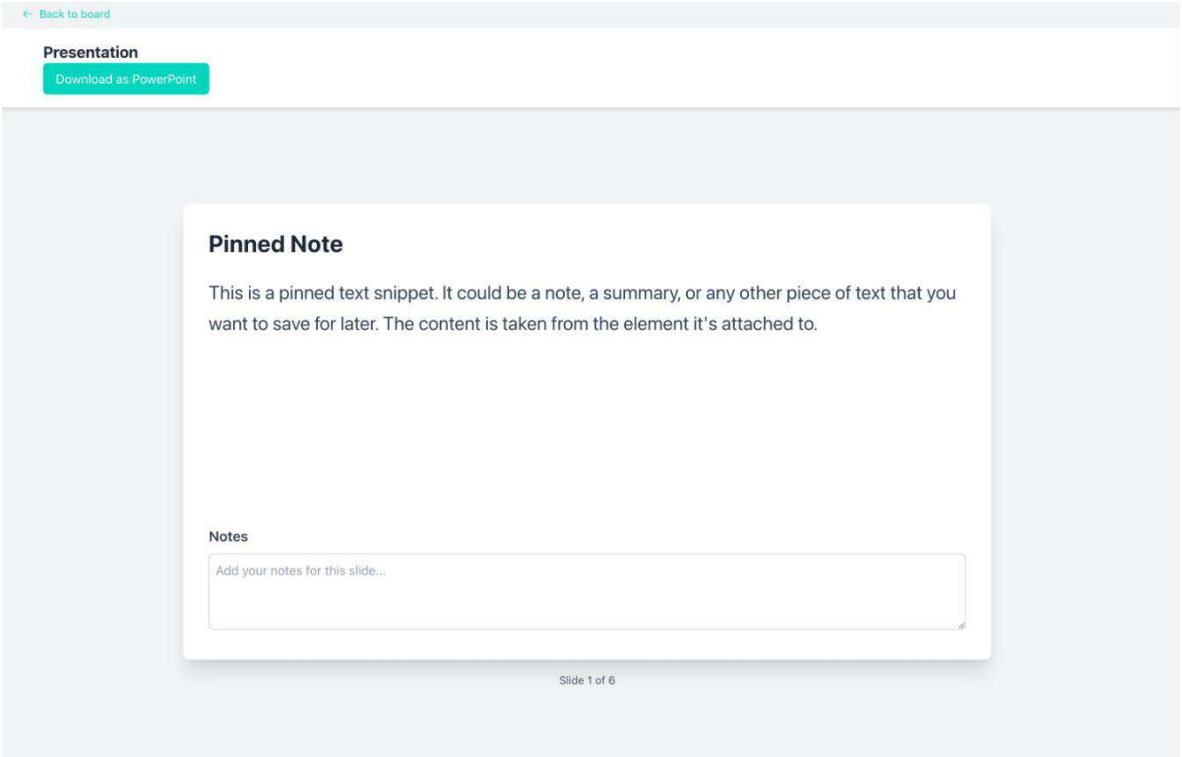
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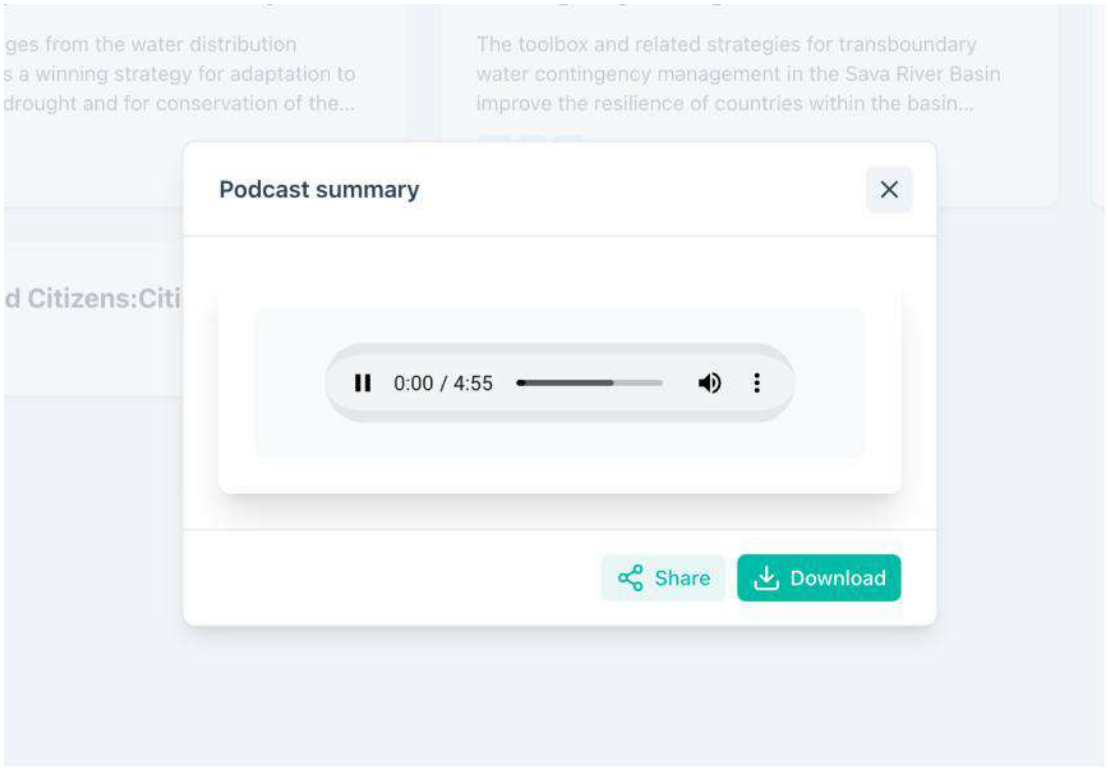


Figure 31. Wireframes of the transmedia content creation functionality.

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8. Conclusions and next steps

The present document reflects a significant milestone in the FARCLIMATE project by translating user insights and content strategies into a detailed, actionable design for the Transformation Hub platform. The platform's design prioritizes user needs, ensuring accessibility, relevance, and engagement through a modular, interoperable architecture and innovative AI integrations.

The standardized recipe structure facilitates clear and consistent communication of complex climate adaptation solutions, while narrative-driven visualizations enhance user comprehension and motivation. The multi-layered platform components work cohesively to deliver a seamless knowledge management and exploration experience.

Co-design activities have proven essential in refining the platform's features and interface, confirming the importance of continual user involvement in the development process to align functionalities with real-world demands.

The Transformation Hub's beta version was released in June 2026 and is currently undergoing user testing within the living labs, generating iterative improvements based on practical feedback (Task 7.3). Concurrently, the visualisation component Connected Action for EU Adaptation (Task 6.5) has been completed and integrated into the Hub, as detailed in D6.5. The Hub remains in this internal beta phase, not yet publicly accessible, until the release of its final version, planned for December 2026; refinement of the user experience and content will continue until the end of the project (September 2027), with lessons learned to be documented in D7.4 Lessons Learned from User Experience Evaluation. The co-design session 'Powering Up the Hub Together', planned with all partners at the La Rochelle transnational meeting (11 November 2026), will be a key milestone in this ongoing process: partners will explore the Hub's current functionalities and work collaboratively to incorporate their Living Lab solutions into the recipe structure, directly growing the Hub's documentary base beyond its initial beta content (see Section 6.1)

Prospects for integrating the Hub with other Mission-funded platforms and systems have not been defined at this stage. Rather than committing to a specific technical roadmap, FARCLIMATE considers this a question to be explored jointly with the EU Mission ecosystem and partner projects such as RESIST, through the engagement spaces described above (see Section 4.1), prioritising integration efforts where they offer clear added value for users rather than integration for its own sake. The Hub's long-term governance, ownership, and financial sustainability beyond the project's lifetime -including its commercialisation potential relative to Climate-ADAPT and other tools- are addressed in D8.4 Preliminary Exploitation Plan, with a fully developed account to follow in D8.5 Final Exploitation Plan.

Overall, the Transformation Hub represents a strategic advancement towards accelerating climate adaptation through digital innovation. It empowers primary users—local and regional actors in key economic sectors—with practical tools to access, share, and generate transformative climate knowledge. The foundational work documented herein sets a robust trajectory for future development, deployment, and scaling within the broader FARCLIMATE mission.

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Annex 1. List of projects in the Mission Projects Catalogue

1. **ARSINOE**
   Innovative, interconnected approaches to strengthen climate resilience at regional and local levels through co-developed solutions focused on water-related risks.
   Website: www.arsinoe-project.eu

2. **ClimEmpower**
   Empowering five vulnerable southern European regions with tools and strategies to enhance climate resilience through user-driven applications and capacity building.
   Website: www.climempower.eu

3. **IMPETUS**
   Multi-scale, cross-sectoral climate adaptation framework featuring Resilience Knowledge Boosters across seven EU biogeographical regions.
   Website: www.climate-impetus.eu

4. **Regions4Climate**
   Developing socially just and climate-resilient communities with cross-sectoral innovations and social equity.
   Website: www.regions4climate.eu

5. **RESIST**
   Fortifying capacity of vulnerable EU regions by implementing and scaling novel climate change adaptation solutions with strong citizen engagement.
   Website: www.resist-project.eu

6. **TransformAr**
   Accelerating transformational adaptation via demonstration of water-related innovation packages across diverse communities.
   Website: www.transformar.eu

7. **VALORADA**
   Harnessing existing data to enable sustainable, climate-resilient development through tools facilitating data sharing and informed planning.
   Website: www.valorada-project.eu

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8. **CLIMAAX**
   Climate risk and vulnerability assessment framework providing standardized yet flexible tools to support tailored regional adaptation.
   Website: www.climaax.eu

9. **Pathways2Resilience**
   Co-developing systemic pathways towards climate-resilient regions by empowering communities and embedding resilience into social and economic fabric.
   Website: www.pathways2resilience.eu

10. **REGILIENCE**
    Building regional climate resilience through knowledge sharing, collaboration and tailored demand-driven support in focus regions.
    Website: www.regilience.eu

11. **ARCADIA**
    Leading NbS adoption via regional strategies integrating innovation, stakeholder engagement and knowledge exchange across Europe.
    Website: www.arcadia-adaptation.eu

12. **CARDIMED**
    Mediterranean climate resilience through a unified framework and digital infrastructure promoting NbS and multi-stakeholder collaboration.
    Website: www.cardimed-project.eu

13. **ClimaGen**
    Demonstrating climate-resilient urban regeneration and renaturing to progress towards net-zero emissions in vulnerable neighborhoods.
    Website: www.climagen.eu

14. **Commit2Green**
    Participatory urban greening and renaturing, embedding ecosystem services into city planning and fostering citizen involvement.
    Website: www.commit2green.eu

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

15. **DesirMED**

    Demonstrating and mainstreaming NbS for climate-resilient transformation in Mediterranean regions with multi-level governance and local engagement.

    Website: www.desirmed.eu

16. **GreenInCities**

    Tackling urban inequality through integrated climate adaptation and regeneration in underserved areas using NbS and advanced technologies.

    Website: www.greenincities.eu

17. **LAND4CLIMATE**

    Enhancing resilience by mainstreaming NbS on private land, engaging landowners and stakeholders to scale ecosystem service benefits.

    Website: www.land4climate.eu

18. **MountResilience**

    Transformative CCA solutions tailored for climate resilience in European mountainous regions focusing on water, agriculture, infrastructure.

    Website: www.mountresilience.eu

19. **NATALIE**

    Accelerating NbS deployment for resilience in diverse European bio-geographical regions through demonstration, co-creation and digital tools.

    Website: www.natalieproject.eu

20. **NBRACER**

    Scaling NbS tailored for Atlantic regional climate resilience through community collaboration and integration in adaptation strategies.

    Website: www.nbracer.eu

21. **ReGreeneration**

    Revitalising marginalized urban areas into green, resilient, socially inclusive smart cities via NbS and community co-design.

    Website: www.regreeneration.eu

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

22. **URBREATH**

    Integrating NbS and advanced technologies like AI for transformative urban climate neutrality and resilience with community involvement.

    Website: https://urbreath.eu

23. **CLIMATEFIT**

    Closing the resilience financing gap by building capacity for resilient investment and co-designing innovative financing strategies.

    Website: www.climatefit-heu.eu

24. **PIISA**

    Piloting innovative insurance products and risk sharing models to catalyse proactive climate adaptation among households and sectors.

    Website: www.piisa-project.eu

25. **SOTERIA**

    Developing innovative insurance solutions for climate change adaptation and establishing communities of practice for scaling.

    Website: www.soteriaclimate.eu

26. **AURORA**

    Enhancing resilience to climate-related health risks using AI-driven monitoring, forecasting and tailored adaptation in the Boreal region.

    Website: www.auroraclima.eu

27. **healthRiskADAPT**

    Developing a health risk assessment system and adaptation options against heatwaves, pollution, fires and pollen threats.

    Website: (not provided)

28. **ISMED-CLIM**

    Mitigating climate-related health risks in the Mediterranean using innovative tools, citizen participation and multi-site living labs.

    Website: www.ismed-clim.eu

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29. **MOUNTADAPT**

    Developing healthcare adaptation solutions to reduce climate impacts in mountainous regions through monitoring and emergency management.

    Website: www.mountadapt.eu

30. **GENESIS**

    Demonstrating NbS for climate resilient water infrastructure in Macaronesia islands focusing on freshwater protection and management.

    Website: www.genesisnbs.eu

31. **ICARIA**

    Advanced modelling of climate hazards and risks to support adaptation of critical infrastructure in vulnerable European regions.

    Website: www.icaria-project.eu

32. **Med-IREN**

    Climate-proofing Mediterranean critical infrastructure with NbS and digital decision tools promoting governance and financing mechanisms.

    Website: www.med-iren.eu

33. **MIRACA**

    Toolkit development for multi-hazard infrastructure risk assessment supporting effective climate adaptation strategies.

    Website: www.miraca-project.eu

34. **NATURE-DEMO**

    Embedding NbS into critical infrastructure to enhance climate resilience via digital platforms and multi-country demonstration sites.

    Website: www.nature-demo.eu

35. **RISKADAPT**

    Online integrated platform enabling asset-level climate risk assessment and adaptation strategy development with multi-risk data.

    Website: www.riskadapt.eu

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

36. **ClimaPannonia**

    Large-scale uptake of systemic NbS for climate resilience in agricultural ecosystems in the Pannonian region.

    Website: www.climapannonia.eu

37. **DRYAD**

    NbS demonstration and modelling to improve resilience of Mediterranean agro-silvo-pastoral ecosystems through community engagement.

    Website: www.dryad-project.eu

38. **Precilience**

    Precision climate resilience testing for agriculture and forestry sectors in European boreal regions via co-created solutions.

    Website: www.precilience.eu

39. **TRANSFORM**

    Developing adaptation roadmaps and crop rotations as NbS to enhance agricultural resilience in key EU regions.

    Website: www.transform-rotations.eu

40. **Adaptation AGORA**

    Supporting community-based adaptation through co-designed, innovative and democratic climate resilience solutions.

    Website: www.adaptationagora.eu

41. **CLIMAS**

    Toolbox empowering citizen engagement for societal resilience using citizen science and design thinking approaches.

    Website: www.climas-project.eu

42. **FARCLIMATE**

    Developing climate-resilient agriculture, forestry and fisheries measures through community engagement and business involvement.

    Website: www.farclimate-project.eu

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

43. **OCEANIDS**

    Climate-informed maritime spatial planning and inclusive blue economy governance through user-driven applications for coastal resilience.

    Website: www.oceanids-project.eu

44. **SpongeBoost**

    Enhancing freshwater ecosystems' sponge functions to deliver multi-benefit green deal solutions for climate adaptation.

    Website: www.spongeboost.eu

45. **SpongeScapes**

    Improving sponge functioning at landscape scales in European catchments for resilience to hydrometeorological extremes.

    Website: www.spongescapes.eu

46. **SpongeWorks**

    Upscaling sponge landscapes by co-creating natural water retention solutions and sustainable management in river basins.

    Website: www.spongeworks.eu

47. **FairFuture**

    Supporting local and regional authorities in developing just climate adaptation pathways that embed risk assessment into policy while fostering equitable, inclusive decision-making.

    Website: www.fairfutureforclimate.eu

48. **JUST4CARE**

    Strengthening urban climate resilience by embedding justice, equity, and inclusion into regional planning through co-created, data-driven adaptation solutions.

    Website: www.just4care.eu

49. **JustREACH**

    Equipping local and regional authorities and communities with practical tools and evidence-based guidance to align climate adaptation with economic, ecological, and social justice goals.

    Website: www.justreach.eu

50. **JUSTSAFE**

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Designing inclusive climate resilience and digital transition strategies that prioritise equitable participation and community empowerment for disproportionately affected groups.

Website: www.justsafe-project.eu

51. **SMARTER**

Enabling transformative, systemic climate adaptation across sectors, scales, and governance levels through integrated tools and standards that strengthen synergies and replicability.

Website: www.smarter-resilience.eu

52. **SystR**

Strengthening systemic resilience to cascading climate impacts by bridging science and policy, breaking sectoral silos, and developing place-based transformative strategies.

Website: www.systemicresilience.eu

53. **TiCCA4DANU**

Accelerating inclusive societal transformation for climate resilience by addressing governance and structural barriers, engaging public authorities, vulnerable groups, and the private sector.

Website: www.ticca4danu.eu

54. **UNDERPIN**

Co-developing and validating an outcome-oriented monitoring framework to measure the effectiveness of climate adaptation solutions, supporting the EU Adaptation Strategy's 2050 resilience objectives.

Website: www.underpinclimate.eu

55. **AdaptationHubs**

Strengthening multi-level governance for climate adaptation by linking the EU with regional and local authorities, promoting peer-learning and implementation of the European Climate Law.

Website: www.adaptationhubs.eu

56. **REGILIENCE+**

Bridging gaps in access to practical climate adaptation knowledge by identifying and sharing effective solutions with local and regional authorities.

Website: www.regilience.eu

57. **COAST-SCAPES**

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Co-designing systemic, nature-based resilience solutions for vulnerable coastal landscapes that enhance biodiversity, reduce climate risks, and strengthen cross-sector governance.

Website: www.coast-scapes.eu

58. **GRACE**

Strengthening resilience in remote rural areas by empowering communities to co-develop nature-based, circular, and digitally supported adaptation solutions.

Website: www.grace-project.eu

59. **NURISH**

Strengthening rural climate resilience through a Regenerative Rural Resilience Framework combining nature-based, technological, and circular solutions with local governance support.

Website: www.nurish-project.eu

60. **REHUBS**

Accelerating climate resilience in vulnerable rural and small communities by strengthening local capacity to plan, finance, and implement long-term adaptation solutions.

Website: www.rehubs-project.eu

61. **TerraTwin**

Developing a Digital Twin integrating climate, biodiversity, and socioeconomic data to support evidence-based adaptation decisions through scenario projections and anomaly detection.

Website: www.terratwin.eu

62. **Trees4Adapt**

Strengthening understanding of the links between climate change and biodiversity through evidence-informed tools and Nature-based Solutions.

Website: www.trees4adapt.eu

63. **BLOSSOM**

Bridging the gap between public climate ambition and private investment by linking authorities with financial actors and testing bankable financing solutions.

Website: www.blossom-project.eu

64. **CLIMINVEST**

Improving the bankability of climate adaptation projects through validated tools that help stakeholders create financially viable initiatives and integrate adaptation into ESG-driven portfolios.

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Website: www.climinvest-horizon.eu

65. **RISE-IN**

Increasing investment attractiveness of nature- and ecosystem-based adaptation solutions by assessing co-benefits and identifying innovative, participatory financing opportunities.

Website: www.rise-in.eu

This project has received funding under the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101112860 and from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Annex 2. Key Type Measures typology

The Key Type Measures (KTM) typology provides a standardized framework for categorizing climate adaptation actions. Developed to facilitate consistent reporting and comparison across different regions, KTMs cluster a diverse array of adaptation options into broad categories such as governance, financial strategies, technological solutions, nature-based approaches, and behavioural change initiatives. This common language enhances clarity and coherence when describing the types of measures implemented to address climate risks, supporting better policy-making and knowledge sharing.

KTM	Sub-KTM[17]	Specifications
A: Governance and Institutional	**A1: Policy instruments**	• Creation / revision of policies • Creation / revision of (implementing) regulations
	A2: Management and planning	• Mainstreaming adaptation into other sectors • Creation / revision of technical rules, codes and standards
	A3: Coordination, cooperation and networks	• Creation / revision of ministerial coordination formats • Creation / revision of stakeholder networks
B: Economic and Finance	**B1: Financing and incentive instruments**	• Creation / revision of incentive mechanisms • Creation / revision of funding schemes
	B2: Insurance and risk sharing instruments	• Creation / revision of insurance schemes and products • Creation / revision of contingency funds for emergencies
C: Physical and Technological	**C1: Grey options**	• New physical infrastructure(s) • Rehabilitation, upgrade and / or replacement of physical infrastructure(s)
	C2: Technological options	• Early warning systems • Hazard / risk mapping • Service / process applications
D: Nature Based Solutions and Ecosystem-based Approaches	**D1: Green options**	• Creation of new / improvement of exiting green infrastructure • Natural and / or semi-natural land-use
	D2: Blue options	• Creation of new / improvement of existing blue infrastructure • Natural and / or semi-natural water and marine areas management
E: Knowledge and Behavioural change	**E1: Information and awareness raising**	• Research and innovation • Communication and dissemination • Decision support tools and databases
	E2: Capacity building, empowering and lifestyle practices[18]	• Identification and sharing of good practices • Training and knowledge transfer • Reporting on lifestyle practices and behaviours

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Annex 3. Pilot examples of applying the recipe structure to climate adaptation solutions from Climate-ADAPT

3.1. Forestry

SECTOR: Forestry

Category: Implemented

GEOGRAPHICAL SCOPE: Kassel, Gießen, Darmstadt (Germany), Continental Biogeographical region

Hazards: Droughts, Extreme Temperatures

Type of solution:

D. Nature based solutions and ecosystem-based approaches – D1. Green options: Afforestation and reforestation as adaptation opportunity, Forest restoration after climate-related disasters

IN SHORT

Title: How to choose climate adapted tree species: Decision support for forest owners in Hesse, Germany

Who: The project partners were the forest owners and advisers: HessenForst, responsible for the state forest and parts of municipal- and private forest, and the Hessian Forest Owners' Association, responsible for all other parts of municipal and private forests. Both provided advice and data throughout the project and were involved in the knowledge transfer processes.

A survey of forest owners and advisors was carried out to develop strategies to promote awareness and use of the decision support tools for municipal and private forests. Since the early steps of the project, stakeholder involvement favoured the acceptance and uptake of recommendations from forest owners

Date: 2018-2025

Short description (include images/video): Climate change and the rapidly changing tree growth conditions pose major challenges for forest ecosystems and the forest sector as a whole. The best way forest management can prepare and mitigate risks is by choosing and mixing adapted tree species based on scientific recommendations. These mixes will allow the forest to thrive under future climate and site conditions.

For each forest site in Hesse a combination of complementary tree species, so called "forest development types" were identified, based on the nutrient and water availability under climate change conditions. These recommendations are intended to support foresters and forest owners in their decisions regarding the optimal choice of tree species.

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The North-West German Forest Research Institute (NW-FVA) has developed the recommendations in the project "Maps for Climate risk and forest development types – improved consulting foundation for new challenges for Hessian forest owners", IKSP-Hessen) funded by the Ministry of Environment, Climate Protection, Agriculture and Consumer Protection, State of Hesse as part of the Integrated Climate protection plan 2025, in collaboration with the German Forest Owners Association for all types of forest ownership in Hesse. This is intended to secure the multiple functions of forests in the long term, but this will also be of particular importance for the reforestation of damaged areas.

The recommendations are publicly accessible and free of charge via a web portal and a smartphone application. Nationwide training for foresters and courses for forest owners are available to help disseminate and implement knowledge about future risks and forest adaptation options.

Economic data: The total cost of the project was 5.655.000 EUR and mainly included personnel cost. The use of tools developed in the project is free for all users. Costs for restoring forests are variable according to the site conditions and to the extent of the area to be restored. An example can be found in the case study "Large- scale forest restoration solutions for resilience to multiple climate stressors in North Rhine-Westphalia, Germany"

Reference information:

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Websites

https://www.nw-fva.de/unterstuetzen/software/baem/hessen

https://www.nw-fva.de//forschen/projekte/ksp-hessen

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https://www.youtube.com/watch?v=mk8XUrf-3sU&t=7s

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Key words: Climate-adapted forestry, Decision support tools, Mixed-species forests,

Knowledge transfer, Drought resilience

SOLUTION DESCRIPTION

Context:

Challenges

Climate change poses many uncertainties for forest managers. The projections predict climate change to be widespread, rapid and intensifying. Therefore, climate scenarios must always be re-examined for tree species recommendations and changes incorporated in forestry decision-making.

Regional climate change projections are not so clear, especially when it comes to the seasonal distribution of precipitation. Furthermore, not only soil characteristics, but terrain conditions such as slope or exposure have a strong impact on the water supply at a specific site. This makes spatially differentiated modelling of climate change effects necessary. In the region of Hesse, the focus is on modelling of water supply, because climate change is increasing the risk of drought stress for tree species in many areas, thereby limiting their suitability. This is due not only to change in precipitation patterns but also to increase of evaporation, related to increasing temperatures. Especially during the warm summer months, this will result in an increasing water deficit in many locations in the future. Projections are particularly severe if the IPCC (2014) RCP 8.5 emissions scenario is considered.

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One of the challenges is to find an indicator for drought stress. It should be calculated for all forest sites in Hesse and should be suitable for assessing the risk of tree species so that recommendations can be made using threshold values.

The damage in recent years caused by storms, drought and bark beetle infestations illustrates the urgency of adapted forest management. Especially in large-scale areas of damage, decisions about reforestation must be made quickly. Those decisions must take the expected climate changes into account, thereby minimizing the risks of future damages and leading to the long-term preservation of vital, stable forests.

Policy context

Case developed and implemented as a climate change adaptation measure.

Legal aspects

The Integrated Climate protection plan 2025, State of Hesse, implements the German Federal government's climate protection plan at state level. It consists of a wide-ranging package of measures for climate change mitigation and adaptation.

According to the Hessian Forest Act, forest owners are free to decide which tree species to choose. However, they are obliged to reforest areas within six years (§7 HWaldG).

The state of Hesse supports forest owners in repairing damage to the forest caused by extreme weather conditions. The recommendations of the NW-FVA are bindingly integrated into the state regulations that establishes a forest subsidies programme ("Richtlinie für forstliche Förderung in Hessen", 30 April 2018, and "Richtlinie zur Förderung von Maßnahmen zur Bewältigung der durch Extremwetterereignisse verursachten Folgen im Wald in Hessen, Extremwetterrichtlinie-Wald, 1 April 2021)".

Objectives: The recommendations for climate-adapted tree species compositions in Hesse, developed as part of the IKSP-Hessen project have the following objectives:

1. To provide site specific information for unmapped forest areas in Hesse's municipal and private forests as a basis for selecting tree species appropriate to the location, as only 80 % of the forests have already been mapped. In this context, the project aims to better spatially represent water and nutrient balance, especially in the broad spectrum of sites mapped as "mesotrophic".

2. To develop silvicultural recommendations forward - looking to the year 2100. The regional climate scenarios from the core ensemble of the ReKliEs-De state-level expert group are used for this purpose.

3. To identify ''forest development types", consisting of a recommended mixture of tree species that complement each other in their growth patterns, in order to minimise or reduce the risk of damage due to climate change.

The final goal is that results are made available to all Hessian forest owners, implementing a new and user-friendly information system usable by forest owners without in-depth technical knowledge.

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Solution(s) implemented: The project included three main activities: (i) mapping site specific characteristics under current and future conditions, (ii) development of recommendations ('recommended forest development types') and (iii) knowledge transfer to favour the uptake of recommendations by forest owners (Web-Service for climate-adapted tree species), as detailed below.

1. Mapping site specific characteristics

Understanding site specific characteristics, such as available water and nutrient supply, is essential for choosing suitable tree species for any forest site. Soil site maps were available at the start of the project for the majority of forest areas in Hesse. In order to close the gap of 20 % undocumented forest area and improve the mapping results, computer models were developed at the NW-FVA to derive the trophic state, the climatic water balance (difference between precipitation and potential evapotranspiration) and the usable field capacity (water available for plants after replenishment in the winter months) for all the forests sites. To compute the area-based estimation of the usable field capacity a total of 4.179 soil profiles were prepared. In addition, the soil map of the Hessian State Surveying Office was used to estimate the trophic levels (Heitkamp et al., 2020). The core element was the assessment of the future water supply by assessing the site water balance during the vegetation period. This parameter consists of the usable field capacity and the climatic water balance. The climatic water balance used is based on climate projections of the RCP 8.5 emissions scenario (IPCC 2014), calculated with the global model ECHAM 6 and the STARS II statistical regional model as the mean value for the reference period 2041 – 2070. In order to establish the local reference, a combined method of inverse distance weighting and height regression was used to scale down to a 50 x 50 m grid.

The new NW-FVA site map thus contains comprehensive information on trophic levels and future site water balance for the entire forest in Hesse, allowing greater weight of climate considerations in the selection of tree species.

2. Development of recommended forest development types

Tree species are categorised according to their water and nutrient requirements using threshold values of the drought stress index. Tree species which complement each other in terms of their ecological requirements and growth behaviour are matched to form mixed stand types, or forest development types.

Depending on the fulfilment of its ecological requirements for the site, the role of a tree species in mixed forests can be classified as leading, mixed, accompanying or excluded from cultivation. In addition to the site water balance and trophic criteria, recommendations also contain some silvicultural and economic settings (e.g. exclusion of pine and birch on water and nutrient-rich sites). For hydromorphic sites, i.e. soils influenced by groundwater and backwater, the allocation of tree species using the site water balance is not suitable, since the usable field capacity is not meaningful here. Instead, they are categorised by the previous system according to the terrain water regime and trophic level.

The main arguments in favour of mixed forests are their greater stability and their generally higher resilience in compensating for disturbances. Forest development types are used in silvicultural planning. They are described by models of the desired forest structure that e.g. categorise their successional position and specify development goals with regard to their protective and recreational function. Timber production targets are included in the form of

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target diameters and production periods. Percentages of tree species are defined for both development and regeneration targets. Site-specific planning information can be derived for each tree species recommended in a forest development type.

The catalogue of forest development types for municipal and private forests comprises 34 forest development types. They are already being utilised by numerous forest owners. The number of visits to the web portal in August 2024 is more than 296,000 (number of clicks) and it is growing. Due to the risk of misinterpretation by non-expert users, the NW-FVA generally advises consulting with specialised forestry personnel.

3. Web-Service for climate-adapted tree species

The decision support system for climate-adapted tree species selection was integrated into HessenForst's operational GIS and made available to forest owners as a freely accessible Web portal (https://www.nw-fva.de/baem/). In addition, the REST-Web-Service on which the entire service is based and the WMS (web map service) can be easily integrated into other software products. The NW-FVA website also contains a quick guide to using the service. The catalogue of forest development types, further background information and the classification tables are available for download.

In the web application, a click on the map opens a table with information on the position, forest site characteristics and recommended forest development types at each forest location throughout Hesse.

To complement the web portal, an app was developed for the Android and iOS (Apple) operating systems for mobile devices. The advantage of the app is that it determines the position of a forest location via GPS. It enables information to be retrieved immediately, so that an assessment of the existing silvicultural situation can be linked directly to the forest site. If there is no internet access available, the selected location is saved and can be opened later to retrieve the associated information. Positioning is particularly helpful if there is no forest division or map basis or if it is difficult to draw boundaries, for example in small private forests.

Finally, the catalogue of forest development types serves as the basis for subsidies from the administrative bodies. The state of Hesse is funding the reforestation of open spaces that have been affected by the extreme drought between 2018 and today. The selection of a forest development type recommended at a specific location is mandatory for forest owners and a prerequisite for receiving subsidies for planting and maintenance.

Implementation phases and timeline:

The project started in 2018 and runs until 2025. The web portal was made available for the first time in October 2020. After intensive further development, a comprehensive update was carried out in May 2023.

The selection and planning of specific restoration or planting measures may take up to one year. Continuous management of the forest stands is important in order to maintain an adapted mixed forest that can provide all ecosystem services. There are corresponding management recommendations for each forest development type, differentiated according to pre-thicket stage, thicket stage, qualification stage and dimensioning stage as well as the maturity and regeneration stage.

The decision support tool is designed to be permanent and is updated on an ongoing basis.

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Success and limiting factors:

Success factors:

In order to put the results into practice as quickly and efficiently as possible, the knowledge transfer process took place on several levels and this represented a key success factor of the project.

First, the composition of the project participants, that involved the HessenForst and the Hessian Forest Owners' Association meant that experienced practitioners were involved in the development and interpretation of the results from the project start. This ensured recognition of the recommendations provided and active incorporation into forest planning from the outset. Therefore, the first validation took place during the ongoing process before the results were presented and made available to the general public. This approach considerably increased the acceptance of the developed tree species recommendations.

A second level of knowledge transfer lies in easy-to-understand documentation and making the results publicly available in a form that transparently supports forest owners and foresters in their decisions. A digital decision support system (DSS) war therefore designed as a suitable tool. This is publicly accessible via an NW-FVA web portal, where forest owners can easily identify their stands and access/download the tree species recommendations developed in the project. A mobile version for Android and iOS mobile phones has also been developed. These applications are the easiest way to locate sites using the GPS function of the mobile device.

As the third stage of knowledge transfer, active training courses were organised in close cooperation with HessenForst in all forestry offices. Lectures were also given at events organised by the Hessian Forest Owners' Association. Free training courses are also offered to forest owners in their own forests. The courses and the web portal were advertised via flyers and adverts in specialized journals. In addition, the creation of video user manuals has begun. These are also available on the NW-FVA website.

Surprisingly, several other sectors, such as environmental planning offices, nature conservation authorities, and entities responsible for drinking water extraction and dams or road construction, expressed interest in using tree species recommendations and in integrating the service into their GIS portals. This demonstrates the success of the initiative undertaken by NW-FVA.

A similar approach, based on the same concept of forest development types, was implemented in the North-Rhine Westphalia state (Germany), within the SUPERB project (see the case study Large forest restoration solutions in NRW), suggesting the replication potential of the project.

Limiting factors:

Although there is a great need for advice and the recommendations were bindingly integrated into the state subsidies for reforestation projects, the tree species recommendations are not established as a new standard yet.

The invitation to provide feedback and the training programme were welcomed, but not to the extent hoped for. In-depth knowledge in the complex field of tree species selection in a changing climate is considered necessary to avoid misinterpretations. Moreover, the target group of decision-makers in the forest is very heterogeneous, requiring high efforts in communication. To overcome these limitations, a training programme will be maintained in the

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long term. On-site training is preferred, but instructional videos are also desired. This will be considered to improve the uptake of recommendations.

Benefits: Silvicultural planning using forest development types that recommend mixed forests will provide greater stability and generally higher resilience to disturbances. This will not only ensure environmental and economic benefits but also secure maintenance of other forest ecosystem services. Though not specifically quantified, it will also support climate regulation, water regulation and supply, erosion control, habitat provision, and recreation.

Lessons learnt: The development of decision support tools for selecting climate-adapted tree species in Hesse has demonstrated the importance of close collaboration between researchers, forestry practitioners, and forest owners. Early stakeholder involvement ensured high acceptance and practical relevance of the recommendations. Additionally, providing accessible digital tools (web portals and mobile apps) significantly facilitated knowledge transfer and uptake among diverse user groups. However, the complexity of climate adaptation measures requires continuous training and clear communication to avoid misinterpretations by non-expert users. Sustained educational efforts remain essential to fully integrate these recommendations into standard forestry practices.

Transferability: This approach is highly transferable to other regions facing similar climate-related forestry challenges. Key transferable elements include the methodology for mapping site-specific characteristics under future climate scenarios, development of mixed-species forest recommendations ("forest development types"), and user-friendly digital decision support systems. Successful replication elsewhere would require adapting the tools to local ecological conditions, ensuring robust stakeholder participation from the outset, and providing ongoing training programs. Similar initiatives have already been effectively implemented in other German states, confirming the broad applicability of this model.

3.2. Agriculture

SECTOR: Agriculture

Category: Implemented

GEOGRAPHICAL SCOPE: Hungary's Great Pannonia plain (Hungary), Pannonian Biogeographical region

Hazards: Flooding

Type of solution:

D. Nature based solutions and ecosystem-based approaches – D2: Nature based Solutions and Ecosystem based approaches: Rehabilitation and restoration of rivers and floodplains, Improved water retention capacity in the agricultural landscape.

A. Governance and institutional policies - A2: Governance and Institutional: Management and planning: Adaptation of flood management plans

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IN SHORT

Title: Temporary flood water storage in agricultural areas in the Middle Tisza river basin - Hungary

Who: The initial purpose of the plan was to include a wide, multi-disciplinary and multi-sectoral participation in the strategy planning process. This has not been fully accomplished in the implementation phase (Sendzimir and Magnuszewski, 2008). The flood mitigation project was designed with an approach aimed at minimizing the amount of agricultural land surface to be involved. In this way, policy makers tried to minimize the potential conflicts with farmers and landowners that could represent an obstacle for the development of the project. The design and implementation of the plan and the rules to operate the reservoirs were made by the central government (national level). The Government also identified the most suitable sites for the construction of the flood-water storage reservoirs. Farmers and landowners , not properly involved in the design of the strategy, were asked to accept the decision of the government (receiving an economic compensation for the potential losses) or be subject to the expropriation of their land for public use. In this second case, according to the landowners interviewed, the sum paid out by the government was considered consistent with the market value.

This case was analysed in the context of the EU FP7 funded project EPI-Water, Evaluating Economic Policy Instruments for Sustainable Water Management in Europe. Within this project, a compensation scheme able to better satisfy the requests of the agricultural sector and the needs of government was designed.

For the EPI-Water project, the participation of the stakeholders has been considered crucial. Landowners and farmers operating in the floodable areas and representatives from the regional water directorate were involved in the development of a compensation scheme that would have been able to more fairly compensate for the losses to the agricultural sector. The analysis conducted within the EPI-Water Project proposed to the farmers and government an Economic Policy Instrument based on a flat fee paid to the farmers plus compensation in case of flood. According to the project results, this scheme, not actually implemented, would have several benefits:

Improved farmers' financial compensation with a scheme that could be perceived as more transparent and fair, increasing the public acceptance of the flood management strategy;

Incentive for the farmers to reduce the amount of value exposed to flood events. This could be realised by a different use of the floodable areas, lowering the value of the crop at risk within the reservoir. This would make the whole scheme cheaper in the long run;

Stakeholder consultations performed during the research project revealed that the parties involved had different interests: representatives of the government were in favour of modifications aimed at improving the scheme, while farmers had mixed opinions driven by their specific economic conditions. However, although for different reasons, both parties expressed scepticism about the viability and enforceability of long term agreements.

Date: 2009-present

Short description (include images/video): The flood risk management strategy of Tisza River was improved with the creation of temporary flood water storage reservoirs. It proved its effectiveness, though the current prevailing land use prohibits unlocking its full potential. An

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up-to date cost-benefit analysis can inform future plans of more recurrent use of such polders to cope with more frequent peak flood events and provide a wider range of nature based solutions at the same time.

The observed increasing exposure to floods in the Tisza River floodplain is a consequence of the river regulation and land reclamation works that historically shaped the landscape of this area. During the last 150 years, an extensive flood defence and water management infrastructure has been constructed. Climate and land use change in the basin are increasing the frequency and magnitude of floods. The Hungarian Government has been pursuing a new flood defence strategy for the Tisza river basin incorporating the use of temporary reservoirs (polders) where peak flood-water can be released. A plan to build six reservoirs was adopted and implemented, with the option to build additional five. The six reservoirs proved to be effective in mitigating the risks of flooding during observed extreme weather events, protecting the downstream territory. At the same time, since a large part of the surface of reservoirs is located in agricultural areas and no land-use change was adopted, an economic compensation scheme was implemented by the Government. It aimed at remunerating farmers in case of damage to the agricultural soil and yield losses during flood events. A cost-benefit analysis of the selected strategy was performed. The analysis revealed that it well represents a trade-off between efficiency in risk reduction and relatively low initial investment costs. The participation in the EU-funded project EPI-WATER stressed the importance of a more active stakeholder involvement in the design of the measures and in the compensation scheme.

Economic data: The solution adopted resulted in an overall cost of around 260 million Euro. The strategy has been implemented with the contribution from the European Regional Development Fund and the Cohesion Fund. Several analyses have been conducted in order to assess costs and benefits of the chosen flood mitigation strategy. The results of a comprehensive ex-post cost-benefit analysis (Koncsos 2006) showed that the implemented scenario, with 6 reservoirs and no modification to the existing dike system, substantially reduces the risk compared to the baseline (no intervention). It represents a trade-off between efficiency in risk reduction and relatively low initial investment costs. The scenario analysis also highlighted that further investments in flood defence infrastructures are economically justified.

An up to date cost-benefit analysis performed in 2022 (Ungvári and Kis, 2022) showed that using most reservoirs is economically justified even for floods with a return period of 20-30 years. Hence, most reservoirs would be advantageous even if they were used with a higher frequency than the originally planned one (100-years events). However it poses the issue of maintaining the current land use (with special reference to agriculture) or adapting it in the long term (towards a forested area) to accommodate new and more frequent use of polders as flooding reservoirs.

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EPIWATER Deliverable 4.2. WP4 EX-ANTE Case Studies Floods and Water Logging in the Tisza River Basin (Hungary)

Key words: Flood risk management, Temporary water storage, Agricultural compensation schemes, Stakeholder engagement, Nature-based solutions

SOLUTION DESCRIPTION

Context:

Challenges

Near the geographical centre of Europe, the Tisza river drains an area of 157,218 km2 with a population of about 14.4 million. On its route from the Ukrainian Carpathian Mountains to the with the Danube in Serbia, the Tisza mainly flows through Hungary's Great Pannonia plain. The topography of the Tisza river basin is characterized by high, narrow chains of mountains surrounding expansive, flat lowlands. With a length of 966 km and an average discharge of 794 m^3/s, the Tisza is the Danube's longest and second largest tributary. Most discharge is generated directly from rainfall but there is a contribution from both snowmelt and subsurface soil water. Serious floods can originate from the mountains when rainwater flows quickly down the slopes and accumulates in lowland areas. This problem has become more and more serious over time as deforestation and soil sealing had progressed and precipitation patterns changed due to climate change.

The river and its tributaries were regulated in the second half of the 19th century. The main purpose of this regulation was to increase the extent of agricultural land, in place of wetlands,

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marshes and areas at risk of regular flooding (Borsos et al., 2018). The length of the river was reduced by over 400 km as the meandering sections were cut through, while the size of the floodplain area decreased by over 90% as dikes were raised to protect against floods. River straightening, combined with other factors (sediment accumulation in some river sections, deforestation, land use change) has caused the continuous increase of peak flood water levels. Taking into account a few historical recorded flood events, peak water level was 753 cm in 1876, 909 cm in 1970 and 1040 cm in 2000 (Szlávik, 2005).

Today, the length of the flood defence dikes along the Tisza and its tributaries in Hungary is 2850 km. The size of the flood-protected territory is 16,000 km2, out of the total catchment area of the Tisza in Hungary of 47,000 km2. As the peak level of floods continued to increase during the last century and a half, so did the height of the dikes. A further rise of peak flood levels is projected for the 21st century as a consequence of climate change, and the current level of flood embankments will not be sufficient to provide adequate protection. Flood defence exclusively based on the enlarging and strengthening of embankments is estimated to be excessively expensive. In 1999, a research project funded by World Bank estimated that the cost of the remaining upgrade works would have been HUF 175 billion, equivalent to EUR 700 million at a 1999 exchange rate (Szlávik, 2005).

In the period 1998-2001 four serious flood events took place on the Tisza river with peak water levels exceeding all historical values. One of the events (2001) included the rupture of a dike and the flooding of areas that were supposed to be protected. This event made clear that neither the height of the dikes, nor their strength were adequate. Afterwards, a 4-year-long project was launched to investigate the validity of the flood risk projections used at the time (studies by VITUKI Environmental and Water Management Research Institute, 2006). The project applied novel methods of time series simulation processes and used a revised historical hydrological database. It considered the impact of several changes (in forest cover, reservoirs, and flood embankments) within the different sections of the rivers passing through Hungary, also including climate change (Haase et al., 2006). The key conclusion of the project was that, compared to previous projections, there is increased uncertainty and higher expected water levels during floods. Water levels are expected to further increase as consequence of climate change. In this regard, a shift in pattern of rainfall events is observed in Central Europe. Even without a substantial change in average precipitation, more concentrated precipitation events with higher discharges volumes are expected (Ungvári, 2022).

Policy context

Case partially developed, implemented and funded as a climate change adaptation measure.

Legal aspects

The designed flood protection strategies were planned as to be integrated into a wider process of regional development. It envisioned large scale landscape and social rehabilitation efforts. Those measures should be combined with the restoration of the natural ecosystem of the region characterised by a complex system of wetlands.

The solution of establishing the temporary flood-water retention areas is in line with the requirements of the EU Water Framework and Flood Directives. The intervention adopts a flood mitigation strategy that is respectful of the natural ecosystems and the natural hydrodynamics. However, since a large portion of the Tisza river basin is dedicated to agriculture, further

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constrains derive from the implementation of the Common Agricultural Policy and its system of subsides that influence landowner decisions.

The compensation schemes for farmers is established through a legal act. However, its implementation left a considerable uncertainty with regard to the agricultural production process, raising the direct costs as well as the opportunity costs for the farmers.

Objectives: The overall objective of the flood protection strategy for the middle Tisza river basin is to adopt cost-effective measures. The proposed measures aimed at ensuring an adequate flood protection level able to cope with the changing conditions of the river basin and the consequences of increasing peak flows. The strategy was designed to respond to the changes in local climatic variability and specific characteristics of the hydrological system.

Solution(s) implemented: As a first reaction to the 1998-2000 floods, the government decided to speed up the on-going process of strengthening the dikes: the first plan (Government decree n.2005/2000) focused on the reinforcement of 740 km of dikes over a ten year period. In the second stage, the governmental strategy intended to intensify the process further by strengthening an additional 550 km of dikes, but in a shorter period of 5 years. The works started, but suddenly the programme was stopped.

A new Act was designed in 2004 with broader objectives: to increase flood safety by the reactivation of former floodplain territories and the management of the water surpluses, the development of the regions with most disadvantageous status and the improvement of living conditions in these regions.

The new plan for flood safety included: the strengthening of the existing weak points of the dike system the restoration of the run-off capacity of the flood channel (the cross-section between the dikes) and the completion of temporary flood reservoirs (also known as “polders”) to reduce the peak of the biggest flood waves with a total capacity of 721 million m3 in the long term. The intention was to give room to the river using agricultural areas as temporary storage reservoirs for containing peak flow during extreme events. According to this plan, the area utilised for agricultural purposes in normal conditions, can be eventually flooded (intentionally and under controlled conditions) and utilised for temporary retention of flood waters in case of emergency. This system is designed to supplement the dikes to cope with floods with a return period of 100 years or higher. It allows buffering during extreme precipitation events and reducing flood wave propagation, with consistent beneficial implications for flood risk mitigation. A mechanism of economic compensation for the farmers involved in the construction of water retention reservoirs was put in place. Compensation is composed on two items: an upfront one-sum compensation for all the inconvenience and value loss associated with the scheme and an event-based damage compensation, to compensate possible economic losses due to the flooding of the agricultural area. The flood risk mitigation system, based on the temporary flood water storage in agricultural areas, proved to be extremely effective for the purposes of disaster risk reduction. It also revealed trade-offs for the agricultural production of the affected areas, that cannot be completely recovered with the compensation scheme.

The first polder was inaugurated in 2009, while all the other five planned temporary reservoirs were completed in the following years (2010-2015) with financial support, both from national and EU funds. One of these polders was successfully used in a 2010 flood event. Hydrological modelling results (Ungvári and Kis, 2022) show that using more than one polder at the same

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time for major flooding events further mitigates risks compared to the use of a single polder. The same study suggests that adding more polders to the current system can be effective in reducing risks with an acceptable investment cost range.

Implementation phases and timeline: The flood protection strategy with the realisation of six water retention areas was implemented during the period 2009-2015. An additional water retention area along the Tisza river was created in 2022.

The water retention areas are planned to last more than 100 years.

Success and limiting factors:

Success Factors

The government's flood risk mitigation strategy has proven highly effective, being both scalable and flexible to address uncertainties in future climate change projections.

Temporary floodwater retention reservoirs significantly reduce the frequency and magnitude of downstream floods, benefiting cities along the river.

Hydrological modeling indicates that using multiple reservoirs simultaneously further enhances flood risk reduction, demonstrating the system's efficiency

Limiting Factors

Stakeholder opposition: Farmers and landowners expressed dissatisfaction due to inadequate involvement in the design and operational rules of the flood management strategy.

Compensation issues: The compensation scheme does not adequately cover all damages, such as soil rehabilitation and financial disruptions caused by seasonal production cycle interruptions, particularly for high-value crops.

Administrative delays: Compensation processing times can extend up to one year, causing frustration among affected stakeholders.

Financial unpredictability: The cost of the compensation scheme is highly variable over time, posing challenges for national budgeting.

Increased flood frequency: Projected climate changes may exacerbate damages to agriculture, heightening tensions between farmers and the government and increasing resistance to new retention areas

Benefits: The use of polder systems offers many benefits in terms of flood risk mitigation. The solution is easily scalable and flexible (activation of a single polder or different combination of two or more polders), able to face the wide range of uncertainty that features future projections of extreme flood events.

Lessons learnt: Implementing temporary flood water storage reservoirs (polders) in agricultural areas along Hungary's Tisza River has proven an effective strategy for mitigating flood risks. A key lesson learned is that stakeholder engagement—especially involving farmers and landowners—is crucial for acceptance and long-term sustainability. The current compensation scheme highlighted significant shortcomings, such as inadequate coverage of indirect agricultural losses and delayed payments, underscoring the need for transparent, fair, and timely compensation mechanisms. Additionally, comprehensive cost-benefit analyses

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have shown that more frequent use of polders could enhance economic viability while effectively managing increasing flood risks due to climate change.

Transferability: The concept of using agricultural lands as temporary flood storage areas is highly transferable to other regions experiencing similar flood management challenges. Essential conditions for successful replication include clear legal frameworks supporting land-use agreements, robust economic compensation schemes that fairly address agricultural stakeholders' concerns, and detailed hydrological modelling to optimize reservoir placement and operation. Furthermore, active stakeholder participation from planning through implementation stages is critical for ensuring broad acceptance and effective long-term operation.

3.3. Fisheries

SECTOR: Fisheries

Category: Implemented

GEOGRAPHICAL SCOPE: Canarias (Spain), Atlantic Biogeographical region

Hazards: Extreme Temperatures

Type of solution:

C. Physical and Technological -C2 Technological option: Establishment of early warning systems

E. Knowledge and behavioural change: public awareness and training - E2. Capacity building, empowering and lifestyle practices: Capacity building on climate change adaptation

IN SHORT

Title: Control of ciguatera poisoning in Canary Islands, Spain

Who: The following stakeholders are involved in the fish control programme:

DG Fisheries, Canary Island Government: public administration with competences in fisheries matters.

Gestión del Medio Rural de Canarias (Management of the Rural Environment of the Canary Islands) GMR Canarias, S.A.U.: public entity that belongs to the GDF providing support in the management of the protocol.

Directorate General for Public Health (DG Public Health), Canary Island Government: public administration with competences in Public Health (specifically Food Safety and Epidemiology departments).

University Institute of Animal Health and Food Safety (IUSA-ULPGC): laboratory in charge of fish analysis within the CP official monitoring.

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Small scale (fresh fish) professional fishing sector: thirty associations participating in sampling on eight islands.

DG Fisheries and GMR, the IUSA-ULPGC laboratory and the professional fishing sector are involved in the preparation and management of the fish samples and are in daily close contact through the traceability web tool system.

DG Fisheries and the DG Public Health are in regular communication, updating on all necessary information for the best application of both protocols (fishing and health). A permanent panel of experts will be established in the near future to assist in the decision-making process regarding the fishing protocol.

Date: 2009-present

Short description (include images/video)

The surveillance system set up by the Canary Islands Government aims to remove certain fish containing ciguatoxins from the market and to improve the detection of ciguatera in humans. The case study illustrates benefits to artisanal fisheries and public health.

Ciguatera poisoning (CP) occurs when people consume fish containing ciguatoxins (CTXs) with a high toxicity level. CTXs are a type of marine biotoxins produced by certain microalgae (Gambierdiscus spp. and Fukuyoa spp.) accumulated by the marine food chain. Within Europe, CP from locally caught fish is largely limited to Macaronesia, but the toxic microalgae are also present in the Mediterranean where, under the changing climate and with warming sea temperatures, they may lead to increased risk of CP. In the Canary Islands, between 2008 and 2023, 22 CP outbreaks were reported affecting 129 people. In recognition of the risk, several control methods have been introduced. Firstly, certain types of fish caught are controlled by the Canary Islands Directorate-General for Fisheries (DG Fisheries) for ciguatoxins before being approved for human consumption. Secondly, the Canary Islands Public Health Service includes CP a notifiable disease, which means that the diagnosed cases are recorded, and the poisoning can be monitored. Thirdly, awareness raising among the healthcare workers and the public is planned. Finally, the Canary Islands Government is participating in the Eurocigua 2 project, co-funded by the European Food Safety Authority and the Spanish Food Safety Authority, which aims to improve the understanding of the CP risks, also taking into account the changing climate. The activities of the Canary Islands Government related with CTX fish protocol are also financed by the European Maritime and Fisheries Fund (EMFF 2014-2020).

Economic data: DGP-GMR activities are financed by the European Maritime and Fisheries Fund (EMFF 2014-2020) and European Maritime, Fisheries and Aquaculture Fund (EMFAF 2021-2027). Also, a study on the economic impact on the fishing sector is currently being carried out (financed by European Regional Development Fund (EDRF) and INTERREG V-A Spain-Portugal MAC 2014-2020). The cost of the actions taken by the General Directorate of Public Health are included in the General Budget for 2023.

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Key words: Ciguatera poisoning, Marine biotoxins, Climate adaptation, Surveillance system, Public health

SOLUTION DESCRIPTION

Context:

Challenges

Ciguatera poisoning (CP) is caused by eating fish that have accumulated ciguatoxins through the food chain due to the presence of certain toxic microalgae (Gambierdiscus spp. and Fukuyoa spp.). Traditional endemic regions for ciguatoxic fish include areas in the Caribbean Sea and the Pacific and Indian Oceans. The fish species most frequently associated with cases of ciguatera include barracuda, grouper, amberjack, red snapper, moray eel, hogfish, mackerel, surgeonfish, and parrotfish.

In Europe, Gambierdiscus and Fukuyoa spp are found in the Spanish and Portuguese Atlantic islands as well as in several Mediterranean islands including Crete, Cyprus and the Balearics, according to the Eurocigua project (2016-2021), co-funded by the European Food Safety Authority and the Spanish Food Safety Authority (AESAN). In the framework of the CTX

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protocol developed by the Canary Islands Directorate-General for Fisheries, 13% of 8,828 certain fish caught in Canary Islands by the professional fishing sector tested positive for CTXs and were disposed of by authorised processors (DG Fisheries, unpublished data).

Ciguatoxins are not destroyed by cooking or freezing the fish. Furthermore, the toxins are colourless, odourless and flavourless, which make it impossible to detect them during eating. Symptoms of CP may include nausea, vomiting, diarrhoea, abdominal cramps, burning sensation of lips, tongue and extremities (also as a response to cold stimulus), a metallic taste in the mouth, joint and muscle pain, skin itching, muscle weakness, blurred vision, painful intercourse, low blood pressure and slow heart rate. Neurological symptoms usually resolve within weeks, although some symptoms can last for months. While CP is rarely fatal, severe cases may result in death (ECDC, 2021).

While outbreaks of ciguatera poisoning in mainland European countries have been associated with the consumption of imported fish, autochthonous outbreaks been reported in the Canary Islands and Madeira. In the Canary Islands, 22 autochthonous outbreaks occurred between 2008-2023, with 129 people affected.

Under the changing climate, the sea surface temperatures are projected to rise by 0.4 – 1.4 degrees Celsius by mid twenty-first century. This is likely to increase the toxic microalgae growth rates, resulting in higher population densities. Range extensions of several degrees of latitude also are anticipated, where species-specific habitat requirements are met (e.g., temperature, suitable substrate, low turbulence, light, salinity, pH) (Tester et al., 2020). In 2017, Gambierdiscus was identified for the first time in the Balearic Islands confirming the presence of this toxic microalgae in the western Mediterranean Sea (Diogène et al., 2021). The increasing densities and range of the toxic microalgae may mean that CP is more widespread in Europe in the future.

Policy context

Case mainly developed and implemented because of other policy objectives, but with significant consideration of climate change adaptation aspects.

Legal aspects

Ciguatera poisoning became a mandatory notifiable disease in the Canary Islands through the entry into force of a modification of the existing national law in 2015 (3992 ORDEN of 17/08/2015 about the establishment of the Canarias Epidemiological Surveillance Network). This legislation specifies that each CP case a physician diagnoses has to be notified to the Public Health authority within 24 hours since the diagnosis, including the patient's and the notifying physician's identification data and the clinical presentation of the poisoning.

The CTX detection protocol has been applied from 2009 by resolution. This protocol is mandatory for all small-scale professional fishing entities. The resolution of the DG Fisheries of August 2022 is currently in force.

Objectives: The aim of the initiatives implemented in Canary Islands are to reduce the number of ciguatera poisoning cases and to limit the risk of outbreaks.

Solution(s) implemented:

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Two main actions were implemented to limit the risk of ciguatera poisoning in the Canary Islands: monitoring the presence of ciguatoxins in certain fish and including ciguatera poisoning as a notifiable disease.

1) Controlling the fish catch for ciguatoxins in fisheries

Since June 2009, the General Directorate of Fisheries of the Canary Island Government has applied a protocol to determine the presence or absence of ciguatoxin in certain species that exceed a given weight, before being sold. This protocol, attached, is mandatory to the small scale (fresh fish) professional fishing sector of the Canary Islands. Recreational fishermen are informed about CP and the existence of this protocol (species and weights). They are encouraged but not obliged to apply the Protocol to the caught species before consuming them.

The target species and threshold weights have been selected by a group of experts (veterinarians, toxicologists, marine biologists, professionals in fisheries and public health). Currently the species (and weights) monitored are: amberjacks (Seriola spp.) – 12 kg; dusky grouper (Epinephelus marginatus) – 12 kg; bluefish (Pomatomus saltatrix) – 9 kg; island grouper (Mycteroperca fusca) – 7kg; and wahoo (Acanthocybium solandri) - 35 kg.

In 2022, criteria for introducing changes to species and weight monitored were established. A new species may be included only if it was the source of a confirmed autochthonous CP case and the fish had been captured in Canary waters. Furthermore, the weight limit of species currently included can be lowered in one of these two situations: (i) if a fish submitted to ciguatoxin detection tested positive exceeds the weight limit by up to 500 gr and shows high toxicity, or (ii) if a fish captured in Canary waters that weighed below the weight limit was the source of confirmed autochthonous ciguatera case, in which case the new weight limit would be set at the weight of that particular fish.

2) Including ciguatera poisoning as a notifiable disease.

Since 2015 ciguatera poisoning is a mandatory notifiable disease in the Canary Islands. It is the only place within the EU, and one of the few around the world (including Florida, Hawaii, and Hongkong) where the physicians diagnosing the poisoning need to report the disease. The physicians, entering the ciguatera as a cause of poisoning into a patient's clinical record within the public health system, automatically receive a notification to complete the notification form. Therefore, public health authorities can further investigate and confirm the case. Private physicians can download the same form and send it to public health authorities by email.

In recent years, the number of ciguatera poisoning cases have decreased in the Canary Islands. Whilst this could be a result of the control measures implemented, this decline could also be associated with the Covid-19 pandemic or low awareness of the healthcare practitioners not reporting the disease.

Implementation phases and timeline: The monitoring programme to determine the presence or absence of ciguatoxin in fish is operational since 2009, but in 2011 the methodology for the CTX detection changed. The obligation to notify CP to the Public Health Authority is in place since 2015. Awareness raising is a continuing process, with activities focussed on informing people and health care workers planned for 2023 and 2024.

The Eurocigua project ran between 2016 and 2020. The Eurocigua II project started in 2022 and will continue until 2025.

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The surveillance system does not have a predefined lifetime. It is planned to be continuously implemented by the Canary Islands Government and be effective in the long term.

Success and limiting factors:

Success Factors

The EuroCigua project (2016–2021) successfully advanced scientific understanding of ciguatera poisoning (CP) in Europe, including its spread, characteristics, and key environmental drivers like climate change.

Analytical methods were developed to measure biotoxin levels in microalgae and fish, enabling better identification and quantification of ciguatoxins.

The project fostered collaboration among experts and institutions across six EU member states, creating a multidisciplinary network for scientific excellence.

Public health professionals, food safety authorities, and EU citizens gained awareness of CP risks through targeted outreach efforts.

EuroCigua II (2022–2025) builds on this foundation by focusing on predictive modelling, harmonization of methods, and capacity building to address future risks.

Limiting Factors

Public awareness of ciguatera poisoning remains low despite media coverage and scientific evidence. In the Canary Islands, only 10% of the population surveyed in 2018 had some awareness of CP, and less than 4% knew about local poisoning cases.

Stakeholder engagement has been insufficient; consumers and other key groups have not been adequately involved in risk communication efforts.

Compensation schemes for affected fisheries or individuals have not been mentioned as part of the initiatives, leaving economic concerns unaddressed.

Climate change increases the frequency and geographical spread of CP outbreaks, complicating mitigation efforts and requiring continuous adaptation

Benefits: During the EuroCigua project (2016-2021), the IUSA- ULPGC laboratory received scientific and technical support for the analyses from the European Reference Laboratory for Marine Toxins (Vigo) and Institute of Agrifood Research and Technology (IRTA). This led to harmonisation of different protocols. Therefore, the participation in the research project had a direct impact on the improvement of the daily activity carried out for the official control programme. The project also allowed direct and indirect contact with the trophic web, analyzing the situation of different fish species, regarding their contribution to the maintenance of ciguatoxins in the marine environment.

In addition, thanks to the EuroCigua project and the collaboration with Canary Government DG Fisheries, 46 ciguatoxic fish from the CP official control were available for laboratory work. The fish were necropsied in IUSA facilities and 660 kg of muscle and livers were delivered to the university of Vigo to prepare Ciguatoxin Reference Materials (Castro et al., 2022), whose future availability will be of benefit to laboratories worldwide working on ciguatoxin detection.

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The EuroCigua project led to the establishment of a collaboration network of different prestigious international institutions involved in developing knowledge on the ciguatera toxins environmental conditions.

The main benefit of the control measures is increased food safety. The benefit for the local fisheries is that under ciguatera toxin testing protocol 7,717 (87%) large fishes reached the commercial chain with confirmed food security. The ciguatera control measures in place allowed avoiding fish capture bans.

Lessons learnt: The implementation of the ciguatera poisoning surveillance and control system in the Canary Islands has highlighted several key lessons. Firstly, establishing mandatory toxin screening protocols for targeted fish species significantly enhances food safety and consumer confidence, benefiting both public health and local fisheries. Secondly, making ciguatera poisoning a notifiable disease has improved monitoring capabilities, enabling quicker responses to outbreaks and better epidemiological understanding. However, despite these measures, public awareness remains low, underscoring the importance of continuous education and targeted communication strategies to effectively inform both healthcare professionals and the general public about the risks associated with ciguatera poisoning.

Transferability: The Canary Islands' approach to controlling ciguatera poisoning is highly transferable to other regions facing similar climate-driven risks from marine biotoxins. Key factors for successful replication include establishing clear regulatory frameworks for mandatory disease reporting and fish testing protocols, fostering collaboration among fisheries authorities, public health agencies, research institutions, and local fishing communities, and securing financial support through regional or international funding mechanisms. Additionally, participation in broader research networks such as EuroCigua enhances knowledge exchange and capacity building, making this model adaptable for implementation in other coastal areas experiencing emerging threats from toxic microalgae due to climate change.

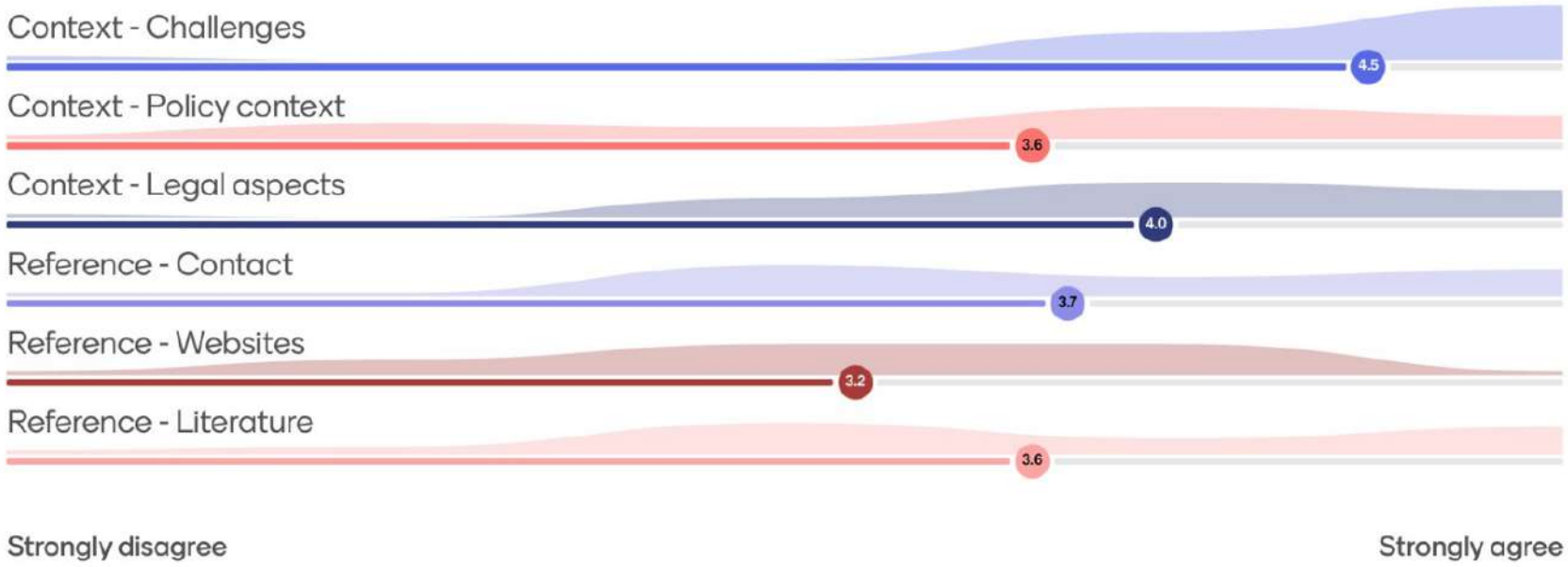
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Annex 4. Relevance of the different ingredients of the recipe - Mentimeter results



Transformation Gub FARCLIMATE

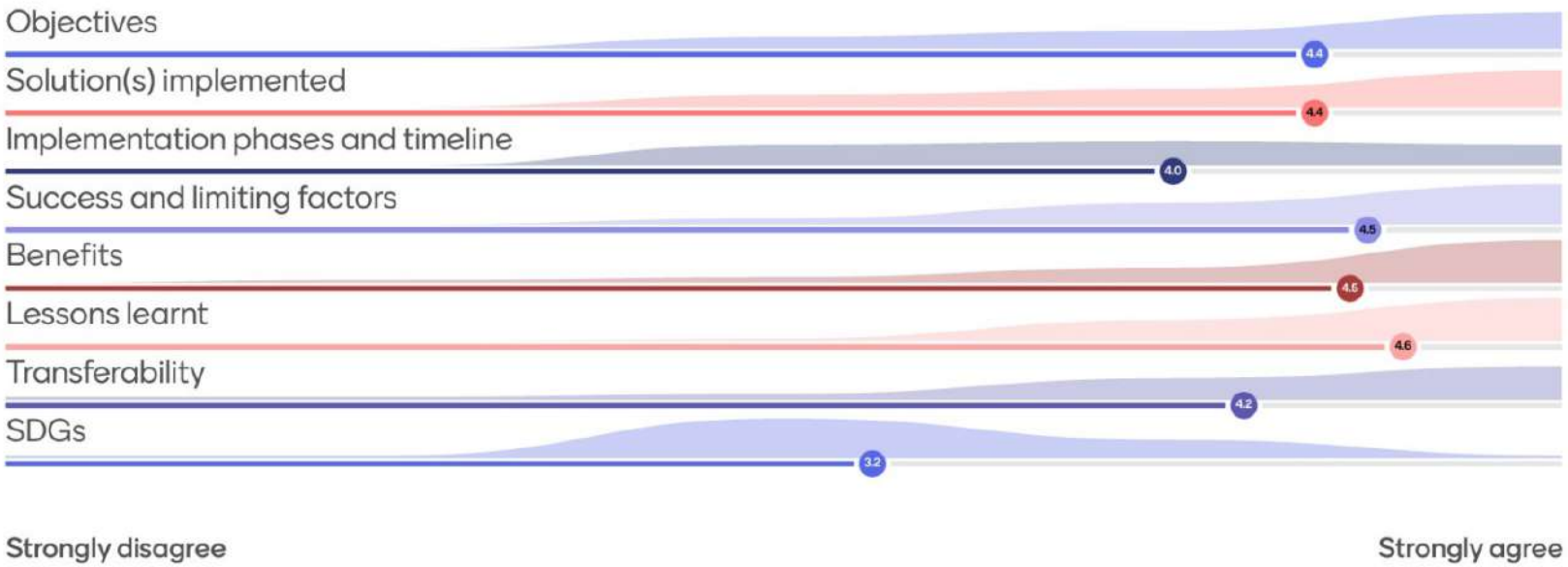
Relevance of each ingredient of the recipe (2/3)



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Transformation Gub FARCLIMATE

Relevance of each ingredient of the recipe (3/3)



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Annex 5. Co-design workshop outcomes and key findings

This annex synthesises the work carried out by the four participant teams during the co-design workshop. The proposals and ideas generated have been organised into three main categories: Information Access, Information Manipulation, and Information Consumption. The synthesis highlights shared priorities across teams, distinctive contributions, and emerging patterns that inform the Transformation Hub design.

🔍 Information Access

1. **Multimodal Resource Access (All Teams):**
   Participants emphasized the importance of diverse content formats—including audio, video, infographics, podcasts, summaries, and structured articles—to make complex information accessible. They highlighted the need to translate academic or technical content into accessible language, support multilingual interfaces (including indigenous languages), and incorporate real-time AI-based translation to facilitate communication and content sharing.
2. **Smart Filtering and Search (Teams 1, 3, 4):**
   Teams proposed advanced filtering capabilities by location, ecosystem, budget, project type, difficulty, and stakeholders involved. Graphical filtering tools such as maps and visual interfaces were suggested to enhance usability. AI-assisted filtering based on user queries or profiles was also considered essential, along with psychologically supportive and user-friendly filters (noted especially by Team 4).
3. **Personalization & User Profiling (Teams 3, 4):**
   The platform should tailor content delivery by asking users about their identity, goals, and preferences. This profiling enables customized information pathways adapted to distinct user groups such as fishers, farmers, or educators.
4. **Case Study Structuring (Team 4):**
   A multi-scale breakdown of case studies (micro, meso, macro) with specific regional, industry, and audience considerations was proposed to facilitate nuanced understanding and applicability.

🛠 Information Manipulation

1. **Customizable Output Formats (All Teams):**
   Users should be able to generate diverse outputs like PowerPoints, reports, videos, infographics, and summaries tailored for meetings, trainings, or community engagement, supporting both individual and collaborative uses.
2. **Conversational Interfaces (Teams 1, 2, 3, 4):**
   The integration of chatbots or AI assistants to respond to natural language queries, assist navigation, and interpret content was highlighted as a key feature. Voice-enabled, hands-free interactions were also suggested to improve accessibility.
3. **Data Contribution by Users (Team 1):**
   Mechanisms for users to upload stories, share field experiences, and provide struc-

tured feedback (e.g., indicating what worked or failed) were proposed. Tools for automatic transcription of meetings to capture rural and local knowledge were also included.

4. **Problem-to-Solution Linking (Teams 2, 3):**
   The platform should allow users to post problems and receive linked examples or resources via AI-driven matchmaking, complemented by visual maps showing problems, actors, and outcomes.

Information Consumption

1. **Multiformat Learning (All Teams):**
   Users value the option to select preferred content formats such as video, text, podcasts, and infographics. Support features like glossaries, tooltips for technical terms (especially noted by Team 3), and Wikipedia-like multimedia entries enhance learning.
2. **Asynchronous and Passive Learning (Team 2):**
   Podcasts designed for multitasking and smart prompts during playback (e.g., to access more information) were seen as important for effective learning on the go.
3. **Community Interaction (Teams 1, 2, 3):**
   The creation of forums or real-time communication hubs, with AI-driven translation for direct contact, was proposed to facilitate peer-to-peer experience exchange and foster a sense of community.

Emerging Design Principles

- **Accessibility**: Ensuring content is available in multiple languages, formats, and complexity levels.
- **Adaptivity & Personalisation**: Supporting user-defined pathways and AI-tailored experiences.
- **Interactivity:** Incorporating conversational AI, voice inputs, and user-generated content.
- **Visual & Intuitive UX**: Employing graphical filters, maps, infographics, and visual learning aids.
- **Multi-Stakeholder Inclusion**: Designing tools suited to diverse groups including scientists, rural practitioners, educators, and youth.
- **Knowledge Co-Creation**: Embedding mechanisms to include local experiences and insights as part of platform content.

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Annex 6. Features characterisation

Feature	User journey	Category
Access to Climate-ADAPT solutions database	Search & Explore	Climate adaptation database
Access to other platforms with climate adaptation solutions	Search & Explore	Climate adaptation database
Access to technical and scientific sources (journals, reports ...) about climate adaptation	Search & Explore	Climate adaptation database
Access to local knowledge about climate adaptation	Search & Explore	Climate adaptation database
AI-based Interactive Search	Search & Explore	Smart search Conversational interface
Smart filtering	Search & Explore	Smart search Conversational interface
AI-based search customized by user profiles	Search & Explore	Smart search Conversational interface User management
Geographic view of results	Analysis & Assessment	Display formats
Text / image display of results	Analysis & Assessment	Display formats
Ecoregional results	Analysis & Assessment	Display formats
AI-enhanced comparisons [Smart, Adaptive]	Analysis & Assessment	Smart analysis Conversational interface
Get insights	Analysis & Assessment	Smart analysis Conversational interface
Chat with the results	Analysis & Assessment	Smart analysis Conversational interface
Mindmap	Analysis & Assessment	Display formats
Node-based interface	Analysis & Assessment	Smart analysis Graphic, interactive interface

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Feature	User journey	Category
Multi-layered solution view	Analysis & Assessment	Smart analysis Graphic, interactive interface
Re-arrange solutions to fit recipe	Analysis & Assessment Information Manageme...	Content creation
User identity	Information Manageme...	User management
Login to save	Information Manageme...	User management
Create boards	Information Manageme...	Display formats Content curation
Save content to board	Information Manageme...	Content curation
Add annotations to saved content	Information Manageme...	Content curation
Explore and analyse saved content with AI	Information Manageme...	Smart analysis Conversational interface
Share "project" read-only	Information Manageme...	Community interaction
Share "project" collaborative	Information Manageme...	Community interaction
Federate	Information Manageme...	Community interaction Content curation User management
Download media	Information Manageme...	Community interaction
Podcast	Information Manageme...	Content creation
Video	Information Manageme...	Content creation
Include AI generated images	Information Manageme...	Content creation
Presentation template	Information Manageme...	Content creation
Posts "instagram style"	Information Manageme...	Content creation
Forum	Information Manageme...	Community interaction
Logbook / timeline	Information Manageme...	Content creation
Recipe building	Information Manageme...	Content creation
Voice-Activated information navigation	Information Manageme... Analysis & Assessment Search & Explore	Voice user interface
AI-Assisted language translation for communication	Information Manageme... Search & Explore Analysis & Assessment	Voice user interface

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Feature	User journey	Category
Multilingual interface	Information Manageme... Analysis & Assessment Search & Explore	AI-based language translation

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Annex 7. Decision matrix for feature integration



Feature	User interest	Technical feasibility	Resource cost	Selection Decision
Access to Climate-ADAPT solutions database				Implement
Access to other platforms with climate adaptation solutions				Implement
Access to technical and scientific sources (journals, reports ...) about climate adaptation				Defer
Access to local knowledge about climate adaptation				Defer
AI-based Interactive Search				Implement
Smart filtering				Implement
AI-based search customized by user profiles				Defer
Geographic view of results				Implement
Text / image display of results				Implement
Ecoregional results				Implement
AI-enhanced comparisons [Smart, Adaptive]				Implement
Get insights				Implement
Chat with the results				Implement
Mindmap				Implement
Node-based interface				Discard
Multi-layered solution view				Implement
Re-arrange solutions to fit recipe				Implement
User identity				Implement
Login to save				Implement
Create boards				Implement
Save content to board				Implement
Add annotations to saved content				Implement
Explore and analyse saved content with AI				Implement
Share "project" read-only				Implement

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Feature	User interest	Technical feasibility	Resource cost	Selection Decision
Share "project" collaborative				Defer
Federate				Defer
Download media				Implement
Podcast				Defer
Video				Defer
Include AI generated images				Implement
Presentation template				Implement
Posts "instagram style"				Implement
Forum				Discard
Logbook / timeline				Discard
Recipe building				Defer
Voice-Activated information navigation				Defer
AI-Assisted language translation for communication				Defer
Multilingual interface				Implement

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