# D2.1
# Demo Implementation Roadmap

**MOUNT RESILIENCE**

# Deliverable Information Sheet

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# List of Acronyms

| | |
|---|---|
| CC | Climate Change |
| CCA | Climate Change Adaptation |
| CCC | Climate Change Challenges |

| FVG | Friuli Venezia Giulia |
|---|---|
| MR | MountResilience |
| NbS | Nature-based Solutions |
| QH | Quadruple Helix |
| RDs | Regional Demonstrators |
| RRs | Regional Replicators |
| SRA | System risk assessment |
| STES | Socio-Technical-Ecological Systems |
| T | Task |
| WP | Work Package |

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# Keywords list

- Pilot Area
- Climate Adaptation
- MountResilience
- Mountains
- Regional Demonstrators
- Implementation roadmap
- Quadruple-helix approach
- Stakeholder engagement
- Local council
- Validation exercise
- Co-creation strategy

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# 1. Introduction

**The Deliverable 2.1 Demo implementation roadmap** is one of the 55 deliverables that will be produced throughout the MountResilience project's lifetime. The six regional demonstrators, the targeted partners group, will be empowered by an innovative and collaborative workspace, designed to tackle both climate and social challenges using a quadruple-helix approach. This workspace fosters strong collaboration between academia, industry, government, and community, ensuring that all key stakeholders contribute to the development and especially the improvement of climate-resilient solutions. By integrating innovation, technology, and community engagement, this workspace aims to enhance the climate resilience of each region, promoting cooperation, trust, and shared knowledge among partners. Finally, an implementation roadmap (D2.1) will be created based on the solutions identified in T1.3. It will detail the suggested pilot implementation stages, timelines, required resources, regional management frameworks, partner responsibilities, and data collection guidelines for impact assessment (T1.5). This phase will also identify common elements across demonstrators, such as reusable templates and technologies.

In order to better understand the process that will lead to the implementation roadmap production of this deliverable, it is essential to begin with the **project's context and the partners involved** in this specific phase of the roadmap creation.

**The overall project in brief:**

As stated in the official project documents (Grant Agreement and Consortium Agreement), **MountResilience** is a project funded by the **Horizon Europe Program**. Over the course of 54 months, it brings together a diverse partnership of more than 45 organizations from various sectors, including governance bodies, research institutes, universities, irrigation consortia, and tourism boards, among others. A key feature of this project is its implementation in a wide-ranging context, where each area involved has its own distinct characteristics, yet all share **one universal trait**: they are **mountainous regions/communities**. This choice highlights the significance of **mountain areas** and acknowledges their **crucial role for the countries involved, as well as for all the communities within them**. **Mountains play a vital role** in our lives, supplying essential resources to a large part of the global population, including those far from mountainous areas (Drexler et al. 2016). They provide 60-80% of the world's freshwater, often called the "world's water towers," regulating water flow and supplying nutrients to lowland crops. Mountains also host rich biodiversity, with nearly two-thirds of continental plant species found there and are key sources of forest and agricultural products like wood, livestock pastures, dairy, fruits, and medicinal plants. Moreover, as popular tourist destinations, mountains attract millions annually for activities such as health, sports, gastronomy, and cultural tourism: therefor sustainable tourism is a vital income source for mountain communities, helping preserve local traditions and food systems (EC, 2021). Mountains face significant challenges from Climate Change (CC), but unlike other areas, they are **particularly vulnerable**. As Manfred Kauffmann of the Swiss Agency for Development and Cooperation highlights, "Global warming is more pronounced in mountain areas than in lowlands". Since the industrial revolution, temperatures in the Alps and Himalayas have risen at double the global average. Mountain water supplies rely heavily on glaciers and snowmelt, and with many glaciers predicted to disappear by the century's end, these vital water sources may vanish. Some of the most visible signs of CC, such as rapid glacier melting, species extinction, extreme weather events, shifting rainfall, floods, and heatwaves, are already affecting mountains. These changes impact key community systems—agriculture, biodiversity, energy, tourism, and water resources—making mountain regions particularly vulnerable (IPCC, 2018). The effects also extend to lower regions, affecting water supply, agriculture, tourism, and health. Mountains' complex terrain creates diverse climates over short distances, increasing the impact of CC. Given the global dependence on mountain resources, urgent climate adaptation measures are needed. Innovative solutions must help communities adjust to the irreversible effects of CC while harnessing new opportunities. Despite differences across European mountain regions, they share common challenges, such as

climate risks, depopulation, poor connectivity, and limited access to services, all exacerbated by COVID-19. Systemic climate adaptation solutions are necessary, adaptable to each region's specific needs. However, recent World Bank data reveals that research on adaptation has stagnated, leaving many EU mountain areas in need of innovative solutions. Mountains face significant adaptation deficits (McDowell et al., 2021) due to several gaps, including limited climate change adaptation (CCA) options, low uptake of existing solutions, and a lack of coherence in response strategies. **MountResilience aims to address these issues by strengthening the adaptation capacity of European mountain regions and closing the adaptation gap.**

**MR partners involved in D2.1:**

The project brings together partners across **Europe** to drive climate-resilient transformation in **10 key mountain regions across 9 countries**. Six regions—**Tirol (Austria), Gabrovo (Bulgaria), Râu Sadului (Romania), Valais (Switzerland), Lapland (Finland), and Piemonte (Italy)—**will serve as "**regional demonstrators**", also called **pilots or Pilot Areas**, where transformative CCA solutions will be tested. These solutions will include both technological and social innovations, with a focus on nature-based solutions (NbS). They will address policy, governance, societal needs, and financing targets, tackling climate challenges typical of the Alpine biogeographical region (EEA, 2012). The demo regions will rely on regional quadruple-helix partnerships and collaborative decision-making processes to engage stakeholders and local communities. The remaining four regions—**Catalonia (Spain), Primorje-Gorski Kotar (Croatia), Friuli Venezia Giulia (Italy), and Subcarpathian (Poland)**— the **Regional Replicators**, will act as "replicator" regions, focusing on increasing their adaptive capacity by applying lessons learned from the demo regions. In addition to solution development, knowledge exchange, and cross-fertilization between regions, the project will also ensure sustainability by promoting CCA scale-up and access to funding through public, private, and PPP instruments at both EU and global levels.



Figure 1.    Project regions (UMIL, 2024)

**The six Regional Demonstrators, or pilots, are the key players involved in achieving the objectives of this deliverable, alongside the stakeholders associated with each of them**. Depending on the project objectives of each Regional Demonstrator within MR, that will be discussed in detail in the following sections of the text, the setup and deployment of the regional pilots will be carefully coordinated with the regional demo's leaders, following a standardized and shared methodology. Carefully considering the specificities of each pilot, in terms of context, challenges, resources, and objectives, this unified approach will ensure consistency across all regions while allowing for flexibility to address specific local needs. **The implementation roadmap** (D2.1 Demo Implementation Roadmap), main outcome of the deliverable, **will provide a detailed plan, including the necessary steps, timelines, required resources, and the allocation of responsibilities among partners.** The roadmap will also feature instructions for data collection, which will be essential for evaluating the impact of the pilots (T1.5 Methodology for the Impact Assessment of the regional demonstrators). Additionally, the process will identify common aspects across the different demonstrators, such as templates, technologies, and best practices that can be shared and reused. This ensures a streamlined approach, maximizing efficiency and fostering innovation that can be scaled or adapted to other regions.

**D2.1 starting point:**

It is essential to highlight some basic background concepts and deliverables strictly linked to the present Deliverable 2.1. To achieves the final aim the MR project uses a **Conceptual Framework** based on **Nature-Based Solutions (NbS)** developed in **D1.1 "MountResilience Conceptual Model for Climate Resilient Transformation"** to guide the development of transformative climate adaptation initiatives. D1.1 report is composed by four key elements:

1. *Socio-Technical-Ecological Systems (STES):* this approach views regions as complex systems where social, technical, and ecological elements are interconnected. Any innovation introduced affects these dimensions through feedback loops. The STES concept helps to analyze regional systems and integrate project innovations within these dimensions.

2. *Three Spheres of Transformation:* this theory focuses on achieving transformative outcomes through localized actions and innovations. It emphasizes the need for a project to engage the following three areas:
    a. **Practical sphere** (specific interventions),
    b. **Political sphere** (regulatory and institutional support),
    c. **Personal sphere** (values and beliefs).
   True transformation requires changes across all three spheres.

3. **Transformative Adaptation**: this refers to **systemic regional changes** that address the root causes of climate vulnerability while ensuring system resilience, reducing climate risks, and promoting social equity.

4. **Nature-Based Solutions (NbS)**: The project's activities focus on NbS, which involve managing and restoring ecosystems to address societal challenges, benefiting both human well-being and biodiversity. A key for the NbS success is the correct stakeholder engagement, needed to implement correctly these solutions.

Furthermore, the project's primary goal is to enhance **adaptive capacity**, leveraging local competences, skills, and assets to tackle climate change issues. **Ecosystem services**, such as food, water, and recreation, are central to the well-being of both people and the environment. A **monitoring framework** will be developed to track progress, drawing from the STES concept to ensure alignment with the project's social, ecological, and technological objectives. Starting from **D1.1 Conceptual model for climate resilient transformation** work whose four main elements have just been presented, **Task 1.2** – *"***Regional diagnosis and baseline for climate adaptation***" focuses on assessing the current state of climate change adaptation (CCA) in each demo and replicator region,** ensuring that solutions are well-integrated into regional structures and processes while leveraging existing capacities and networks. Based on this close collaboration, therefore **D1.2 "Regional diagnosis and baseline for climate adaptation"** aimed to create a **comprehensive understanding of adaptation needs, opportunities, and solutions** with some key points:

1. **Information collection framework:**

   - Region-specific climate challenges.

   - Existing CCA strategies, projects, and policies.

   - Key regional actors involved in CCA.

   - Gaps in knowledge, tools, and methodologies for transformational *adaptation*.

**2. Regional diagnosis reports and factsheets:** these documents summarized the status of CCA efforts, transformative capabilities, and barriers to achieving adaptation goals in each region.

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**3. Methodology:** the task involved desk research, document analysis, interviews with key actors, and regional validation workshops to gather insights.

**4. Integration with other tasks:** the results fed into **T1.3 – "Climate resilient transformation strategies for project regions"**, and feed regional demonstrators of Work Package (WP) 2 Regional Demonstrators, Regional Replicators of **Task 3.2 – "Replication Lab for transferring knowledge and solutions to replicator regions"** in WP3, and the exploitation plan of **Task 5.2 – "Support to the scale-up process"** of WP5, and will be published in **D1.2. – "Regional diagnosis and baseline for climate adaptation".** They will also provide the baseline for the impact assessment in **T1.5 – "Methodology for the Impact Assessment of the regional demonstrators".**

Finally, the **D1.3 – "Climate resilient transformation strategies for project regions"** report outlines the **regional transformation strategies** needed for climate-resilient action. The process began by defining the boundaries of regional challenges, using insights from **D1.1 – "Conceptual model for climate resilient transformation"** and **D2.2 – "Capacity-building for regions for increased climate resilience",** and involving stakeholders through a co-creation approach. This included expert input and a validation process with Local Councils better explained next (**Task 2.1 – "Implementation Roadmap"**). Using frameworks like STES and SRA, stakeholders identified adaptation pathways. A bibliographic search on Nature-Based Solutions (NbS) and related adaptation strategies led to the creation of a catalogue of options and factsheets. These resources provide a foundation for the **implementation roadmap (D2.1)** and future decision-making (**D2.2 – "Capacity-building for regions for increased climate resilience"**). All information will be made available in an open-source tool on the project site, allowing regions to implement strategies and assess their own climate adaptation actions (**D2.3 – "Testing and demonstrating transformative solutions on climate resilience in Lapland" and D2.8 – "New global interaction & co-creation system for faster adaptation to climate change in Valais").**
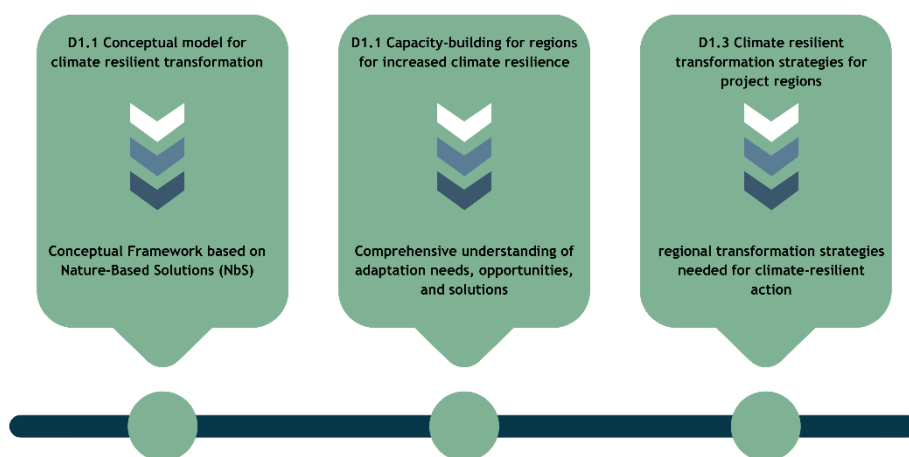


Figure 2.    D2.1 starting point snapshot (UMIL, 2024)

# 2. Methodology

The next sections of this chapter aim to explain the key conceptual factors that influence the development of the project and deliverable's intervention logic and methodology. The overall methodology of MR project and the deliverable 2.1 refers to the structured approach used to guide the planning, execution, and management of activities to meet its objectives of enhancing climate change adaptation in European mountain regions.

The impacts of Climate Change (CC) are intensifying globally, and effects are visible especially in mountainous areas, highlighting the urgent need for effective adaptation strategies. In consideration of the general Mission on adaptation to CC aims by 2030 (engage all regions in building climate resilience, support 150 regions in developing adaptation plans and solutions, and implement 75 large-scale demonstrations of climate resilience), MountResilience will help accelerate climate adaptation in 10 European regions, as already mentioned, achieving 7% of these targets by 2028. Within the context of MR project, which spans an ambitious 54 months and involves an extended and diverse partnership, it becomes essential to emphasize the necessity for a **structured methodology to guide the project's actions**.

**Key conceptual considerations of MR and D2.1:**

To begin with, it is essential to highlight some key conceptual considerations that form the foundation of this project and consequently the creation of 2.1 deliverable:

**Table 1** key conceptual considerations of MR and in D2.1 (UMIL, 2024)

| Maximizing the re-applicability potential | |
|---|---|
| **In MR:** all the regions/communities involved in the MR are in the European Mountainous biogeographical region, nevertheless, as the European Parliament concluded (European Parliament – Directorate General for Internal Policies - Policy Department – Structural and Cohesion Policy. (2016)), mountain areas are highly diverse, making it impossible to provide a one-size-fits-all solution or a universal integrated strategy. MR seeks to leverage this diversity by incorporating 6 RDs allowing for the integration of a wide range of perspectives, knowledge, experiences, and needs into the project's solutions, outcomes, and final deliverables. The goal is to create a portfolio of heterogeneous climate change adaptation CCA, capable of fitting various European contexts, thereby maximizing the potential for re-applicability and facilitating the transfer of the achieved results to other | **In D2.1:** To promote the efficiency of this general conceptual consideration in D2.1 Replicators are invited to participate in every other month update and monitoring meetings (RDs' state of the art meetings, better explained in the following sections) conducted by the regional demonstrators, with the aim of staying engaged in the loop and, if needed, sharing any questions or concerns about the potential re-application of the actions initially implemented in the pilot regions. |

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mountain regions. In the specific context of MR, it will be the replicators who will test and implement the solutions adopted by the demonstrators in order to verify their re-applicability and the efficiency of the results transfer promoted through the project.

## Place-based approach for a positive and just transition

**In MR:** despite the specificities of each mountain area, climate risks and the consequences of CC are common to all European mountains (EEA, 2021). However, exposure to these risks varies in levels, as does their preparedness for change and their adaptive capacity. This is why **MR proposes a bottom-up, place-based approach** that takes into account their specific characteristics, resources, and needs. Moreover, the importance of this bottom-up approach lies in ensuring the engagement of key stakeholders affected by climate change and its adaptation strategies at the national, regional, and community levels, while also customizing this engagement (through preliminary regional diagnosis, personalized support, involvement of specific actors based on needs and objectives, and assistance for implementation in pilot regions as well as re-applicability in replicator regions).

**In D2.1:** At the core of the engagement approach developed through D2.1 will be the commitment to **equity and the enhancement of local knowledge through co-creation methods** and the **inclusion of all relevant stakeholders** in the area being addressed through the **quadruple-helix (QH) approach** and the **five steps engagement process,** both better explained in the next sections.

## Enabling transformative adaptation

**In MR:** To achieve the ambitious objectives of the project, it is essential to adopt a **holistic** view and create key enabling conditions that **facilitate an effective transition**, such as innovation, community and stakeholder engagement, new decision-making processes, and specific funding instruments. This approach underpins the activities of the regional demonstrators and is an integral part of the new EU adaptation strategy (UNFCCC, 2019): **multi-scale, multi-sectoral, and systematic adaptation** (G. Fedele at al, 2019) is considered the most effective way to enhance the capacity to anticipate and mitigate/recover from the impacts of climate change.

**In D2.1**: the D2.1 suggest implementation solutions and stages involving multi-scale partners and stakeholders (local, regional and national level) multi-sectoral (academia, government, industry and community) and systematic that takes into account the overall framework and not just the objectives of the individual pilot areas, recognizing interconnections and relationships between different systems, and proposing a predefined and shared action plan.

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**MR main stages and D2.1 related stages:**

To realize its ambitious goals, MountResilience will follow three main stages summarized as follow:

➢ *Preparing the ground for climate resilient transformation [M1-M14]:* To achieve the ambitious project objectives, the first step is to create a context and support framework that can guide and monitor the activities of the regional demonstrators, ensuring an appropriate and scientifically relevant systemic approach. An impact assessment framework for climate adaptation will also be established. (**WP1 Support framework for transformation to climate resilience** activities);

➢ *Development, demonstration and local scale-up of region-specific cross-sectoral tech and social innovation solutions [M6-M54]*: Driven by a common methodology to ensure consistent implementation across regional demonstrators, and supported by knowledge, tools, and practices provided through an extensive capacity-building and mentorship program, regional partners along with selected stakeholders will deploy cross-sectoral technological and social climate change adaptation (CCA) innovations and nature-based solutions (NbS) in the demo sites. This will lead to behavioral changes, improved governance, and better coordination across sectors and stakeholders, fostering policy alignment, technology adoption, and community awareness (**WP2 Regional Demonstrators** activities). Capacity-building efforts will address both shared capacity gaps and specific regional needs, while regional partners will lead the demonstrators' activities, ensuring systemic solutions and broad outreach;

➢ *Sustainability and broader take-up [M1-M54]:* The actions in this stage aim to ensure MR's long-term impact, promoting sustainability, adoption, and scalability of its results beyond the consortium. This will be achieved through knowledge transfer, communication, dissemination, and networking, with clear sustainability pathways for scaling and market deployment of validated solutions. Three platforms (ICP, RepLab, CoP) will enable knowledge exchange and replication across regions (**WP3. Knowledge transfer, cross-fertilization and replication**). A communication task force will enhance outreach and visibility at a local and European level (**WP4 Communication, dissemination and networking** activities). Additionally, the project will explore further funding opportunities and provide tailored support for innovation and exploitation through expert coaching (**WP5. Effective Upscaling and Exploitation for Sustainability** activities).

Given that a structured methodology is vital in coordinating the diverse efforts of numerous partners involved in this project. It establishes a clear framework that ensures all stakeholders are aligned and facilitates effective communication and collaboration. This structured approach helps reduce the risk of misunderstandings and inefficiencies, enabling us to work towards common goals in a more effective way. Furthermore, the complexity of Climate Change necessitates a **holistic approach** that considers its social, economic, and political dimensions, as pointed out in the previous deliverables (**D1.1 – "Conceptual model for climate resilient transformation", D1.2 – "Regional diagnosis for CCA" and D1.3 – "Climate resilient regional transformation strategies"**). A well-defined methodology allows us to integrate scientific research with practical solutions that are sensitive to local contexts and community needs. This is particularly important in fostering stakeholder engagement. Effectively involving all quadruple helix actors requires a systematic approach that ensures every voice is heard and incorporated into the decision-making process. By outlining clear strategies for stakeholder engagement, we can promote inclusivity and transparency throughout the project

In line with the overall considerations, **logical and methodological framework** that underpin the project, **Deliverable 2.1** is structured as follows:

**1) Usage of well-defined glossary as baseline of common understanding:**

As a methodological standpoint, the importance of including a glossary lies in providing everyone with reference definitions for key concepts that will be addressed. This ensures a baseline of common understanding, minimizing the risk of misinterpretations and enhancing clarity throughout the process. A well-defined glossary helps to align participants with varying levels of expertise, fostering effective communication and a more coherent approach to tackling the subject matter. It serves as a foundational tool that promotes consistency and transparency in the discussions and activities that follow (Table 2).

**Table 2** Glossary of terms (UMIL, 2024)

| Key concept | Definition |
|---|---|
| Co-design, co-production and co-creation | The difference between co-design and co-production is that co-design addresses the problem and identifies a solution, whereas co-production embeds the solution into reality. Co-creation is identified as the way in which both of these are addressed. (McDougall, 2012) Co-design: "This approach goes beyond consultation by building and deepening equal collaboration between citizens affected by, or attempting to, resolve a particular challenge. A key tenet of co-design is that users, as 'experts' of their own experience, become central to the design process." (Max Hardy, 2017) |
| Core group of stakeholders | A sub-group of stakeholders who work with the process designer/facilitator to design and support the stakeholder dialogue. The sub-group often comprises the range of authorities that have a statutory responsibility for the work at hand. (Dialogue Matters. "Stakeholder Participation Glossary.") |
| Engagement | We think of engagement as an integrated, proactive, reciprocal, capacity-building and relationship-building approach to participation and decision-making. While the strategies we employ to achieve these ends will vary, we consider these principles foundational to our project efforts. In practice, this means our intention is to build new and/or enhance existing relationships and foster/enhance dialogue among and within individuals and groups with diverse experiences and perspectives related the common issue-frame of water and agriculture. (Sterling et al. 2017) |
| Factsheet | A factsheet is a short, typed or hand-written document that contains the most relevant information about a particular subject in the least amount of space. The goal is to provide facts and key points about a topic in a clear, concise, and easy-to-understand way. (Cubon-Bell, V. 2019) |
| Implementation | The phase of research in which the study design is carried out. This phase includes outreach and recruitment of study participants as well as the collection and analysis of data. Implementing a study can be an iterative process in which stakeholders are consulted on various aspects of implementation to provide real-time feedback to the investigators. (Dialogue Matters. "Stakeholder Participation Glossary.") |
| Key stakeholder | A stakeholder who is essential to the process. Key stakeholders include people who:<br>• Hold statutory responsibility<br><br>• Hold crucial information |

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| | • Have resources they can use for implementation<br><br>• Are strong opponents<br><br>• Are strong supporters (Dialogue Matters. "Stakeholder Participation Glossary.") |
| **Local Council** | It is an informal working group made up of a core of key stakeholders aimed at facilitating communication, collaboration, and participation among community members, stakeholders, and government representatives. These councils serve as a bridge, enabling quadruple-helix actors to voice their opinions, share feedback, and actively participate in local decision-making processes. (Dialogue Matters. "Stakeholder Participation Glossary.") |
| **Participation** | In the Cambridge Dictionary the meaning of the term participation is explained as "the fact that you take part or become involved in something". (Cambridge Dictionary) But participation within an engagement process is viewed as a mean to reduce inequalities of power in society, and as "a mean of empowerment in order to support inclusiveness and participatory and deliberative democracy" (Hedensted Lund, D. 2018). |
| **Roadmap** | "A roadmap is a strategic blueprint that captures and communicates the basic plan and goals for a project. A roadmapping tool can be used to create, update, and share this document, typically in a visual way". ("Roadmapping Tool." Product Plan Glossary) |
| **Stakeholder Engagement** | Practice of interacting with and influencing project stakeholders to the overall benefit of the project and its advocates. Stakeholder engagement is a longitudinal activity, which means engaging at least some of the same stakeholders more than once during the engagement period (e.g., from planning to dissemination/implementation or throughout one or more phases of a study). (Dialogue Matters. "Stakeholder Participation Glossary.") |
| **Stakeholder** | Broadly defined, stakeholders can be considered all those who either can affect, or will be affected by a discussion, decision, or initiative. As with most effective community engagement efforts, these individuals and groups will vary depending on the community context in which they occur. They will also vary depending on the goals of your engagement effort. The stakeholder groups convened around a change in land management practices will be very different from those engaged in revising a regulation or implementation policy affecting surface or groundwater. (When et al. 2017) |

**2) Establishment of innovative and collaborative workspace for regional demonstrators:**

In the context of the MR project, **centered on the principle of co-creation and on project's participatory activities**, Task 2.1. "The establishment of an innovative and collaborative workspace" refers to the creation of a **dynamic environment that encourages active participation and collaboration among all stakeholders involved in the project.** This entails:

**Table 3** Dynamic environment purposes (UMIL, 2024)

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|---|---|
| **Innovative Workspace** | **This involves designing a physical or virtual space** that fosters discussions, open communication, and the exchange of ideas. Such a workspace is equipped with tools and resources that facilitate brainstorming, problem-solving, and collaborative decision-making. |

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|  | **The chosen working spaces are Microsoft Teams shared folder as a virtual space for partners, Local Council meetings as "physical" one for both partners and stakeholders** (one meeting every six months is suggested). |
|---|---|
| **Collaborative Environment** | This workspace aims to promote **teamwork among diverse participants**, including community members, experts, local authorities, and other stakeholders (**quadruple helix approach**). This collaborative approach **ensures that different perspectives are heard and integrated into the project**, leading to more comprehensive and effective solutions. |
| **Focus on Co-Creation** | As already underlined, **co-creation** emphasizes the importance of **involving all partners and stakeholders in the project's development**. By establishing a collaborative workspace, the project encourages stakeholders to contribute their knowledge, skills, and experiences. This involvement helps in **co-designing solutions** that are not only innovative but also **contextually relevant and widely accepted thanks to a bottom-up approach.** |
| **Facilitation of Interaction** | The workspace serves as a **platform for workshops, meetings, and discussions**, where **stakeholders and partners** can share their insights and collaboratively develop ideas (Local Council meeting – in person or in remote modality). This **interaction is crucial for building trust** and ensuring that **everyone feels valued and empowered in the decision-making process**. |
| **Outcome-Oriented** | The ultimate goal of establishing such a workspace **is to generate actionable outcomes** that address specific challenges or goals already shared though past deliverables within the project. **By fostering a culture of collaboration and innovation**, the workspace aims to **yield effective solutions that are collectively owned by the partners and the stakeholders**. |

In summary, the establishment of an innovative and collaborative workspace in a co-creation-focused project as MR, is about creating an inclusive, interactive environment that leverages the collective expertise of all participants to develop and implement effective solutions. In projects and task involving multiple partners, 6 regional demonstrators to be precise, and spanning several years, establishing a **well-defined engagement strategy** is crucial for several reasons (Table 4):

**Table 4** Engagement strategy purposes (UMIL, 2024)

| **Alignment of Goals** | A clear engagement strategy ensures that all partners and stakeholders of MR share a **common understanding of the project's objectives**. This alignment **fosters collaboration and minimizes the risk of divergent priorities** that can derail progress. |
|---|---|

| | |
|---|---|
| **Stakeholder Involvement** | Effective engagement helps **identify and involve key stakeholders early in the project**. This inclusion not only enriches the decision-making process with diverse perspectives but also enhances the project's relevance and acceptance in the community. |
| **Trust Building** | Long-term projects such as MR require sustained relationships among partners. A robust engagement strategy promotes transparency and open communication, which are essential for building trust. Trust is vital for overcoming challenges and conflicts that may arise throughout the project's lifecycle. |
| **Resource Optimization** | With a structured approach to engagement, resources can be allocated more efficiently. Partners can better coordinate their efforts, share responsibilities, and leverage each other's strengths, leading to more effective outcomes. |
| **Adaptability and Flexibility** | Projects often face unforeseen challenges that necessitate adjustments. A well-defined engagement strategy includes mechanisms for ongoing feedback and assessment, enabling the project to adapt to changing circumstances and stakeholder needs. |
| **Sustained Commitment** | Engaging partners throughout the project's duration fosters a sense of ownership and commitment to the project's success. When partners feel involved and valued, they are more likely to contribute actively and invest their resources into the project. |
| **Monitoring and Evaluation** | A clearly articulated engagement strategy includes specific metrics for monitoring partner involvement and satisfaction. This data can inform future actions and improve the project's overall effectiveness. |
| **Long-Term Impact** | Ultimately, a well-structured engagement strategy contributes to the sustainability of the project's outcomes. By fostering strong relationships and ongoing collaboration, the project can continue to deliver benefits long after its formal conclusion. |

In summary, **a defined engagement strategy is integral to the success of multi-partner, long-term projects**. It creates a solid foundation for collaboration, enhances stakeholder involvement, and ensures that the project remains responsive and relevant throughout its duration.

**3) Adoption of a collective and collaborative strategy**:

It is now widely acknowledged that CC is a multifaceted challenge that cannot be addressed by any single organization alone; thus, a collective and collaborative approach is essential. **Collective strategy** is defined as "the joint formulation of policy and implementation of action by members of inter-organizational collectives" (Astley, 1984) while **collaborative strategy** is defined as the joint determination of vision and long-term collaborative goals to address a given social problem, along with the adoption of both organizational and collective courses of action and the allocation of resources to carry out these actions (Clarke Fulle, 2010). In other words, interventions on this broad matter includes the aggregation of several partners' efforts (Fombrun & Astley, 1983).

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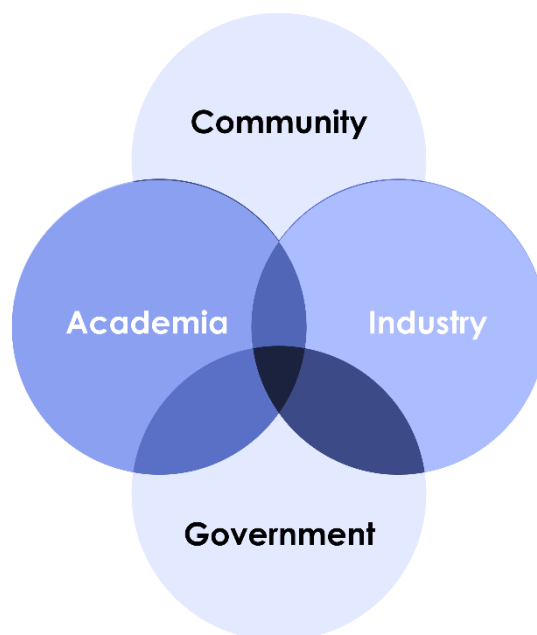
Figure 3.     Quadruple-Helix Approach snapshot (UMIL, 2024)

## 4) Integration with the Quadruple-helix (QH) approach:

Given the above, it was considered effective to integrate strong and active stakeholder engagement into the collaboration of the partnership, specifically by the quadruple-helix approach (Caravannis et Al., 2009). This model serves as an ideal framework for this endeavor, because by integrating the efforts **of four key actors** from academia, industry, government and community-civil society can leverage their unique strengths and perspectives to formulate **comprehensive and effective climate adaptation actions to be implemented** (Paskaleva et Al, 2021). The quadruple helix model represents a novel social dynamics framework centered on networking, breaking down barriers between institutions, and fostering integration and cooperation across various social sectors (Klasnic, 2016). Innovation literature regards it as a systemic, open, and user-centric model for knowledge creation involving government, industry, academia, and community (Arnkil et al., 2010).

This is a conceptual framework that emphasizes collaboration among four key stakeholders to drive innovation and address complex societal challenges. It extends the traditional Triple Helix model (Levdesdorff et al., 1998), which involves collaboration among academy, industry, and government, by adding a fourth helix: civil society, named Community. Here are some specifics about the involved actors:

**Table 5** Components of the Quadruple Helix (UMIL, 2024)

| Sector | Role | Contribution |
|--------|------|--------------|
|        |      |              |

| Academy | Represents universities and research institutions that generate knowledge and technology through research and education. | Provides scientific expertise, innovation, and new ideas, often through research and development (R&D) initiatives. Academics can also contribute to training the workforce needed for emerging industries. |
|---|---|---|
| Industry | Comprises private sector organizations and businesses that apply research findings to create products, services, and economic value. | Provides funding, practical application of research, and insights into market needs. Companies are instrumental in transforming innovations into commercially viable solutions. |
| Government | Includes local, regional, and national authorities responsible for policy-making and regulatory frameworks. | Facilitates collaboration by creating supportive policies, providing funding, and ensuring that innovation aligns with societal goals. Governments can also address regulatory barriers that may hinder innovation. |
| Community | Represents the general public, community organizations, and non-governmental organizations (NGOs) that engage in social advocacy and community involvement. | Provides insights into societal needs, values, and preferences. Citizens can actively participate in the co-creation of solutions, ensuring that innovations are socially acceptable and beneficial to the community. |

Another important aspect of the chosen approach is the involvement of entities at multiple levels: local, regional, and national. This multi-level engagement ensures that the project captures a broad spectrum of perspectives and expertise, facilitating a more comprehensive understanding of the challenges and opportunities faced by the communities involved. Engaging local stakeholders allows for the incorporation of grassroots insights, while regional and national entities can provide strategic guidance, resources, and support. This collaboration fosters alignment across different governance levels, ensuring that initiatives are not only relevant to local contexts but also supported by broader policy frameworks. Ultimately, this inclusive approach enhances the project's effectiveness and sustainability.

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**5) Five steps engagement process**:

Thus, once the approach was established—utilizing the quadruple helix model and a multi-level framework—the engagement process (Table 6) proceeded through a collaborative process model with **five phases** offered by Waddell and Brown (1997).
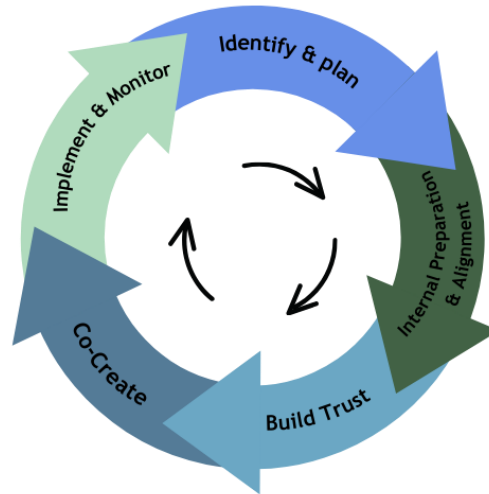


Figure 4.    The five steps of the Engagement process (UMIL, 2024)

**Table 6** The five steps of the engagement process Waddell and Brown (1997) (UMIL, 2024)

| Phase | Activity |
|---|---|
| **Identify and plan** | - Conduct a stakeholder analysis to identify individuals, groups, and organizations that may be affected by the project or have the power to influence it.<br>- Create a stakeholder map visualizing relationships and the potential impact of each stakeholder on the project.<br>- Classify stakeholders based on their level of interest and influence (e.g., high power/high interest, high power/low influence).<br>- Develop a strategic plan outlining how and when stakeholders will be engaged throughout the project. |
| **Internal Preparation and Alignment** | • Conduct internal bilateral meetings with each RD leader to discuss mapped stakeholders and refine engagement strategies.<br><br>• Align the project team on the project's vision, goals, and objectives to ensure a cohesive approach during ad hoc meetings (**Project Management Board (PMB) meetings** and **Regional Demonstrators' state of the art meeting (RDs' state of the art meeting)**). To be more precise, the overall purpose of the **PMB** is to ensure effective management of large and complex project with a wide range of project partners, including the facilitation of the interaction between the different levels and responsible actors. The |

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| | |
|---|---|
| | members are defined in the Consortium Agreement and are: Università degli Studi di Milano, UMIL, as Project Coordinator and WP2-WP6 leader, Zentrum fur Soziale Innovation GMBH (ZSI) as WP1 leader, INOVA + - Innnovation Services, SA (INOVA) as WP3 leader, Euromontana as WP4 leader, Meta Group SRL (META) as WP5 leader, Regional Council of Lapland (RCL) as Lapland Regional Demonstrator leader, Standortagentur Tirol GMBH (SAT) as Tirol Regional Demonstrator leader, Regione Piemonte (REGPIE) as Piedmont Regional Demonstrator leader, Rohealth – Cluster Pentru Sânâtate Şi Bioneconomie (ROHEALTH) as Râu Sadului Regional Demonstrator leader, Applied research and communications fund (ARC) as Gabrovo Regional Demonstrator leader and finally Ecole Polytechnique Federale de Lausanne (EPFL) as Canton Valais Regional Demonstrators leader. The PMB will meet at least once a month, mostly online, and in a regular date and time that is defined from the beginning of the project. The regular PMB meetings serve the purpose of reviewing the project status and discussing bottlenecks and next steps. Communication between Project Coordinator, WP leaders and Regional Leaders is fundamental and therefore is highly encouraged. The PMB will monitor the effective implementation of the project and collect information regularly with the cooperation of all PMB members (recording meeting registrations and minutes are already shared with all partners). **RDs' state of the art meeting** on the other hand is one every two months meeting in which each Regional Coordinator provide updates concerning its regional demonstrator's activities and eventual concerns. This online meeting is the occasion to share information within the regional demonstrators' group and to involve Regional Replicators (as auditors) in order to keep everyone in the loop of the project and foster the internal alignment.<br><br>• Establish clear roles and responsibilities for team members regarding stakeholder engagement: RD leader is the referent of all stakeholders. |
| **Build Trust** | • Initiate early engagement with stakeholders through informal meetings or surveys to gather insights and opinions.<br><br>• Be transparent about the project's goals, processes, and potential impacts, including sharing information.<br><br>• Actively listen to stakeholder concerns and feedback, showing that their input is valued and considered.<br><br>• Establish regular communication channels (e.g., newsletters, updates) to keep stakeholders informed and engaged throughout the project. |
| **Co-Create** | • Organize co-creation workshops where stakeholders can collaboratively brainstorm ideas and develop solutions.<br><br>• Utilize participatory methods such as focus groups, design thinking, or participatory design to facilitate engagement. |

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| | |
|---|---|
| | • Document stakeholder contributions and incorporate their insights into project plans and decisions. |
| | • Foster an environment where all voices are heard, encouraging diverse perspectives to inform the co-creation process. |
| **Implement and Monitor** | • Implement the project according to the co-created plans, ensuring that stakeholders are involved in the execution where appropriate. |
| | • Establish monitoring and evaluation mechanisms to assess the effectiveness of stakeholder engagement and project outcomes. |
| | • Provide regular updates to stakeholders about project progress, challenges, and changes, maintaining open lines of communication. |
| | • Collect feedback from stakeholders' post-implementation to identify lessons learned and areas for improvement for future engagements. |

The stakeholder mapping process, grounded **in the five steps of Engagement (Table 6)**, provides a structured approach to effectively engage stakeholders throughout a project.

By identifying and planning, preparing internally, building trust, co-creating, and implementing with continuous monitoring, organizations can foster collaborative environments that lead to more successful outcomes and sustainable relationships with stakeholders. This approach not only enhances project quality but also ensures that stakeholder voices are heard and valued throughout the entire process.

**First step**: In order to gather all the information necessary while keeping at the same time the data manageable, each regional demonstrator coordinator was asked to conduct a **mapping exercise** in March 2024 to establish a preliminary baseline. This exercise consisted of three main Canva designed to facilitate stakeholder mapping:

1. **Stakeholder Register**: This first Canva served as **a register of stakeholders** present in each area (Table 7) of demonstrators, organized into three levels, **local, regional, and national** and grouped according to **the four sectors of the quadruple helix framework**. The register requested the following information for each stakeholder (Figure 5):

**Table 7** Stakeholders register sections (UMIL, 2024)

| Institution | Sector | Referent | Role | Expertise | Contact |
|---|---|---|---|---|---|
| | | | | | |

Figure 5.    Stakeholder map process Excel File, 1st Canva, Stakeholder Register (UMIL 2024)

2. **Stakeholder Assessment**: This second Canva required an **assessment** of the **current level** of involvement of each organization in the MR project and asked for the **desired level** of engagement that pilot areas aim to achieve through their efforts (Figure 7). The assessment categories were organized as follows (Figure 6):



Figure 6.       Assessment categories (UMIL, 2024)

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Figure 7.     Stakeholder map process, 2nd Canva, Stakeholder Assessment (UMIL 2024)

3. **Stakeholder matrix**: The third and final Canva contained a table with three columns: one reporting the name of the institutions, the second indicating **the level of interest** and the third the **level of influence** (Figure 8) that each identified stakeholder has regarding the themes that MR focuses on in each pilot area.



Figure 8.     Stakeholder matrix indicators

The values in this **table ranged from 1 to 10**. Using a predefined function put in the table, these values were processed to create a **matrix** (Figure 9) that provided a clear visualization, a snapshot, of the **stakeholders with the highest interest and involvement**.
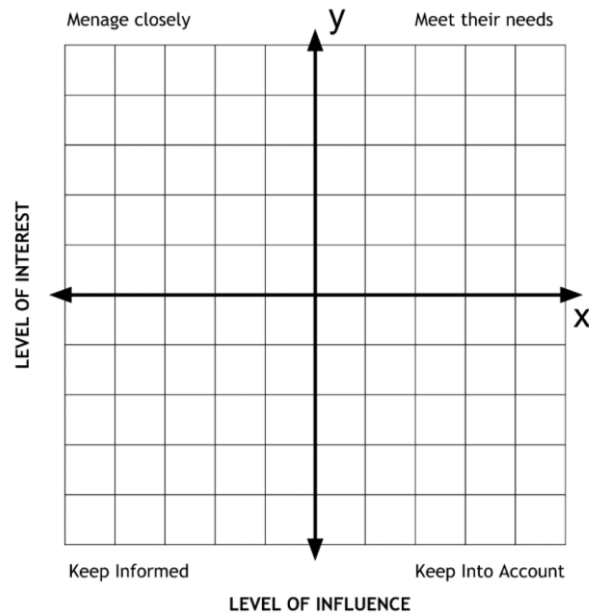


Figure 9.    Stakeholder engagement matrix (UMIL 2024)

Based on this assessment, those stakeholders were invited to become members of the **Local Council** as, potentially, the most relevant stakeholder able to guarantee the active participation and continuity needed.
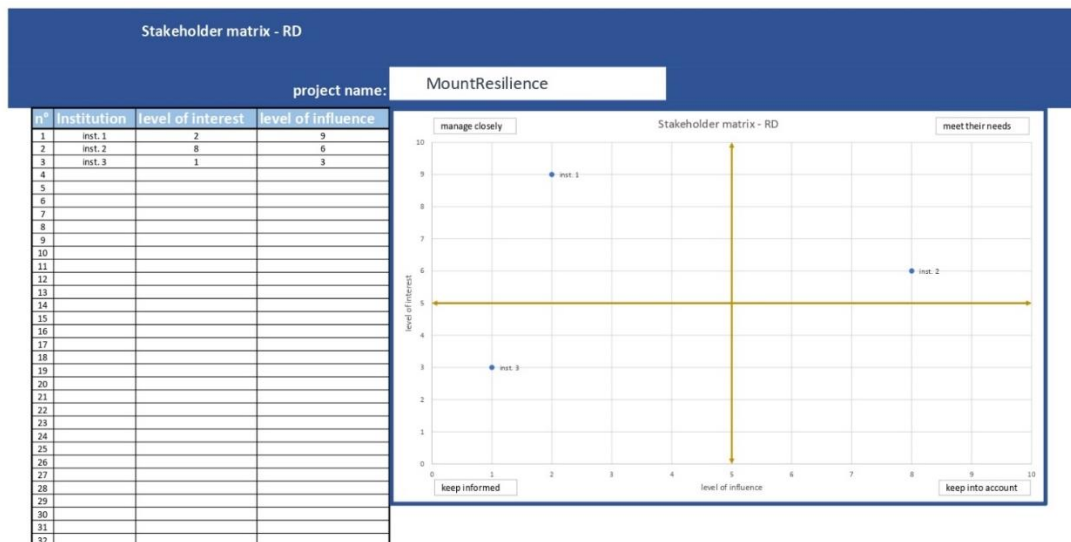


Figure 10.    Stakeholder map process, 3rd Canva, Stakeholder Matrix (UMIL 2024)

**As second phase** of the five steps of the engagement strategy, **internal preparation and alignment** has been set up with lead partners of each RD. Firstly, **internal bilateral meetings** were held with each Regional Demonstrator (RD) coordinator to discuss the identified stakeholders and refine the engagement strategies. These discussions focused on understanding the specific needs and expectations of each stakeholder, ensuring that our approach was tailored and effective. By fostering open communication, we aimed to strengthen our collaborative efforts and improve overall stakeholder relations. Secondly, it was essential to align the project team with the project's vision, goals, and objectives. To achieve this, we convened ad hoc meetings, including **Project Management Board (PMB) meetings and Regional Demonstrators' state-of-the-art meetings** explained in the previous section. These sessions ensured that all team members were on the same page and working towards a common purpose, thereby fostering a cohesive and unified approach to our project initiatives. The concept of the Local Council requires clarification to prevent misunderstandings. The name might suggest a council made up of local government bodies; however, this is not the case. In line with the principles of multi-scale and multi-sectoral involvement described above, the stakeholders in the Local Council represent local, regional, and national levels. The term "local" is used here to emphasize the connection with a specific pilot area, not the level of the members involved. Additionally, it is important to outline the functions and expectations of this body: the Local Council is established for each regional demonstrator and is an **informal working group** created in collaboration between UMIL and the regional demonstrators. Its purpose is to ensure greater involvement of the **quadruple helix stakeholders in project activities**, thereby adhering as closely as possible to the project's foundational principle of **co-creation.** The Local Council's role is to form **working groups** of stakeholders who, while external to the project itself, are nonetheless essential to its success. These stakeholders should be capable and willing to engage actively and consistently throughout the project's duration.

Moreover, to streamline stakeholder engagement, we established clear roles and responsibilities for all team members. The **RD coordinator served as the primary contact for the Local Council and all stakeholders: RD's coordinator is the Local council Coordinator**. This designation clarified accountability and ensured that communication was both effective and efficient. By defining these roles, we aimed to eliminate any ambiguity and promote a more organized engagement process.

In the table below (Table 8) the practical indications share with the Consortium and specifically with RDs:

**Table 8** Practical indications share with the Consortium and specifically with RDs (UMIL, 2024)

| Format | preferably in person, but also possible remotely |
|---|---|
| **Activities Responsible – Local Council Coordinator** | Regional Demonstrator's Coordinator or a Delegate |
| **Language used** | Conducted in native language / translation of papers by moderator |

| Timeline | 1 meeting per 6/months (2 times/year) → always with LC members, one with all the stakeholders mapped and available |
| --- | --- |
| **Documents to be prepared and always sent to UMIL** | List of participants with name, role and institution |
| **Monitoring** | Singular minutes drafting and sharing with UMIL, Local Council members and other stakeholders to be kept in the loop. Fixed update communications each 3 months (more or less) and annual Report. |

Only after this information has been shared **Local Council members have been selected** based on the follow considerations:

- ➢ Consideration of the context and specific objectives of each pilot region.
- ➢ Consideration of existing stakeholders in each area and their level of influence and interest.
- ➢ Consideration of their willingness to be active members.

**Building trust** is a fundamental aspect of stakeholder engagement, and the **third step of the selected engagement strategy**, as it creates a solid foundation for effective collaboration and communication. The strategy suggests RD's coordinator/Local Council Coordinator to initiate early engagement with stakeholders through informal meetings and surveys to gather insights and opinions. This proactive approach allowed the coordinators to understand their perspectives and build a foundation for collaboration. In addition, there was transparency about the project's goals, processes, and potential impacts by sharing relevant information with stakeholders. This openness helped establish credibility and foster trust among all parties involved. Moreover, RDs' coordinators actively listened to stakeholder concerns and feedback, demonstrating that their input was valued and considered in the decision-making processes, reason why validation factsheets were provided (more details will follow). This practice reinforced their commitment to address their needs and foster a collaborative environment. Finally, there was the establishment of regular communication through MR website contents, such as newsletters and updates, to keep stakeholders informed and engaged throughout the project. By providing consistent information, it was ensured that stakeholders felt included and aware of the project's progress.

**The fourth step, the core one, is Co-Creation**. RDs' coordinators organized a sort of co-creation workshop where stakeholders could collaboratively brainstorm ideas and develop solutions guided by the factsheets. These workshops, conducted during the meetings, provided a platform for meaningful interaction, allowing stakeholders to actively contribute to the project. Moreover**,** participatory methods were used to facilitate stakeholder engagement (like interview, questionnaire, co-creation laboratory – validation of the factsheets, and so on). To keep track of the stakeholder contributions UMIL, as WP leader asked to RDs' Coordinators to document them and incorporate their insights into project plans and decisions. By acknowledging their input, it would be demonstrated that their expertise was valued and directly influenced the project's direction, as done for D1.3 and for this D2.1 too. The aim of this initiative was to cultivate a sense of ownership among stakeholders, ensuring that the project benefited from their collective wisdom and expertise.

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Once the strategy has been established, it was essential to consider the **Implement and Monitor final step**, an important element of this deliverable. UMIL, as leader of the Deliverable, put in place an **implementation plan** ensuring that stakeholders were involved in the execution where appropriate. This engagement allowed stakeholders to remain invested in the process and ensured that their insights were reflected in the implementation. This deliverable also established **monitoring and evaluation mechanisms** to assess the effectiveness of stakeholder engagement and project outcomes (every 6-months meeting, reports, workshops and so on). These mechanisms enabled the institution in charge off to track progress and make informed adjustments as necessary, ensuring alignment with stakeholder expectations and in **strict collaboration with T1.5**. Regular updates to stakeholders about project progress, challenges, and changes, maintaining open lines of communication will be provided. This transparency helped to build trust and kept stakeholders informed, allowing for a collaborative approach to problem-solving. In addition, the project entails a feedback loop from stakeholders **after the implementation phase in order** to identify lessons learnt and areas for improvement for future engagements. This reflective practice not only enhanced our understanding of the stakeholder experience but also contributed to the continuous improvement of our engagement strategies. By focusing on implementation and monitoring, MR aimed to create a dynamic and responsive project environment that valued stakeholder contributions and adapted to emerging needs.

## 6) Use of participatory methods

In line with MR's general principle of co-creation and co-design, the activities proposed in this deliverable place a strong emphasis on using participatory methods to engage the partnership and stakeholders. As will be shown in the following sections, most steps involve the active engagement of these target groups, with workshops, focus groups, and questionnaires being the most recommended methods.

**Table 9** suggested participatory methods (UMIL, 2024)

| | |
|---|---|
| **Focus Group** | **A qualitative research method based on group discussions to explain attitudes and methods (OpenLab, 2021)** |
| **Creative brainstorm** | A creative technique to quickly generate a large number of new ideas. (OpenLab, 2021) |
| **Workshop** | An interactive session designed to engage participants in discussions, activities, or hands-on projects related to a specific topic or objective. (CSEE ETUCE, 2022) |
| **Questionnaire** | An effective participatory tool used to gather information, opinions, and feedback from participants in a structured format (CSEE ETUCE, 2022) |

## 7) Factsheet proposal

Starting for the Factsheet meaning underling in the glossary, a factsheet is a concise, typed or handwritten document designed to present essential information on a specific subject in a compact, clear, and accessible format" (Cubon-Bell, 2019). The purpose of a Factsheet is to organize and communicate key details effectively, providing a quick

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reference on topics such as Climate Change adaptation. Typically, one page long for research summaries (Valente, 2005), these Factsheets in MR capture insights from exercises conducted with participants, as in deliverable D1.2. This section consolidates validated feedback from regional demonstrator partners, stakeholders, and replicators, forming six Factsheets for regional demonstrators and four for replicators. Raw data was reinterpreted where feasible to align with responses received. The next figure summarizes the methodology for creating Factsheets used in D1.3. The first column shows the main phases of the implementation process (RAST); the second column links these phases to related project tasks; the third provides feedback examples; and the fourth lists exercises used with MountResilience stakeholders and partners. To effectively create roadmaps for pilot regions that meet the needs of regional demonstrators while emphasizing the importance of co-creation, it has been utilized the outputs from D1.1 and D1.2 to identify key aspects for developing tailored adaptation practices. In D1.3, essential information, which serves as a baseline for the implementation stages, has been summarized in structured Factsheets—one for each demonstrator and replicator region. These Factsheets highlight the main outcomes from individual exercises and the validation process – trough workshop, that involved Local Councils.
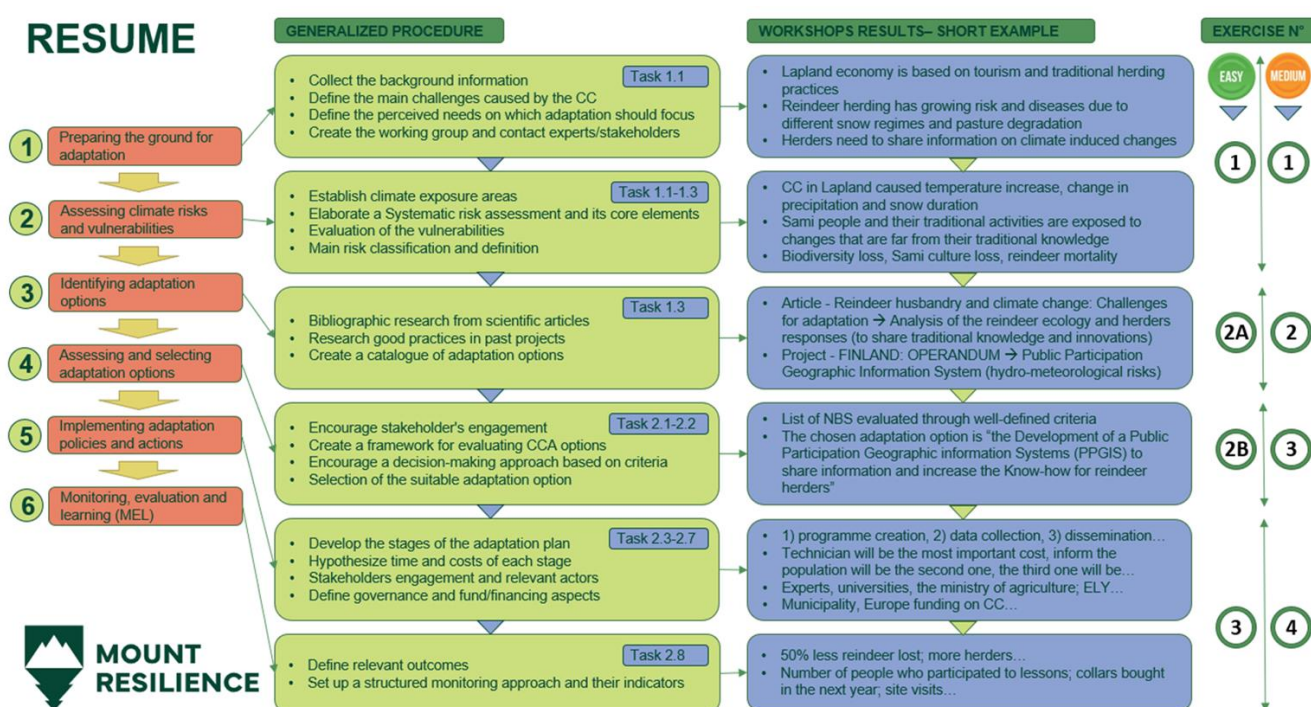


Figure 11.   Factsheet exercise definition based on Project tasks (UMIL, 2024)

## 8) The implementation roadmap production

According to the project's documents, an **implementation roadmap** must be established with the aim of preparing a homogeneous ground for regional demonstrators' actions. The goal is **to outline the steps necessary for executing a plan or achieving specific goals**. It serves **as a visual representation of the project timeline, detailing key activities, milestones, resources, and responsibilities required for successful implementation**.

The purposes of an Implementation Roadmap are (Table 10):

**Table 10** Implementation roadmap purposes (UMIL, 2024)

| | |
|---|---|
| **Alignment** | It aligns the project team and stakeholders with a **shared vision and objectives.** By presenting a cohesive plan, it facilitates communication and coordination among different parties involved in the project. |
| **Tracking Progress** | An implementation roadmap allows for **tracking progress against set milestones and timelines.** This enables project managers and teams to monitor advancements, identify potential delays, and adjust plans as necessary. |
| **Resource Allocation** | The roadmap helps **identify the resources (financial, human, and material) required** for each implementation phase of the project. This facilitates better planning and allocation of resources to ensure that the project stays on track. |
| **Risk Management** | By visualizing the various components of the project, the roadmap **can help identify potential risks and challenges early on**. This allows teams to develop strategies for mitigation and ensure that the project can adapt to unforeseen circumstances. |
| **Stakeholder Engagement** | The implementation roadmap can serve as a **communication tool for engaging stakeholders, helping them understand the project's progression and how their contributions fit into the overall plan.** |

Furthermore, this **implementation roadmap aims to build a strong and lasting relationship with stakeholders over almost five years**, ensuring that their contributions are valued and integrated into the decision-making process and project activities. Moreover, in order to better understand the utility of this process, here are **proposed targets** for stakeholder engagement, divided into three main phases (Table 11): **project start, mid-project, and project end.**

**Table 11** The three targets for stakeholders' engagement efficiency monitor (UMIL, 2024)

| Project Start | Mid-project | Project End |
|---|---|---|
| **Set up of the engagement strategy**<br><br>**-** Create an engagement plan shared with all project partners | **Regular Updates**<br><br>- Provide regular updates on project status through newsletters or meetings. | **Closing Public Event**<br><br>- Host a closing event to present results and celebrate successes, encouraging participation from all stakeholders |

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| Stakeholder Identification | Interactive Workshops | Final Report |
|---|---|---|
| **-** Create a list of all relevant stakeholders from government, academy, industry and community at local, regional and national level. | - Organize workshops to discuss progress, gather feedback, and identify any necessary adjustments. | - Involve stakeholders in reviewing the final report, ensuring their contributions are represented |
| **Local council establishment meeting**<br><br>- Organize kickoff meetings to present the project and gather input from Local Council members. | **Mid-Term Evaluation**<br><br>- Conduct a mid-term analysis with stakeholders to reflect on results achieved and challenges faced. | **Continuity Plan**<br><br>- Collaborate with stakeholders to develop a shared plan for continuing activities after the project's conclusion. |

These targets can help ensure effective and sustainable stakeholder engagement throughout the project's lifecycle.

## 7) Gender Equality check:

Finally, all leaders and partners of Regional Demonstrators are reminded to continuously monitor gender equity in accordance with MR **D6.8 Gender Dimension Plan (GDP),** of MR project. To this end, it is suggested to continuously monitor the following indicators taken by official GDP deliverable:

**Table 12** Gender equity indicators taken by official GDP D6.8 (UMIL, 2024)

| Action | Description of the Action | Tool |
|---|---|---|
| **Inclusive Decision-Making Processes** | Actively involving diverse stakeholders, including women and marginalized groups, in core groups and decision-making processes to ensure a comprehensive range of perspectives are considered | Quadruple-helix approach |
| **Equal Opportunity in Project Implementation** | Ensuring no gender limitations during project planning, procurement or execution phases, facilitating equal participation and contribution from both men and women | No gender requirements for any activities |

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| **Inclusive Event Organization** | Organizing events open to everyone, fostering safe and inclusive atmosphere where all participants feel comfortable expressing their opinions | Choose an environment free from gender restrictions. |
| **Systematic data collection and Analysis** | Systematically collecting and analyzing data based on gender equality parameters to provide insights into recruitment, career development, decision-making processes, and work-life balance | Register of the stakeholders has the "role" section |

In conclusion, the implementation of Climate Change adaptation strategies demands a structured methodology that facilitates the effective engagement of quadruple helix actors. By fostering collaboration among government, industry, academia, and civil society, comprehensive and sustainable solutions can be developed that address the complex challenges posed by Climate Change and its effects. This approach will not only enhance our capacity to adapt but also contribute to the overall resilience of communities and ecosystems.

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# 3. **The results**

In this chapter, the results obtained by the engagement process so far, and the suggested implementation roadmaps created based on the feedback gathered by partners and stakeholders of each Regional Demonstrator will be presented. Starting from the context of each pilot area, a section with the Local Council membership selectede will be provided. Next, the common suggested Implementation roadmap concerning the stakeholder engagement will be proposed. Finally. One suggested implementation roadmap for each regional demonstrators based on the most recommended implementation suggestions gathered during the validation exercises conducted on D1.3 and D2.1 will be propose as well.

## 3.1. **The Regional Demonstrators' Local Council set up**

Following the considerations and methodology outlined in the previous sections, the results will now be presented, specifically the membership of each regional demonstrator's Local Council (i.e., relevant stakeholders external to MR pilot area partnership), along with some observations.

### Gabrovo

**Table 13** Gabrovo Main information (UMIL, 2024):

| Location and Demographics | **Gabrovo** is a municipality in **Bulgaria's North Central Region,** covering an area of 556 km² with a population of approximately 65,813, 90% of whom live in urban areas. |
|---|---|
| **Geographical Features** | The region is characterized by **five rivers and extensive forests**, over half of which are protected. Its proximity to the **Balkan Mountains influences local climate**. |
| **Climate Impact**: | The area experiences **high humidity**, particularly in winter, and variable precipitation patterns. Climate change is anticipated to lead to **rising temperatures, altering seasonal patterns,** and i**ncreasing the risks of droughts, forest fires, and invasive species**. |
| **Public Health Risks** | Climate change poses significant **public health challenges, including increased heatwaves, droughts, and related health issues, especially among vulnerable** |

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| | **populations** (the elderly, those with chronic illnesses, outdoor workers, and individuals in inadequate housing). |
| **Air Quality Issues**: | Gabrovo has faced **air quality challenges**, including exceedances of sulphur dioxide levels, which further impact public health. |
| **Infrastructure Challenges**: | **Aging infrastructure and soil sealing** contribute to heat stress and other health concerns, particularly for urban residents. |
| **Overall goal**: | To **improve adaptation and preparedness strategies** to address the interconnected geographical and climate challenges in Gabrovo. This includes **safeguarding the natural environment and enhancing the health and well-being of its residents in the face of worsening climate-related risks.** |
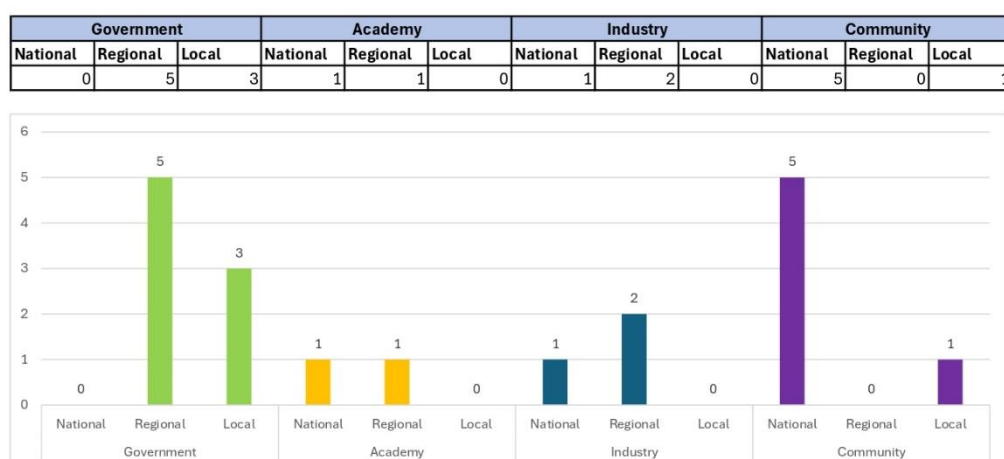


Figure 12.   Gabrovo stakeholder map analysis (UMIL 2024)

Presented below is a comprehensive overview of the data for the Gabrovo Pilot area.

**Overall Insights:**

The selection of stakeholders in Gabrovo reflects a strategic approach to address the complex challenges posed by climate change and public health risks. The prominence of the regional government, with five stakeholders involved, highlights its critical role in policymaking and resource management. This strong presence ensures that adaptation strategies are aligned with regional priorities and can leverage government support effectively. The local government's involvement, with three stakeholders, is equally vital. Their understanding of local issues, infrastructure challenges, and community needs can facilitate the implementation of targeted initiatives that directly benefit urban

residents. However, the limited engagement from the academic sector can be concerning. The industry sector's representation is also minimal, particularly at the local level. This gap may hinder collaboration with local businesses, which are crucial for sustainable economic development and environmental stewardship. Increasing industry participation could foster a more holistic approach to climate adaptation, integrating economic viability with ecological resilience. In contrast, the strong presence of community stakeholders at the national level, though lacking at regional and local levels, indicates a potential disconnect. Effective local engagement is essential for ensuring that community voices are heard and that adaptation strategies reflect the unique needs and values of Gabrovo's residents. Strengthening local community involvement will be crucial for fostering trust and ensuring that initiatives are socially acceptable and impactful.

Overall, while the current stakeholder composition in Gabrovo demonstrates a solid foundation for addressing climate and public health challenges, enhancing academic and local industry participation, as well as strengthening local community engagement, will be key to developing a more comprehensive and effective response.

## Lapland

**Table 14** Lapland main information (UMIL, 2024):

| | |
|---|---|
| **Location and Demographics**: | Lapland is Finland's northernmost region, spanning 1,000,366 km² and home to approximately 178,530 people, making it one of Europe's most sparsely populated areas. A significant portion of the population includes the Sámi, Europe's only recognized indigenous group, who often reside in remote rural areas. |
| **Poverty Risk**: | In 2021, 14% of Lapland's population was at risk of poverty. |
| **Climatic Conditions**: | The region experiences extreme climate conditions, including long winters lasting about 200 days, average temperatures below 0°C, and Polar Nights lasting up to 51 days. Summers are short, with temperatures ranging from 6°C to 16°C, accompanied by Polar Days where the sun does not set. |
| **Climate Change Threats**: | Climate change poses a serious threat, with projected temperature increases of 3-4°C by the end of the century, especially during winter. This warming could lead to more extreme weather events, shorter snowy seasons, and increased summer precipitation |
| **Impact on Sámi Culture**: | The Sámi culture, centered around reindeer herding, faces challenges from industrialization and climate change, particularly due to shrinking winter lichen pastures, which endanger traditional livelihoods. |

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| Economic Dependence: | Lapland's economy heavily relies on tourism (5.7% of regional GDP pre-pandemic) and employs 8% of the workforce, especially among young people. Forestry, mining, and agriculture are also significant economic sectors. |
|---|---|
| Biodiversity: | The region's unique landscape, marked by treeless fells and limited forests, contributes to distinct biodiversity that is sensitive to changing climatic conditions. Municipalities like Enontekiö and Utsjoki may experience varying impacts from climate change on local ecosystems and tourism. |
| Main Goal: | The overarching goal is to **enhance the adaptive capacity** of Lapland to mitigate the impacts of climate change, particularly for its vulnerable indigenous Sámi population and its economy, which heavily relies on tourism. This includes addressing the environmental and social changes that threaten traditional livelihoods, cultural practices, and overall community resilience in the face of significant climatic challenges. |

| Government | | | Academy | | | Industry | | | Community | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| National | Regional | Local | National | Regional | Local | National | Regional | Local | National | Regional | Local |
| 2 | 5 | 2 | 2 | 0 | 2 | 2 | 14 | 10 | 2 | 2 | 0 |
| 9 | | | 4 | | | 26 | | | 4 | | |



Figure 13.    Lapland stakeholder map analysis (UMIL 2024)

Presented below is a comprehensive overview of the data for the Lapland Pilot area.

***Overall Insights***:

The stakeholder selection for Lapland effectively addresses the region's unique challenges posed by climate change and socio-economic issues, particularly for the vulnerable Sámi population. The strong representation of the government sector at the regional level, with five stakeholders, indicates a solid commitment to local governance and

policy development. This engagement is crucial for implementing strategies that can adapt to climate impacts while preserving traditional Sámi practices and livelihoods. On the academic involvement is important to point out the presence of a research institute in the partnership. Increased collaboration with academic institutions could provide valuable insights into climate resilience and support the integration of traditional knowledge with scientific research, particularly regarding the impacts of climate change on biodiversity and the Sámi culture. The industry sector's robust presence—14 stakeholders at the regional level and 10 locally—positions it as a key player in economic development and sustainability initiatives. This strong industrial engagement can drive innovation in sectors like tourism, forestry, and mining, creating opportunities that align with both economic growth and environmental stewardship. Collaborating with industry can also help mitigate the impacts of climate change on local ecosystems, benefiting both the economy and community resilience. However, the community sector's moderate presence at the national and regional levels, coupled with a lack of local stakeholders, raises concerns about grassroots engagement. Strengthening local community involvement is essential for ensuring that initiatives reflect the specific needs and values of Lapland's residents, particularly the Sámi people. This could enhance social cohesion and empower communities to actively participate in decision-making processes that affect their livelihoods and cultural practices.

Overall, while the current stakeholder composition in Lapland demonstrates a strong foundation for addressing the region's climate and socio-economic challenges, enhancing academic engagement and local community representation will be critical for developing a holistic approach that ensures the sustainability of both the environment and the Sámi culture in the face of significant climatic changes.

## Piedmont

**Table 15** Piedmont main information (UMIL, 2024):

| Location and Demographics: | Piedmont (Piemonte) is a northwestern Italian region home to approximately 4.34 million residents, characterized by a diverse landscape comprising 43% mountains (the Alps and Apennines) and 31% hills. |
|---|---|
| Climate: | The region's climate is a blend of continental and Mediterranean influences, supporting rich biodiversity and productive agricultural practices. |
| Ecosystems: | Piedmont encompasses the Po Basin, covering 70,000 km², which includes vital montane ecosystems and wetlands that provide habitats for diverse wildlife. |
| Economic Profile: | Piedmont is among the top 20% of OECD regions economically, with key sectors including manufacturing (notably companies like FIAT and Ferrero) and agriculture, which utilizes 36% of the land and accounts for over a third of Italy's agricultural output. |
| Agricultural Changes: | The agricultural landscape is undergoing significant changes, marked by a 74% decline in livestock farms over the past 30 years. This decline has led to increased |

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| | consolidation, concerns about abandoned agricultural land, and challenges in ecosystem management. |
| **Environmental Pressures**: | The region faces considerable nitrogen load pressures on water quality due to agricultural practices. |
| **Climate Change Effects**: | Piedmont is experiencing rising temperatures, particularly in higher elevations, alongside changing precipitation patterns. Overall rainfall is expected to decrease slightly, leading to longer dry periods and increased drought risks. Additionally, more intense rainfall events may result in flooding and landslides. |
| **Main Goal**: | The primary goal is to **address the challenges posed by climate change** and the evolving agricultural landscape in Piedmont, particularly by improving water quality management, enhancing ecosystem resilience, and adapting agricultural practices to ensure sustainable development. This involves tackling issues such as declining livestock farms, abandoned land, and the impacts of changing climate conditions on both the environment and local economies. |

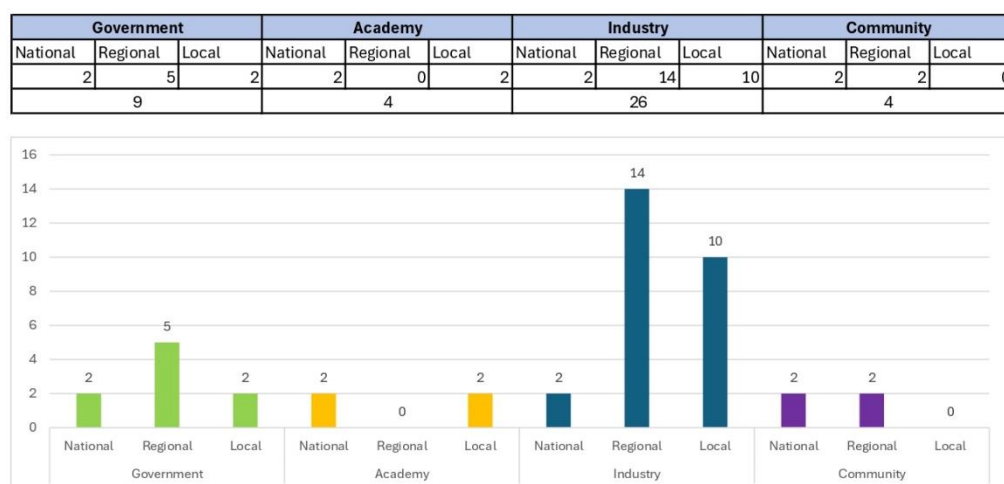| Government | | | Academy | | | Industry | | | Community | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| National | Regional | Local | National | Regional | Local | National | Regional | Local | National | Regional | Local |
| 1 | 1 | 4 | 0 | 0 | 3 | 0 | 1 | 4 | 0 | 0 | 0 |
| 6 | | | 3 | | | 5 | | | 0 | | |
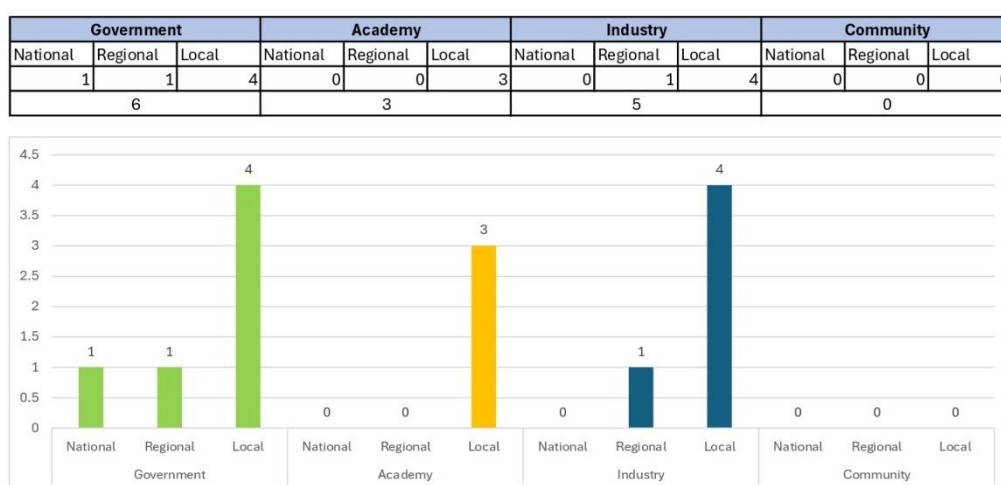


Figure 14.    Piedmont stakeholder map analysis (UMIL 2024)

Presented below is a comprehensive overview of the data for the Piedmont Pilot Area.:

The stakeholder selection for Piedmont is crucial for addressing the multifaceted challenges arising from climate change and shifts in agricultural practices. The government sector's strong representation at the local level, with four stakeholders, highlights the importance of effective local governance in implementing strategies that can adapt to climate impacts while supporting the region's diverse agricultural landscape. However, the limited involvement of the academic sector is due to the fact that POLITO and UNITO, the two main universities of Piedmont, are already

partners of the project. Have these universities engaged enhance the understanding of sustainable agricultural practices and ecosystem management, particularly in addressing the nitrogen load pressures affecting water quality. The industry sector's robust local engagement, with four stakeholders, signifies its potential to drive economic development and innovation. Given Piedmont's economic profile, which includes major manufacturing firms, this collaboration can foster sustainable practices that benefit both local economies and the environment. Strengthening partnerships between industry and local governments could be instrumental in promoting adaptive agricultural practices and improving resilience against climate change. The community sector's lack of influential representatives raises concerns about grassroots engagement. Community involvement is essential for ensuring that adaptation strategies reflect local needs and values. Including at least one community stakeholder would be beneficial for fostering local participation and ensuring that initiatives are equitable and effective. In summary, while the current stakeholder composition in Piedmont provides a strong foundation for addressing climate and agricultural challenges, enhancing academic engagement and strengthening community representation are critical steps. This comprehensive approach will help ensure that Piedmont can effectively navigate the complexities of climate change while promoting sustainable development and protecting its rich biodiversity.

## Râu Sadului

**Table 16** Râu Sadului main information (UMIL, 2024):

| | |
|---|---|
| **Projected Climate Changes**: | From 2021 to 2050, Sibiu County is expected to experience significant climate changes, with average annual temperatures potentially rising to 10.2°C in Sibiu and 8.3°C in Păltiniș. Increased greenhouse gas emissions could further elevate these temperatures. |
| **Precipitation Patterns**: | Shifts in precipitation are anticipated, leading to reduced snowfall and rainfall, shorter snowy periods, and more intense heavy rainfall events. |
| **Drought and Wildfire Risks**: | Droughts lasting from days to months will pose high risks to agriculture, and wildfires are expected to remain a concern. |
| **Agricultural Challenges**: | Agriculture in Sibiu is facing multiple challenges, particularly due to the prevalence of fragmented small farms. Heatwaves contribute to heat stress in crops and livestock, reducing productivity and increasing health risks for farmers. |
| **Soil and Biodiversity Issues**: | Changing weather patterns lead to soil salination and biodiversity loss, further straining water resources. |

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| Extreme Weather Impacts: | Extreme weather events, such as heavy rainfall, increase the risk of landslides and floods, particularly in vulnerable areas, resulting in soil erosion and diminished fertility. |
|---|---|
| Threats to Mountainous Regions: | In mountainous areas like Cristian and Râu Sadului, the agricultural sector is threatened by heatwaves and changing precipitation patterns, resulting in lower yields and health issues for livestock. |
| Cultural and Knowledge Loss: | Climatic changes contribute to land abandonment and a loss of local knowledge and traditions, impacting community resilience. |
| Main goal | The primary goal is to **address the significant challenges posed by rising temperatures and extreme weather** to agricultural productivity and food security in Sibiu County. This includes developing strategies to mitigate the impacts of climate change on small farms, enhance agricultural resilience, protect biodiversity, and preserve local knowledge and traditions in the face of environmental changes. |

| Government | | | Academy | | | Industry | | | Community | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| National | Regional | Local | National | Regional | Local | National | Regional | Local | National | Regional | Local |
| 5 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 2 |



Figure 15. Râu Sadului stakeholder map analysis (UMIL 2024)

Presented below is a comprehensive overview of the data for the Râu Sadului Pilot area.

**Overall Insights:**

The stakeholder selection for Sibiu County is critical for addressing the significant challenges posed by projected climate changes and their impact on agriculture and food security. The strong representation of national government stakeholders, with five participants, underscores a robust commitment to tackling these issues at a high policy level.

However, the relatively lower involvement at the local level, with only two stakeholders, suggests a top-down approach that may not fully address the unique needs and challenges faced by local communities. Increasing local government engagement could enhance the effectiveness of initiatives by ensuring they are tailored to specific regional contexts. The academic sector shows a solid presence at the national level, with three stakeholders indicating strong involvement from higher education institutions. However, the limited engagement at the regional and local levels, with only one stakeholder each, highlights a potential disconnect. This suggests that while national policies may be informed by academic research, there is an opportunity to strengthen the connection between local academic institutions and practical, on-the-ground efforts. Engaging regional universities and research centers could provide valuable insights into local agricultural challenges and climate adaptation strategies. The industry sector's representation is minimal across all levels, particularly at the local and regional levels. With only two national stakeholders, this indicates a gap in local industrial engagement. Strengthening industry involvement at the local level could foster innovation and economic development that directly addresses the agricultural challenges posed by climate change. Collaboration between local industries and farmers could lead to the adoption of sustainable practices and technologies that enhance resilience. The community sector is fairly well represented, particularly at the national level with three stakeholders and some presence locally with two participants. This indicates that community voices are considered in broader discussions, which is essential for ensuring that local needs are addressed. However, the underrepresentation at the regional level, with only one stakeholder, suggests a need for greater regional community engagement. Strengthening this involvement would enhance inclusivity and ensure that local traditions and knowledge are preserved, which is vital for community resilience in the face of climate change. In summary, while the current stakeholder composition in Sibiu County provides a foundation for addressing climate and agricultural challenges, enhancing local government engagement, bolstering regional academic participation, and increasing industry involvement at the local level are critical steps. This comprehensive approach will help ensure that Sibiu County can effectively navigate the impacts of climate change while promoting agricultural resilience and preserving local knowledge and traditions.

## Tyrol

**Table 17** Tyrol main information (UMIL, 2024):

| | |
|---|---|
| **Climate Variability:** | Tyrol's climate varies significantly, with northern and central areas influenced by Atlantic weather patterns and the southern part shaped by Mediterranean conditions. |
| **Economic Dependence on Tourism:** | The region relies heavily on tourism, especially winter sports, which accounts for nearly half of annual stays. Remote areas depend almost entirely on tourism for their income. |
| **Temperature Increases:** | Since 1900, temperatures in the Alps have risen by up to 2°C, with projections indicating an additional increase of 0.8–4.2°C by the end of the century. |

| | |
|---|---|
| **Impact on Snow and Precipitation:** | Warming temperatures are expected to reduce seasonal snow by 20-40% and alter seasonal precipitation patterns. By 2100, winter precipitation may rise by 10%, while summer precipitation could decrease by over 20%, leading to irregular rainfall and increased flood risks. |
| **Snowline and Artificial Snowmaking:** | The snowline is projected to rise approximately 150 meters for each degree Celsius increase, reducing essential snow cover for winter sports and increasing reliance on artificial snowmaking, which puts additional stress on water resources. |
| **Ecosystem Disruption:** | Rising temperatures prompt species migration to higher altitudes, disrupting native ecosystems and increasing the risk of invasive species. Forests, particularly spruce, face threats from pests and storm damage. |
| **Glacier Retreat:** | By the end of the century, 65% to 95% of European glaciers could disappear, impacting tourism and increasing natural hazards like rockfalls and mudslides. The retreat of glaciers presents challenges for ski resorts and diminishes their appeal. |
| **Extreme Weather Events:** | The frequency of extreme weather events is expected to increase, threatening infrastructure and public safety. Urban heat islands exacerbate health risks, especially for vulnerable populations. |
| **Main goal:** | The main goal is to **develop urgent adaptation strategies** to address the impacts of climate change on Tyrol's tourism-dependent economy and natural ecosystems. This includes mitigating the effects of rising temperatures, reducing reliance on artificial snowmaking, protecting native ecosystems, and enhancing infrastructure resilience to extreme weather events. The aim is to ensure sustainable tourism and the preservation of Tyrol's natural environment in the face of ongoing climate challenges. |

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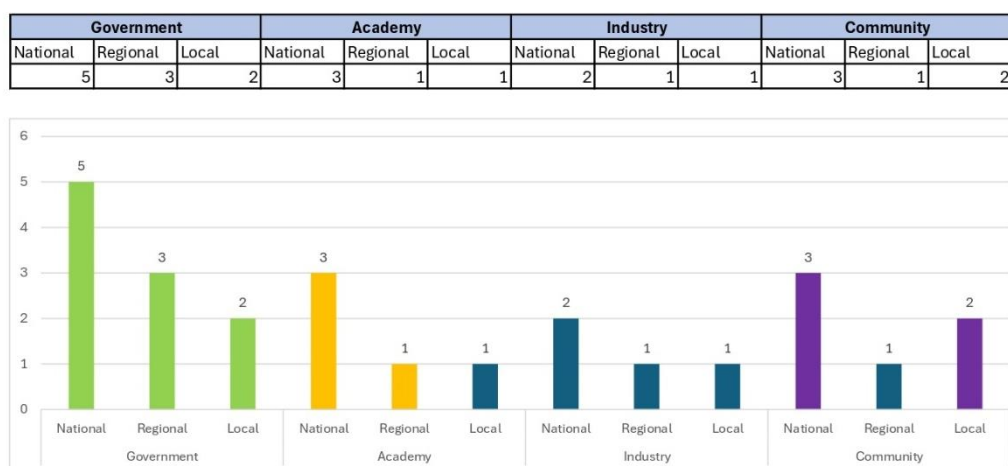| Government | | | Academy | | | Industry | | | Community | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| National | Regional | Local | National | Regional | Local | National | Regional | Local | National | Regional | Local |
| 1 | 11 | 0 | 0 | 2 | 0 | 1 | 7 | 0 | 1 | 5 | 1 |



Figure 16. Tyrol stakeholder map analysis (UMIL 2024)

Presented below is a comprehensive overview of the data for the Tyrol Pilot area.

**Overall Insights:**

The stakeholder selection for Tyrol is essential for addressing the pressing challenges posed by climate change, particularly its impacts on the tourism-dependent economy and local ecosystems. The strong presence of regional government stakeholders, with eleven participants, highlights a robust commitment to regional governance and decision-making. However, the lack of national and local representation suggests a disconnect that could hinder effective policy implementation. Engaging local government stakeholders is crucial for ensuring that regional strategies are translated into actionable initiatives on the ground. The academic sector's exclusive focus on regional engagement, with no national or local representatives, due to the fact the Innsbruck University, a national level institution, is in the partnership, contributing to higher-level policy discussions. The community sector's balanced representation across national, regional, and local levels reflects a commitment to incorporating community voices into governance. With five regional stakeholders and one at the local level, community interests are being recognized in regional discussions, which is crucial for ensuring that adaptation strategies are relevant and effective. However, the limited national representation may mean that community concerns are not fully integrated into broader policy frameworks, highlighting an area for improvement.

In summary, while the stakeholder landscape in Tyrol provides a strong foundation for addressing climate and tourism-related challenges, increasing local industry participation can be a critical next step. This comprehensive approach will help ensure that Tyrol can effectively develop and implement adaptation strategies, protecting its economy and natural ecosystems in the face of ongoing climate challenges.

## Valais

**Table 18** Valais main information (UMIL, 2024):

| Location and Population: | Valais is Switzerland's third-largest canton, located in the southwest, bordered by Italy and France, with a population of 348,503 residents. |
|---|---|
| Water Resource Characteristics: | Known as Europe's "water tower," Valais paradoxically experiences low precipitation levels, with some valleys receiving less than 600 mm of rain annually. |
| Snow Cover and Glacier Loss: | Snow cover has diminished by an average of 12 days from 1970 to 2015, and the region's glaciers, which contain a significant portion of Switzerland's ice volume, have experienced substantial mass loss |
| Irrigation Systems: | Traditional irrigation systems known as "Suonen" or "bisses" channel glacier meltwater for agricultural use, but their utilization is declining. |
| Water Usage Drivers: | Water usage in Valais is primarily driven by tourism (especially skiing), agriculture, and hydropower, which accounts for nearly 30% of Switzerland's energy production. |
| Environmental Concerns: | Increased reliance on artificial snow and the construction of reservoirs raise environmental concerns, while the drinking water supply has become a pressing issue, particularly due to the impacts of dams. |
| Climate Projections: | By mid-century, summer temperatures in Valais could rise by up to 4°C, with changes in precipitation patterns increasing drought risks. Rainfall is expected to replace snowfall at mid-altitudes, and river discharge peaks are likely to shift from June to May due to earlier snowmelt. |
| Future Water Availability: | Glacier loss may exceed two-thirds by the century's end, leading to decreased water availability. While current water volumes are adequate until 2050, seasonal variability presents significant challenges. |
| Main Goal: | The primary goal is to develop effective water management strategies to address the challenges posed by climate change on water availability in Valais. This involves ensuring sustainable water use for agriculture, tourism, and hydropower, while adapting to increased temperatures, altered precipitation patterns, and glacier loss. The aim is to prevent potential water shortages and conflicts in the future, ensuring that Valais can maintain its vital water resources amid ongoing environmental changes. |

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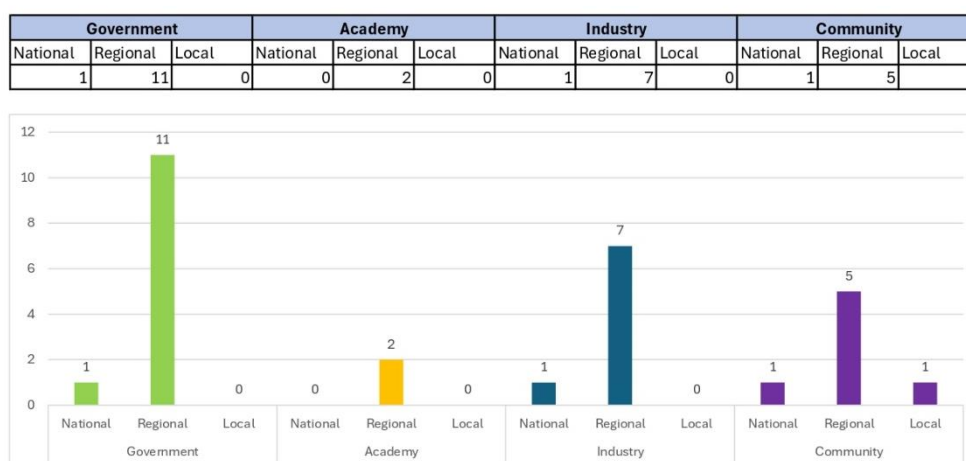| Government | | | Academy | | | Industry | | | Community | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| National | Regional | Local | National | Regional | Local | National | Regional | Local | National | Regional | Local |
| 1 | 2 | 2 | 1 | 4 | 0 | 1 | 2 | 1 | 1 | 1 | 3 |
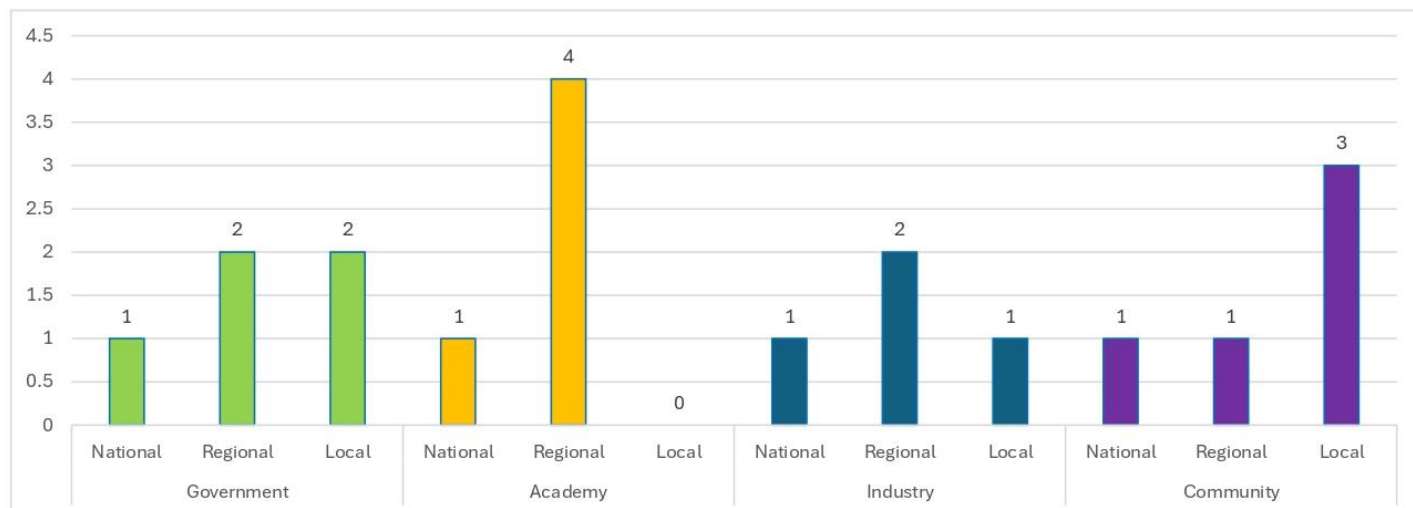


Figure 17.    Valais stakeholder map analysis (UMIL, 2024)

Presented below is a comprehensive overview of the data for the Valais Pilot area

**Overall Insights:**

The stakeholder composition for Valais is essential for developing effective water management strategies to tackle the significant challenges posed by climate change. The balanced representation across national, cantonal, and local government levels indicates a well-rounded engagement in water governance. However, enhancing national-level involvement could help align regional and local initiatives with broader policies and priorities, ensuring a cohesive approach to water resource management. The academic sector's strong focus, due to the fact that a relevant institution of this sector is in the partnership While this is beneficial for addressing local issues, expanding academic engagement at the national and local levels could enrich policy discussions and ground-level initiatives with vital expertise. Greater collaboration between academic institutions and local stakeholders could foster innovative solutions tailored to the unique challenges of Valais. Industry representation is balanced across all levels, indicating a commitment to community-level projects. This local focus is valuable for addressing immediate needs, but there is potential for increasing industry engagement at regional and national levels. Doing so could facilitate collaboration on broader economic strategies and innovation, enhancing the overall resilience of Valais's water resources. Community engagement is currently strongest at the local level, which is crucial for ensuring that local concerns and needs are directly addressed. However, there is significant potential to increase community involvement at the national and regional levels. Expanding this engagement could enhance the inclusivity of water management strategies and ensure that diverse community perspectives are considered in decision-making processes.

In summary, while the current stakeholder landscape in Valais provides a solid foundation for addressing water management challenges, increasing national government engagement, expanding academic involvement, and fostering deeper industry participation are critical steps. This comprehensive approach will help Valais develop

sustainable water management strategies that can effectively adapt to the impacts of climate change and ensure the preservation of its vital water resources.

## 3.2. The common implementation roadmap of stakeholders' engagement

Taking into account all the elements described regarding the Local Councils, here a suggested implementation roadmap, a common tool for every RD, will outline specific activities, objectives, and timelines for **engaging stakeholders throughout the entire duration of the project.** Stakeholder participation is denoted as one of the key components of MR project, as mentioned before, and this structured approach ensures that stakeholder involvement is **not only planned but also effectively executed**, fostering collaboration and addressing the needs and concerns of all relevant parties at each stage of the project. To create a clear, visually appealing, and comprehensible tool, a graphical roadmap will be developed, outlining activities, timelines, and objectives in a graphical manner. Here's a suggested implementation roadmap common to every RDs (Table 19) for stakeholder engagement over the next four years.

**Table 19** Suggested implementation plan (UMIL, 2024):

**Year 1-2: Planning and Initial Stakeholder Engagement**

**1**. **Stakeholder Mapping (Feb-April 2024)**

- – Identify and classify all relevant stakeholders from the quadruple-helix with TU-Wien and UMIL support.
- – Assess their level of interest and influence on the project.
- – Identification of core stakeholders for the Local Council establishment.

2. **Development of the Engagement Strategy (May – July 2024)**

- – Conducting bilateral meetings between UMIL and the leaders of each RD to review the core stakeholders identified from the stakeholder matrix and jointly plan the first Local Council meeting, the Local Council Establishment meeting.
- – Suggestion of the rules of involvement of the Local Council by UMIL: attendance register including name, surname, organization, and sector of each participant, creation of meeting minutes, meetings conducted in the native language, preferably in person, but remote participation is allowed.

3. **Local Council establishment (July – September 2024)**

- – Each leader convened the Local Council and shared with the stakeholders a work agenda that included a contextualization of the work of this informal group.
- – It was set up and shared with the members a methodology to create an environment of trust and openness to encourage interaction.

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– A common workshop was set up to validate the factsheet provided by UMIL in order to gather feedback concerning D1.3 and D2.1 by a co-creation workshop.

4. **First co-creation exercise (August– September 2024**)

– UMIL provided the leaders and coordinators of the Local Council, as well as the project partners, with the validation factsheets for D1.3 and D2.1 to gather feedback on adaptation strategies and on the implementation in the coming years of the project; it was suggested to propose that factsheets through a workshop both for partners and for local council members (during the local council meeting).

5. I**nternal communication plan (November - December 2024)**

– In order to maintain constant and transparent communication with the stakeholders who are members of the Local Council it is suggested that the RDs' Coordinators/Local Council Coordinators establish and share a communication plan with a fixed schedule (every 6 months): a predetermined communication channel (Email, shared folder) and a quick, accessible medium for everyone (newsletter, or a PowerPoint update on activities).

6. **Second Local Council meeting (February - March 2025)**

– From the second meeting onward, ideally occurring every 6 months, it is suggested that the leaders establish a work agenda that includes regular updates on the activities conducted within their pilot region. To further enhance co-design efforts, it is also recommended to organize active engagement activities such as focus groups or thematic workshops.
– It is also suggested to include at least a minimal planning of Local Council activities for the following year, in anticipation of the project activities that the RD will carry out.
– Extend the invitation also to other stakeholders mapped in the previous stakeholder mapping step even if they are not Local Council members.

7. **First Local Council annual report (By April 2025)**

– In order to monitor the progress of engagement and activities of the Local Council, it is suggested that the RDs' Coordinators/Local Council Coordinators draft an annual report outlining key activity points, strengths, and challenges of the working group to share with the project coordinator UMIL.
– It serves as initial report.

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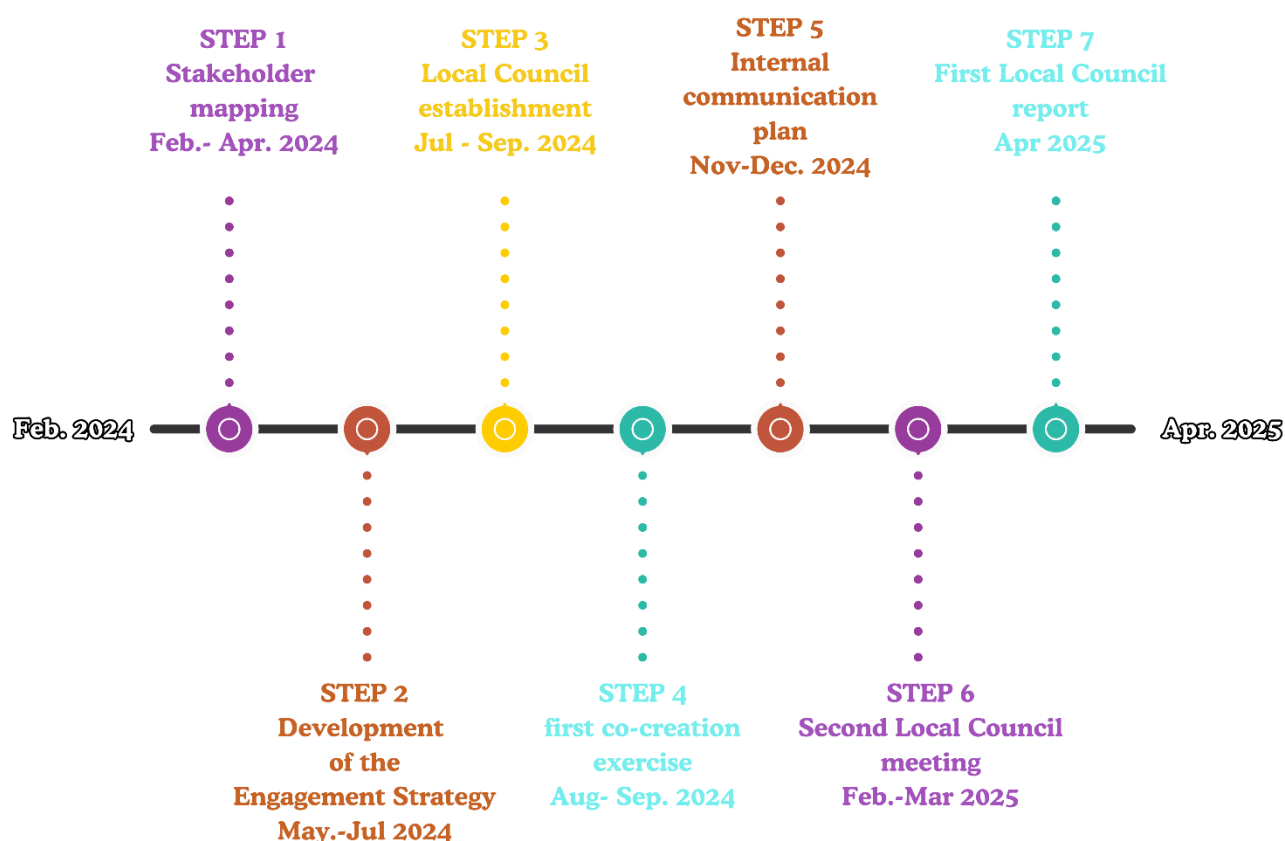
Figure 18.    First and Second year stakeholder engagement implementation roadmap (UMIL, 2024)

**Year 3: Implementation of the stakeholder engagement and Co-Creation**

**1. Sending an update communication (May – June 2025):**

– Following the establishment of the communication plan with stakeholders implemented during the first year, it is suggested to Regional Coordinators/Local Council Coordinator to send the first update (newsletter, email, PowerPoint, etc.) to UMIL coordinator, all regional demo's partners, Local Council members and potential regional demo's stakeholders in general.

**2.Third Local Council Meeting (August-September 2025):**

- The third meeting of the Local Council should be organized like the previous ones, with a tailored agenda depending on the activities of the RD that require feedback at that specific time.
- Consider creating an activity that encourages active participation such as Workshop, Focus Group, Questionnaire to gather feedback and suggestions

**3. Sending an update communication (November– December 2025)**

– Following the first update it is suggested to Regional Coordinators/Local Council Coordinator to send an update (newsletter, email, PowerPoint, etc.) to all partners, Local Council members and potential regional demo's stakeholders in general.

**4.Fourth Local Council Meeting (February – March 2026)**

- The fourth meeting of the Local Council should be organized like the previous ones, with a tailored agenda depending on the activities of the RD that require feedback at that time.
- Consider creating an activity that encourages active participation such as Workshop, Focus Group, Questionnaire to gather feedback and suggestions
- Extend the invitation also to other stakeholders mapped in the previous stakeholder mapping steps (the ones not Local Council's members but still potentially relevant stakeholders).

**5.Second Local Council annual report (By April 2026)**

– In order to monitor the progress of engagement and activities of the Local Council, it is suggested to Regional Coordinators/Local Council Coordinator to draft, based on stakeholders and partners feedback, an annual report outlining key activity points, strengths, and challenges of the working group and share it with the project coordinator UMIL.
– It serves as a mid-term report.
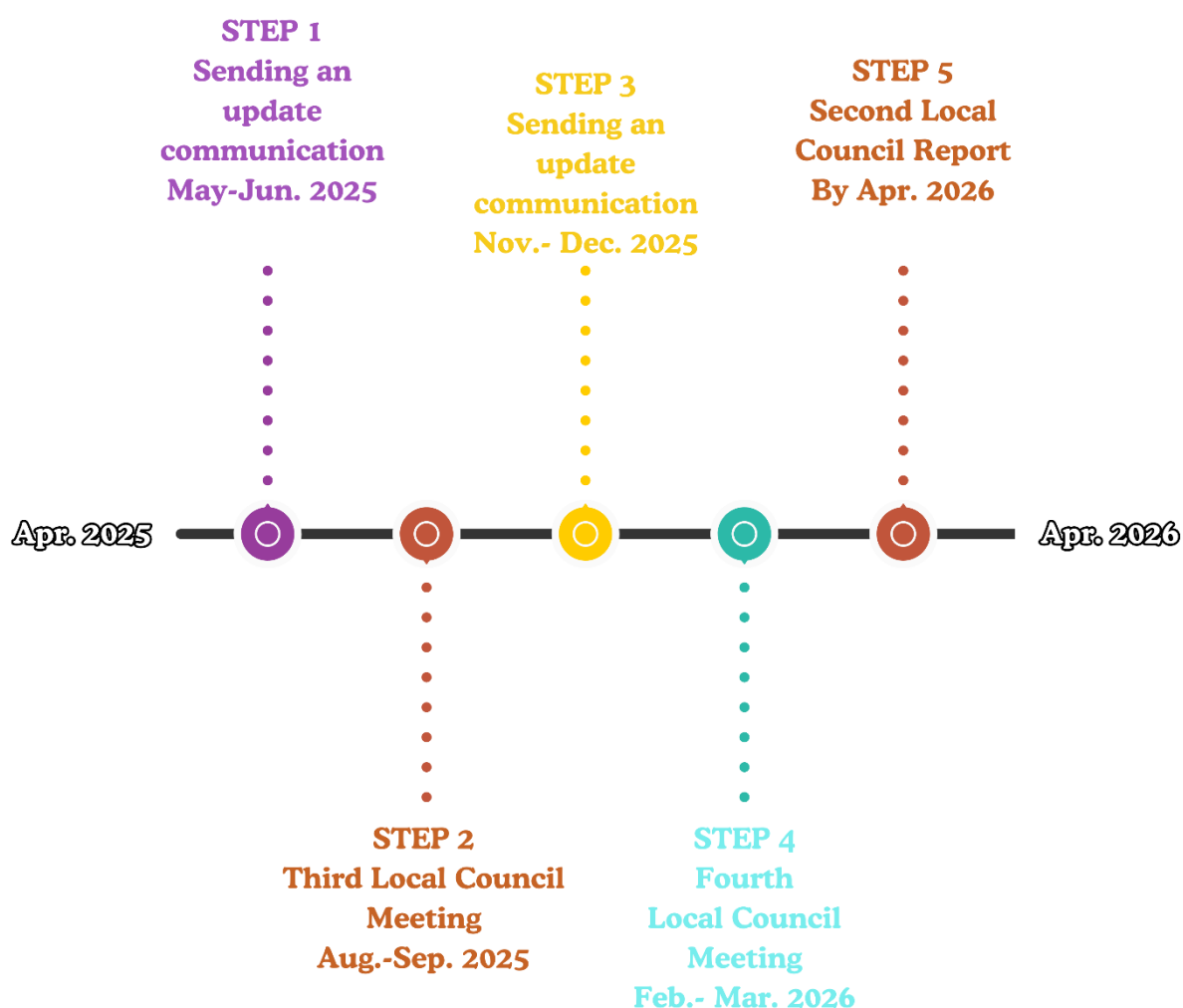
Figure 19.    Third year stakeholder engagement implementation roadmap (UMIL, 2024)

**Year 4 and 5: Consolidation and Final Feedback**

**1. Sending an update communication (May - June 2026)**

– Following the first and the second update it is suggested to Regional Coordinators/Local Council Coordinator to send an update (newsletter, email, PowerPoint, etc.) to UMIL coordinator, all regional demo's partners, Local Council members and potential regional demo's stakeholders in general.

**2. Fifth Local Council meeting (August – September 2026):**

- The fifth meeting of the Local Council should be organized like the previous ones, with a tailored agenda depending on the activities of the RD that require feedback at that moment.

- Consider creating an activity that encourages active participation concerning the specific ongoing activities of the demo area (Workshop, focus group, questionnaire).

**3. Sending an update communication (November – December 2026)**

– Following the others update it is suggested to Regional Coordinators/Local Council Coordinator send an update (newsletter, email, PowerPoint, etc.) to UMIL coordinator, all regional demo's partners, Local Council members and potential regional demo's stakeholders in general.

**4. Sixth Local Council Meeting (February – March 2027):**

– The sixth meeting of the Local Council should be organized like the previous ones, with a tailored agenda depending on the activities of the RD that require feedback.
– Consider creating an activity that encourages active participation, (Workshop, Focus Group, Questionnaire) especially in preparation of the next public event with the RD's partnership and community of the RD to show the project activities and results so far.
– Extend the invitation also to other stakeholders mapped in the previous stakeholder mapping steps.

**5.Third Local Council Report (By April 2027)**

– In order to monitor the progress of engagement and activities of the Local Council, it is suggested that the RD Coordinators/Local Council Coordinators draft an annual report outlining key activity points, strengths, and challenges of the working group to share with project coordinator UMIL.

6. **Public event with the population (May – June 2027)**

– Organizing a public event to present the activities of the Local Council and partners in the regional demonstration is crucial to implement even more the engagement of the community and raise awareness about project topics. Moreover, public events can strengthen local identity and pride by celebrating the unique contributions of the area.
– This is also a unique opportunity to share the results achieved through activities in the field.
– Extend the invitation also to other stakeholders mapped in the previous stakeholder mapping steps and with related Regional Replicator.

7.**Seventh Local Council meeting (August – September 2027)**

– The Seventh meeting of the Local Council should be organized like the previous ones, with a tailored agenda depending on the activities of the RD that require feedback at that specific time.
– Consider creating an activity that encourages active participation (Workshop, Focus Group, Questionnaire) especially focusing on feedback about the previous public event with all communities to show the project activities and results so far.

**8. Sending an update communication (November – December 2027)**

– Following the others update it is suggested to RD's Coordinators/Local Council Coordinators to send a fourth update (newsletter, email, PowerPoint, etc.) to UMIL coordinator, all regional demo's partners, Local Council members and potential regional demo's stakeholders in general, focusing especially on the last Local Council meeting as the final activity of the project's lifetime.

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**9.Eight and final Local Council meeting and Report (By February 2028)**

- As a final meeting, it is suggested to focus on the feedback of the results obtained during the 's work and to dedicate time to a group discussion on the strengths and weaknesses identified over the years.
- It is suggested to establish a shared approach for continuity to stay in the loop and continue this co-design even beyond the project timeline.
- Finally, the RD's Coordinators/ Local Council Coordinators are requested to produce a final report that summarizes the entire engagement plan, highlighting the strengths and weaknesses identified.

Extend the invitation also to other stakeholders mapped in the previous stakeholder mapping step.
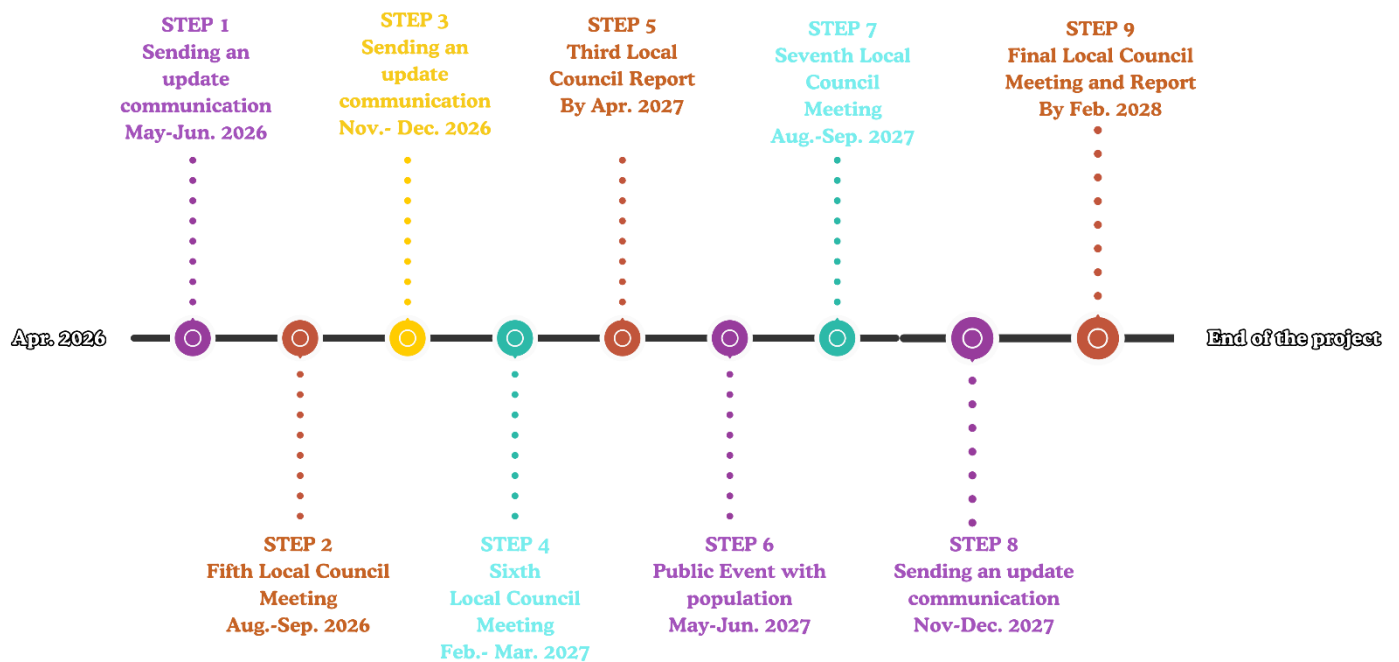


Figure 20.    Fourth and Fifth stakeholder engagement implementation roadmap (UMIL, 2024)

## 3.3. **Suggested implementation roadmap for each RD**

To propose the most realistic implementation suggestions, project documents were reviewed, and feedback was collected from partners and stakeholders. The chosen method involved the completion of factsheets, the structure of which was provided by UMIL. In these factsheets, explained in the methodology section, partners and stakeholders had the opportunity to offer suggestions and comments regarding the necessary implementation actions for each regional demonstrator. The regional demonstrator coordinators/local council coordinators administered these exercises by organizing workshops, one for partners and one for stakeholders, following the instructions provided by UMIL.

**Factsheet distribution list:**

**Table 20** List of participant's leaders from each regional demonstrator project who was in charge to distribute, collect and validate processes through Local Councils (UMIL, 2024)

| RD | FIGURES (pseudonymized) | Papers collected |
|---|---|---|
| Gabrovo | Local council leader (G-LCL) <br> Exercise participant (G-EP) | Partners' Factsheets: 6 <br><br> Stakeholders' Factsheet: 7 <br><br> Local council date: 28/08/2024 <br><br> Feedback Date: 30/08/2024; 12/09/2024 |
| Lapland | Local council leader (L-LCL) <br> Exercise participant (L-EP) | Partners' Factsheets: 1 (resumed) <br><br> Stakeholders' Factsheet: 2 (resumed) <br><br> Local council date: 04/2024, validation done online in September <br><br> Feedback Date:16/09/2024 |
| Piedmont | Local council leader (P-LCL) <br> Exercise participant (P-EP) | Partners' Factsheets: 2 (resumed) <br><br> Stakeholders' Factsheet: 2 (resumed) <br><br> Local council date: 13/09/2024; 20/09/2024 <br><br> Feedback Date: 10/09/2024; 19/09/2024; 25/09/2024 |

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|---|---|---|
| Râu Sadului | Local council leader (R-LCL) <br><br> Exercise participant (R-EP) | Partners' Factsheets: 3 (resumed) <br><br> Stakeholders' Factsheet: 1 (resumed) <br><br> Local council date: 12/09/2024 <br><br> Feedback Date: 17/09/2024 |
| Tyrol | Local council leader (T-LCL) <br><br> Exercise participant (T-EP) | Partners' Factsheets:2 (resumed) <br><br> Stakeholders' Factsheet:2 (resumed) <br><br> Local council date: 10/09/2024 <br><br> Feedback Date: 13/09/2024 |
| Valais | Local council leader (V-LCL) <br><br> Exercise participant (V-EP) | Partners' Factsheets: 1 (resumed) <br><br> Stakeholders' Factsheet: 3 (resumed) <br><br> Local council date: 18/07/2024; 20/08/2024 <br><br> Feedback Date: 16/09/2024; 18/09/2024 |

Before presenting the suggested implementation roadmap for each regional demonstrator is essential to point out some general consideration at the basis:

> ➤ ***The suggested timing for the implementation steps:***

Given the importance of providing reasonably defined, yet flexible timelines, the following time indications are divided into phases corresponding to a range of MR months:

**1. Early Stage (0-18 months).**

**2. Middle Stage (19-36 months).**

**3. Late Stage (37-54 months).**

Additionally, it should be noted that the proposed timelines are based on the assumption that RD partners and stakeholders will begin their activities with the first suggested solution, following the project's sequence of steps. If the priority implementation activity is instead determined to be one listed later, the timeline may vary from the suggested schedule accordingly.

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## 3.4. **Gabrovo suggested implementation roadmap**

### 3.4. Suggested Solutions and Actions for Implementing Adaptation within MR project

What emerged as a priority for implementation in Gabrovo is outlined in the table below (Table 21):

**Table 21** Gabrovo implementation priority (UMIL, 2024):

| Discussed area: Sustainable water resource | | |
|---|---|---|
| In the second case, the necessity of sourcing water from alternatives to the aqueduct network is clear. The practices identified include rainwater harvesting, green roofs, and rainwater treatment. This underscores the emphasis placed on the urban gardening project for Gabrovo in the final exercise, reflecting participants' overarching vision of "sustainable green city areas" and "sustainable urban resilience" (G-EP). Regarding water resources, key themes included the exploration of "*new methodologies for assessing and utilizing underground water resources*" (G-EP), the need for updated management policies, and the development of strategies for water resource usage, alongside the continual demand for funding. Overall, both sets of results indicate that themes related to "*innovative technological solutions and ecosystem-based approaches*" (D1.2; p. 22) consistently emerged. | | |
| **Suggested solution for the implementation** | **Strengths** | **Weaknesses and challenges** |
| Rainwater harvesting and water reuse system for irrigation, with photovoltaic power supply | • *Groundwater, freshwater and tip water preservation*<br>• *Lower energy consumption and less bills for irrigation*<br>• *Water availability during dry periods*<br>• *Increased water retention* | • *High costs: installation and maintenance*<br>• *Dependent on weather conditions*<br>• *Photovoltaic systems need space in the city* |

**Table 22** Outputs from Exercise 4 (a) – Gabrovo Regional Demonstrator Partners Factsheet (UMIL, 2024)

| IMPLEMENTATION ACTION | SET-UP TIME | PROJECT MONTHS SUGGESTION | PROJECT STAGE | COSTS | MAIN ACTORS |
|---|---|---|---|---|---|

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| Assignment for design | 3 months | (M15-M18) | Early | Low | Project members |
|---|---|---|---|---|---|
| Design | 6 months | (M15-M21) | Early | High | Designer's company |
| Implementation | 6 months | (M21-M27) | Middle | High | Construction company |
| **OUTCOMES** | Green city parks in the summer; lower bills for irrigation | | | | |
| **INDICATORS** | Quantity of rainwater used for irrigation | | | | |
| **FUNDING & FINANCING** | MR project | | | | |

## 3.4. Additional Implementation suggestions

**Table 23** Additional implementation suggestion (UMIL, 2024):

| **Discussed area: Raising awareness** |
|---|
| Concerning the population, the impact of climate change (CC) on human health has been acknowledged as one of the significant health risks identified, as noted in D1.2: "Extreme weather events pose significant health hazards, especially for vulnerable populations such as the elderly" (D1.2, p. 18). Stakeholders recognize the need for action on "raising awareness about the risks associated with sun exposure and high temperatures" (G-EP). However, some participants deemed this danger less relevant, indicating a variation in the perceived risk associated with health factors. Similarly, biodiversity loss received a comparable assessment, possibly because a portion of the population is less exposed to these issues. |

| **Suggested solution for the implementation** | **Strengths** | **Weaknesses and challenges** |
|---|---|---|
| Raising awareness about Climate Change risks | • *Low costs and easy to be implemented*<br>• *Population and stakeholders' participation*<br>• *Inform on risks, preventing bad practices and actions* | • *Unpredictability of people*<br>• *Slow results and hard to be measured*<br>• *Difficulties to engage stakeholders and lack of interest* |

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| | • *Encourages the adoption and the acceptance of sustainable practices*<br>• *Base for climate policies and action and solution acceptance* | • *Quality of the information provided* |
|---|---|---|

**Table 24** Additional implementation Gabrovo suggestion (UMIL, 2024):

| **Suggested solution for the implementation Raising awareness about risks** | |
|---|---|
| **SOLUTION STRENGTHS:** | low costs; avoiding exposure to risks |
| **SOLUTION WEAKNESSES:** | The general *irresponsibility of people* toward climate-related health risks; there is a recognized need for creating organizations |
| **SOLUTION IMPLEMENTATION STAGES:** | selection of channels for raising awareness; creating organizations focused on raising awareness and educating the community; support |
| **OUTCOMES:** | To achieve a community that is more aware about risk issue and responsive to the problems created by it. |
| **INDICATORS:** | reduced number of irresponsible people |
| **FINANCINC AND COSTS:** | national and municipal budget – 25.000 euros |
| **ACTORS INVOLVED:** | municipality; media; environmental NGO |
| **Discussed area: green infrastructures** | |

Among the three main aspects indicated during the validation phase, the one concerning temperature received less attention in the database search, with only a few cases and primarily linked to greenery systems for cooling down outdoor spaces. Despite this, solutions linked to the increase of the green infrastructures are seen as necessary by participants, both for a better city livelihood and for runoff mitigations

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| Suggested Solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Increase green roofs and green areas | • *Urban heat island effect mitigation*<br>• *Decreasing health risk for old people and workers*<br>• *Cooling effects; less energy use*<br>• *Runoff control*<br>• *Better air quality* | • *Needs a high initial investment*<br>• *Builders may have interest in creating green areas*<br>• *Public may prefer parking areas*<br>• *Not all buildings can support green roofs*<br>• *Long-term planning, management and maintenance* |

## Suggested solution: green roofs

| | |
|---|---|
| **SOLUTION STRENGTHS:** | better air quality; decrease of temperatures |
| **SOLUTION WEAKNESSES:** | lack of investment interests |
| **SOLUTION IMPLEMENTATION STAGES:** | raising awareness campaigns; demonstration project, residential buildings projects |
| **OUTCOMES:** | better air quality; decrease of temperatures |
| **INDICATORS:** | area of green roofs built |
| **FINANCINC AND COSTS:** | external financing |
| **ACTORS INVOLVED:** | municipality; private property owners; businesses |

## Suggested solution: Increasing green areas

| | |
|---|---|
| **SOLUTION STRENGTHS:** | improving life quality; decreasing health risks; lowering temperatures |
| **SOLUTION WEAKNESSES:** | financing; investor interests in building vacant green areas; public dissatisfaction due to lack of parking spaces |
| **SOLUTION IMPLEMENTATION STAGES:** | mapping of existing public green areas, strategy for sustainable development of green infrastructure; |

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| | designing & projects; realization (building/constructing); maintenance |
|---|---|
| **OUTCOMES:** | increased green areas; improved management of the green infrastructure; better quality of life of the population; reducing carbon footprint and temperatures |
| **INDICATORS:** | existing green areas renovated; new green areas built; area of built green zones, number of people who will benefit |
| **FINANCINC AND COSTS:** | EU projects; national/ municipal budget; public – private partnerships, 7.500.000 euro |
| **ACTORS INVOLVED:** | municipality, businesses, communities, stakeholders, public institutions |

# 3.5. **Lapland suggested implementation roadmap**

## 3.5. Suggested Solutions and Actions for Implementing Adaptation within MR project

What emerged as a priority for implementation in Lapland is outlined in the table below (Table 25)

**Table 25** Lapland implementation priority (UMIL, 2024)

**Solution: Climate-ADAPT**

| IMPLEMENTATION STAGES | SET-UP TIME | PROJECT MONTHS SUGGESTION | PROJECT PHASE | COSTS | MAIN ACTORS |
|---|---|---|---|---|---|
| Preparing the ground for adaptation | 2024 | M15-M18 | Early | Low | Municipalities |

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| | | | | | |
|---|---|---|---|---|---|
| Assessing Climate Change risks and vulnerabilities | 2025 | M18-M25 | Middle | Moderate | Municipalities and LUKE and FLTB |
| Identifying adaptation options | 2025 | M25-M28 | Middle | Moderate | Municipalities and Luke and FLTB |
| Assessing adaptation options | 2026 | M29-M36 | Middle | Moderate | Municipalities and Luke and FLTB |
| Implementing adaptation | 2027 | M37-M47 | End | High | Municipalities and RCL |
| Monitoring and evaluating | 2027-2028 | M48-M53 | End | Low | Municipalities |
| **OUTCOMES** | CC Adaptation plan for municipalities | | | | |
| **INDICATORS** | | | | | |
| **FUNDING & FINANCING** | MR project | | | | |

## 3.5. Additional Implementation suggestions

**Table 26** Additional implementation Lapland suggestion (UMIL, 2024):

| Discussed area: Sharing knowledge |
|---|
| Stakeholders viewed the development of culture-based tourism and year-round tourism differently, with research focusing on eco-tourism and experience-based options. Consequently, the proposed exercises for the Factsheet creation highlighted a search for opportunities related to snowless tourism and the subarctic area in general, where "*more information is needed on the growth of year-round tourism demand*" (L-EP). However, this does not imply a departure from technology; rather, the selection of solutions to be implemented has influenced the decision to utilize Public Participation Geographic Information Systems (PPGIS), which stakeholders identified as necessary, albeit not their first choice in terms of impact and feasibility.<br><br>When searching for related articles and projects, some participants noted that "*more information is needed on the implementation of smartphone apps*" (L-EP) and highlighted "*missing information on marketing challenges and opportunities*" (L-EP). Additionally, negative impacts on winter tourism are attributed to unstable weather conditions and fluctuating temperatures, factors that must be considered for any potential tourist transitions. |

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Participation Geographic Information Systems (PPGIS) | • *Monitoring impact*<br>• *Data collection and accuracy*<br>• *People's awareness and acceptance of adaptation and solutions*<br>• *Local communities' involvement*<br>• *More localized information* | • *Usability and effectiveness*<br>• *Broad group engagement*<br>• *Training and dissemination may be long and not accepted*<br>• *Limited access for rural communities* |

| Suggested Solution: Public Participation Geographic Information Systems (PPGIS) | |
|---|---|
| **SOLUTION STRENGTHS:** | the tool can assist in monitoring impact and help to understand adaptation and solutions; base information is already obtained |
| **SOLUTION WEAKNESSES:** | usability; effectiveness; the challenge is how to engage a broad group in reporting data |
| **SOLUTION IMPLEMENTATION STAGES:** | integrate local Knowledge and PPGIS structure; PPGIS dissemination |

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| | |
|---|---|
| **OUTCOMES:** | Increased knowledge sharing and enhanced community engagement |
| **INDICATORS:** | Number of PPGIS Users, increased awareness levels |
| **FINANCINC AND COSTS:** | / |
| **ACTORS INVOLVED:** | Local Communities, Tourism Operators Technology Developers |

## Discussed area: Traditional lifestyle

Aspects that consider local culture emerged among the researched projects and feedback received, as everyone's lifestyle is affected. For instance, it was noted that "*changes in the region's fish, grouse, or moose harvests— whether negative or positive—as well as changes in reindeer herding practices, will all impact the local community*" (L-LCL). Furthermore, "*a significant portion of the population, even those not from reindeer herding families, relies on natural resources as part of their lifestyle. When these resources change, people must adapt their way of living*" (L-LCL). Thus, it is understandable that stakeholders are interested in aspects related to year-round subsistence livelihoods that can provide resources for both animals and humans.

In this context, participants highlighted existing projects aimed at protecting Arctic foxes from the extinction, restoring biodiversity, and enhancing tourism to promote cultural heritage, effectively integrating nature and local economies. Climate change impacts both Sámi and non-Sámi residents because "*our comfortable life here relies on imported energy, food, and raw materials, which adds context to discussions on self-sufficiency*" (L-LCL). Additionally, while the lack of job opportunities may not directly affect administrative or national levels, it can alter the way people live in the region and, consequently, their culture.

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Forest restoration and management, including selective timbering | • *Habitat type maintenance (reindeer)*<br>• *Biodiversity support*<br>• *Carbon sequestration*<br>• *Sustainable resources*<br>• *Local economy and livelihood support*<br>• *Avoid invasive species* | • *Ethical concerns, societal barriers*<br>• *Political climate links*<br>• *Maintenance and reforestation costs*<br>• *Long term planning*<br>• *High risk of mismanagement* |

## Suggested solution: Forest restoration and management, selective timbering

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| | |
|---|---|
| **SOLUTION STRENGTHS:** | maintains a specific habitat type; investing in strengthening forest carbon sinks |
| **SOLUTION WEAKNESSES:** | high employment demand; ethical concerns (nature natural change or forestry practices?), political climate links; action and maintenance costs. |
| **SOLUTION IMPLEMENTATION STAGES:** | evaluation of forest use practices; planning of new methods |
| **OUTCOMES:** | Enhanced local livelihoods, public awareness and engagement and restored biodiversity |
| **INDICATORS:** | forest-related indicators, such as restored tundra area |
| **FINANCINC AND COSTS:** | first trial with project fundings |
| **ACTORS INVOLVED:** | municipalities, private forest owners, Metsähallitus (administrator of state-owned land and waters |

| **Discussed area: Winter tourism** |
|---|

This topic is intrinsically linked to the main focus of the regional demonstrator: tourism. As noted, "*the influence of the tourism sector as the primary employer in Lapland is recognized as crucial for climate change adaptation (CCA) efforts*" (D1.2; p. 44), often providing essential support for local communities. The promotion of tourism at multiple levels is evident in its swift recovery from the pandemic. For instance, "*in 2023, the number of internationally registered overnight stays in Lapland increased by 22% compared to 2022, while the overall growth for all of Finland was 15.4%*" (L-LPL).

Tourism also plays a central role in discussions about urban life. The regions of Utsjoki and Enontekiö frequently engage in conversations regarding the challenges associated with short-term rentals, such as those offered by Airbnb, and the potential implementation of a tourist tax to mitigate the negative impacts of tourism (L-LPL). Despite these challenges, there is a prevailing sentiment that the tourism sector should remain connected to local traditions and culture. This calls for "*a deeper analysis of the long-term benefits of cultural tourism*" as a means of fostering local identity. Indeed, the projects and articles explored were those focused on sustainable tourism that prioritizes local culture.

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Development of Year-Round Tourism | • *Year-round and long-term benefits* | • *Population acceptance* |

| | • Businesses, employees, and local communities' opportunities<br>• Customer's safety<br>• Seasonal dependency reduced<br>• Heritage and cultural preservation | • Reaction by actors in the tourism sector are unknown<br>• Resource management and over-tourism related problems<br>• Risk of degradation of natural sites |
|---|---|---|

**Suggested solution: Development of year-round tourism to reduce dependence on the winter season and create year-round jobs**

| | |
|---|---|
| **SOLUTION STRENGTHS:** | great opportunities to provide benefits year-round; already known and attempted; long-term and extensive benefits: numerous businesses, employees, and local communities; customers safety |
| **SOLUTION WEAKNESSES:** | population acceptance; tourism reaction unknown |
| **SOLUTION IMPLEMENTATION STAGES:** | Idea generation and product development for tourism services; marketing and sales |
| **OUTCOMES:** | diversified tourism offerings, increased economic opportunities |
| **INDICATORS:** | number of tourists and usage of services |
| **FINANCINC AND COSTS:** | businesses, regions, and public support is needed, for example, through projects |
| **ACTORS INVOLVED:** | businesses, tourism regional organizations, transportation companies, regional authorities, municipalities |

## 3.6. Piedmont suggested implementation roadmap

### 3.6. Suggested Solutions and Actions for Implementing Adaptation within MR project

What emerged as a priority for implementation in Piedmont is outlined in the table below (Table 27)

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**Table 27** Piedmont implementation priority (UMIL, 2024)

| Discussed area: Water management |
|---|
| Water scarcity and drought-related issues were frequently highlighted during the local council meetings, particularly in light of the projection that "*water needs are expected to rise in a business-as-usual scenario*" (D1.2; p. 56). This scenario poses a potential source of conflict, (also D1.3, Factsheets, Valais), and the "*changing precipitation patterns present significant hazards for the region*" (Arpa & Regione Piemonte, 2020), altering the typical timing of water availability for agricultural practices. These two fundamental aspects underscore the regional "*challenge between small and large reservoirs*" (P-EP), necessary for farmers to have a reliable water supply during the summer months, which hinders effective "*management of water sources under abnormal climatic conditions*" (P-EP). This situation has been classified as high risk and is further evidenced by numerous proposed tools aimed at improving groundwater storage.<br><br>Optimizing management among the various organisations and users is crucial, not only to provide water to farmers efficiently and reduce costs but also to ensure a prompt response during emergencies. While the priorities for using water resources are known, the internal usage methods of each consortium are defined within complex emergency plans: "*the priorities for the use of water resources are known, but the internal use methods of each entity are defined within the emergency plans and are extremely complex*" (P-EP). As indicated in D1.2 and supported by this feedback process, there is a pressing need for a "*water management emergency plan in exceptional cases*" (P-EP). The fragmentation among the various consortia and entities remains a significant challenge, despite the "*ongoing process of regional reorganization of irrigation entities*" (P-EP). |

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Develop a Tool for Water Management – Decision-Support (DS) Tool - to mimic water availability and anticipate critical scenarios | • *Water availability in real time data*<br>• *Farmers and consortia conflicts reduced by the presence of an established decision-making mechanism*<br>• *Final users' security*<br>• *Better cooperation and data sharing*<br>• *Water wasted reduction*<br>• *Less costs for end users* | • *Changes are hard to be accepted by farmers*<br>• *Hard developing and programming phases*<br>• *Requires more technical experts*<br>• *Depending on data correctness* |

**Suggested solution: Develop a tool for water management - Decision-support (DS) tool to mimic water availability and anticipate critical scenarios for farmers and consortia.**

**Table 28** Outputs from Exercise 4 (a) – Piedmont Regional Demonstrator Partners Factsheet (UMIL, 2024)

| IMPLEMENTATION STAGES | SET-UP TIME | PROJECT MONTHS SUGGESTION | PROJECT PHASE | COSTS | MAIN ACTORS |
|---|---|---|---|---|---|
| Daily updating | 2-3 months | (M15-M18) | Early stage | Low | Farms, irrigation consortium, regional authorities |
| Data collection: retrieve old data available and buy and install new sensor for monitoring | 6 months | (M15-M21) | Early stage | Medium | University |
| Sharing data/aims among stakeholders | 3 months | (M17-M20) | Early stage | Medium | Irrigation consortium |
| Creation of a model for forecasting available water to distribute | 6 months | (M20-M26) | Mid-stage | Medium | University |
| Creation of a model of the irrigation network | 6 months | (M26-M32) | Mid-stage | Medium | University |
| Sharing data among stakeholders weekly/monthly during the irrigation season | 1-2 year | (M32-M54) | Late stage | Low-Medium | Irrigation consortium, regional authorities, farmers |
| OUTCOMES | | | | | |
| INDICATORS | Water availability, water management, irrigation, water utilization | | | | |
| FUNDING & FINANCING | MR project | | | | |

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## 3.6. Additional Implementation suggestions

**Table 29** Additional implementation Piedmont suggestion (UMIL, 2024):

| Discussed area: Agriculture |
|---|
| Many participants highlighted the "*inefficient water usage practices in agricultural pricing models and regulations*" (D1.2; p. 56) concerning water resources, particularly targeting the agricultural sector, which is identified as the primary area of exposure to climate change. Water-related issues significantly impact the region's economy, as emphasized in D1.2. In the deliverable it was noted that "*the most important agricultural products in Piedmont are cereals (e.g., rice and corn) and livestock, the latter accounting for nearly half of the final agricultural production in Piedmont*" (ESTAT, 2004). |

Despite a generally high level of awareness regarding water scarcity challenges—especially in agriculture—there remains a pressing need for improved monitoring and optimization of water usage at the individual level. This need was underscored by the feedback received, which focused on both organizational and economic aspects, particularly rising costs related to catastrophic events. Increased periods of intense rainfall elevate the risk of flooding and, to a lesser extent, landslides (Navarro et al., 2022; Tiranti & Ronchi, 2023). Consequently, "*environmental damages, loss of production, and reduced profitability*" (P-EP) were identified as major risks. Discussions also emerged regarding food protection and crop damage prevention from floods, which included considerations for utilizing insurance and technologies related to canalization. Such measures are essential, particularly since they can serve as "*a method of drainage that could be 'helped' by reducing upstream resources during extreme weather events*" (P-EP).

Economic losses in the agricultural sector, especially for water-intensive crops like rice, jeopardize the quality of Piedmont's product chain. This situation is particularly damaging in mountain areas, which are witnessing a decline in traditional agricultural and pastoral activities, resulting in depopulation and land abandonment (D1.2; p. 62). Reducing costs and promoting effective water management also necessitate an "*upgrade in water use*" (P-EP). In conditions of resource scarcity, optimization is crucial: "*the irrigation infrastructure is largely characterized by a fragmented system of public and private consortia*" (D1.2; p. 60). Additionally, it must be noted that "*climate change affects management costs, including maintenance, on-call, and overtime expenses for operators*" (P-EP).

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Innovation in crop irrigations techniques | • *Less water usage*<br>• *Less pollution from fertilizers*<br>• *Improved crops quality and resistance*<br>• *Soil preservation*<br>• *Can be easily integrated with other solutions* | • *Long times to be adopted and accepted by farmers*<br>• *Initial investment and more maintenance*<br>• *Bad management can cause soil degradation*<br>• *Not applicable to all crops (e.g., rice)* |

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| Suggested Solution: Innovation in crops irrigations techniques | |
|---|---|
| **SOLUTION STRENGTHS:** | water better use; water management |
| **SOLUTION WEAKNESSES:** | changes are hard to be accepted |
| **SOLUTION IMPLEMENTATION STAGES:** | assessment and planning, training and capacity building, infrastructure improvement, scaling up |
| **OUTCOMES:** | competitive productions – Water saving |
| **INDICATORS:** | n° of hectares changed; water volume saved |
| **FINANCINC AND COSTS:** | Funding Sources |
| **ACTORS INVOLVED:** | farmers; ICT; universities; SMEs |

| Discussed area: Biodiversity | |
|---|---|

Feedback also highlighted biodiversity, which "*reflects the geo-morphological and bio-climatic features of the area, including the presence of three biogeographical regions (Alpine, Continental, and Mediterranean)*" (D1.2; p. 52). This issue is not only directly related to climate change but also reflects the consequences of changes in the agricultural sector. For instance, "*the development of new irrigation infrastructure*" could lead to further destruction of biodiversity and conservation efforts in the area (D1.2; p. 56).

This challenge is further exacerbated by pollution and CO2 emissions, although feedback suggests that their impact may be less significant than what emerged in the interviews. Additionally, tourism received limited consideration in this context, despite the fact that "*natural and cultural heritage, as well as local communities, are strongly affected by processes of climate change*" (D1.2; p. 61).

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Integration of Climate Change adaptation into the work of local authorities (**From Tyrol case study**) | • *High impact*<br>• *Provide policy coherence and awareness*<br>• *Community and decision-maker involvement*<br>• *Holistic approach* | • *Actual system is difficult to be changed*<br>• *Dependent on decision-makers and political will*<br>• *Political, administrative and local barriers* |

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| | | • *Low financial resources* |
|---|---|---|
| **Suggested Solution: Integration of Climate Change adaptation into the work of local authorities** | | |
| **SOLUTION STRENGTHS:** | | Holistic approach, high impact |
| **SOLUTION WEAKNESSES:** | | Low financial resources, government barriers |
| **SOLUTION IMPLEMENTATION STAGES:** | | assessment phase, stakeholder engagement, policy development, capacity building, monitoring and evaluation. |
| **OUTCOMES:** | | Improved integration of climate change adaptation into local governance. Enhanced biodiversity conservation efforts. Increased community engagement in environmental decision-making. |
| **INDICATORS:** | | Number of new policies implemented that address climate change and biodiversity. Level of stakeholder participation in policy development processes. Changes in biodiversity metrics (e.g., species diversity, habitat quality) in the region. |
| **FINANCINC AND COSTS:** | | potential funding sources: Government grants, environmental NGOs, and public-private partnerships aimed at promoting sustainability |
| **ACTORS INVOLVED:** | | Local authorities and government officials. Community organizations and NGOs focused on environmental issues. Academic institutions conducting research on biodiversity and climate change. Local businesses and tourism operators that may be impacted by policy changes. |

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## 3.7. Râu Sadului suggested implementation roadmap

### 3.7. Suggested Solutions and Actions for Implementing Adaptation within MR project

What emerged as a priority for implementation in Râu Sadului is outlined in the table below (Table 30)

**Table 30** Râu Sadului implementation suggestion (UMIL, 2024)

| Discussed area: Soil trophicity |
|---|

One of the key points arising from previous considerations is the loss of soil fertility, which has led to an increased demand for amendments. While this issue was identified during direct interviews, it was not emphasized as much as in the feedback received. As noted, "*high temperatures and heat waves are expected to affect annual agricultural production by reducing crop yields, increasing pest infestations, and causing fertility loss*" (D1.2; p. 78). Therefore, it is not surprising that "*both teams identified pastures as the area exposed to risk*" (R-LCL), with erosion and pasture degradation highlighted as major problems in the exercises (R-EP).

The vision of creating "*meadows with higher productivity and biodiversity, climate-resilient*" (R-EP) necessarily involves participants advocating for the use of organic or foliar fertilizers, bio stimulants, and nitrifying bacteria—solutions identified as relatively easy to implement—to support humus formation. Soil amendments aimed at promoting the growth of existing species with high nutritional value, along with overseeding, are all strategies intended to enhance productivity and prevent further deterioration, as reflected in the projects and articles searched in the database. This approach also includes traditional practices use, with participants emphasizing "*the importance of both rational grazing and the sustainable solutions proposed in the project*" (R-EP).

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Integrated Meadow Management (mowing, mulching, overseeding, fertilizing, and alternate grazing and mowing) | • *New technologies for soil analysis*<br>• *Soil health and fertility enhancement*<br>• *Resilient pasture*<br>• *Soil erosion and preservation*<br>• *Can protect wide mountain areas* | • *Soil degradation if not well managed*<br>• *Risk related to use of soil improvers*<br>• *Greater management time and costs*<br>• *Lack of experts* |

**Solution: integrated meadow management, including mowing, mulching, overseeding, fertilizing and alternate grazing and mowing.**

**Table 31** Outputs from Exercise 4 (a) – Râu Sadului Regional Demonstrator Partners Factsheet (UMIL, 2024)

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| IMPLEMENTATION STAGES | SET-UP TIME | PROJECT MONTHS SUGGESTION | PROJECT PHASE | COSTS | MAIN ACTORS |
|---|---|---|---|---|---|
| Scanning and assessment of existing vegetation | 2 months | (M15-M17) | Early phase | medium | Râu Sadului Mayoralty, ICDM research (local project partners) |
| Soil analysis | 2 months | (M17-M19 | Middle phase | medium | Holland Farming |
| Product specifications to achieve targeted results according to plant needs (type and amount of amendment to be applied) | 1 month | (M19-M20) | Middle phase | low | ICDM |
| Procurement of amendments | 1 month | (M20-M21) | Middle phase | medium | Râu Sadului Mayoralty/ Holland Farming |
| Soil preparation | 2 months | (M22-M23) | Middle phase | medium | Râu Sadului Mayoralty |
| Application of amendments | 1 month | (M24-M25) | Middle phase | low | Râu Sadului Mayoralty |
| Monitoring of effects | 3 years | (M26-M54) | Middle phase - Late phase | low | Râu Sadului Mayoralty ICDM |
| OUTCOMES | | | | | |
| INDICATORS | | | | | |
| FUNDING & FINANCING | MR project | | | | |

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## 3.7. Additional implementation suggestions

**Table 32** Additional implementation Râu Sadului suggestion (UMIL, 2024):

| **Discussed area: Depopulation and land abandonment** |
|---|
| While some areas require protection due to external pressures and urban expansion (D1.2; p. 83), others are facing abandonment, particularly in the depopulated mountain regions. It is not surprising that participants identified mountain area abandonment as the highest-impact exposure field, followed by the decline in livestock numbers and the resulting decrease in farming and cultivated areas. The "*loss of soil fertility, which adversely affects both plant and grass growth as well as the land's infrastructure necessary for cultivation*" (D1.2; p. 79), leads to not only "*socio-economic losses*" (R-EP) but also social conflicts and a general degradation of the environment, making it more vulnerable to climate change. This concern is evident in participants' feedback, who consistently emphasized the need for a "*sustainable model for conservation and rural development in Special Areas of Conservation*" and the "*core principles for successfully implementing and upscaling Nature-based solutions—Harnessing the power of ecosystems for adaptation to climate change*" (R-EP). |

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Traditional practices (e.g., rotational grazing) for mountain areas | • *Traditional practices preservation and use* <br> • *Prevent depopulation* <br> • *Elder population acceptance* <br> • *Preserve meadows quality* <br> • *Improving biodiversity and natural regeneration* <br> • *Low-cost* <br> • *Wild-fires reduction* | • *Limited effectiveness* <br> • *Conflict with sheep farmers* <br> • *Requires initial knowledge transfer by involving elder population* |

| **Suggested solution: Rotational grazing** | |
|---|---|
| **SOLUTION STRENGTHS:** | improving and conserving biodiversity |
| **SOLUTION WEAKNESSES:** | withdrawal of sheep farmers from the Alpine area |
| **SOLUTION IMPLEMENTATION STAGES:** | analysis of the pastoral value, determination of the degree of burden/ duration, number of plots, evaluation |
| **OUTCOMES:** | iincreasing feed quality |

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| **INDICATORS:** | production (quantity, quality, number of animals), spore, area, number of farmers applying the solution, etc.) |
| **FINANCINC AND COSTS:** | APIA subsidies, own sources, projects |
| **ACTORS INVOLVED:** | pastors, local and central authorities, NGOs, research institutes and universities |
| **Suggested solution: Sustainable solutions for regenerating mountain meadows** | |
| **SOLUTION STRENGTHS:** | improving and conserving biodiversity |
| **SOLUTION WEAKNESSES:** | limited effectiveness |
| **SOLUTION IMPLEMENTATION STAGES:** | field analysis, vegetation, elaboration and selection of solutions, implementation, evaluation |
| **OUTCOMES:** | improving environmental quality (soil, biodiversity, productivity) |
| **INDICATORS:** | production (quantity, quality, number of animals), spore, area, number of farmers applying the solution, etc.) |
| **FINANCINC AND COSTS:** | APIA subsidies, own sources, projects |
| **ACTORS INVOLVED:** | pastors, local authorities, service providers, NGOs, research institutes and universities |

Note: participants proposed a stage of workshops/dissemination, which should be noted, and additionally highlighted that some activities are repeated annually, and this must be considered in the implementation phases.

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# 3.8. Tyrol suggested implementation roadmap

## 3.8. Suggested Solutions and Actions for Implementing Adaptation within MR project

What emerged as a priority for implementation in Tyrol is outlined in the table below (Table 33)

**Table 33** Tyrol implementation suggestion (UMIL, 2024)

| Discussed area: Buildings and heat |
|---|
| In the Austrian Alps, average temperature change predictions indicate an increase of 0.8–1.2°C (low/high emission scenarios) by the 2030s, 1.6–2.6°C by the 2050s, and 2.8–4.2°C by the 2080s (Steiger & Stötter, 2013). Existing buildings and structures are inadequate to cope with rising temperatures and the heat island effect, which not only challenge infrastructure but also increase the vulnerability of the local population (D1.2; p. 112).<br><br>Current adaptation measures to address heatwaves and the heat island effect in buildings are generally deemed insufficient (D1.2; p. 106). Consequently, the primary objective is to "*prevent buildings from overheating*" (T-EP), which is a medium to long-term goal. Urban areas and densely populated regions are particularly exposed, leading to a focus on re-naturalization systems, guidelines for mitigating overheating, and cooling solutions in the database. The issue impacts not only infrastructure costs, including energy and water use, but also public health, placing additional burdens on residents and workers. The most significant health risks identified include increased stress on the population, strain on the healthcare system, heightened social inequality, and financial loss (T-EP). |

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Changes in the buildings and settlements, avoiding overheating through active and passive measures | • *More data and simulation*<br>• *Better comfort and livelihood*<br>• *Quality of living spaces and life in general*<br>• *Less air conditioning (heating in winter) and energy consumption*<br>• *Long term sustainability* | • *Initially expensive*<br>• *Difficult to be implemented in the existing buildings*<br>• *Limited effectiveness* |

Suggested solution: Innovative solutions for adaptation - Changes in the buildings and settlements; Avoidance of overheating through active and passive measures

**Table 34** Outputs from Exercise 4 (a) – Tyrol Regional Demonstrator Partners Factsheet (UMIL, 2024)

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| IMPLEMENTATION STAGES | SET-UP TIME | PROJECT MONTHS SUGGESTION | PROJECT PHASE | COSTS | MAIN ACTORS |
|---|---|---|---|---|---|
| Collecting data on which buildings are affected by overheating problems and the cause | 3 months | (M15-M18) | Early phase | \ | Project partners, municipalities, house owners |
| Simulation of the building and derivation of measures | 2 weeks each | (M18-M22) | Early phase/Middle phase | Medium, costs for the simulation software | Project partners |
| Support in the implementation of the measures and implementation of the measuring points for monitoring | 3 months | (M22-M25) | Middle phase | Medium, costs for the measuring instruments | Project partners, municipalities, house owners |
| Derivation of the results and development of counselling services and information material | Implementation phase | (M25-M30) | Middle phase | high (print, advertising agency) | Project Partners, advertising agency |
| OUTCOMES | | | | | |
| INDICATORS | | | | | |
| FUNDING & FINANCING | MR project | | | | |

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**Solution: Transformation process for the mountain resort**

**Table 35** Outputs from Exercise 4 (b) – Tyrol Regional Demonstrator Partners Factsheet (UMIL, 2024)

| IMPLEMENTATION STAGES | SET-UP TIME | PROJECT PHASE | COSTS | MAIN ACTORS |
|---|---|---|---|---|
| Case study selection | 2 months | Preparation | \ | Workshops, travel, maybe external analysis/ data |
| Understanding the social-ecological context (stakeholder, tourism patterns, existing offers, vulnerabilities, needs etc.) | 2 months | Early stage | Low (travel, print, data) | UIBK, SAT, case study organisations, tourism associations |
| Development of place-based adaptation measures and/ or future scenarios | 1 month | Implementation | Workshops, travel, maybe external analysis/ data | UIBK, SAT, case study organisations, Stakeholders, |
| Implementation and monitoring concept | 6 months | Implementation | Workshops, travel, maybe external analysis/ data | UIBK, SAT, case study organisations |
| **OUTCOMES** | Transformative tourism development strategies, nature-based adaptation measures for ski resorts, nature-based offers | | | |
| **INDICATORS** | Number development strategies; n° of adaptation measures; n° of nature-based offers, n° of workshops; ration between summer/ winter revenue, n° of year-round jobs | | | |
| **FUNDING & FINANCING** | MR Project | | | |

## 3.8. Additional implementation suggestions

**Table 36** Additional implementation Tyrol suggestion (UMIL, 2024):

| Discussed area: Sharing knowledge and policy actions |
|---|

To address climate change effectively, greater awareness and knowledge at all levels are essential. There is currently a "*lack of awareness and sensibilization not only among the local population but also among local governments and economic actors*" (D1.2; p. 105). Furthermore, even when high-level political actors and decision-makers recognize the need for climate change adaptation, ambitious policies and concrete actions are often lacking (D1.2; p. 111), primarily due to political barriers.

Participants sought solutions to enhance decision-making, such as employing climate coaches, facilitating knowledge sharing among citizens, using questionnaires to gather data, promoting participation, and implementing multi-governance/management plans. The growth of awareness and the involvement of local authorities were identified as highly effective strategies, leading to the recommendation for the "*installation of citizen councils*" (T-EP) to discuss environmental issues.

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| *Integration of Climate Change adaptation into the work of local authorities* | • *High impact*<br>• *Provide policy coherence and awareness*<br>• *Community and decision-maker involvement*<br>• *Holistic approach* | • *Actual system is difficult to be changed*<br>• *Dependent on decision-makers and political will*<br>• *Political, administrative and local barriers*<br>• *Low financial resources* |

| Suggested solution: Innovative solutions for adaptation (passive & active cooling solutions, technical solution and behavioural change) |
|---|

| | |
|---|---|
| **SOLUTION STRENGTHS:** | good passive measures prevent overheating, better room quality |
| **SOLUTION WEAKNESSES:** | expensive and difficult to implement in existing buildings, positive effect on health |
| **SOLUTION IMPLEMENTATION STAGES:** | information, recommendation, counselling, further training, promotion, adapting the legal framework |

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| **OUTCOMES:** | increased awareness and engagement, strengthened policy frameworks, improved data collection and analysis |
| **INDICATORS:** | building's temperature |
| **FINANCINC AND COSTS:** | the earlier integrated in planning, the more cost efficient, funding |
| **ACTORS INVOLVED:** | residents, spatial planning, politics and administration, landowners |

### Discussed area: Green & blue infrastructures

 The management of green and blue spaces is central to the previous two themes. Selected solutions from the database include integrated city management, green and blue infrastructures, pocket parks, and tools for managing and innovating urban greenery and traffic. Green areas were identified as having high feasibility and effectiveness, making them ideal for addressing issues such as flooding, heatwaves, livelihood, and passive heat mitigation (T-EP).

Heat stress also indirectly impacts health, leading to various challenges that arise from the increase in both indigenous and new disease vectors (such as mosquitoes, bugs, and ticks) and new plants with high allergenicity (D1.2; p. 96). This underscores the importance of effective management of blue and green infrastructures.

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| *Green & blue infrastructure implementation* | • *Better air quality*<br>• *Protection from heavy weather events*<br>• *Reduced health risk*<br>• *Better biodiversity and life quality* | • *High installation and maintenance costs*<br>• *Expensive for public*<br>• *Limited space in city*<br>• *Long time to be effective* |

### Suggested solution: Green & blue infrastructure implementation

| | |
|---|---|
| **SOLUTION STRENGTHS:** | cooling effect, better air quality, better protection during heavy weather events (sponge city principle), improved quality of stay, reduced risk to health due to heat |

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| **SOLUTION WEAKNESSES:** | high maintenance costs, expensive for the public but not for the individual, drinking water available free of charge |
| **SOLUTION IMPLEMENTATION STAGES:** | 1. political will/consensus, 2. concept development with participatory process and consideration that green measures need a lot of time to be effective, 3. examination of legal and infrastructural conditions, 4. implementation of the measures at test locations and evaluation, 5. Large-scale construction measures and maintenance |
| **OUTCOMES:** | air and life quality |
| **INDICATORS:** | temperature, air quality, frequency of use of squares, number of squares with water access, flow rate in the canal during extreme weather events |
| **FINANCINC AND COSTS:** | fundings |
| **ACTORS INVOLVED:** | residents, spatial planning, politics and administration, landowners |

# 3.9. **Valais suggested implementation roadmap**

## 3.9. Suggested Solutions and Actions for Implementing Adaptation within MR project

What emerged as a priority for implementation in Valais is outlined in the table below (Table 37)

**Table 37** Valais implementation suggestion (UMIL, 2024)

**Solution: in watershed quantitative and qualitative monitoring - Transformation of data into inclusive digital interface for an informed decision-making process.**

| |
|---|
| **Discussed area: Data digitalization and sharing** |

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One of the first needs (shared with Piedmont) is the capacity to inform stakeholders and users nationally to improve decision-making. "*Direct benefits thanks to improved resources management, and enhanced capacities for action and impact*" (V-EP), which can only be achieved by overcoming the barrier to proactive and foresighted water management; this is caused among others by the lack of transparent monitoring of water uses and needs (D1.2; p. 126). Providing new open-source data should therefore be the starting point: solutions were identified for glacier and water monitoring, with more accurate measures for water management, continuous monitoring systems, and the use of new and modern technologies, including artificial intelligence (V-EP). "*Continuous monitoring of glaciers and water allows for informed decisions and effective adaptation measures*" (V-EP), with actions often linked to natural systems, such as forests and lakes, for the preservation of resources through successful interventions. Additionally, this also aims at identifying risks, such as landslides and flooding, and fostering community collaboration and long-term engagement (V-LCL).

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Transformation of data into inclusive digital interface for an informed decision-making process. | • *Enhanced system for qualitative and quantitative monitoring.*<br>• *Real time data viability*<br>• *Fast reactions in case of extreme events*<br>• *Population awareness and security* | • *Long-term commitment*<br>• *Access to initial data*<br>• *Continuous maintenance, development and related costs*<br>• *Technological barrier for rural areas*<br>• *Needs for a collaboration between different stakeholders*<br>• *Control on data collection, accuracy and transformation processes* |

**Table 38** Outputs from Exercise 4 (a) – Valais Regional Demonstrator Partners Factsheet (UMIL, 2024)

| IMPLEMENTATION STAGES | SET-UP TIME | PROJECT PHASE | | COSTS | MAIN ACTORS |
|---|---|---|---|---|---|
| Planning and preparation | 2024 | done | Early phase | Low/ in person meeting costs – in case | Local government agencies; community stakeholders |
| Stakeholders' identification | 2024 | done | Early phase | low | Quadruple-helix sectors |
| Collect of documents, analysis, online workshop with 14 regional/local stakeholders' representatives | 2024 | done | Early phase | low | Academics and economists |

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| Monitoring system definition: scientific measures, indicators, technical validation | 2 months | (M15-M17) | Early phase | Medium | Environmental engineers |
|---|---|---|---|---|---|
| Design hypothesis for the Valais Demonstrator | 2 months | (M17-M19) | Middle phase | Medium | Contractors specializing in environmental monitoring and IT; decision-making methodology with stakeholders; citizen information sharing |
| Implementation methodology and monitoring strategy | 3 months | (M19-M24) | Middle phase | Medium | All the above |
| **OUTCOMES** | Improved water quality in the watershed due to enhanced filtration and reduced runoff; increased biodiversity, with healthier aquatic and terrestrial ecosystems; greater community engagement and awareness of watershed management practices; creation of recreational and educational opportunities for local communities | | | | |
| **INDICATORS** | Measure the variety and abundance of species (flora and fauna) in the restored areas compared to baseline data; monitor key water quality indicators such as: nutrient concentrations (e.g., nitrogen, phosphorus), pH level, turbidity, dissolved oxygen levels; measure changes in hydrological patterns within the watershed, including flow rates pre- and post-restoration. | | | | |
| **FUNDING & FINANCING** | MR project | | | | |

## 3.9. Additional implementation suggestions

**Table 39** Additional implementation Valais suggestion (UMIL, 2024):

| Discussed area: Management of water resources |
|---|

The management of water resources is directly linked to data and continuous monitoring. Water needs are projected to rise in a business-as-usual scenario, particularly in urban areas and livestock farming (Milano & Reynard, 2022). This increase will significantly impact economies that are heavily dependent on water availability, particularly in the two most important industries in the region: hydropower and tourism (D1.2; p. 119).

Interview participants noted specific issues related to water usage during peak tourist seasons and discussed how to effectively manage these priorities (D1.2; p. 124). As example, in winter season villages of few hundreds of inhabitants can grow ten times due to skiers' presence.

In terms of hydropower, it is important to note that the Canton of Valais monitors overall water quality and manages usage rights and regulations for hydropower production (Kanton Wallis, 2013). Additionally, integrating renewable energy sources can help mitigate the effects of climate change and ensure a more sustainable energy supply for the region (V-EP).

Currently, there is sufficient water, and the issue is not yet widely recognized by the public. However, there is a significant risk of decreased water availability, which could lead to social divisions (V-EP) and potential conflicts over water usage. Proposed solutions include managing the watersheds of the region's rivers and lakes, creating snow water reservoirs, promoting sustainable resource management, protecting ecosystems, and implementing integrated water management practices. As highlighted by the local council, Valais emphasizes the importance of stakeholders' perceptions in mountainous areas, advocating for the co-creation of solutions rather than unilateral implementation (V-LCL).

| Suggested solution for the implementation | Strengths | Weaknesses and challenges |
|---|---|---|
| Regeneration of humid area for integrated management of water resources | • *Flood and drought mitigation*<br>• *Water flow regulation*<br>• *Water resource protection*<br>• *Biodiversity increase*<br>• *Better management for end users*<br>• *Carbon sequestration* | • *Long time to be fully operational*<br>• *High costs for slow results*<br>• *Land use priorities could be different* |

| Suggested solution: Regeneration of Humid Area for Integrated management of water resources | |
|---|---|
| **SOLUTION STRENGTHS:** | crucial role of wetlands in regulating water flow and preventing floods; adaptation to water scarcity or excess |
| **SOLUTION WEAKNESSES:** | requiring time to become fully operational |
| **SOLUTION IMPLEMENTATION STAGES:** | identification of suitable sites, design and planning of the restoration process, implementation of restoration measures, and continuous monitoring of the evolution |

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| | of the areas; tests have been conducted and demonstrate feasibility. |
| **OUTCOMES:** | reduction of flood and drought risks through water flow regulation. |
| **INDICATORS:** | groundwater levels and water flow restored areas |
| **FINANCINC AND COSTS:** | fundings through government grants |
| **ACTORS INVOLVED:** | local and regional authorities for permits and planning activities |

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# 4. Conclusions

In conclusion, Deliverable 2.1 serves as both a guiding framework and a crucial monitoring tool in the MountResilience project, facilitating effective planning, stakeholder engagement, and adaptive management. Recognizing the importance of structured roadmaps as both planning and monitoring tools, D2.1 ensures that each phase of the project's implementation is backed by strategic stakeholder engagement—a challenge in most projects, yet essential for MR's success. This roadmap serves not only as a detailed guide for localized action plans across the six regional demonstrators but also as a cohesive framework that addresses project-wide goals. In fact, a comprehensive roadmap detailing activities, timelines, and involved stakeholders is invaluable for effective project planning and execution. It provides a clear, structured path that guides each phase of implementation, aligning tasks with deadlines and assigning responsibilities. This clarity enhances coordination among stakeholders, ensures accountability, and facilitates tracking progress. Ultimately, such a roadmap promotes collaboration, helps identify and address challenges early, and keeps the project aligned with its strategic goals.

D2.1 draws from a comprehensive review of the MR project's objectives and methodology to establish targeted action plans for each demonstrator, rooted in the Five Steps Strategy for stakeholder engagement. Far from being a mere procedural step, stakeholder engagement is treated as a core methodology underpinning every aspect of the project's execution, ensuring that climate adaptation solutions identified in D1.3 are implemented with strong community and partner support using the Quadruple Helix approach - an approach that integrates the previous triple-helix model, encompassing government, academia, industry, and community.

Effective communication is emphasized as a critical component of this roadmap, with mechanisms to provide transparent, continuous updates to all partners stakeholders. Dedicated briefings and tailored communication channels ensure stakeholders are kept informed on progress, concerns, and planned actions. The collaboration process, outlined in WP3, includes a dynamic feedback loop between the Regional Demonstrators and Replicator areas, facilitating real-time adjustments based on ongoing workshops, joint sessions, and emerging challenges. This approach allows for a responsive management style that evolves to meet regional needs effectively. Crucial here is the role of the RDs' coordinators: as coordinators of the local councils and primary actors in maintaining communication with the partnership, the stakeholders (including local council members and other mapped participants) and the UMIL coordinator play a key role.

The structured interaction and oversight process is reinforced through bi-monthly state-of-the-art and Project Management Board meetings, enabling timely adaptation and alignment with the MR project's goals. WP1 tasks provide comprehensive tracking of outcomes and challenges, allowing each pilot area to refine its implementation pathway even within the non-binding framework of the MR Grant Agreement.

In sum, Deliverable 2.1 empowers each regional demonstrator with a flexible yet structured roadmap to address climate resilience, fostering sustainable, collaborative solutions that are rooted in a holistic, stakeholder-driven methodology. By aligning these roadmaps with the MR project's overarching vision, MountResilience ensures that its strategic goals remain responsive, impactful, and well-supported across all regions.

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