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Climate-Resilient Development Pathways in Metropolitan Regions of Europe

Deliverable 1.9. – Report on the engagement of 5 target groups for each case study area

February 2025

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Acronyms

CC	Climate Change
CSAs	Case Study Areas
EH	Extreme Heat
LLs	Living Labs
NBS	Nature-based Solutions
SH	Stakeholders
SIA	System Innovation Approach
SME	Small and medium enterprises
SWF	Surface Water Flooding
T	Task
TG	Target Groups
UHI	Urban Heat Island
UN SDSN	UN Sustainable Development Solutions Network
WP	Work Package
WS	Workshop

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Executive Summary

Deliverable"D1.9 – Report on the Engagement of 5 Target Groups for Each Case Study Area" provides a detailed description of activities conducted during the first round of in-depth stakeholder engagement, including Workshop 1, across eight Case Study Areas, namely Prague, Leipzig, Funen-Odense, Athens, Barcelona, Bologna, Brașov, and Birmingham. It documents the engagement of five key target groups (TGs)—Regions, Communities, Industry, Research and Academia, and Policymakers—to identify risks, drivers, potential adaptation and mitigation solutions and barriers to them. These workshops addressed political, economic, social, technological, legal, and environmental dimensions within the Living Lab (LL) contexts of each Case Study Area.

The engagement process described in the report is central to the objectives of Task 1.1 and WP1, which focus on establishing LLs to co-design adaptation and mitigation pathways, advance the climate knowledge base, and facilitate multi-stakeholder collaboration using the System Innovation Approach (an extensive description of System Innovation Approach can be found in D1.1. “Target groups (stakeholders) engagement strategy”). Through the active participation of local and regional authorities, community groups, industrial stakeholders, academic institutions, and policymakers, the workshops gathered crucial insights to support the co-creation of climate-resilient development solutions. This engagement ensures that the outcomes of the CARMINE project align with local governance priorities while promoting inclusivity, analytical rigor, and innovative policy development.

The report establishes a foundation for developing climate adaptation and mitigation pathways while integrating local knowledge into broader governance frameworks. By involving the five target groups in a structured manner, it strengthens participatory data management and fosters collaboration to enhance climate resilience. Additionally, it serves as a valuable resource for gathering insights from the Case Study Areas, shaping more effective policies, and improving climate risk management across various administrative levels.

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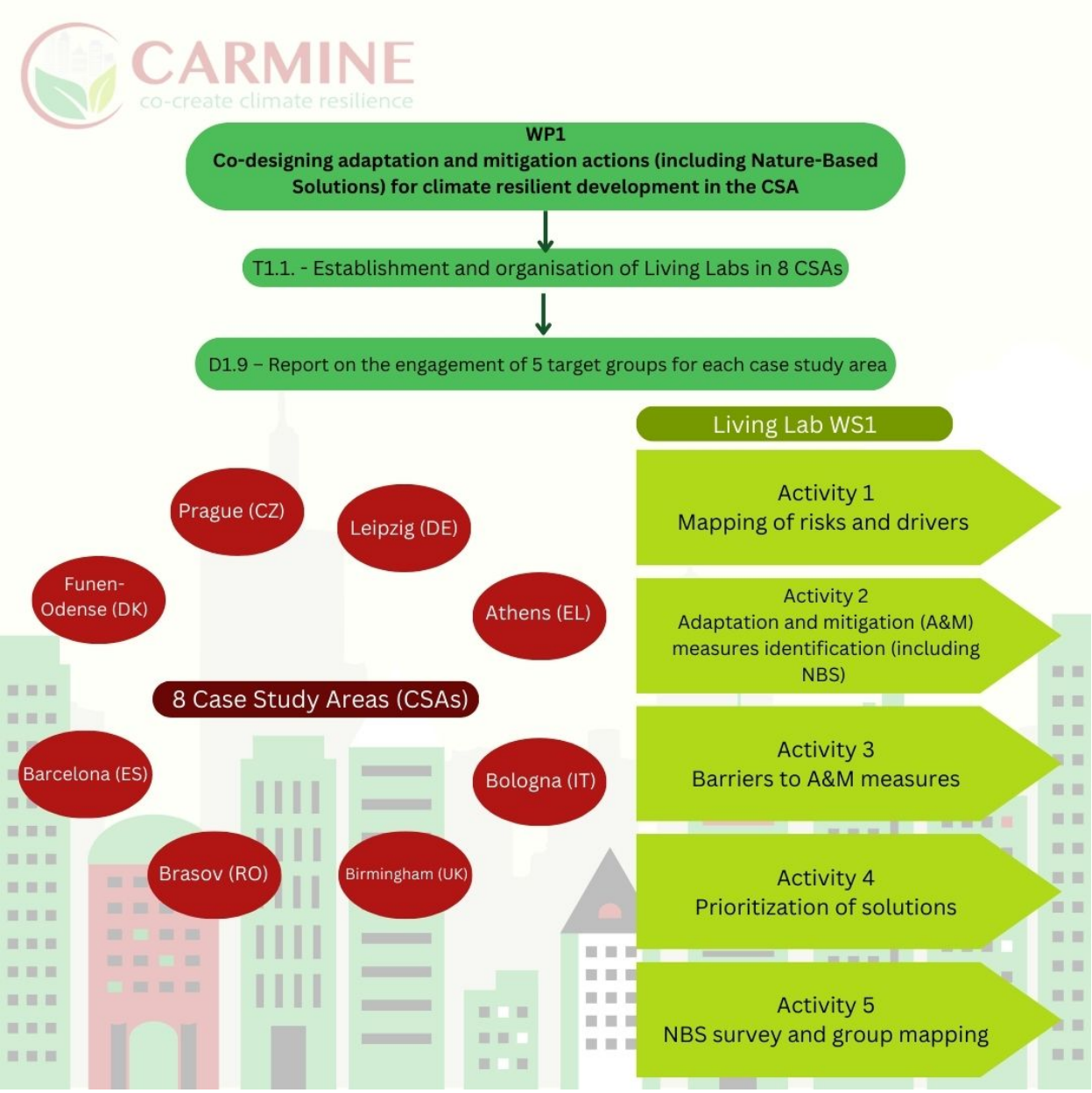

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1. Introduction

1.1 Purpose of the Report

Deliverable D1.9 – Report on the engagement of 5 target groups for each case study area, serves as a comprehensive documentation of the activities conducted during Workshop 1 across eight diverse Case Study Areas (CSA) (namely Prague, Leipzig, Funen-Odense, Athens, Barcelona, Bologna, Brasov and Birmingham). The 5 target groups are the following**: TG1. Regions** (local, regional, municipal authorities and organisations), **TG2. Communities** (local communities, citizen associations, "third sector" nonprofits), **TG3. Industry** (large enterprises, industrial associations, SMEs, start-ups), **TG4. Research & Academia ecosystem** ((a) Research organisations; (b)

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Research communities and associations; (c) Relevant EU projects and initiatives; (d) Regional, national, EU and international-wide research and development networks, clusters, platforms and partnerships), **TG5. Policymakers** ((a) European associations and working groups (b) Decision makers and national public authorities).

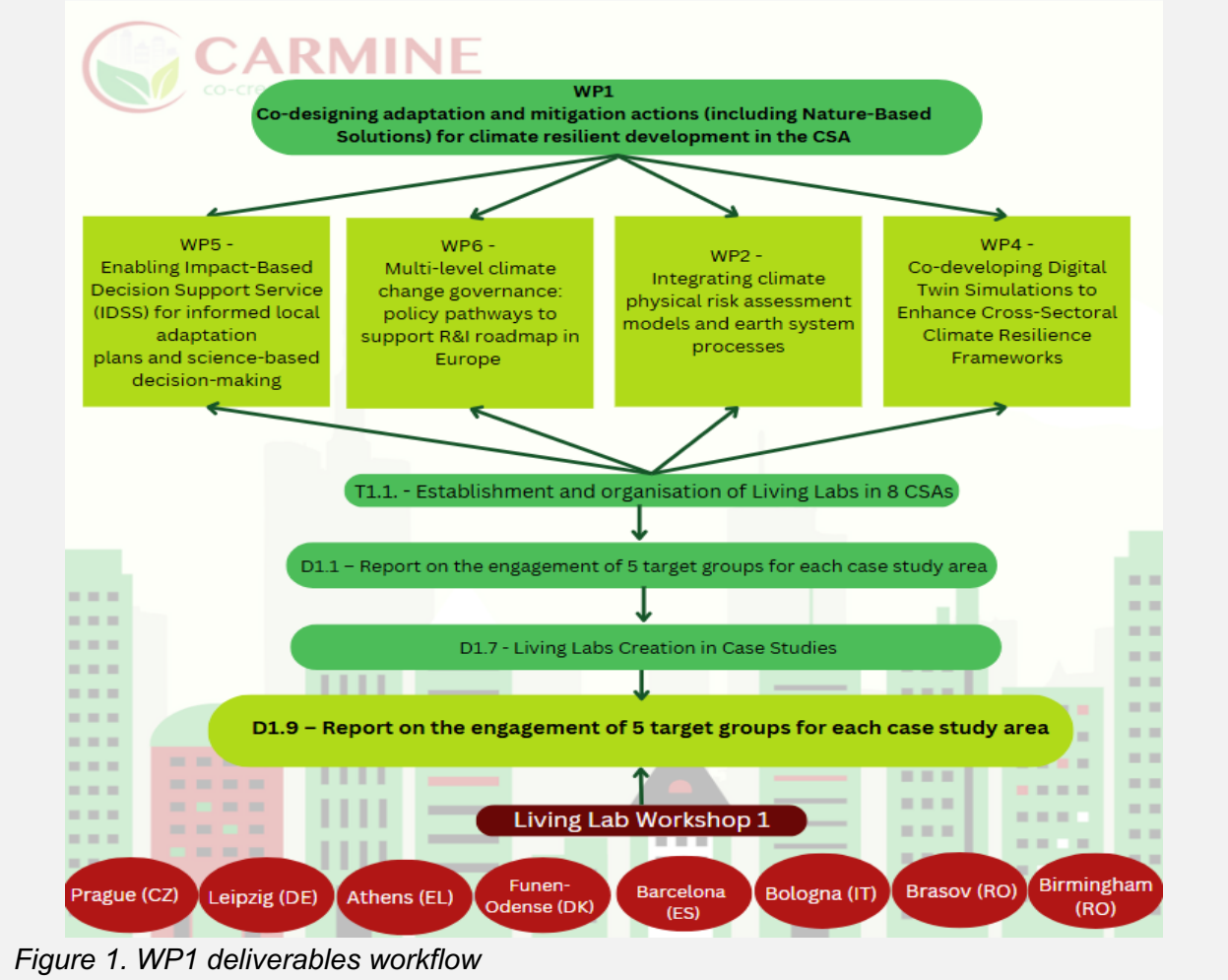

Figure 1. WP1 deliverables workflow

Through the engagement of the five distinct target groups, this report identifies the risks, drivers, adaptation and mitigation solutions, and implementation barriers within the eight case study areas as defined by the stakeholder TGs and emergent from the first round of workshops in each LL; based on political, economic, social, technological, legal and environmental aspects. By identifying risks, drivers, existing and potential solutions and barriers, the deliverable lays the groundwork for and the co-development of adaptation and mitigation pathways, aligning local engagement strategies with the overarching goals of CARMINE. This contributes to the project's mission to co-create knowledge-based solutions for climate-resilient development pathways while supporting multi-level governance and adaptation actions. Ultimately, this report acts as a nexus

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for collecting and improving knowledge and data from CSA level for better policy development and climate risk management at all administrative levels, based on the integrated input from various perspectives, including all target groups (TGs). Deliverable 1.9 follows Task 1.1, which establishes LLs in each CSA, identifying and mapping relevant actors from different sectors and administrative levels that enables research and innovation processes, participatory data stewardship, and involvement of multiple sectoral stakeholders and TGs to jointly test, develop and create climate-resilient solutions. WP1 “Co-designing adaptation and mitigation actions (including Nature-based Solutions) for climate resilient development in the CSA” whose overall objectives are to:

1. Co-create a systematic framework based on System Innovation Approach (SIA)
2. Advance climate knowledge base
3. Facilitate direct interaction between the stakeholders participating in the LLs
4. Co-design pathways (including NBS)

Deliverable D1.9 is directly connected to multiple tasks and work packages within the CARMINE project, particularly concerning stakeholder engagement, climate risk assessment, decision-support systems, policy recommendations, and dissemination efforts. Specifically:

- T1.2: Building on T1.1, T1.2 establishes a joint assessment of the CC challenges, their interdependencies and synergies at CSA scale by integrating the local perspectives with scientific available data sources (open science), state of the art tools, practices and methodologies relevant to local adaptive capacity, TGs resilience and disaster risk management. Within the LLs, a “hands-on” complex activity including series of workshops, focus groups, interviews, and questionnaires are used with each TG and collectively, to evaluate knowledge gaps, stakeholder and user needs and requirements, but also sectoral climate-related goals, threats and barriers in the local adaptation planning, enabling discussion and exploration of CC and their effects and links with natural and anthropogenic driving factors. At the end of the participatory (bottom-up) exercise, each LL has a multi-criterion mapping system for the main CC risks (multi-actor, multi-sectoral), represented by a network of factors (i.e., main issues, challenges and drivers related to CC risks) and their causal relations. The mapping system provides the knowledge baseline for the preliminary identification of transformative adaptation measures in CSAs (incl. “no-regrets”, “low-regrets”, “win-win”, “multiple benefits”), and co-design of A&M pathways, incl. NBS. T1.2 also prioritizes essential ecosystem services to be considered within T1.4 and supports the co-design process of impact related indicators (T2.1).

- T1.3: The Stakeholder Community Hub (SC-HUB) is a user-friendly, interactive, web-based platform allowing for direct interaction between the stakeholders participating in the LLs, connecting top-down and bottom-up approaches to co-design adaptation options that support cross-sectoral climate resilience. The SC-HUB describes and integrates the goal,

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objectives, outcomes and collected data, as well as the LL systems maps, testing and validation of the decision-support tools (DTs, IDSS), to facilitate engagement and allow the uptake of LL results by relevant organizations. The SC-HUB coordinates the activities related to data and information in each LL and provides regular feedback to the external stakeholders on intermediate results on climate risks assessment, cross-sectoral interdependencies and uncertainties level. The SC-HUB will be linked to project website (WP7).

- T1.4 develops and applies a participatory and iterative process of geo-designing A&M pathways towards resilient metropolitan communities in each CSA, considering both conventional and NBS approaches. The A&M pathways consist of scenario narratives and alternative futures, understood here as the spatial representation of potential future states. In each CSA, T1.4 organizes at least three geo-design workshops (online or physical), for exploratory consultations, co-development feedback, and jointly geo-design alternative futures. Impacts of the alternative futures are explored concerning climate resilience (in interaction with WP2 and WP3) and concerning biodiversity and metropolitan ecosystem services via expert-based evaluation. T1.4 builds upon specific challenges and transformative adaptation measures identified in T1.2, harnesses the communication through the SC-HUB in T1.3, considers and informs the modelling and scenario-building efforts in WP2 and WP3 in an iterative process
- T2.1: Based on the CSA analysis (T1.1) and engagement with stakeholders (TG1-TG5) in each LL (T1.2 and T1.3), T2.1 analyses the relevant climate hazards and impacts identified for each CSA, in terms of frequency, severity, and occurrence, and develops climate modelling and tools for hazards evaluations. Together with WP1, T2.1 develops co-design processes to involve key actors and local users in the LLs to identify gaps and needs related to the local modelling of climate impacts. This task works with the Living Labs in each case study area to understand the climate change challenges and interdependencies, understand CSA climate goals, identify knowledge gaps, stakeholder and user needs and requirements, identify threats and barriers in the local adaptation planning, identify synergies between the case study regions and prioritise essential ecosystem services. The proposed frameworks for scenario gaps and needs from T2.1 are discussed with the stakeholders (TG1-TG5) in each LL, as per the stakeholder communication strategy (T1.1), and also via the SC-HUB (T1.3), directly linked with WP3, WP4, and WP5.

- T4.3: The project facilitates the co-development of a Digital Twin (WP4) in each CSA, using the data sources defined and/or produced in WP1, together with existing open datasets and by exploiting the AI/ML or simulation models developed and customized in WP2. The main outcomes of the DTs address critical climate and societal challenges (WP2

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and WP3) and create the framework for supporting the local adaptive capacity and science-based decision-making, including NBS approaches. The focus of each DT considers known climate hazards each area is affected by, and their output is validated by the LLs stakeholders.

- T5.1: WP5 enables an operational service (the IDSS) for metropolitan decision-makers and policy makers, which provides interactive access to tailored actionable data, information and tools to support the local adaptive capacity and cross sectoral climate resilience in CSAs. IDSS builds on the data and knowledge of local stakeholders (WP1),

- T6.1: In WP6, Integrating the perspectives and needs of the stakeholders and TGs (LLs, SC-HUB), T6.1 accurately identifies conflicts, trade-offs, and synergies between EU climate adaptation and governance approaches and policies to support adaptation plans and strategies at the regional and local level.

Figure 2 depicts a graphical representation of the interconnections between D1.9. and relevant tasks within the CARMINE project.

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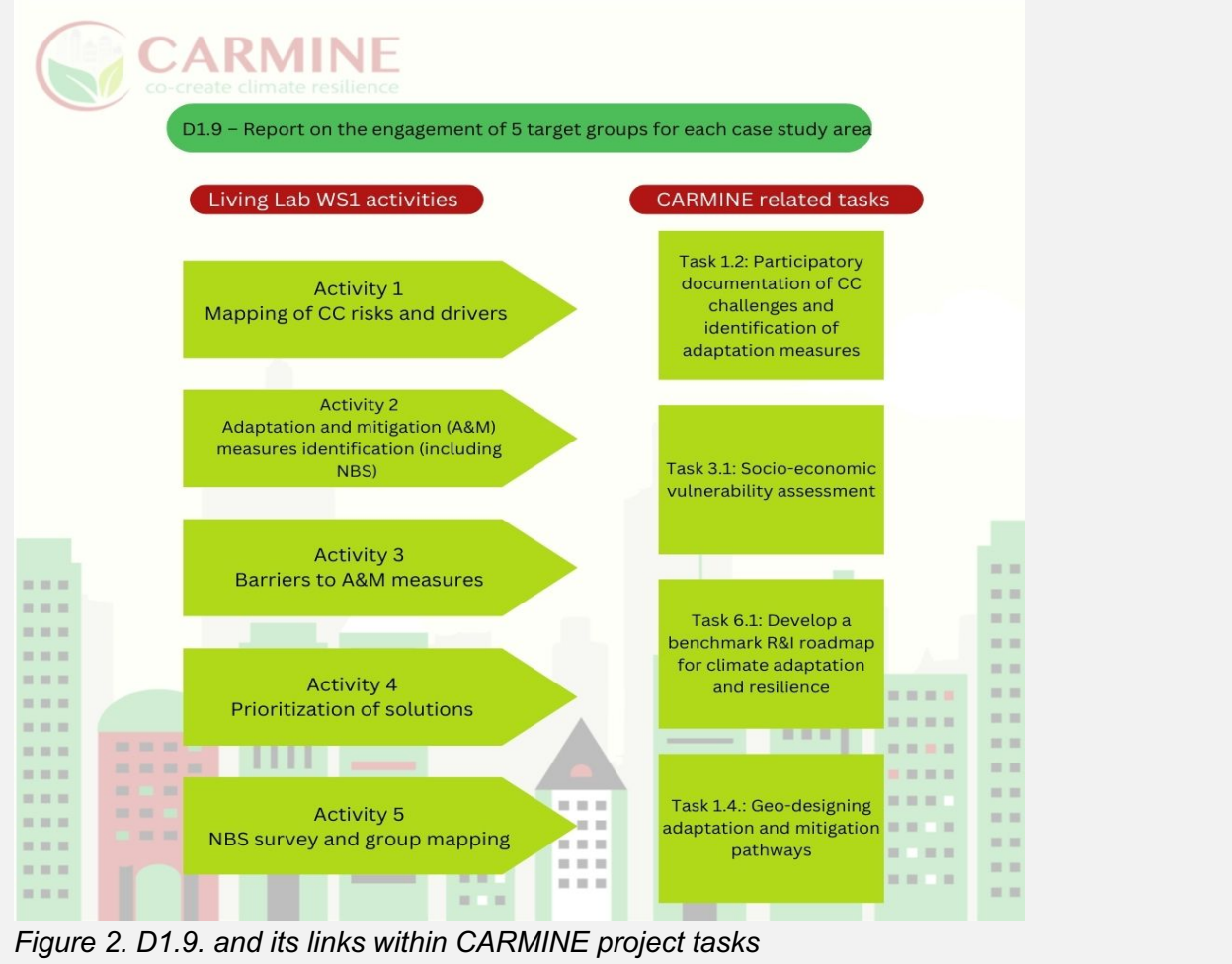

Figure 2. D1.9. and its links within CARMINE project tasks

Description of Target Groups (TG)

The stakeholder engagement process within CARMINE is designed to include five key target groups (TGs), each contributing unique perspectives and expertise to the project's goals:

- **Regions (TG1):** This group encompasses local, regional, and municipal authorities responsible for governance and policy development, planning, procurement, project implementation and emergency management. Representatives include regional and municipal authorities from the eight case study areas. These authorities ensure alignment between project outcomes and regional policy frameworks.
- **Communities (TG2):** Functional urban communities, urban communities (city, town), village communities, rural communities, knowledge-based communities, international (for example tourists, expats) communities, young communities; Citizens and societal actors, NGOs and vulnerable communities from all CSAs, who ensure that the project addresses grassroots priorities and integrates diverse, inclusive perspectives.

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- **Industry (TG3):** Comprising large enterprises, companies, SMEs, start-ups, and industrial associations, this group provides practical insights, technical expertise, and innovation. In each CSA, CARMINE focuses on the following industries, with relevance for climate change risks: manufacturing (including high tech engineering), electronics and machine-building, steel production, transportation equipment, chemicals, advanced materials, construction, agri-food, and tourism.
- **Research and Academia (TG4):** Research organizations—including universities, research centers, and specialized institutions—along with research communities, associations, and key EU projects and initiatives, contribute valuable expertise in climate resilience, systems innovation, and data-driven adaptation strategies. Additionally, regional, national, EU-wide, and international research and development networks, clusters, platforms, and partnerships play a crucial role in advancing knowledge and fostering collaboration in these fields.
- **Policymakers (TG5):** This group includes European associations and working groups as well as decision makers and national public authorities engaged in climate governance.

This report centres on the engagement of the five target groups mentioned above, each playing a crucial role in the success of LL activities. Local government representatives bring a policymaking perspective, ensuring that municipal priorities and governance frameworks are aligned with workshop outcomes. Community groups, and social-mission organizations, particularly those representing or working with marginalized or vulnerable populations, provide essential grassroots insights and emphasize inclusivity. The industry sector contributes expertise and resources, particularly in areas like urban infrastructure and technological innovation, making them pivotal in driving practical solutions and supporting blended finance. Academic and research institutions add a layer of analytical rigor and innovation, leveraging their expertise to inform strategies. Lastly, policymakers can implement evidence-based strategies to address societal challenges, foster sustainable development. Engaging these diverse groups ensures a holistic approach to addressing climate change challenges while fostering meaningful collaboration across sectors. Appendix 6.1 provides the WS1 template that was filled out before, during and after the workshop by each CSA recording the input of the representatives from each of the five target groups. The results of WS1 for each CSA can be found here.

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2. Methodology for Engaging Target Groups (TGs) in LL WS1

2.1 Coordination and support of CARMINE living labs

2.1.1 Living Lab Workshop 1 training for facilitators in Athens

On September 10th and 11th, 2024, partners gathered in Athens for a two-day LL-facilitator training workshop. Organized by ATHENA RC, the workshop welcomed representatives from seven Case Study Areas (CSAs) involved in the project (namely, Prague, Leipzig, Athens, Barcelona, Bologna, Brasov and Birmingham).

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The training workshop presented the stakeholder engagement methodology, the Systems Innovation Approach (SIA) grounded in Systems Thinking, and discussed its application within the LLs. The presentation elaborated on key elements of the process, including Stakeholder (SH) Identification, SH Mapping, and Shortlisting. The three workshops that will guide the implementation of LLs in CARMINE were outlined. These

WS1: CC Challenge and Systems mapping
WS2: Sector based CC Goals (Envisioning)
WS3: Outline A&M Pathways

Each CSA then presented its local context, covering its primary challenges, stakeholder engagement efforts, prior work on Climate Challenge (CC), and Adaptation & Mitigation (A&M) solutions. Timelines for the implementation of the LL s for each CSA were also discussed.

WS1 guidelines, which had been sent to all participants prior to the workshop, were then presented followed by a mock workshop where all participants assumed the roles of facilitators or stakeholder personas, enabling them to practice the process in an imaginary case study scenario.

On the second day of the workshop, the Geo-design Workshop (T1.4), which will be integrated into the three LL workshops took place. Additionally, the Stakeholder Community Hub - a web platform designed to facilitate communication not only between CSAs but also among stakeholders - was introduced. A timeline for the first workshop was provided, with all partners expected to complete it by mid-December 2024.

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Figure 3. Living Lab facilitators' training in Athens

By the end of the two days, CSA facilitators received the training, knowledge, and guidance needed to successfully implement the WS activities. The mock session provided facilitators with firsthand experience of the participatory activities, enabling them to facilitate the workshop more effectively. Throughout the training, CSA facilitators got accustomed with potential hurdles they might face while conducting the workshop activities and facilitators got equipped with the necessary competences and tips to address any difficulties that may arise during the implementation of each workshop activity. For the CSA that could not attend the Athens training, an online training was conducted on November 7, 2024 from 10:30-12:30. Figure 3 presents a picture from the training.

2.1.2 Preparatory meetings

The Athena RC team organized individual meetings with each CSA in preparation for the organization of WS1 after the training in Athens in September 10-11.

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The first preparatory meeting was conducted within the month of October 2024 (see Table 2), for 7 CSAs. Funen-Odense participated in the additional online training that took place on November 7th but did not attend any of the preparatory meetings.

Table 1. CSA Preparatory meetings before WS1

CSA	1st Preparatory meeting before WS1	2nd Preparatory meeting before WS1	Additional support meetings before WS1	WS1	Post WS1 meeting
Prague	14/10	12/11	18/11	20/11	27/11
Leipzig	21/10	25/11		09/12	16/12
Odense	-	-	-	-	-
Barcelona	15/10	25/11		03/12	10/12
Athens	11/10	13/11	19/11	05/12	9/12
Bologna	29/10	18/11		25/11	6/12
Brasov	10/10	18/11		28/11	9/12
Birmingham	10/10	20/11		28/11	11/12

During the meeting, each CSA was requested to confirm the scheduled date of their WS1 and provide an update on the status of venue arrangements. Recommendations were offered concerning room setup, highlighting the importance of a flexible space. Specifically, it was suggested to avoid amphitheatre-style layouts in favour of rooms where tables could be rearranged to facilitate group activities.
The discussion then focused on preparations for inviting SHs. CSAs were asked to report whether they had shared the "Save the Date," made direct contact with SHs, or reached out through alternative methods, as well as the type of feedback received. For those who had received responses, the CSAs provided updates on the number of confirmed attendees. Additionally, it was emphasized that the number of invited SHs should remain manageable to ensure that all participants can have the opportunity to contribute meaningfully during the workshop.

To ensure balanced sector representation, the MIRO board was revisited, and CSAs highlighted the SHs who had confirmed their participation, assessing whether all sectors were adequately represented. Any identified imbalances were addressed to ensure that all perspectives, across a broad range of sectors, were included to foster comprehensive and diverse discussions. If gaps in sector representation were identified, CSAs were encouraged to address them by inviting representatives from related sectors or contacting SHs directly via phone or email to underscore the importance of their participation. Ultimately, CSAs were asked to ensure that the appropriate stakeholders were invited.

Geodesign activity

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The NBS ranking activity includes an individual activity (using mobile phones) and a group activity of 2-3 people using laptops provided by the CSAs. Instructions and links were sent to all CSAs along with translations of the activities in the respective language.

Validation workshop

The validation workshop option (see Deliverable 1.1 Chapter 2.3.1.) was discussed in order to assess with the CSAs whether a validation workshop would take place. If a validation workshop was considered, CSAs were asked to report it on the Validation Template. In it, CSAs were asked to fill in the list of Risks/Drivers/A&M solutions and Barriers already identified, the source of information for each of them, the participatory method used to collect the information and the target group of SHs involved in terms of sector they were representing (see Table 3).

Table 2. Validation template

List of Risks / drivers / solutions / barriers already identified	Source of information (name of project/initiative including a very brief summary - lead institution - date/time - weblink if any)	Participatory Method used to collect this information (survey, workshop etc.)	Target SH groups who were involved

The final decision regarding whether the workshop was going to be a validation or a full workshop was reached based on the completed validation template.

Two of the CSAs, Athens and Bologna, decided to deliver a validation workshop, based on previous stakeholder engagement initiatives that took place within the CSA prior to the CARMINE project. (see Table 4). These CSAs were asked to prefill the PESTLE wheel with the existing information and validate it during the workshop. (For more information on PESTLE wheel, please see Section 2.2.2.)

Table 3. Validation workshop, online workshop and justification

CSA	Validation workshop	Format (physical/online)	Justification if online
Prague	Full workshop	Physical	
Leipzig	Full workshop	Online	Many SHs could not come in person; difficult to find a date for all SHs to be present. they will try to have physical presence workshop for WS1
Barcelona	Full workshop	Physical	

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Athens	Validation workshop including a scenario activity	Physical	
Bologna	Validation workshop followed by smaller WSs	Online	Some SHs cannot leave their jobs to come in-person, but follow-up meetings with SHs are conducted to collect all relevant information
Brasov	Full workshop but including pre-SH workshop inputs (2 are planned)	Physical	
Birmingham	Full workshop	Physical	

After the first cycle of meetings, the 2nd Preparatory meetings were organized in the month of November 2024 (see Table 2). All CSAs were asked to prepare their draft agenda and discuss it during the 2nd preparatory meeting.

2.1.3 Workshop format

The format of the workshop was then discussed. It had been stressed during the training in Athens and during the 1st preparatory meeting that an online workshop should not be favoured especially for the first workshop. It is very important to establish a community among the stakeholders, and this can best be best achieved with the physical presence and the interaction, not only during the WS itself, but also during the breaks. Additionally, during an extended online workshop, participants may find it more challenging to stay engaged and are more likely to get distracted or shift their attention to other activities compared to a physical, in-person workshop.
Two of the CSAs, Bologna and Leipzig decided to have their workshop online due to the limited availabilities of their stakeholders. Nonetheless physical interactions with stakeholders are also planned while the next rounds of LL workshops will be held onsite.

SH attendance
The SH attendance was reassessed to ensure adequate representation across the various sectors. CSAs were requested to share their agendas once finalized and to follow up with those who have not yet confirmed their participation. This follow-up could be done via email or phone call to encourage their interest and secure their attendance at the workshop.

Agenda and activities

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Particular attention was given to the time allocated for each activity to ensure a smooth flow of the workshop. For example, breaks were planned to allow Facilitators to set up tools such as Mentimeter for the prioritization activity (Activity 4), which follows the presentation of A&M solutions (Activity 3). Similarly, a break after the Risks Mapping activity (Activity 1) was scheduled to enable the transfer of risks to a second wheel, if necessary, especially in instances where the group was divided into two due to its size.
The PESTLE wheel link was shared with all CSAs who were advised to either print it and display it on the wall or use a digital version projected onto the wall. (For more information on PESTLE wheel please look at Section 2.2.2.). CSAs were discouraged from taking notes directly on the MIRO board as this approach requires a high level of familiarity with the tool. While using MIRO could generate results, it carries the risk of overlooking important aspects of the discussion or distracting from the flow of the discussion, which are critical for capturing nuanced insights.
Finally, a post workshop meeting was scheduled with all CSAs within a week after the LL workshop in order to capture the first impressions and discuss any difficulties before reporting on the Report template which is to be delivered by December 15 (see Table 2).

2.1.4 Support for engaging vulnerable communities

A key point addressed during the preparatory meetings was the participation of people from populations vulnerable to climate hazard or from organizations working with these populations. Discussions focused on identifying the best ways to approach this participation to ensure that the priorities, concerns and perspectives of vulnerable populations was present in WS1. Suggestions were provided to approach them even informally (for example, to attend a tree planting activity as CSA Birmingham had suggested). The vulnerability parameter was also discussed in terms of age (very young-very old) or in terms of health (disability) or in terms of income (low income), depending on the challenge each CSA is addressing. The participation of young people was particularly stressed, not only because climate change challenges will directly affect them in the future but also because their point of view is particularly valuable for A&M solutions. If the representation of vulnerable groups could not be achieved for the workshop, it was suggested that they can hold individual meetings/interviews with them outside of the LLs.
Regarding the vulnerable communities, a reminder was given to all CSAs to have a dedicated note taker noting down the responses of people representing or working with vulnerable populations. In the case that CSAs reported that vulnerable communities' representatives did not confirm their participation, it was suggested to discuss during a post workshop meeting a follow up strategy for alternative means of interaction outside the LL workshop, for example conducting an interview or giving them a questionnaire, online or face to face.

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2.2 Engaging target groups to tackle Climate Change challenge(s) in CSAs

2.2.1 WS1 objectives and format

The methodology for the LL workshop is designed to be flexible, allowing for the inclusion of complementary tools and methods, provided they are discussed and validated with the WP1 team and that the required outputs are delivered in the specified format. For this initial round of workshops, the primary objectives of LLs were to validate the Climate Change (CC) Challenges at the CSA level, map the associated risks and drivers, identify and review CC adaptation and mitigation measures (including nature-based solutions) and barriers for implementation, prioritize the A&M solutions, and map potential NBS during the ranking exercise.

While each CSA had its own unique objectives and stakeholder context, sessions and activities could be adjusted or expanded as needed to suit specific requirements. A proposed agenda for WS1, including indicative timings, was provided (Table 5) to guide the planning process.

Table 4. Suggested Agenda for WS1

10 min	Welcome and round table
5 min	Agenda and Objectives - General Timeline of the Workshop
10 min	Introduction to CARMINE and Case Study Area
5 min	Introduction of the Stakeholder Community Hub (SC-Hub) Tool
50 min	**Activity 1:** Validation of the CC challenge and mapping of risks and drivers
10 min	Break
30 min	**Activity 2:** Adaptation and mitigation measures identification
30 min	**Activity 3:** Barriers to adaptation and mitigation measures
10 min	Break
20 min	**Activity 4:** Prioritization of solutions
60 min	**Activity 5:** NBS mapping
15 min	Plenary, conclusion and next steps - Summarize key findings and set objectives for the Living Lab

2.2.2 Activity 1: Validate the CC challenge(s) and mapping of risks and drivers

The objective of this activity was to validate the CC challenge(s) the CSAs initially prioritized, and map related risks and drivers using the PESTLE wheel. The PESTLE wheel is a strategic framework designed to analyse and map the external factors that influence the challenge (Figure

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3). It categorizes these factors into six key dimensions: political, economic, social, technological, legal, and environmental. The political aspect examines government policies, regulations, and political stability, while the economic dimension and built environment focuses on trends such as inflation, market conditions, and employment rates. Social and health factors address societal trends, cultural norms, and demographic changes, and the technological category evaluates advancements, innovations, and research developments. Legal factors include laws, regulations, and compliance requirements, whereas environmental considerations encompass sustainability, climate change, and ecological impacts. By organizing these elements visually in a wheel format, the PESTLE framework facilitates a comprehensive understanding of the external drivers, risks, and opportunities affecting the specific challenge. Preparation for the activity involved ensuring that each CSA had a large-format (A0) printout of the PESTLE wheel, with one wheel allocated per CC challenge (a maximum of two challenges is recommended). Following the Athens training workshop, suggestion was given to use small-format sticky notes to allow sufficient space for recording all necessary information on the wheel. If the LL addressed two challenges, participants were divided into two groups, with each group focusing on one challenge. Participants could choose which challenge to work on, and facilitators documented which stakeholders were assigned to each challenge. Each participant was provided with sticky notes and a pencil. For groups exceeding 15 participants, even when addressing a single challenge, the group was divided into two sub-groups to conduct the same activities, ensuring effective participation and interaction. Facilitators clearly described the purpose of the activity and outline the process participants will follow. The PESTLE wheel template is available in high-resolution PDF format on the CARMINE SharePoint.

2.2.2.1 How were TGs actively engaged?

The process began with a group exercise to confirm and validate the LLs focus on CC challenges, such as flooding. Participants reviewed the pre-selected CC challenges presented by the facilitators and engaged in discussions to confirm, validate, or suggest additional challenges. The exercise concluded with stakeholders reaching a consensus on the primary CC challenge(s) the CARMINE LL would address. Following this, participants were asked to individually map the risks and underlying factors (drivers) associated with the selected CC challenge(s). Using the PESTLE wheel, stakeholders categorize risks into Political, Economic, Social, Technological, Legal, and Environmental dimensions (Figure 4). For instance, for the CC challenge "flooding," risks might include “erosion” (environmental), “damage to infrastructure” (economic), or “loss of life” (social). Facilitators provided guidance to ensure a shared understanding of what constitutes a CC risk, framing the exercise with questions like, “What could be the direct impact of the CC challenge the LL is addressing?” This structured approach ensured diverse perspectives and a comprehensive analysis of CC risks and their drivers.

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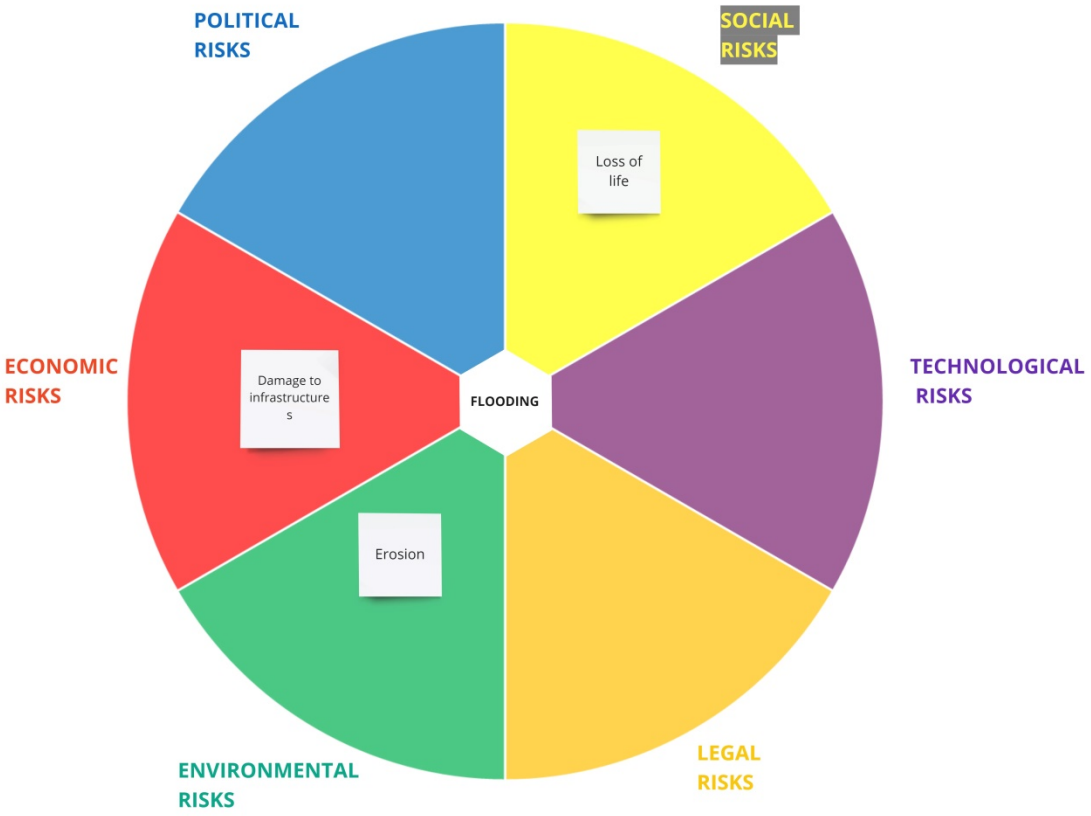

Figure 4. Example of mapping CC challenge and risks using the PESTLE wheel

Participants were first asked to take a few minutes (5 to 10 minutes) to think about any risks connected to the selected CC challenge. They wrote each risk on a separate sticky note. Once finished, they placed their sticky notes in the relevant section of the PESTLE wheel. Facilitators played a key role during this activity, helping participants formulate their ideas clearly and guiding them in categorizing the risks correctly. As the exercise progressed, facilitators removed duplicates and took note of how often each risk was mentioned, ensuring the discussion stayed focused and productive.

The second part involved identifying the factors driving these risks through a group discussion lasting around 25 minutes. Facilitators encouraged participants to explore the underlying causes, known as drivers, behind each risk and map them onto the PESTLE wheel (Figure 5). One facilitator kept track of the discussion by noting the drivers on the wheel, ensuring all input was captured accurately. The goal was to foster collaboration while producing a well-structured analysis of the risks and their causes.

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One facilitator moderated the discussion ensuring the note taker had enough time to capture the relevant inputs. Facilitators were urged not to hesitate to pause the discussion or ask for clarifications.
Multiple types of drivers can be behind one risk. Facilitators connected the risks and drivers by drawing arrows.
e.g.: Risk: “Damage of infrastructure” Economic driver: “lack of investment in risk prevention” Legal driver: “poor planning” Technological driver: “inefficient flood protection system”

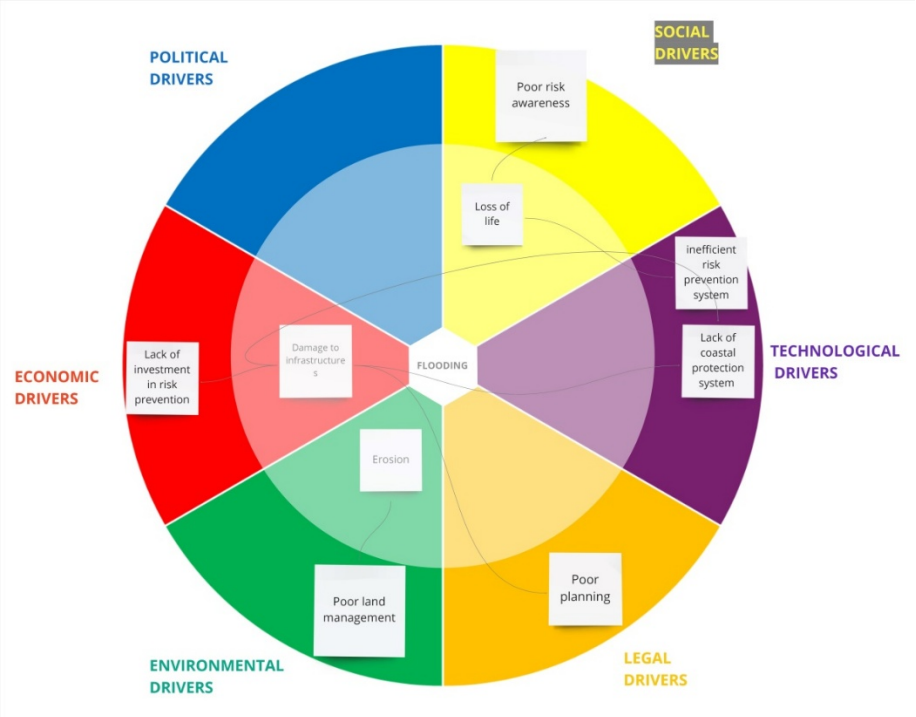

Figure 5. Example of mapping CC challenge, related risks and associated drivers using the PESTLE wheel

2.2.3 *Activity 2: Adaptation and mitigation (A&M) measures identification (including Nature-Based Solutions)*

The objective of this activity was to identify adaptation and mitigation measures, including opportunities for innovative NBS to address CC risks while considering the underlying drivers. Facilitators began by preparing the activity, ensuring the PESTLE wheel was ready with the challenge, risks, and drivers clearly outlined. They then explained the purpose of the activity and guided participants through the process. This involved reviewing each CC risk and its associated

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drivers, helping participants brainstorm and identify potential adaptation and mitigation measures. The goal was to foster creative and practical ideas that address the identified risks effectively.

2.2.3.1 How were TGs actively engaged?

Facilitators guided participants in suggesting potential measures to address each identified CC risk, considering the related drivers. This was conducted as a group exercise, where participants proposed ideas that were then plotted in the appropriate section of the PESTLE wheel (Figure 6), with special attention given to NBS. One facilitator took notes directly on the PESTLE wheel, recording the suggested measures, while another moderated the discussion to ensure all inputs were captured accurately. If needed, the discussion was paused or clarified to allow the note-taker sufficient time. Facilitators also connected risks and measures by drawing arrows on the PESTLE wheel, using different colours than those used for drivers, as one adaptation or mitigation measure may address multiple risks. For example, a risk like "damage to infrastructure" linked to a technological driver such as an "inefficient flood protection system" might be addressed by an environmental measure like a reforestation program.

Figure 6. Example of mapping CC challenge, related risks, associated drivers and A&M measures using the PESTLE wheel

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2.2.4 Activity 3: Barriers to A&M measures

The objective of this activity was to identify barriers to implementing A&M measures addressing CC risks, and to prioritize them. Facilitators began by preparing the PESTLE wheel, ensuring it included the challenges, risks, drivers, and A&M measures identified earlier. During the break, they set up the prioritization exercise, finalizing questions for a poll that includes the specific A&M measures suggested by stakeholders (with the poll drafted in advance of the workshop). Once the activity began, facilitators explained the purpose and process, reviewing each A&M measure with the participants. They led a discussion to identify the hurdles to implementing these solutions, using the PESTLE wheel to categorize and organize the barriers systematically.

2.2.4.1 How were TGs actively engaged?

In a group setting, facilitators guided participants in identifying potential political, economic, social, technological, legal, and environmental barriers associated with the A&M measures. Participants suggested barriers, which were then plotted in the relevant sections of the PESTLE wheel and linked to the corresponding A&M measures (Figure 7). One facilitator recorded the barriers on the PESTLE wheel, while another moderated the discussion, ensuring the note-taker had enough time to capture all relevant inputs accurately. Facilitators were encouraged to pause the discussion or ask for clarification when needed. As some barriers may be linked to multiple A&M measures, facilitators connected these relationships by drawing arrows on the PESTLE wheel, using colours distinct from those used for drivers and A&M measures. This ensured a clear and organized mapping of barriers in relation to the measures.

> e.g.: Risk: “Damage of infrastructure” Technological driver: “inefficient flood protection system” “Reforestation program” Political barrier: “Governance over land” Economic barrier: “Financial incentives supporting activities that drive deforestation”

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Figure 7. Example of A&M measures and related barriers using the PESTLE wheel

2.3 Activity 4: Prioritization of solutions

Using online interactive polling tools like Slido or Mentimeter, participants ranked individually each A&M measure that had been identified in the previous activity, on a 1-to-5 scale based on the urgency (from not urgent to very urgent) and ease of implementation (from very easy to very difficult, considering environmental, technical, and cost factors). Urgency was assessed based on

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how quickly the risk needs to be addressed, while ease of implementation considers factors such as cost, availability of technology or resources, and social acceptance.
Using online plotting tools, the results of the survey were automatically generated so workshop participants saw the prioritization result and could reflect on it. If not, post-workshop the CSA team plotted each measure on an urgency/ease diagram (Figure 8) based on the average scores.

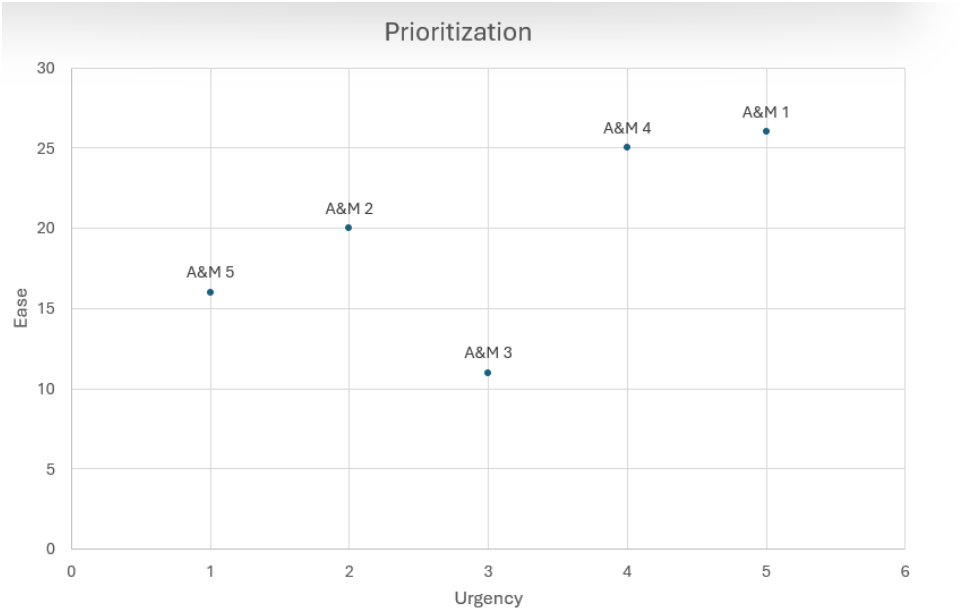

Figure 8. Plotting A&M measures for prioritization purpose

2.3.1 Activity 5: NBS survey and group mapping

The objective of this activity was to gather stakeholders' preferences for prioritizing relevant NBS, their associated benefits, and planning criteria for addressing challenges in their metropolitan region. Additionally, the activity included mapping successful NBS initiatives and identifying areas where NBS benefits are most needed. The session consisted of two main exercises: an individual NBS survey, lasting 10–15 minutes, and two group mapping activities, lasting 45–50 minutes. The format was flexible and was conducted as either an in-person workshop or an online webinar. Participants needed their personal mobile devices for the individual survey, while laptops or tablets, provided by the CSA team, were used for small group mapping activities.

Individual NBS Online Survey:

The online survey was designed to gather stakeholder preferences regarding NBS and their perceived benefits in addressing relevant challenges within their metropolitan region. Additionally, it sought input on criteria stakeholders believed are essential for achieving successful outcomes

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from NBS. The survey built upon the challenges identified by the LLs in the CARMINE project and reflected the discussions and analyses conducted using the PESTLE wheel.
Stakeholders completed the survey individually using the online platform Maptionnaire, which was accessible via a QR code or link provided to them. The survey was expected to take 10–15 minutes and could be completed on participants' mobile devices.
If necessary, paper versions of the survey were provided as a back-up. However, the CSA teams then had the responsibility to collect, digitize, translate, and send the data to the T1.4 leads (LUH).
At the end of the survey, stakeholders created a unique anonymous identifier, which they used when entering data into Maptionnaire during the subsequent group mapping activities. This ensured continuity and consistency across both individual and group exercises.

Moving from Individual to Group Activities

Before starting the mapping exercises, the facilitators were responsible for either organizing the stakeholders into groups of 2-3 people, or if the stakeholders organized themselves, the facilitators ensured groups of appropriate size. Additionally, facilitators ensured that ideally there was at least one member per group who was somewhat familiar with the concept of NBS.
Each group chose one person from within their group to be the secretary. This person oversaw entering in the responses to the mapping exercises that follow on behalf of the group. The responses were based on the group consensus, agreed through very short discussions to ensure staying within the time of the activity.
The secretary's first task was to enter the anonymous identifiers from each member of their group within Maptionnaire.

Group Mapping Activities

There were two group mapping activities that were also completed in Maptionnaire. Each mapping activity was done once per challenge.
Mapping 1 aimed to understand stakeholder perspectives of what makes NBS successful and where they may be located in their metropolitan region.
Mapping 2 aimed to understand where NBS benefits are needed the most and why.
If these activities were taking place as part of an *in-person* workshop, facilitators needed to provide one tablet or laptop per group so that the online mapping activities could be completed. If the activities were conducted through an *online meeting or webinar*, the online meeting platform used (Teams, Zoom, etc.) could be used to separate participants into groups. More details and the results from the Geodesign NBS activity are reported in D1.4. - Geo-designed A&M pathways - Version 1.

3. CSA engagement of the relevant TGs in LL WS1

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3.1 Prague (CZ)

3.1.1 Target Groups engaged

3.1.1.1 Living Lab participants

Living Lab Challenge: Heat

The LL workshop was part of a daylong event, “Resilience to Heat in Urban Environments” hosted by the City of Prague and co-organized by the Institute of Computer Sciences and the Czech University of Life Sciences. The event started with a morning session and an introduction to ongoing projects that also focus on heat resilience in Prague (Destination Earth, CROSSEU, Impetus 4 Change). A total of 13 participants (8 online) joined the morning session, while 10 participants who remained until the end of the workshop responded to the questionnaire on the prioritization of solutions and the NBS participatory mapping activities.

The workshop successfully engaged participants from all target groups as identified in D1.7 (see below), from varied sectors, including city planning, academia, health, and smart city initiatives, offering a comprehensive perspective on climate adaptation and urban challenges. Participants from academia, health, and policymaking demonstrated high motivation, contributing actively to discussions, particularly on climate adaptation strategies and vulnerable groups. Attendees representing children and the elderly brought valuable insights, highlighting the need for inclusive approaches to climate adaptation:

Regions (TG1)

Representatives included individuals from the following institutions:

- IPR Praha (City Planning)
- National Public Health Institute (Státní zdravotní ústav) [focusing on prevention and monitoring, particularly for heat-vulnerable groups such as the elderly)

Communities (TG2)

- No representatives from TG2 (the CSA initially identified 2 representatives but in the follow up discussion it was decided they were not deemed as TG2).

Industry (TG3)

Representatives included individuals from the following institutions:

- OICT – Operator ICT (Smart city and data management)

Research and Academia (TG4)

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Representatives included individuals from the following institutions:

- Univerzita Palackého v Olomouci (Katedra geografie): Specializing in geography.
- FŽP ČZU: A lecturer in urban planning and architecture.
- Univerzita Karlova: A lecturer and researcher in climate science and climate change impact modeling.
- Czech Academy of Sciences: Represented by a climate researcher who also provided a parental perspective.
- Ústav informatiky AV ČR, v. v. i. (ICS): Two researchers specializing in informatics.

Policymakers (TG5)

Representatives included individuals from the following institutions:

- Department of Environmental Protection (Odbor ochrany prostředí Magistrátu hl. m. Prahy), including the author of Prague's climate change adaptation strategy.

Overall, participants came from some of the TGs, with a strong emphasis in TG4 (Research and Academia) and less emphasis in Industry (TG3), representing a good mix of expertise and perspectives, enabling a well-rounded discussion on various political, environmental, social, technological, legal and environmental risks, their drivers, identifying solutions and barriers to the solutions, all related to heat wave (Figure 9).

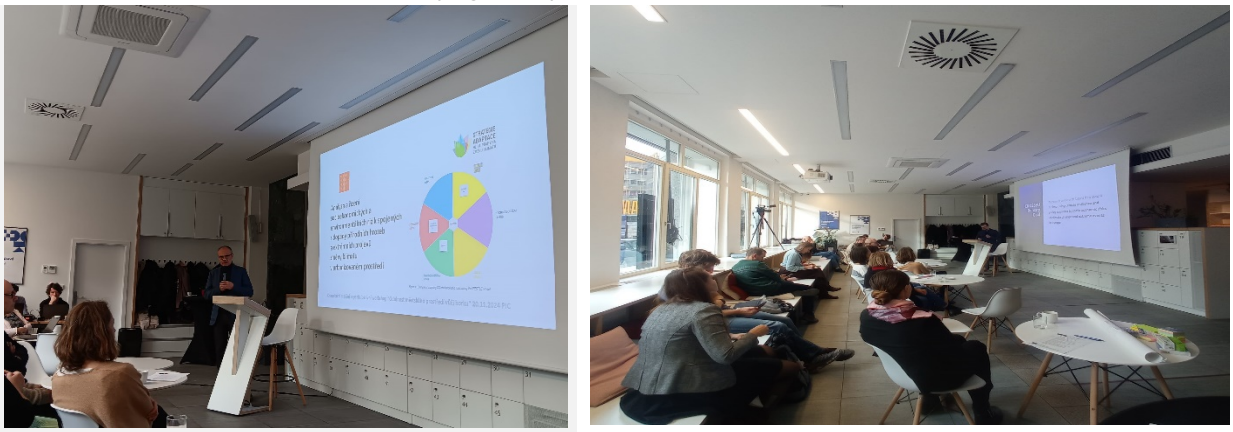

Figure 9: Living Lab in Prague

3.1.1.2 Missing participants and notes

- The private sector, landowners/ developers, were not invited as the organizers did not know who to invite but after running the workshop, they now have a much clearer view of who they could contact.
- Public institutions: The Ministry of regional development did send a representative who left however after the morning session, being more interested in the national and regional aspects.

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- Private sector: Developers and landowners were not initially identified as a target group to be invited but they will be invited in the upcoming workshops.
- Public administration: Participants representing city districts and near-Prague municipalities from the metropolitan area were invited but did not respond.

3.1.1.3 Engagement of vulnerable communities

Vulnerable communities as identified within D1.7 were engaged during the first workshop. CSA Prague team identified representative from the health sector – prevention and monitoring as representing the elderly and two mothers as representing children so they recorded their input as the vulnerable community input. However, during the post workshop meeting, it was discussed that these representatives could not be in fact identified as representatives of the vulnerably community. Representatives of the vulnerable communities whom they had originally identified as representatives from nursing homes and kindergartens, the elderly and children, did not come as they said they had no time to participate. Regarding representatives of tourists whom they had identified also as vulnerable communities; they were not invited as they did not know who to invite. Nevertheless, in the report they reported the input from these two initially identified as vulnerable participants and so it is kept in this manner in the present document.

3.1.2 Target groups perceptions on climate change risks

The workshop provided a comprehensive overview of climate challenges faced by Prague, with active involvement from all participants. The atmosphere of the workshop was relaxed, and people were generally motivated to participate and discuss the different questions. The main challenge was to explain the purpose of some of the activities (e.g., the PESTLE wheel), but some parts (especially the drivers and barriers) encouraged the participants to engage in fruitful discussions.
The LL of Prague identified a total of 12 risks connected to their main challenge. The risks are presented below as classified in the PESTLE wheel:

Political risks:

1. Missing long-term planning
2. Climate as a tool of political campaigns (anti-/pro-climate policies)

Economic risks:

3. Higher energy demands
4. Lower productivity/effectivity

Social risks:

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5. Increased mortality and morbidity among vulnerable groups (elderly, sick)
6. Social isolation (elderly)
7. Lower attractivity of cities for new residents
8. Worsen food quality/security

Technological risks:

9. Quality of input data/information for decision making
10. Damaged infrastructure (e.g. railway tracks)

Legal risks:

11. Missing legislation/policies for effective climate/heat adaptation

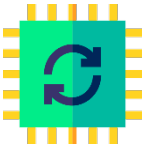
Environmental risks:

12. Water quality/scarcity for the city and for the vegetation (connected with droughts)

Vulnerable communities:

The identified as vulnerable communities' representatives identified as risks the health issues for the elderly.

3.1.3 Climate change risks and associated drivers



After assessing the risks, the LL participants in Prague identified 11 key drivers contributing to the region's climate risks. These drivers highlight interconnected issues spanning political, economic, social, technological, legal, and environmental domains.

- **Political drivers and their associated risks:**

  D1. Inclination to populists who offer 'simple' solutions (i.e.: climate protection policies are presented as a waste of money and lack of common sense).

  Associated risks:

  - Missing long-term planning
  - Climate as a tool of political campaigns (anti-/pro-climate policies)
  - Increased mortality and morbidity among vulnerable groups (elderly, sick)
  - Social isolation (elderly)
  - Lower attractivity of cities for new residents
  - Worsen food quality/security

- **Economic drivers and their associated risks:**

  D2. Air conditioning of buildings and food

  Associated risks:

  - Higher energy demands

  D3. Compound effect of different crisis (COVID19 pandemic, energetic crisis, war etc.) i.e. leads to prioritization of other issues and enhanced impact of climate related events (or vice versa) *

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Associated risks:

- Lower productivity/effectivity

❖ **Social drivers and their associated risks:**

D4. Demographic changes increase the size of vulnerable groups (elderly, children).

Associated risks:

- Increased mortality and morbidity among vulnerable groups (elderly, sick)
- Further increases the risk of social isolation (elderly)

D5. Insufficient capacity of social services

Associated risks:

- Further increases the risk of social isolation (elderly)

❖ **Technological drivers and their associated risks:**

D6. Insufficient technological adaptation, too many dark surfaces*

Associated risks:

- Lower attractivity of cities for new residents

D7. Poor (rain/waste) water management

Associated risks:

- Water quality/scarcity for the city and for the vegetation (connected with droughts)
- Lower attractivity of cities for new residents

❖ **Legal drivers and their associated risks:**

D8. Personal data protection – difficult to obtain accurate health data

Associated risks:

- Increased mortality and morbidity among vulnerable groups (elderly, sick)
- Further increases the risk of social isolation (elderly)

D9. Lack of legal documents for an effective adaptation of cities and companies (no siesta)

Associated risks:

- Higher energy demands
- Lower productivity/effectivity
- Lower attractivity of cities for new residents

❖ **Environmental drivers and their associated risks:**

D10. Climate change

Associated risks:

- All risks

D11. Poor water and greenery management*

Associated risks:

- Water quality/scarcity for the city and for the vegetation (connected with droughts)

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3.1.4 A&M solutions identified by target groups

In Prague, the LL identified 11 well-thought A&M solutions to tackle the region's climate challenges. These solutions are designed to reduce risks, address key contributing factors, and build resilience. Each solution was carefully linked to specific risks and their root causes. Below is a detailed breakdown of how these solutions target particular risks and drivers, organized by category and which barriers were identified for each of these solutions. Figure 10 presents the PESTLE wheel for Prague.

Political A&M solutions

1. Long-term planning independent on the political representation (e.g.: unpolitical* (without politicians) discourse and long-term planning)

- **Addresses risks:**
  All risks mainly:
  Missing long-term planning, climate as a tool of political campaigns (anti-/pro-climate policies), higher energy demands and lower productivity/effectivity.
- **Targets drivers:**
  All drivers mainly inclination to populists who offer 'simple' solutions.
- **Associated barriers:**
  Political 1: Lack of science-based decision making
  Political 2: Low motivation

Economic A&M solutions

2. Good economic management*

- **Addresses risks:**
  Higher energy demands,
  Lower productivity/effectivity,
  Quality of input data/information for decision making,
  Damaged infrastructure (e.g. railway tracks, missing legislation/policies for effective climate/heat adaptation, water quality/scarcity for the city and for the vegetation (connected with droughts)
- **Targets drivers:**
  Air conditioning of buildings and food, compound effect of different crisis (COVID-19 pandemic, energetic crisis, war etc.) i.e. leads to prioritization of other issues and enhanced impact of climate related events (or vice versa),
  Demographic changes increasing the size of vulnerable groups (elderly, children),
  Insufficient capacity of social services,

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Lack of legal documents for an effective adaptation of cities and companies (no siesta),
Climate change,
Poor water and greenery management

- **Associated barriers:**
  Political 1: Lack of science-based decision making
  Political 2: Low motivation
  Economic: Prioritization of “cheap” quick solutions over “expensive” sustainable solutions

Social A&M solutions

3. Environmental education/dissemination:

Examples provided by LL participants: a) During the summer 2024 information campaigns about heat risks and individual prevention measures in the public transport took place. Next plans include: highlighting vehicles with AC through more campaigns for the public b) Organizing (online) lectures by experts for students – PR activities of the universities and the Czech Academy of Sciences.

- **Addresses risks:**
  Increased mortality and morbidity among vulnerable groups (elderly, sick),
  Social isolation (elderly),
  Lower attractivity of cities for new residents, worsening food quality/security.
- **Targets drivers:**
  Inclination to populists who offer 'simple' solutions,
  Demographic changes increasing the size of vulnerable groups (elderly, children),
  Insufficient capacity of social services.
- **Associated barriers:**
  Economic: Underfunded research
  Social 1: Unclear communication of the CC research by scientists to the public
  Social 2: Low communication skills of the experts
  Social 3: Different experts convey different information
  Social 4: The scientific (correct) information is often too simplified or misinterpreted by media
  Social 5: Complex topics, difficult to understand

Technological A&M Solutions

4. Civil engineering solutions (AC, insulation of buildings, shade protection of (transport) infrastructure, smart surfaces)

- **Addresses risks:**
  Lower attractivity of cities for new residents,
  Worsen food quality/security,

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Quality of input data/information for decision making,
Damaged infrastructure (e.g. railway tracks).

- **Targets drivers:**
  Insufficient technological adaptation,
  There are too many dark surfaces,
  Poor (rain/waste) water management.
- **Associated barriers:**
  Political: low motivation
  Economic: Underfunded research
  Technological 1: Lack of money
  Technological 2: Insufficient technical infrastructure

5. Local specific solutions

No associated risks, drivers or barriers reported

6. Open data (i.e. research results as well as data from the city/government for researchers/decision makers)

- **Addresses risks:**
  Quality of input data/information for decision making
- **Targets drivers:**
  Personal data protection – difficult to obtain accurate health data. climate change
- **Associated barriers:**
  Political: Low motivation
  Economic: Underfunded research
  Technological 1: Lack of money
  Technological 2: Insufficient technical infrastructure

Legal A&M Solutions

7. Minimum requirements for buildings and urban planning as a law

- **Addresses risks:**
  Missing legislation/policies for effective climate/heat adaptation (and most others indirectly)
- **Targets drivers:**
  Personal data protection: it is difficult to obtain accurate health data,
  Lack of legal documents for an effective adaptation of cities and companies (no siesta).
- **Associated barriers:**
  Legal: People on decision/policy making positions are not interested enough in the issue. Therefore, there is lack of "engaged" people in the high management positions and hence lack of legal power.

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{Interesting comments from participants were reported:
"most strategies and action plans are only recommendations, not legally enforceable laws Hence, it is up to the current political representation how much they prioritize these strategies (how much money and people they provide/devote).
"Prague has enough funds to be a "pioneer" in testing and implementation of A&M solutions and show the way to other (smaller) cities"}

Environmental A&M Solutions

8. More green and blue infrastructure => walkable streets and cities *

- **Addresses risks:**
  Lower attractivity of cities for new residents,
  Water quality/scarcity for the city and for the vegetation (connected with droughts).
- **Targets drivers:**
  Insufficient technological adaptation,
  Too many dark surfaces,
  Poor (rain/waste) water management,
  Poor water and greenery management.
- **Associated barriers:**
  Environmental: Lack of water for irrigation since it is expensive

Vulnerable communities: They mentioned as solutions mainly education/dissemination, information campaigns.

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Figure 10: Living Lab in Prague PESTLE wheel Barriers and Solutions

3.1.5 Solutions prioritisation

Participants prioritised solutions based on ease of implementation, urgency, and importance. Measures such as local-specific solution design, open science/data encouragement, and environmental education were highly rated across all criteria. The prioritisation exercise emphasised the importance of immediate, impactful, and scalable actions, including:

- Strengthening long-term political commitment to climate adaptation.
- Promoting innovative cooling solutions.
- Developing comprehensive legal frameworks to support sustainable urban growth.

Unpolitical (i.e., independent on a 4-year election period) long-term planning was selected as the most urgent solution, but also as the most difficult solution to implement. It should be noted that one representative of Prague 5 (a district in Prague), who was present only in the morning session

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of the workshop, highlighted the important role of the private sector with the following words: “Politicians do not own the city, private sector does. Politicians can’t do much without the private sector.” Other important solutions (with high urgency) were A&M 5 (Local-specific solution design), A&M 8 (more blue-green infrastructure), and A&M 4 (Local-specific solution design), insulation and air conditioning of buildings. These findings suggest that NBS are important, but not also they are not the only way to deal with the heat stress. The prioritization process used a Mentimeter poll and group discussions. Participants evaluated each solution on a 1-to-5 scale, considering ease of implementation, urgency, and importance. The results were visualized using graphical outputs to facilitate informed discussions. Figure 11 presents the solution prioritization for Prague. The axes show the sum of scores for each solution on a 1-to-5 scale (5=most urgent/easiest implementation).

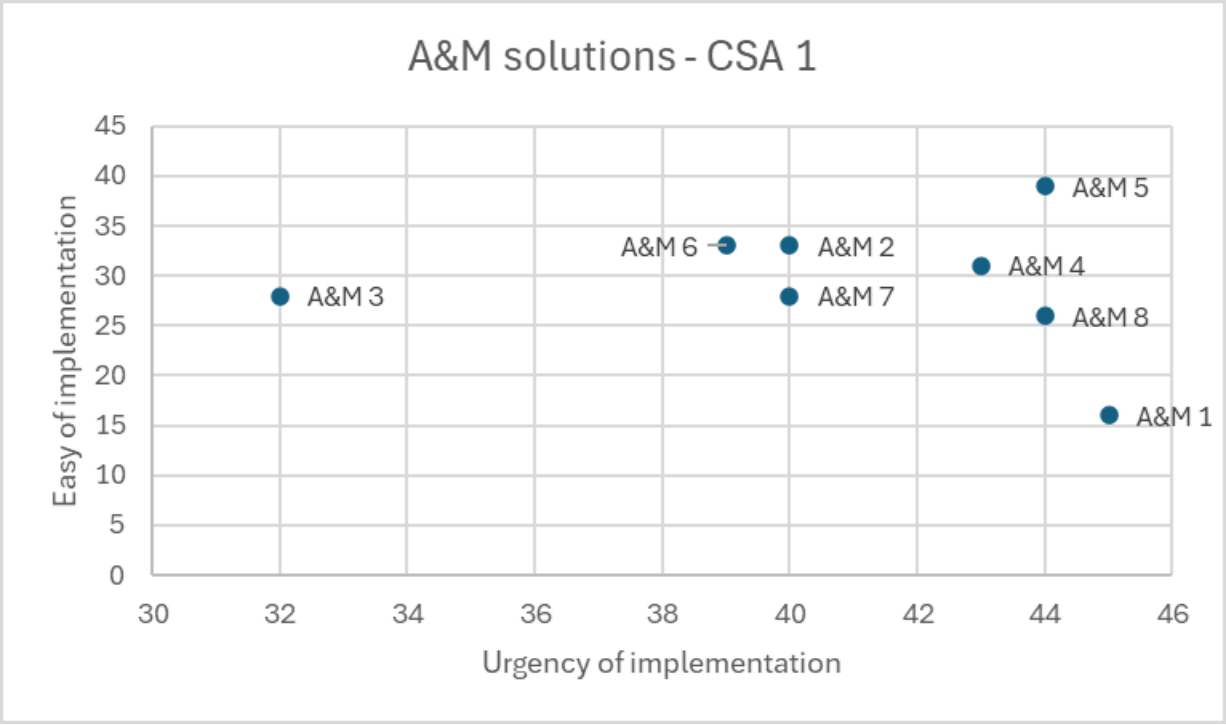

Figure 11: Living Lab in Prague: Prioritization of Solutions.

3.1.5.1 *Additional outputs (if any)*

Participants provided valuable insights, highlighting critical challenges and opportunities in implementing strategies and action plans:

On the nature of strategies and action plans they reported that most strategies and action plans are merely recommendations, not legally enforceable laws. Their implementation depends heavily on the priorities of the current political leadership and the resources—both financial and human—they are willing to allocate.

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On Prague's role as a pioneer they commented that Prague has sufficient funds to act as a pioneer in testing and implementing A&M solutions and that by taking the lead, it can set an example and pave the way for smaller cities to follow.

3.1.6 Target groups engagement assessment

The engagement of target groups in the Prague workshop was evaluated based on participation rates, diversity, and the level of contribution to discussions. Key stakeholder groups included local government representatives, urban planners, academics, and community organizations. Participants actively contributed to identifying risks, prioritizing solutions, and addressing barriers. Efforts to ensure broad engagement included targeted invitations, pre-event briefings, and structured breakout sessions. Feedback from participants highlighted the effectiveness of these measures in fostering inclusive and productive discussions.
The assessment emphasized the importance of continued collaboration and dialogue with all target groups to ensure the successful implementation of identified solutions.

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3.2 Leipzig (DE)

3.2.1 Target Groups engaged

3.2.1.1 Living Lab participants

Living Lab Challenge: Heatwaves

The LL in Leipzig was conducted online and focused on heatwaves, identified as a pressing challenge based on stakeholder perceptions and risk assessments. The workshop engaged a diverse range of stakeholders, ensuring representation from industry (utility, energy, management, climate adaptation and innovation), public administration and academia. Youth was represented by PhD students. A total of 14 participants actively participated in the workshop, representing various sectors across different target groups as identified in D1.7 (see below):

Regions (TG1)

Representatives included individuals from the following institutions:

- Markkleeberg – Department for City Planning and Development
- City of Leipzig – Department of Mobility
- City of Leipzig - Office for Urban Greenery and Waters
- City of Leipzig – Department of Environment Protection
- Leipzig Water Utilities

Communities (TG2)

- No representatives from TG2

Industry (TG3)

Representatives included individuals from the following institutions:

- Markkleeberg's Department for Real Estate Management
- Leipzig Mobility: Representation included an expert in innovation management from Leipzig Mobility, focusing on data-driven and technological approaches to mobility and urban challenges.
- Leipzig Water Utilities, focusing on public service delivery and asset management.

Research and Academia (TG4)

Representatives included individuals from the following institutions:

- University of Freiburg and Furtwangen University of Applied Sciences [contributing research and expertise in climate adaptation, energy systems, and sustainability].

Policymakers (TG5)

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- No representatives from TG5

Figure 12 presents the LL that took place online in Leipzig.

Figure 12. CSA Leipzig Living Lab

3.2.1.2 Missing participants and notes

To accommodate the conflicting and busy schedules of participants, the workshop was conducted online. However, two representatives—one from Leipzig Water Utilities and another from the City of Leipzig Digital City Group—were unable to attend due to scheduling conflicts. Despite this, they expressed interest in participating in future workshops.
The private sector was not invited to this initial workshop; however, efforts will be made to include them in subsequent sessions. Additionally, separate activities have been planned to address the concerns of vulnerable groups who were unable to attend this workshop.

3.2.1.3 Engagement of vulnerable communities

Vulnerable communities [see D1.7] were not adequately represented in the workshop despite being invited. The primary reasons cited for their absence include the lack of personal contact during the invitation process, as invitations were sent solely via email, and insufficient notice given prior to the event.
To address this, participants from the workshop have offered assistance in reaching out to these communities. Additionally, the CSA will take proactive steps to engage them, presenting the findings from WS1 and extending a more personalized invitation to ensure their participation in

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WS2. The CSA has plans to get more representatives of the vulnerable communities involved from hospitals, retirement homes and schools.

3.2.2 Target groups perceptions on climate change risks,

To ensure the workshop discussions were both informed and targeted, Leipzig CSA undertook a comprehensive review of relevant documents from the Leipzig municipality. This review included climate risk assessments, city planning strategies, and climate adaptation action plans. The aim was to identify key climate risks, drivers, barriers, and existing or planned adaptation and mitigation projects.

Additionally, a survey was conducted with LL participants to gather their perspectives on local climate challenges. The survey results highlighted heatwaves and their economic implications as the most immediate concern among participants. Objective risk assessments and expert opinions confirmed heatwaves as a critical risk while identifying wildfires as a potential long-term issue. To keep the discussion on focus, the workshop scope was limited to heatwave challenges. Figure 13 shows the PESTLE wheel from Leipzig CSA.

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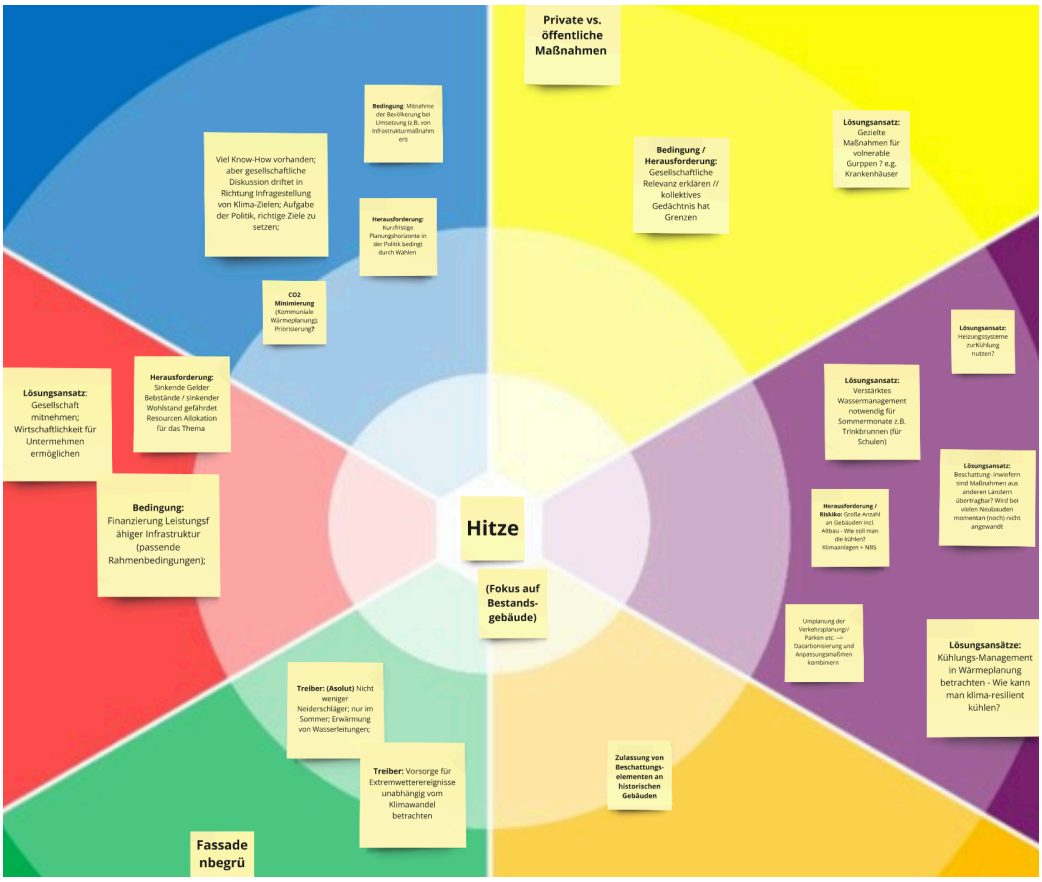

Figure 13. PESTLE Wheel for Leipzig

The LL in Leipzig identified 20 risks connected to climate change, emphasizing the multi-dimensional impact of these challenges. Each risk is presented under the relevant section. For some sections the Leipzig LL has identified subsections where risks have been identified in order to provide a comprehensive understanding of their implications.

Political risks:

- Citizens reject public action for climate change mitigation and adaptation Increasing the risk of protests

Economic risks:

Related to Health

- Higher healthcare costs
- Production losses due to increased sick leave

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- Need for additional support measures (e.g., cooling rooms, emergency care)

Related to Infrastructure

- Increased repair costs and maintenance needs for roads and public buildings
- High costs for water management and supply

Related to Justice*

- Costs for measures to reduce social inequalities (e.g., greening, subsidizing cooling systems)

Related to Tourism

- Decline in visitor numbers at outdoor events (potentially also less tourists in general)

Related to NBS

- High costs of NBS
- Uncertain benefits
- Loss of ecosystem services (e.g., cooling, air purification) if existing NBS are lost due to extreme heat.

Related to Buildings

- Higher energy costs for the city and citizens
- Need for building upgrades (e.g., air-conditioning, insulation, shading, etc.)

Social risks:

Related to health

- Increase in heat-related illnesses (e.g., dehydration)

Related to justice

- Unequal access to cooling green spaces and air-conditioned buildings

Technological risks:

- Strain on energy supply due to increased use of air conditioning
- Damage to roads and buildings

Legal risks:

- Stringent regulation and lengthy approval processes may delay urgent action

Environmental risks:

- Loss of street trees and vegetation due to drought and heat
- Higher water demand for irrigating green spaces and public areas

Concerning the *vulnerable communities*, it was reported that vulnerable communities are particularly threatened by extreme heat because they are most likely to face adverse health or economic consequences and/or they are least prepared to protect themselves through private investments.

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3.2.3 *Climate change Risks and associated drivers*

After identifying the risks, the LL in Leipzig identified 15 key drivers contributing to the region's climate risks. These drivers reflect systemic issues across political, economic, social, technological, legal, and environmental dimensions

- **Political drivers and their associated risks:**

  D1. Citizens reject public action for climate change mitigation and adaptation.

  Associated risks:

  - Political polarization and the uprising of the AfD, a far-right political party that at least partially denies climate change and opposes climate action is dividing the population.

- **Economic drivers and their associated risks:**

  D2. Higher healthcare costs; Production losses due to increased sick leave; Need for additional support measures (e.g., cooling rooms, emergency care)

  Associated risks:

  - Heat-related impacts on health and productivity

  D3. Increased repair costs and maintenance needs for roads and public buildings; High costs for water management and supply

  Associated risks:

  - Accelerated deterioration of infrastructure due to extreme heat

  D4. Costs for measures to reduce social inequalities (e.g., greening, subsidizing cooling systems)

  Associated risks:

  - No associated risks were identified

  D5. Decline in visitor numbers at outdoor events (potentially also less tourists in general)

  Associated risks:

  - Unattractive temperatures for tourist activities
  - Loss of revenue in the gastronomy and cultural sectors

  D6. High costs of NBS; Uncertain benefits; Loss of ecosystem services (e.g., cooling, air purification) if existing NBS are lost due to extreme heat

  Associated risks:

  - Costs for reforestation and irrigation
  - Additional costs for shading or cooling infrastructure
  - Insufficient rainwater management for urban irrigation concepts

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D7. Higher energy costs for the city and citizens; Need for building upgrades (e.g., air-conditioning, insulation, shading, etc.)

Associated risks:

- Increased need for air-conditioning, leading to more electricity demand and associated investment needs.

❖ **Social drivers and their associated risks:**

D8. Increase in heat-related illnesses (e.g., dehydration)

Associated risks:

- No associated risks were identified

D9. Unequal access to cooling green spaces and air-conditioned buildings.

Associated risks:

- High building and population density in low-income neighborhoods

❖ **Technological drivers and their associated risks:**

D10. Strain on energy supply due to increased use of air conditioning; Damage to roads and buildings

Associated risks:

- Increasing energy demand with simultaneously inefficient infrastructure
- Material fatigue due to extreme heat (e.g., asphalt)

❖ **Legal drivers and their associated risks:**

D11. Stringent regulation and lengthy approval processes may delay urgent action

Associated risks:

- No associated risks were identified

❖ **Environmental drivers and their associated risks:**

D12. Loss of street trees and vegetation due to drought and heat; Higher water demand for irrigating green spaces and public areas

Associated risks:

- Insufficient irrigation capacities
- Unsuitable tree species
- Reduced precipitation and increased evaporation

Vulnerable communities are particularly threatened by extreme heat because they are most likely to face adverse health or economic consequences and/or they are least prepared to protect themselves through private investments.

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3.2.4 Adaptation and Mitigation solutions identified by target groups

Political A&M solutions:

1. Campaign to communicate the need for climate action – focus on addressing polarization
   - **Addresses risks:**
     Citizens reject public action for climate change mitigation and adaptation.
   - **Targets drivers:**
     Political polarization and the uprising of the AfD, (A far-right political party that at least partially denies climate change and opposes climate action is dividing the population).
   - **Associated barriers:**
     Political 1: Large parts of the population are sceptical of whether climate investments are justified.
     Political 2: The technical know-how to address climate impacts is there, problem is the political polarization and lack of unanimous support for action.

2. Gain political support for the financing of large-scale infrastructural interventions
   - **Addresses risks:**
     Citizens reject public action for climate change mitigation and adaptation.
   - **Targets drivers:**
     Political polarization and the uprising of the AfD (A far-right political party that at least partially denies climate change and opposes climate action is dividing the population).
   - **Associated barriers:** Not reported

Economic A&M solutions

3. Critically assess return on investment of interventions
   - **Addresses risks:**
     Inefficient allocation of public resources
   - **Targets drivers:**
     Lack of thorough cost-benefit analysis
   - **Associated barriers:**
     Economic 1: Declining wealth threatens availability of resources for climate action.
     Economic 2: Need to ensure that Leipzig gets more attractive for companies as a location for future investments and companies do not feel overburdened by regulations.

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Economic 3: Need to justify public investment needs (why can't the private sector solve it?).

Social A&M solutions

4. Environmental education/dissemination: Explain action needs to general public and justify public investments (related to political communication campaign)
   - **Addresses risks:**
     Citizens reject public action for climate change mitigation and adaptation.
   - **Targets drivers:**
     Political polarization and the uprising of the AfD (A far-right political party that at least partially denies climate change and opposes climate action, is dividing the population).
   - **Associated barriers:** Not reported

Technological A&M solutions - building cooling

5. Evaluate whether existing district heating networks to be used for cooling purposes in summer?
   - **Addresses risks:**
     Summertime indoor temperatures exceed health, comfort, and productivity thresholds.
   - **Targets drivers:**
     Most existing buildings are not equipped with air conditioning units.
   - **Associated barriers:** Not reported

6. Improve water management (e.g., storage of rainwater for use in fountains and public waterbodies)
   - **Addresses risks:**
     Summertime indoor temperatures exceed health, comfort, and productivity thresholds.
   - **Targets drivers:**
     Most existing buildings are not equipped with air conditioning units.
   - **Associated barriers:** Not reported

7. Combine Air Conditioning (predominantly private investment) with nature-based solutions (public investments)
   - **Addresses risks:**
     Summertime indoor temperatures exceed health, comfort, and productivity thresholds.
   - **Targets drivers:**
     Most existing buildings are not equipped with air conditioning units.

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- **Associated barriers:** Not reported

8. Evaluate cooling potential of denser construction and better sealing
   - **Addresses risks:**
     Summertime indoor temperatures exceed health, comfort, and productivity thresholds.
   - **Targets drivers:**
     Most existing buildings are not equipped with air conditioning units.
   - **Associated barriers:** Not reported

Technological A&M solutions - Integrated City Planning

9. Consider trade-offs between transportation planning (e.g., parking spots with electric charging) and nature-based solutions such as street trees => combined planning needed
   - **Addresses risks:**
     Conflicting objectives between A&M initiatives,
     City planning is not aligned with climate projections.
   - **Targets drivers:**
     Lack of alignment between departments that plan climate change adaptation/ mitigation interventions,
     Bureaucratic inertia (doing things the way they have always been done).
   - **Associated barriers:** Not reported

10. Learn from southern countries to inform city planning (e.g., shading of buildings, narrow streets, etc.)
    - **Addresses risks:**
      No Risks reported
    - **Targets drivers:**
      Lack of pan-European best practice sharing
    - **Associated barriers:** Not reported

Legal A&M solutions

11. Drastically simplify regulations (e.g., for protection of historic buildings) to allow for effective deployment of interventions
    - **Addresses risks:**
      Stringent regulations block implementation of effective A&M measures
    - **Targets drivers:**
      Local authorities bound by state/national regulations,
      Bureaucratic culture of following rules without questioning implications.
    - **Associated barriers:** Not reported

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Environmental A&M solutions

12. Explore cooling potential of green facades
    - **Addresses risks:**
      Summertime indoor temperatures exceed health, comfort, and productivity thresholds.
    - **Targets drivers:**
      Most existing buildings are not equipped with air conditioning units.
    - **Associated barriers:** Not reported

Vulnerable communities: They mentioned mainly targeted measures to reduce heat exposure to the most vulnerable groups (e.g., air conditioning and other building upgrades in hospitals, old age homes, educational facilities, etc.).
Regarding the vulnerable communities, targeted measures to reduce heat exposure of most vulnerable groups (e.g., air conditioning and other building upgrades in hospitals, old age homes, educational facilities, etc.) were proposed.

3.2.5 Solutions prioritization

Using the online interactive polling tool Mentimeter, participants ranked individually each A&M measure that has been identified in the previous activity, on a 1-to-5 scale based on the urgency (from not urgent to very urgent) and ease of implementation (from very easy to very difficult, considering environmental, technical, and cost factors). Urgency is assessed based on how quickly the risk needs to be addressed, while ease of implementation considers factors such as cost, availability of technology or resources, and social acceptance. The results of the survey were automatically generated so workshop participants saw the prioritization result and could reflect on it. Involving citizens and educating them received the highest scores across all criteria. More specifically, the measures ranked as follows:

- Involving citizens and educating them
- Urban greening and waterbodies
- Providing support for green technology adoption
- Renovating buildings

Figures 14 and 15 show in a graphical way the outputs of the prioritization solutions:

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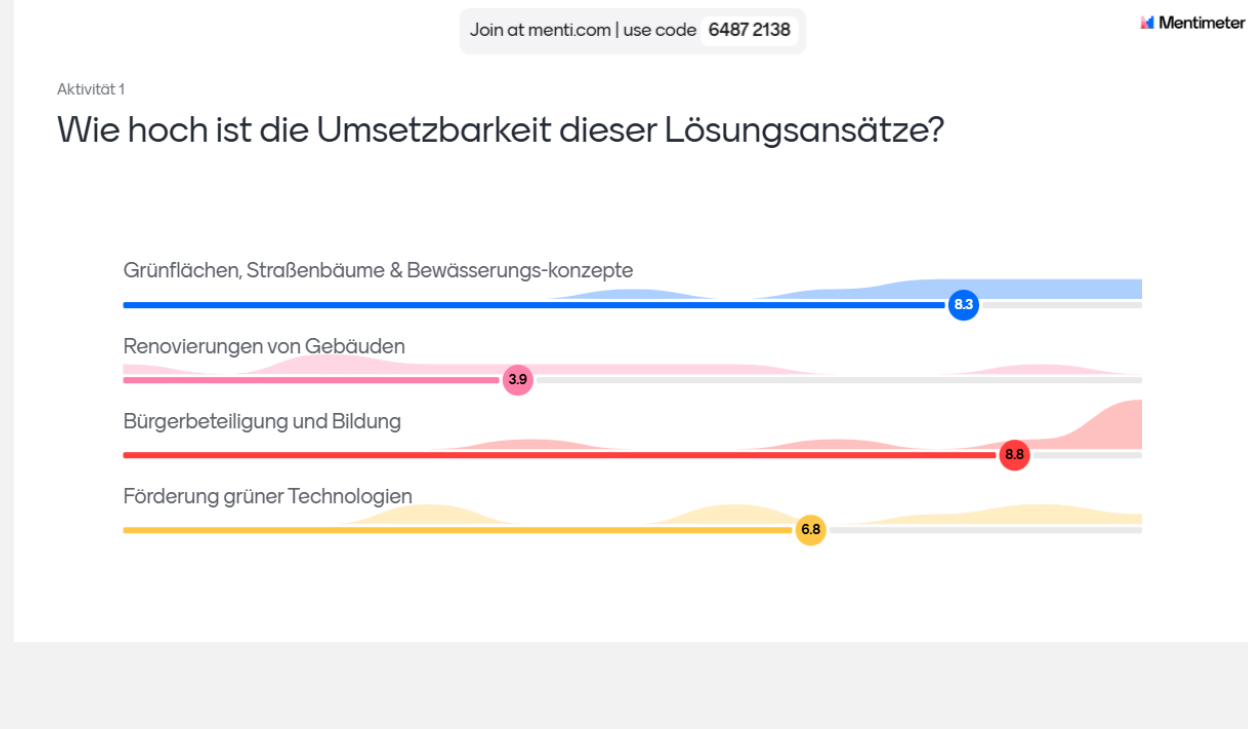

Figure 14. How feasible is the implementation of the following A&M solutions?

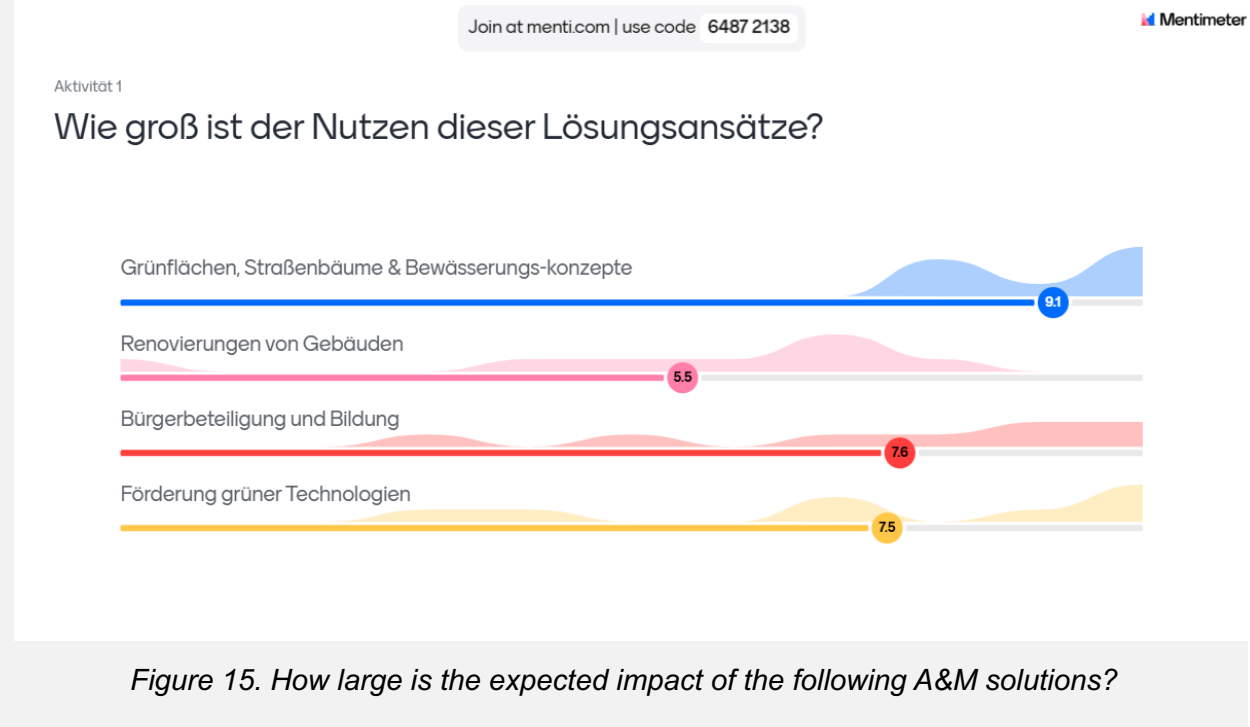

Figure 15. How large is the expected impact of the following A&M solutions?

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3.2.5.1 Additional outputs (if any)

CSA Leipzig provided an executive summary with their key findings (not requested, CSA Leipzig took the initiative to provide it):

Political

Participants emphasized the growing risk of political polarization as a barrier to climate action. Convincing the public of the necessity and effectiveness of large-scale public investments in adaptation and mitigation emerged as a critical challenge. Transparent communication and framing public investments as essential for long-term urban resilience were identified as key strategies to build societal buy-in.

Economic

The economic impacts of heatwaves were a central concern. Key insights included:

- Rising healthcare costs due to heat-related illnesses.
- Productivity losses stemming from increased sick leave and reduced worker performance in high temperatures.
- Increased costs for repair and maintenance of infrastructure, such as roads and public buildings, affected by extreme heat.
- The need for targeted public investments to subsidize cooling infrastructure while managing limited resources.

Social

Discussions highlighted significant social inequities in climate adaptation measures. Participants noted:

- Unequal access to cooling infrastructure, such as green spaces and air-conditioned buildings, particularly in low-income neighbourhoods.
- Disproportionate vulnerability of marginalized groups to heat-related health impacts, necessitating targeted interventions like cooling centres and urban greening in underserved areas.
- The importance of public education to build understanding and support for climate adaptation initiatives.

Technological

Participants identified vulnerabilities and opportunities within the technological domain, including:

- Strain on energy supply systems due to rising demand for air conditioning during heatwaves.

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- The need to integrate nature-based solutions with technological infrastructure, such as combining air conditioning with urban greenery and enhancing rainwater storage and usage.
- Innovative approaches, including utilizing district heating networks for cooling and adopting shading techniques from regions with similar climate challenges.

Legal

Legal and regulatory barriers were identified as significant challenges to effective adaptation. Key concerns included:

- The complexity of infrastructure regulations, particularly in historic areas, hindering the deployment of interventions.
- The need for streamlined permitting processes to accelerate the implementation of climate-resilient projects, such as green facades and urban redesign efforts.

Environmental

Environmental risks and opportunities were a major focus, with participants noting:

- The loss of urban greenery due to drought and heat, threatening ecosystem services.
- Reduced precipitation and increased evaporation, intensifying water shortages and raising irrigation demands.
- A dedicated session on NBS solutions, during which participants identified existing efforts such as urban greenery projects and highlighted areas requiring expanded initiatives, including urban greening and creation of waterbodies.

Key takeaways

Stakeholders agreed that addressing heatwave-related challenges requires a multi-faceted approach, combining urban planning innovations, social equity measures, and robust climate adaptation strategies. While some measures, such as greening initiatives, align with ongoing municipal efforts, others—like ensuring equitable access to cooling infrastructure—will require new investments and policy adjustments.

3.2.6 Target groups engagement assessment

WS1 served as a critical initial step in engaging SHs and setting the foundation for subsequent workshops in the LL initiative. Despite initial hesitation from participants, the event successfully fostered meaningful engagement and collaboration, thanks to the skilled facilitation and structured activities. The insights and lessons learned from WS1 will shape the approach for future workshops.

Participant Engagement

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At the outset, participants appeared reluctant to engage, possibly due to the online format. There was a noticeable lack of clarity among SHs about their expected roles, with many initially assuming a passive, observational stance. However, as the workshop progressed, the dynamics shifted significantly. A key turning point was the introduction of structured activities like the PESTLE wheel and the NBS activity which encouraged active participation and fostered deeper engagement. Stakeholders from Leipzig displayed confidence, likely due to their familiarity with similar initiatives. As the workshop progressed, and thanks to the skillful facilitation which managed to overcome the difficulties posed by the online format, all participants were actively involved, contributing to robust discussions and meaningful outputs.

Facilitation

Facilitators demonstrated exceptional skill and experience in managing an online format. The workshop included 11 participants, representing diverse sectors, such as Industry, Academia, Policy Makers and Youth Representation. The Private Sector was not invited to this workshop, but it is planned for inclusion in the upcoming workshops.

While there was strong representation across sectors, key vulnerabilities in representation were noted in the Vulnerable Communities. These groups were invited but did not participate due to late invitations and a lack of personal contact in the approach. Future planned actions to ensure their participation include stakeholders who attended WS1 have offered to assist in outreach efforts and the CSA will proactively engage with these groups, sharing findings from WS1 and extending personalized invitations to WS2.

Strengths and areas for improvement

- **Strengths:**
  - The diversity of participants enhanced the richness of discussions, providing a holistic view of climate challenges.
  - The structured approach, including interactive group activities like the PESTLE wheel, ensured balanced participation and actionable outputs.
  - The skilled facilitation created a collaborative environment and enabled participants to transition from passive listeners to active contributors.
- **Areas for improvement:**
  - Initial participant reluctance highlighted the need for clearer communication of workshop objectives and participant roles.
  - The absence of vulnerable communities underscored the importance of timely and personalized outreach to ensure inclusivity.
  - Future workshops should explore strategies to better engage participants in online formats, such as pre-event briefings or icebreaker activities.

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Overall, facilitators expressed satisfaction with the outcomes of WS1, emphasizing that its success was pivotal for the entire LL initiative. The confidence gained from WS1 sets a positive tone for WS2, which will involve in-person participation to further strengthen collaboration and engagement.

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3.3 Funen-Odense (DK)

3.3.1 Target groups engaged

Living Lab Challenge: Storm Surge Flooding

The LL in the Funen–Odense CSA was implemented differently compared to other CSAs. In September 2024 and additionally in January 2025, the CSA team (DTU) held meetings with Svendborg and Odense municipalities, Geocenter Funen, the Association of Danish Municipalities, and the Danish Environmental Protection Agency to discuss flood risk assessment.

Given that the Odense/Fünen region is very far ahead in the planning and implementation options with extreme flooding events having occurred several times, all municipalities including those in the region have developed climate risk assessment plan and have also/are in the process of identifying adaptation strategies. Municipalities like Odense and Svendborg have plans, which officially are approved by their local government. Behind these plans, there have been a lot of local stakeholder meetings organized by the municipalities and other organisations.

Stakeholder interactions and co-knowledge production with the local society has been for a very long time and are also an intensive ongoing process in the Odense/Fünen region. It includes a range of activities including both participation in local meetings on climate risks and adaptation options, direct ongoing contacts with provision of technical advice to stakeholders on request, and also direct collaboration about modelling of climate risks and adaptation options at local level. The municipalities of Odense and Svendborg, which are major focal points in our case study, are also members of the official steering committee of the damage cost model, being used in this case study for CARMINE (WP3) - the municipalities jointly with other Danish municipalities actually own this open source model (DTU Damagecost model).

It is also here important to know, that there is a general election in all Danish municipality boards in November 2025, and this implies that it is not appropriate now to organize broad stakeholder meetings, which could light fire to local controversies.

As such, in order to avoid stakeholder fatigue and duplication of efforts the CSA team has gleaned preliminary information in accordance with the requested outputs of workshop 1 from existing documentation. In addition taking into consideration the stakeholders that have been engaged. Furthermore, the CSA team is in the process of designing and implementing a survey to collect information on NBS in the region, their co-benefits to SDGs and other impact areas; assessment of social impacts on people and local societies; and assessment of burden sharing - who is going to pay for adaptation. Building on these outputs, the CSA team will seek to engage stakeholders identified within their mapping (including the vulnerable communities) in keeping with the

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objectives of the CARMINE project. The following sections present information extracted from the developed climate plans within the region.

3.3.1.1 Consultation participants

Representatives in the Funen - Odense LL included individuals that were representing the following categories related to TGs presented in D1.7:

- Local citizens,
- Business,
- Nature conservation, local political parties,
- Members of the local government,
- Municipalities and local Danish experts,
- Danish industry,
- Insurance sector, engineering consultants,
- Academia,
- Public media.

3.3.2 Target groups perceptions on climate change risks

The risks concerning storm surge flooding are listed below:
Svendborg damages on:

1. Buildings including permanent houses, summer houses, industrial buildings,
2. Health impacts,
3. Infrastructure and transport impacts,
4. City life,
5. Cultural values,
6. Nature values.

Climate Risk and Adaptation Plan for Svendborg 2023
The plan was approved by the local government, with priorities for selecting adaptation options based on:

- Many co- benefits exist
- Risk reduction in areas with high economic value
- Make important nature areas more flooding robust
- Protect areas with special values like critical infrastructure and small Island societies

More information can be found here.

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The information was gathered using a participatory approach, primarily through desk research. Additionally, the municipality conducted local workshops and adhered to the legal procedures for public hearings on projects with environmental implications.
Odense damages on:

1. Buildings including permanent houses, summer houses, industrial buildings
2. Health impacts,
3. Infrastructure and transport impacts,
4. City life,
5. Cultural values,
6. Nature values.

Climate Risk and Adaptation Plan – Svendborg 2023
The plan was approved by the local government, with adaptation priorities focused on:

- Biodiversity,
- Economy,
- Collaboration,
- Traffic safety,
- Health,
- Multifunctionality,
- Environment in the sea.

The information was collected using a participatory approach, primarily through desk research. Additionally, the process included local workshops, public hearing procedures for projects with environmental implications, and joint project planning with the dike association in the Seden Beach area and near Kerteminde Road. The final decisions were made by the local government.
More information can be found here.

3.3.3 Adaptation and Mitigation Solutions Identified by target groups

Svendborg
The following adaptation and mitigation solutions were identified:

- Storm surge risk reduction in built environment,
- Flood risk reduction for Svendborg harbor,
- Protection of 20 special cultural assets in the coastal environment,
- Protection of flora and fauna in beach areas,
- Risk reduction for infrastructure in small Islands NBS.

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The participatory method used to collect this information was desk research. The participatory method used to collect this information included desk research. The prioritization of solutions and implementation involved several steps, such as prioritisation of solutions, implementation, dialogues with citizens, mapping of risks and values, citizen dialogues, choice of protection level, choice of implementation plan, burden sharing and finance, initiation projects, risk and damage mapping, identification and planning of risk reduction projects in partnership with local citizens.

Odense

The following adaptation and mitigation solutions were identified:

Flood risk reduction and Odense canal:

- Hard protection like a dike,
- Sluise.

Elderly Home:

- Hard protection like a dike,
- Seden beach area and Kerteminde road,
- Reestablishment of old nature and creation of new nature NBS.

The participatory method used to collect this information included desk research, local workshops, public hearing procedures for projects with environmental implications, and joint project planning with the dike association in the Seden Beach area and near Kerteminde Road. Final decisions were made by the local government.

Barriers

General barriers include challenges related to burden sharing: determining who will pay (private citizens, businesses, local government, or the state). Finance is also a significant barrier. Information regarding these barriers was gathered from several Danish workshops and meetings, as well as media and political debates. The participatory method involved participation by DTU in meetings and discussions.

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3.4 Athens (EL)

3.4.1 Target Groups engaged

3.4.1.1 Living Lab participants

Living Lab Challenge: Urban heat and mortality and health risks: pioneering solutions for urban heat resilience

The LL in Athens brought together a wide array of stakeholders to foster collaboration and ensure diverse perspectives from the public, private, academic, and non-governmental sectors. A total of 13 participants (Figure 16) actively engaged in the workshop, representing various target groups as identified in D1.7 (see below):

Regions (TG1)

Representatives included individuals from the following institutions:

- Athens Primary Education Directorate A. and Schools4Climate Network
- New Metropolitan Attika S.A.

Communities (TG2)

Representatives included individuals from the following institutions:

- SOS Children's Villages
- Youth Initiative (Protovoulia Neon)
- Organization Earth
- Commonspace, AUA, and Urban Heat Watch (consultancy company working with local communities)
- Design Clips and OASIS school yards (consultancy company working with local communities)

Research and Academia (TG4)

Representatives included individuals from the following institutions:

- Harokopeio University
- University of Thessaly
- University of Dresden

Policymakers (TG5)

- Representatives included individuals from the following institutions:
- Kifissia Municipality
- Ministry of the Environment and Energy

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- UN Habitat and Arsht-Rock

This diverse group brought a wealth of knowledge and perspectives to the LL, contributing to a robust and collaborative exploration of urban challenges and opportunities.

Figure 16. Living Lab in Athens

3.4.1.2 Missing participants and notes

Despite efforts to ensure broad participation, several key stakeholders were notably absent from the LL in Athens due to resource constraints or lack of availability. The missing participants included:

- Public administration and policy: Representatives from other relevant municipal bodies, regional authorities and central government ministries in urban development, climate adaptation, health and emergency management.
- Education sector: Additional representatives from schools and education networks focused on environmental awareness and resilience.
- NGOs and civil society: Organizations working directly with disadvantaged communities and populations vulnerable to heat, representing workers, or involved in broader climate and urban resilience efforts were underrepresented.

Scheduling conflicts, limited staff availability (particularly for NGOs and civil society groups) and competing commitments were the primary reasons for these absences. Follow-up activities are being planned to engage vulnerable groups and organizations that were unable to participate in the workshop, ensuring their perspectives are integrated into the ongoing process.

3.4.1.3 Engagement of vulnerable communities

Special attention was given to vulnerable communities [see D1.7], particularly children, socio-economically disadvantaged families, and youth, during the LL in Athens. Although the direct participation of these groups was limited, their needs were addressed through active involvement from their advocates:

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- Children and Families: Representatives from SOS Children's Villages, an NGO focusing on children and socio-economically vulnerable families, played a pivotal role in ensuring that these groups' perspectives were integrated into the discussions. Additionally, the Director of Environmental Education from Athens Primary Education Directorate A. and the Schools4Climate network contributed insights on the needs of children and school communities.
- Youth: A youth activist from Youth Initiative (Protovoulia Neon) attended and participated in all activities. While initially finding it challenging to engage in technical discussions, they provided valuable feedback and expressed a strong interest in continuing to represent youth perspectives in future initiatives.

The CSA team also conducted a meeting before the LL with the representative of UNICEF Greece that coordinated a recent survey of children and youth in schools and read the report that was produced based on this survey and related focus groups and research.

These contributions ensured that the concerns and experiences of some vulnerable groups were represented indirectly through their advocates and participants. Plans are in place to conduct additional activities to gather more comprehensive insights directly from these communities, reinforcing their inclusion in the decision-making process.

3.4.2 Target groups perceptions on climate change risks, drivers, solutions, barriers

The workshop facilitated comprehensive discussions to identify and address climate change risks, drivers, solutions, and barriers in the Athens Metropolitan Region. The LL Challenge was urban heat and mortality and health risks: pioneering solutions for urban heat resilience. Figure 17 provides the PESTLE wheels from Athens CSA.

Figure 17. PESTLE Wheel for Athens

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The LL in Athens identified 23 risks connected to climate change, emphasizing the multi-dimensional impact of these challenges..

Political risks:

7. Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity [also mentioned in economic risks and social risks and health].
8. Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers) [also mentioned in economic risks and social risks and health].
9. Problems in the policy context (such as inadequate implementation of mitigation policies).
10. Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help). [also mentioned in social risks and health].
11. Urban heat island (UHI) [also mentioned in economic risks].
12. Not enough advocacy for environmental rights and protections [also mentioned in legal and environmental risks].
13. Not enough partnerships between civil society and State and academic institutions. [also mentioned in legal and environmental risks].

Economic risks:

14. Impact on economy (including reduced tourism, business insurance costs).
15. Risk (exposure and vulnerability) for outdoor and indoor workers. [also mentioned in social risks and health].
16. Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult). [also mentioned in economic risks and social risks and health].
17. Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes.) [also mentioned in economic risks].
18. Urban greenery and biodiversity impacted, are not maintained. [also mentioned in environmental risks].
19. Insufficient cool spaces (outdoor and indoor). [also mentioned in social risks and health].
20. Food insecurity [also mentioned in social risks and health and environmental risks].
21. Wildfires [also mentioned in environmental risks].
22. Rising sea levels [also mentioned in environmental risks].

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Social risks and health:

23. Physical and mental health impacts.
24. Increase in violence, including domestic violence.
25. Children and infants are vulnerable.
26. Mortality among seniors.
27. Risk to pets.

Technological risks:

28. Power outages.

Environmental risks:

29. Drought.

Concerning *vulnerable communities*, identified risks are related to schools and children and other vulnerable populations, exposure and vulnerability of workers, language barriers, most of the social and health factor risks, and risks related to the need for more advocacy, access to information by socio-economically vulnerable populations, and more partnerships between civil society organizations and government/public agencies.

3.4.3 Climate change Risks and associated Drivers

After identifying the risks, the LL in Athens identified 53 key drivers contributing to the region's climate risks. These drivers reflect systemic issues across political, economic, social, legal, and environmental dimensions.

- **Political drivers and their associated risks:**

D1. Lack of a national strategy for extreme heat.

Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).

D2. There is no inter-agency working group to address heatwave emergencies.

Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).

D3. Lack of relevant data at the local level.

Associated risks:

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- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help). [Political (because government agencies collect/provide info).

D4. Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community.

Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Urban Heat Island (UHI).
- Not enough partnerships between civil society and State and academic institutions.

D5. Lack of a comprehensive strategy for substantive participatory processes and engagement by government.

Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Not enough partnerships between civil society and State and academic institutions.

D6. There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform.

Associated risks:

- Not enough partnerships between civil society and State and academic institutions.

D7. Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government.

Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).

D8. Blindness and ignorance in relation to the management of trees in the city.

Associated risks:

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- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help). Urban Heat Island (UHI).
- Urban greenery and biodiversity impacted, not maintained.

D9. Development facilitated through for-profit contracts and contractors.
Associated risks:

- Not enough partnerships between civil society and State and academic institutions.

D10. Failure to modernize social infrastructure.
Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help)
- Urban Heat Island (UHI).
- Insufficient cool spaces (outdoor and indoor).
- Not enough partnerships between civil society and State and academic institutions.

D11. Lack of data for timely information.
Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).

D13. Need for interdepartmental organization and coordination.
Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Urban Heat Island (UHI).

D14. Informing social groups.
Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).

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- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes).
- Children and infants are vulnerable.
- Mortality among seniors.

D15. Management of Municipality personnel and municipal infrastructure.

Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers
- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes.)
- Insufficient cool spaces (outdoor and indoor).

D16. Procedures

Associated risks:

- No drivers were identified.

D17. Quick reflexes of local government (wrong decision?)

Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).

❖ **Economic drivers and their associated risks:**

D18. Poverty, high unemployment.

Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Risk (exposure and vulnerability) for Outdoor and indoor workers.
- Increase in violence, including domestic violence.
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- Mortality among seniors.
- Food insecurity.

D19. Lack of outdoor spaces and parks.

Associated risks:

- Urban Heat Island (UHI).

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- Insufficient cool spaces (outdoor and indoor).

D20. Schools, health facilities and public buildings are not energy efficient.
Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes.)
- Children and infants are vulnerable.
- Insufficient cool spaces (outdoor and indoor).
- Not enough partnerships between civil society and State and academic institutions.

D21. Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options.
Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes).
- Insufficient cool spaces (outdoor and indoor).
- Mortality among seniors.

D22. Expansion of metal elements (damage to infrastructure and things with metal).
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Impact on the economy.
- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Urban Heat Island (UHI).
- Power outages.

D23. NOK (New Building Regulations) overdevelopment.
Associated risks:

- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).
- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Urban Heat Island (UHI).

D24. Workers have limited mobility/ transit options.

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Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Impact on economy.
- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).

D25. Technical characteristics of the built environment and buildings.

Associated risks:

- Problems in the policy context (Inadequate implementation of mitigation policies. Methodologies for harmonizing policies.).
- Urban Heat Island (UHI).

D26. High energy consumption of buildings and cost of energy upgrading.

Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Impact on economy.
- Power outages.

D27. Health system - efficiency and adequacy of resources.

Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Increase in violence, including domestic violence.
- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Children and infants are vulnerable.
- Mortality among seniors.

❖ **Social drivers and their associated risks**

D28. Poverty

Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.

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- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- Children and infants are vulnerable.
- Food insecurity.
- Not enough partnerships between civil society and State and academic institutions.

D29. Lack of shade in outdoor spaces.

Associated risks:

- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).
- Urban Heat Island (UHI).
- Insufficient cool spaces (outdoor and indoor).

D30. Media coverage in some cases that makes it difficult for the public to understand the health risks of extreme heat.

Associated risks:

- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).

D31. Lack of funding for social organizations.

Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- Insufficient cool spaces (outdoor and indoor).
- Food insecurity.
- Not enough advocacy for environmental rights and protections.
- Not enough partnerships between civil society and State and academic institutions.

D32. Lack of funding for the health sector.

Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.

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D33. Socio-economic inequalities.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Risk (exposure and vulnerability) for Outdoor and indoor workers.
- Increase in violence, including domestic violence.
- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- Children and infants are vulnerable.
- Mortality among seniors.
- Food insecurity.

D34. Unsafe very hot working environment.
Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Risk (exposure and vulnerability) for Outdoor and indoor workers.

D35. Buildings not energy-shielded.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes).
- Insufficient cool spaces.
- Mortality among seniors.

D36. School buildings unsuitable with no adaptation.
Associated risks:

- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes).
- Children and infants are vulnerable.

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D37. Power outages.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Urban greenery and biodiversity impacted, not maintained.

D38. Socio-economic characteristics and age of the population.
Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Mortality among seniors.

D39. Mortality and morbidity in vulnerable groups also energy poverty.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- Children and infants are vulnerable.
- Mortality among seniors.

D40. Safety at work.
Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Risk (exposure and vulnerability) for Outdoor and indoor workers.
- Problems in the policy context (such as inadequate implementation of mitigation policies).

❖ **Legal drivers and their associated risks:**

D41. Lack of a comprehensive legal framework for managing extreme heat emergencies.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.

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- Problems in the policy context (such as inadequate implementation of mitigation policies).

❖ **Environmental drivers and their associated risks:**

D42. Air pollution (increases health risk of heat and vice versa.)

Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Risk (exposure and vulnerability) for Outdoor and indoor workers.
- Children and infants are vulnerable.
- Mortality among seniors.
- Wildfires.

D43. Nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase.

Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Drought.
- Wildfires.

D44. Wildfire smoke increases health risk of heat, and wildfires are increasing around Athens metro.

Associated risks:

- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Drought.

D45. Overtourism.

Associated risks:

- Impact on economy.
- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).
- Problems in the policy context (such as inadequate implementation of mitigation policies).

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- Not enough advocacy for environmental rights and protections.

D46. Inadequate electricity networks.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Power outages.

D47. Lack of risk awareness.
Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).

D48. Lack of urban greenery.
Associated risks:

- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).
- Urban Heat Island (UHI).
- Urban greenery and biodiversity impacted, not maintained.
- Insufficient cool spaces (outdoor and indoor).

D49. Public drinking fountains and water elements. Plans for dealing with heat on the ground (for example, drinking water).
Associated risks:

- Risk (exposure and vulnerability) for outdoor and indoor workers.
- Children and infants are vulnerable.
- Urban Heat Island (UHI).
- Urban greenery and biodiversity impacted, not maintained.
- Food insecurity.

D50. Lack of knowledge of urban greenery.
Associated risks:

- Problems in the policy context (such as inadequate implementation of mitigation policies).
- Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- Urban Heat Island (UHI).
- Urban greenery and biodiversity impacted, not maintained.

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- Insufficient cool spaces (outdoor and indoor).
- Food insecurity.

D51. Lack of specifications and certification in the maintenance of city trees.
Associated risks:

- Urban greenery and biodiversity impacted, not maintained.

D52. The atmosphere is becoming stuffier, and we have pollution problems.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).
- Wildfires.

D53. Possibly reducing traffic.
Associated risks:

- Mobility challenges (for example public transit is not cool and as a result more need to use private vehicles since walking is difficult).

D54. Access to air-conditioned spaces.
Associated risks:

- Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity.
- Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers.
- Physical and mental health impacts.
- Increase in violence, including domestic violence.
- Risks for schools (since school buildings get hot. Risk even when schools close and children have to be in hot homes).
- Insufficient cool spaces (outdoor and indoor).
- Not enough partnerships between civil society and state and academic institutions.

Vulnerable communities often have less awareness and information about risks and how to take action to reduce vulnerability - and they rely on social service organizations or gov agencies to provide guidance (participants working with families and children that need support). People don't

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get information about workshops like this or other opportunities for co-creation or participatory processes, all residents should have access to info and opportunities (participants working with children and families that are socio-economically vulnerable).

No information was provided under Technological Factors, and only one driver was identified for Legal Factors. This may be attributed to the current participants' limited experience in working on these issues or with the relevant professional sectors, or with analyzing these factors.

3.4.4 Adaptation and Mitigation Solutions Identified by target groups

The LL in Athens identified a comprehensive set of existing and proposed A&M solutions designed to address the region's climate-related challenges. These solutions aim to reduce risks, address drivers, and promote resilience. The A&M solutions identified were connected to the risks and drivers mentioned above.

Political A&M solutions

1. All schools (across country), need renovation plan for flood and heat risk reduction, at the level that exists for seismic risk and emergency preparedness plans and supplies. Too many schools in Athens situated in high-flood risk locations [also identified as economic A&M solution]**:**

   - **Addresses risks:**
     Risks for school buildings get hot.
     Risk even when schools closed and children have to be in hot homes, children and infants are vulnerable.
   - **Targets drivers:**
     Informing social groups,
     Management of municipality personnel and municipal infrastructure, schools, health facilities and public buildings are not energy efficient,
     Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
     Health system - efficiency and adequacy of resources,
     Poverty,
     Socio-economic inequalities,
     Buildings not energy-shielded,
     School buildings unsuitable with no adaptation,
     Mortality and morbidity in vulnerable groups also energy poverty,
     Air pollution (increases health risk of heat and vice versa.),

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Public drinking fountains and water elements, access to air-conditioned space.

- **Associated barriers:**
  Political 1: Lack of technical standards for new technical solutions.
  Political 2: Studies for specialization and prioritization of measures.
  Political 3: Outdated infrastructure design and design specifications (materials etc.)
  Political 4: Lack of expertise of private individuals and providers.

2. <u>Schools as climate shelters for all community (this would require additional planning, renovations and investment from risk reduction):</u>

   - **Addresses risks:**
     Old buildings with low energy efficiency that increase energy requirements,
     Energy poverty/insecurity, insufficient cool spaces (outdoor and indoor)
   - **Targets drivers:**
     Lack of relevant data at the local level,
     Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
     Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
     Poverty,
     High unemployment, expansion of metal elements (damage to infrastructure and things with metal),
     High energy consumption of buildings and cost of energy upgrading,
     Lack of outdoor spaces and parks,
     Socio-economic inequalities,
     Buildings not energy-shielded,
     Power outages,
     Mortality and morbidity in vulnerable groups also energy poverty,
     Lack of shade in outdoor spaces,
     Lack of funding for social organizations,
     Lack of a comprehensive legal framework for managing extreme heat emergencies,
     Air pollution (increases health risk of heat and vice versa.),
     Inadequate electricity networks, the atmosphere is becoming more stuffy and we have pollution problems,
     Access to air-conditioned spaces,
     Lack of knowledge of urban greenery.
   - **Associated barriers:** No associated barriers were identified.

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3. A holistic process for equitable engagement in decision-making and urban planning - this requires that everyone has correct information and that there is transparency (open data and clear procedures) so that everyone can participate equally:

   - **Addresses risks:**
     Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers),
     Risk information and awareness (data that are not available in appropriate formats,
     Socio-economically vulnerable do not know where to get help),
     Not enough partnerships between civil society and State and academic institutions
   - **Targets drivers:**
     Lack of planning,
     Strategies and cartographic/spatial data for the preparedness and response of the local community,
     Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
     There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform,
     Development through for-profit contracts and contractors,
     Failure to modernize social, informing social groups,
     Management of Municipality personnel and municipal infrastructure,
     Poverty, high unemployment,
     Schools, health facilities and public buildings are not energy efficient,
     Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
     Workers have limited mobility/ transit options,
     High energy consumption of buildings and cost of energy upgrading,
     Health system - efficiency and adequacy of resources, poverty,
     Lack of funding for social organizations,
     Lack of funding for the health sector,
     Socio-economic inequalities,
     Unsafe very hot working environment,
     Socio-economic characteristics and age of the population,
     Mortality and morbidity in vulnerable groups also energy poverty,
     Safety at work,
     Air pollution (increases health risk of heat and vice versa.),

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Wildfire smoke increases health risk of heat, and wildfires are increasing around Athens' metro,
The atmosphere is becoming stuffier and we have pollution problems,
Access to air-conditioned spaces, lack of relevant data at the local level,
Blindness and ignorance in relation to the management of trees in the city,
Lack of data for timely information,
Informing social groups,
Media coverage in some cases makes it difficult for the public to understand the health risks of extreme heat,
Lack of risk awareness,
Lack of knowledge of urban greenery.

- **Associated barriers:** No associated barriers were identified.

4. Need a training program for government employees factored into every new program that will be implemented, so they develop expertise and capacity. Lifelong learning programs at universities can be set up as needed

- **Addresses risks:**
  Problems in the policy context (such as inadequate implementation of mitigation policies).
- **Targets drivers:**
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information,
  Need for interdepartmental organization and coordination,
  Quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,
  NOK (New Building Regulations) overdevelopment,
  Health system - efficiency and adequacy of resources,
  Buildings not energy-shielded,
  Safety at work,
  Lack of a comprehensive legal framework for managing extreme heat emergencies, nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
  Overtourism,

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Lack of risk awareness,
Lack of knowledge of urban greenery.

- **Associated barriers:**

  Political 1: Prioritization and planning, financing, specialization and coordination between departments.
  Political 2: Time-consuming approval procedures e.g. environmental.
  Political 3: Capacity building: planning, procurement, implementation, evaluation.
  Political 4: Lack of technical competence of civil servants / weak multi-level governance.
  Political 5: Training of engineers and municipal employees and audit services.

5. Align A&M measures and NBS solutions with water management policies/strategies [also identified as legal and environmental A&M solution]:

- **Addresses risks:**

  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Urban Heat Island (UHI),
  Urban greenery and biodiversity impacted, not maintained, insufficient cool spaces (outdoor and indoor),
  Food insecurity,
  Drought,
  Not enough advocacy for environmental rights and protections.

- **Targets drivers:**

  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information,
  Need for interdepartmental organization and coordination,
  Quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,
  NOK (New Building Regulations) overdevelopment,
  Health system - efficiency and adequacy of resources,
  Buildings not energy-shielded,
  Safety at work,

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Lack of a comprehensive legal framework for managing extreme heat emergencies,
Nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Blindness and ignorance in relation to the management of trees in the city,
Lack of outdoor spaces and parks,
Expansion of metal elements (damage to infrastructure and things with metal),
Lack of shade in outdoor spaces,
Lack of urban greenery,
Public drinking fountains and water elements,
Plans for dealing with heat on the ground (for example, drinking water),
Lack of specifications and certification in the maintenance of city trees,
Management of Municipality personnel and municipal infrastructure,
Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
Lack of funding for social organizations,
Access to air-conditioned space,
Poverty, high unemployment,
Socio-economic inequalities.

- **Associated barriers:** No associated barriers were identified.

6. <u>"Climate Schools 2024-2030" strategy currently in development by city of Athens (solar panels, other physical renovations, and educational programming):</u>

   - **Addresses risks:**
     Risks for school buildings get hot. risk even when schools closed, and children have to be in hot homes,
     Children and infants are vulnerable.
   - **Targets drivers:**
     Informing social groups,
     Management of municipality personnel and municipal infrastructure,
     Schools, health facilities and public buildings are not energy efficient,
     Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
     Health system - efficiency and adequacy of resources,
     Poverty,
     Socio-economic inequalities,

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Buildings not energy-shielded,
School buildings unsuitable with no adaptation,
Mortality and morbidity in vulnerable groups also energy poverty,
Air pollution (increases health risk of heat and vice versa),
Public drinking fountains and water elements,
Access to air-conditioned space.

- **Associated barriers:** No associated barriers were identified.

7. Strategy for participatory and inclusive processes in decision making:

- **Addresses risks:**
  Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers),
  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help),
  Not enough advocacy for environmental rights and protections,
  Not enough partnerships between civil society and State and academic institutions
- **Targets drivers:**
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
  Failure to modernize social infrastructure,
  Informing social groups, management of Municipality personnel and municipal infrastructure,
  Poverty, high unemployment,
  Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
  Workers have limited mobility/ transit options,
  High energy consumption of buildings and cost of energy upgrading,
  Health system - efficiency and adequacy of resources,
  Lack of funding for social organizations,
  Lack of funding for the health sector,
  Socio-economic inequalities,
  Unsafe very hot working environment,
  Socio-economic characteristics and age of the population,
  Mortality and morbidity in vulnerable groups also energy poverty,

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Safety at work,
Air pollution (increases health risk of heat and vice versa.),
Wildfire smoke increases health risk of heat, and wildfires are increasing around Athens' metro,
The atmosphere is becoming stuffier, and we have pollution problems, access to air-conditioned spaces,
Lack of a national strategy for extreme heat,
There is no inter-agency working group to address heatwave emergencies,
Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
Lack of data for timely information,
Need for interdepartmental organization and coordination,
Quick reflexes of local government (wrong decision?),
Schools, health facilities and public buildings are not energy efficient,
NOK (New Building Regulations) overdevelopment,
Buildings not energy-shielded,
Lack of a comprehensive legal framework for managing extreme heat emergencies,
Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Lack of relevant data at the local level,
Blindness and ignorance in relation to the management of trees in the city,
Media coverage in some cases that makes it difficult for the public to understand the health risks of extreme heat,
There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform,
Development through for-profit contracts and contractors.

- **Associated barriers:** No associated barriers were identified.

8. <u>Institutional strategy for informing and activating youth:</u>

- **Addresses risks:**
  Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers),
  Physical and mental health impacts,
  Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).

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- **Targets drivers:**
  Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
  Failure to modernize social infrastructure,
  Informing social groups,
  Management of Municipality personnel and municipal infrastructure,
  Poverty, high unemployment,
  Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
  Workers have limited mobility/ transit options,
  High energy consumption of buildings and cost of energy upgrading,
  Health system - efficiency and adequacy of resources,
  Lack of funding for social organizations,
  Lack of funding for the health sector, socio-economic inequalities,
  Unsafe very hot working environment,
  Socio-economic characteristics and age of the population,
  Mortality and morbidity in vulnerable groups also energy poverty,
  Safety at work,
  Air pollution (increases health risk of heat and vice versa.),
  Wildfire smoke increases health risk of heat, and wildfires are increasing around Athens' metro,
  The atmosphere is becoming stuffier, and we have pollution problems,
  Access to air-conditioned spaces,
  Lack of relevant data at the local level,
  Blindness and ignorance in relation to the management of trees in the city,
  Lack of data for timely information,
  Media coverage in some cases makes it difficult for the public to understand the health risks of extreme heat,
  Lack of risk awareness.
- **Associated barriers:** No associated barriers were identified.

9. <u>Implementation of political planning & cross-sectoral integration:</u>

- **Addresses risks:**
  Problems in the policy context (such as inadequate implementation of mitigation policies).
- **Targets drivers:**
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,

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Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
Lack of data for timely information,
Need for interdepartmental organization and coordination,
Quick reflexes of local government (wrong decision?),
Schools, health facilities and public buildings are not energy efficient,
NOK (New Building Regulations) overdevelopment,
Health system - efficiency and adequacy of resources,
Buildings not energy-shielded,
Safety at work,
Lack of a comprehensive legal framework for managing extreme heat emergencies, nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery.

- **Associated barriers:** No associated barriers were identified.

10. Monitoring, evaluation and learning system:

- **Addresses risks:**
  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help).
- **Targets drivers:**
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information,
  Need for interdepartmental organization and coordination,
  Quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,

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Buildings not energy-shielded,
Safety at work,
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Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Lack of relevant data at the local level,
Informing social groups,
Poverty, high unemployment,
Media coverage in some cases that makes it difficult for the public to understand the health risks of extreme heat,
Lack of funding for social organizations, socio-economic inequalities,
Mortality and morbidity in vulnerable groups also energy poverty.

- **Associated barriers:**
  Political 1: Delay in publishing mortality data after a heat wave.
  Political 2: Need to have a forensic medicolegal investigator for heat waves – investigate deaths after each heat wave (barrier and proposed measure).

11. <u>Upgrading procurement operations and regulations:</u>

- **Addresses risks:**
  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Urban Heat Island (UHI).
- **Targets drivers:**
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information,
  Need for interdepartmental organization and coordination,
  Quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,

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Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Blindness and ignorance in relation to the management of trees in the city,
Lack of outdoor spaces and parks,
Expansion of metal elements (damage to infrastructure and things with metal),
Lack of shade in outdoor spaces,
Lack of urban greenery,
Public drinking fountains and water elements.
Plans for dealing with heat on the ground (for example, drinking water).

- **Associated barriers:**

  Political: In procurement procedures, multi-benefits are not factored into evaluation - limits ability of municipalities and other gov agencies to select appropriate partners and contractors.

  Economic: Challenges in requiring/providing incentives for the renovation/upgrade of apartment buildings.

12. Legal separation of jurisdictions/ authorities at regional level:

- **Addresses risks:**

  Problems in the policy context (such as inadequate implementation of mitigation policies).

- **Targets drivers:**

  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information, need for interdepartmental organization and coordination, quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,

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Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery.

- **Associated barriers:**
  Economic: Large parks in Athens (το Πάρκο Τρίτση, το Πεδίον του Άρεως, ο Λόφος Φινοπούλου και το Αττικό Άλσος) are not always used as cool green spaces during heatwaves (regional authority closes them due to fire risk).

13. Bottom-Up Knowledge Hub:

- **Addresses risks:**
  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help),
  Not enough partnerships between civil society and State and academic institutions.
- **Targets drivers:**
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information,
  Need for interdepartmental organization and coordination,
  Quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,
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Lack of risk awareness,
Lack of knowledge of urban greenery,
Lack of relevant data at the local level,
Informing social groups,
Poverty, high unemployment,
Media coverage in some cases makes it difficult for the public to understand the health risks of extreme heat,
Lack of funding for social organizations,
Socio-economic inequalities,
Mortality and morbidity in vulnerable groups also energy poverty,
Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform,
Development through for-profit contracts and contractors,
Access to air-conditioned spaces.

- **Associated barriers:**

  Political: Studies and especially research in the drawers – need an institution that collects and helps utilize/apply date, research and knowledge, but bottom-up utilization is needed.

14. <u>Crisis management plans & training:</u>

- **Addresses risks:**

  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help),
  Not enough partnerships between civil society and State and academic institutions.

- **Targets drivers:**

  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,

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Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
Lack of data for timely information,
Need for interdepartmental organization and coordination,
Quick reflexes of local government (wrong decision?),
Schools, health facilities and public buildings are not energy efficient,
NOK (New Building Regulations) overdevelopment,
Health system - efficiency and adequacy of resources,
Buildings not energy-shielded,
Safety at work,
Lack of a comprehensive legal framework for managing extreme heat emergencies,
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Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Lack of relevant data at the local level,
Informing social groups,
Poverty, high unemployment,
Media coverage in some cases makes it difficult for the public to understand the health risks of extreme heat,
Lack of funding for social organizations,
Socio-economic inequalities, mortality and morbidity in vulnerable groups also energy poverty,
Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform, development through for-profit contracts and contractors,
Access to air-conditioned spaces.

- **Associated barriers:**

  Political: Barriers - Risk data, awareness and perception:

  - Climate data in appropriate spatial analysis and format
  - Lack of health data at European and national level.
  - Lack of population information.
  - Lack of standardisation of heat wave categories.

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- Confusion of stakeholder/ general public due to multiple definitions of heat wave

Economic: Large parks in Athens (το Πάρκο Τρίτση, το Πεδίον του Άρεως, ο Λόφος Φινοπούλου και το Αττικό Άλσος) are not always used as cool green spaces during heatwaves (regional authority closes them due to fire risk).

Economic A&M solutions

15. Financial institutions (ESPA management agencies, insurers, other investment agencies) to evaluate all projects and investments for climate adaptation and risk reduction, including for heat:

- **Addresses risks:**
  Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity,
  Problems in the policy context (such as inadequate implementation of mitigation policies),
  Impact on economy (including reduced tourism, business insurance costs).
- **Targets drivers:**
  Lack of relevant data at the local level, lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community, poverty - high unemployment,
  Expansion of metal elements (damage to infrastructure and things with metal),
  High energy consumption of buildings and cost of energy upgrading,
  Socio-economic inequalities,
  Buildings not energy-shielded,
  Power outages,
  Mortality and morbidity in vulnerable groups also energy poverty,
  Air pollution (increases health risk of heat and vice versa.),
  Inadequate electricity networks,
  The atmosphere is becoming stuffier, and we have pollution problems,
  Access to air-conditioned spaces,
  Workers have limited mobility/ transit options,
  High energy consumption of buildings and cost of energy upgrading,
  Overtourism,
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,

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Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate related measures, and conflicting authorities of government agencies and various levels of government,
Lack of data for timely information,
Need for interdepartmental organization and coordination,
Quick reflexes of local government (wrong decision?) schools,
Health facilities and public buildings are not energy efficient,
NOK (New Building Regulations) overdevelopment,
Technical characteristics of the built environment and buildings,
Health system - efficiency and adequacy of resources,
Buildings are not energy-shielded, safety at work,
Lack of a comprehensive legal framework for managing extreme heat emergencies, nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery.

- **Associated barriers:**
  Political 1: Obstacles or lack of connection of policies for climate adaptation.
  Political 2: Responsibilities of bodies not harmonized and irrational.
  Political 3: Cooperation of levels of government for adaptation.
  Political 4: Lack of resources to address issues.
  Economic: It is economically unprofitable to build private rooftop gardens/green roofs.

16. Vertical garden at Serafeio Athletic & Community Complex (city of Athens):

- **Addresses risks:**
  Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity,
  Urban Heat Island (UHI),
  Insufficient cool spaces (outdoor and indoor).
- **Targets drivers:**
  Lack of relevant data at the local level,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Poverty, high unemployment,
  Expansion of metal elements (damage to infrastructure and things with metal),
  High energy consumption of buildings and cost of energy upgrading,
  Socio-economic inequalities,

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Buildings not energy-shielded,
Power outages,
Mortality and morbidity in vulnerable groups also energy poverty,
Air pollution (increases health risk of heat and vice versa),
Inadequate electricity networks,
The atmosphere is becoming stuffier, and we have pollution problems,
Access to air-conditioned spaces,
Blindness and ignorance in relation to the management of trees in the city,
Failure to modernize social infrastructure,
Need for interdepartmental organization and coordination,
Lack of outdoor spaces and parks,
NOK (New Building Regulations) overdevelopment,
Technical characteristics of the built environment and buildings,
Lack of shade in outdoor spaces,
Lack of urban greenery, public drinking fountains and water elements,
Plans for dealing with heat on the ground (for example, drinking water),
Lack of knowledge of urban greenery,
Management of municipality personnel and municipal infrastructure,
Schools, health facilities and public buildings are not energy efficient, inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
Lack of funding for social organizations.

- **Associated barriers:** No associated barriers were identified.

17. Renewal of cooling specifications in programs/regulation [also identified as legal and political A&M solution]**:**

- **Addresses risks:**
  Old buildings with low energy efficiency that increase energy requirements, energy poverty/insecurity,
  Urban greenery and biodiversity impacted, not maintained,
  Wildfires
- **Targets drivers:**
  Lack of relevant data at the local level,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Poverty, high unemployment,
  Expansion of metal elements (damage to infrastructure and things with metal),
  High energy consumption of buildings and cost of energy upgrading,
  Socio-economic inequalities,

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Buildings not energy-shielded,
Power outages,
Mortality and morbidity in vulnerable groups also energy poverty,
Air pollution (increases health risk of heat and vice versa),
Inadequate electricity networks,
The atmosphere is becoming stuffier, and we have pollution problems,
Access to air-conditioned spaces, lack of a national strategy for extreme heat,
There is no inter-agency working group to address heatwave emergencies,
Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate-related measures, and conflicting authorities of government agencies and various levels of government,
Lack of data for timely information,
Need for interdepartmental organization and coordination,
Quick reflexes of local government (wrong decision?),
Schools, health facilities and public buildings are not energy efficient,
NOK (new building regulations) overdevelopment,
Technical characteristics of the built environment and buildings,
Health system - efficiency and adequacy of resources,
Buildings not energy-shielded,
Safety at work,
Lack of a comprehensive legal framework for managing extreme heat emergencies, nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
Overtourism,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Informing social groups,
Management of municipality personnel and municipal infrastructure,
Inaccessible cooling centres: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
School buildings are unsuitable with no adaptation.

- **Associated barriers:**

  Political: Housing regulations may refer to heating but not to cooling (active or passive).

  Economic 1: It is economically unprofitable to build private rooftop gardens/green roofs.

  Economic 2: Challenges in requiring/providing incentives for the renovation/upgrade of apartment buildings.

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18. Specialization, maturation/ scaling & technical studies:

- **Addresses risks:**
  Problems in the policy context (Inadequate implementation of mitigation policies. Methodologies for harmonizing policies.),
  Urban Heat Island (UHI).
- **Targets drivers:**
  Lack of a national strategy for extreme heat,
  There is no inter-agency working group to address heatwave emergencies,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Absence of metropolitan governance body with jurisdiction over metropolitan environment and climate-related measures, and conflicting authorities of government agencies and various levels of government,
  Lack of data for timely information,
  Need for interdepartmental organization and coordination,
  Quick reflexes of local government (wrong decision?),
  Schools, health facilities and public buildings are not energy efficient,
  NOK (New Building Regulations) overdevelopment,
  Technical characteristics of the built environment and buildings,
  Health system - efficiency and adequacy of resources,
  Buildings not energy-shielded,
  Safety at work,
  Lack of a comprehensive legal framework for managing extreme heat emergencies,
  Nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
  Overtourism,
  Lack of risk awareness,
  Lack of knowledge of urban greenery,
  Blindness and ignorance in relation to the management of trees in the city,
  Lack of outdoor spaces and parks,
  Expansion of metal elements (damage to infrastructure and things with metal),
  Lack of shade in outdoor spaces,
  Lack of urban greenery,
  Public drinking fountains and water elements,
  Plans for dealing with heat on the ground (for example, drinking water).
- **Associated barriers:**
  Political 1: Lack of technical standards for new technical solutions.

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Political 2: Studies for specialization and prioritization of measures.
Political 3: Outdated infrastructure design and design specifications (materials etc.).
Political 4: Lack of expertise of private individuals and providers.
Economic 1: Need to be able to do bigger pilot projects, where mistakes and learning can take place (for participatory planning for urban heat mitigation and green spaces). This requires funding.
Economic 2: No funding for scaling successful/ impactful projects.

19. Specifications guide for management & support of existing urban greenery [also identified as political and environmental]**:**

- **Addresses risks:**
  Old buildings with low energy efficiency that increase energy requirements,
  Energy poverty/insecurity,
  Urban Heat Island (UHI),
  Urban greenery and biodiversity impacted, not maintained,
  Insufficient cool spaces (outdoor and indoor).
- **Targets drivers:**
  Lack of relevant data at the local level,
  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Poverty - high unemployment,
  Expansion of metal elements (damage to infrastructure and things with metal),
  High energy consumption of buildings and cost of energy upgrading,
  Socio-economic inequalities,
  Buildings not energy-shielded,
  Power outages,
  Mortality and morbidity in vulnerable groups also energy poverty,
  Air pollution (increases health risk of heat and vice versa),
  Inadequate electricity networks,
  The atmosphere is becoming stuffier, and we have pollution problems,
  Access to air-conditioned spaces,
  Blindness and ignorance in relation to the management of trees in the city,
  Failure to modernize social infrastructure,
  Need for interdepartmental organization and coordination,
  Lack of outdoor spaces and parks,
  NOK (New Building Regulations) overdevelopment,
  Technical characteristics of the built environment and buildings,
  Lack of shade in outdoor spaces,

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Lack of urban greenery,
Public drinking fountains and water elements,
Plans for dealing with heat on the ground (for example, drinking water),
Lack of knowledge of urban greenery,
Lack of specifications and certification in the maintenance of city trees,
Management of municipality personnel and municipal infrastructure,
Schools, health facilities and public buildings are not energy efficient,
Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
Lack of funding for social organizations,
Lack of urban greenery,
Access to air-conditioned spaces.

- **Associated barriers:**

  Political 1: Lack of technical standards for new technical solutions.
  Political 2: Studies for specialization and prioritization of measures.
  Political 3: Outdated infrastructure design and design specifications (materials etc.)
  Political 4: Lack of expertise of private individuals and providers.

Social A&M solutions

20. Systems and networks to ensure youth and other diverse groups have access to information about opportunities and processes for participating in decision-making (with municipalities and other institutions) [also identified as political and political]**:**

- **Addresses risks:**

  Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers),
  Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help),
  Not enough partnerships between civil society and State and academic institutions.

- **Targets drivers:**

  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
  Failure to modernize social infrastructure,
  Informing social groups,
  Management of municipality personnel and municipal infrastructure,
  Poverty, high unemployment,

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Inaccessible cooling centers: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
Workers have limited mobility/ transit options,
High energy consumption of buildings and cost of energy upgrading,
Health system - efficiency and adequacy of resources,
Lack of funding for social organizations,
Lack of funding for the health sector,
Socio-economic inequalities,
Unsafe very hot working environment,
Socio-economic characteristics and age of the population,
Mortality and morbidity in vulnerable groups also energy poverty,
Safety at work,
Air pollution (increases health risk of heat and vice versa),
Nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
Wildfire smoke increases health risk of heat, and wildfires are increasing around Athens' metro,
The atmosphere is becoming stuffier and we have pollution problems,
Access to air-conditioned spaces,
Lack of data for timely information,
Blindness and ignorance in relation to the management of trees in the city,
Lack of data for timely information,
Media coverage in some cases that makes it difficult for the public to understand the health risks of extreme heat,
Lack of risk awareness, lack of knowledge of urban greenery,
Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform,
Development through for-profit contracts and contractors,
Schools, health facilities and public buildings are not energy efficient.

- **Associated barriers:** No associated barriers were identified.

21. <u>Finance and support for social infrastructure (the facilities of social and community organizations) for heat/climate resilience, because people turn to these organizations for help during heatwaves and other emergencies:</u>

- **Addresses risks:**

  Old buildings with low energy efficiency that increase energy requirements,

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Energy poverty/insecurity,
Socio-economic vulnerabilities (including vulnerability of pregnant women with economic precarity and people with language barriers),
Risk information and awareness (data that are not available in appropriate formats, socio-economically vulnerable do not know where to get help),
Insufficient cool spaces (outdoor and indoor),
Mortality among seniors,
Food insecurity,
Not enough partnerships between civil society and State and academic institutions.

- **Targets drivers:**

Lack of relevant data at the local level,
Lack of planning,
Strategies and cartographic/spatial data for the preparedness and response of the local community,
Poverty - high unemployment,
Expansion of metal elements (damage to infrastructure and things with metal),
High energy consumption of buildings and cost of energy upgrading,
Socio-economic inequalities,
Buildings not energy-shielded,
Power outages,
Mortality and morbidity in vulnerable groups also energy poverty,
Air pollution (increases health risk of heat and vice versa),
Inadequate electricity networks,
The atmosphere is becoming stuffier, and we have pollution problems,
Access to air-conditioned spaces,
Lack of a comprehensive strategy for substantive participatory processes and engagement by government,
Failure to modernize social infrastructure,
Informing social groups,
Management of municipality personnel and municipal infrastructure,
Inaccessible cooling centres: exclusion of residents from green and cooling areas due to distance and travel time or limited safe travel options,
Workers have limited mobility/ transit options, health system - efficiency and adequacy of resources,
Lack of funding for social organizations,
Lack of funding for the health sector,
Unsafe very hot working environment,
Socio-economic characteristics and age of the population, safety at work,

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Nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase, wildfire smoke increases health risk of heat, and wildfires are increasing around Athens' metro,
Blindness and ignorance in relation to the management of trees in the city,
Lack of data for timely information,
Media coverage in some cases that makes it difficult for the public to understand the health risks of extreme heat,
Lack of risk awareness,
Lack of knowledge of urban greenery,
Schools, health facilities and public buildings are not energy efficient,
Lack of shade in outdoor spaces,
Lack of urban greenery,
Public drinking fountains and water elements,
Plans for dealing with heat on the ground (for example, drinking water),
There are requirements in local urban plans and special urban plans for climate adaptation and civil protection plans, but there is no substantive engagement of people that know the local area, only a dry online platform,
Development through for-profit contracts and contractors.

- **Associated barriers:**

  Political: Data, awareness and perception: awareness and information of the wider population about high temperatures.

  Social and Health: Overcrowding of facilities providing social services during heatwave conditions.

Environmental solutions

22. Hadrian Aqueduct:

- **Addresses risks:**

  Urban Heat Island (UHI),
  Urban greenery and biodiversity impacted, not maintained,
  Drought.

- **Targets drivers:**

  Lack of planning, strategies and cartographic/spatial data for the preparedness and response of the local community,
  Blindness and ignorance in relation to the management of trees in the city,
  Need for interdepartmental organization and coordination,
  Lack of outdoor spaces and parks,
  Expansion of metal elements (damage to infrastructure and things with metal),
  NOK (new building regulations) overdevelopment,
  Technical characteristics of the built environment and buildings,

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Lack of shade in outdoor spaces,
Lack of urban greenery,
Public drinking fountains and water elements,
Plans for dealing with heat on the ground (for example, drinking water),
Lack of knowledge of urban greenery,
Lack of specifications and certification in the maintenance of city trees, nearly 40% of Attica's forests have burned down in the last 8 years (NOA analysis) and wildfires are projected to increase,
Wildfire smoke increases health risk of heat, and wildfires are increasing around Athens metro.

- **Associated barriers:** No associated barriers were identified.

Concerning the vulnerable communities, it was discussed that all schools nationwide require comprehensive renovation plans to mitigate risks associated with flooding and heat, comparable to the systematic approach implemented for seismic risk. Additionally, schools need emergency preparedness plans and adequate supplies. Notably, a significant number of schools in Athens are located in high-risk flood zones, underscoring the urgency of such measures. It is essential to establish systems and networks that ensure youth and other diverse groups have access to information regarding opportunities and processes for engaging in decision-making. These systems should foster collaboration with municipalities and other relevant institutions. A holistic and equitable approach to engagement in decision-making and urban planning is crucial. This requires the dissemination of accurate information and the establishment of transparent practices, including open data and clear procedures, to ensure equal participation for all stakeholders.

The measures presented during the validation exercise varied widely, encompassing policies, small-scale projects, and large-scale urban interventions. Participants noted that these measures differed significantly in terms of potential impact, timeframes, and the stakeholders involved. This variation made it challenging to assess and prioritize them effectively. A more structured approach—such as grouping measures into categories like "quick wins," "long-term actions," or "large urban interventions"—could have provided greater clarity and focus for the participants. It was also observed that the facilitators' presentation of the measures as a unified list for ranking and prioritization might have contributed to this challenge, particularly in the context of the subsequent Mentimeter exercise.

The Mentimeter prioritization and ranking activity revealed additional issues. Participants came from diverse professional backgrounds and possessed varying levels of expertise and familiarity with the issues and projects under discussion. This disparity affected their ability to engage meaningfully with the exercise as they were asked to rank measures for their feasibility or "ease of implementation". Some participants found that certain actions were described using titles that were too generic (despite the titles being summarized from previous discussion), making it difficult

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to evaluate their feasibility or prioritize them effectively. As a result, some responses appeared to be more reflective of participants' need to complete the task rather than of substantive evaluation.

Despite these challenges, some of the potential solutions discussed during this exercise and in the extended discussions throughout the day could serve as a foundation for LL 2. However, it was noted that little attention was given to technological and legal factors, and almost no discussion occurred around environmental factors. This might be attributed to the professional backgrounds of the participants, who seemed to have more direct experience with social, political, and urban built environment efforts and projects.
Although a participant from a government Ministry was present, their contributions centered on broader climate adaptation policy and strategy considerations, reflecting their area of expertise and relevance to the topics discussed.

Some enabling factors for the implementation of A&M solutions were identified:

- Increasing EU and Greek climate adaptation and mitigation legislation.
- Green Fund (Πράσινο Ταμείο) supervised by Ministry of Environment and Energy - has various funding programs that contribute to climate neutrality and adaptation, urban revitalization, and fire prevention in municipalities with suburban forests.
- EU laws, policies, strategies and funding mechanisms that require and/or support changes and action at the national, regional and local levels.
- The technical specifications of EU require any project with lifespan over a certain number of years has to go through a climate resilience evaluation, need to submit a climate resilience and adaptation assessment with the project file. (unclear how much this is implemented).
- New ESPA (National Strategic Reference Framework, NSRF program) will factor in climate vulnerability and how projects align with climate adaptation policies.

3.4.5 Solutions prioritisation

Participants prioritised solutions based on ease of implementation, urgency, and importance. Measures like promoting water-saving practices, protecting wetlands, and improving wastewater treatment received high scores across all criteria. Figure 18 presents the findings for the prioritization of solutions. The axes show the sum of scores for each solution on a 1-to-5 scale (5=most urgent/easiest implementation). Table 6 explains the solutions for Athens CSA.

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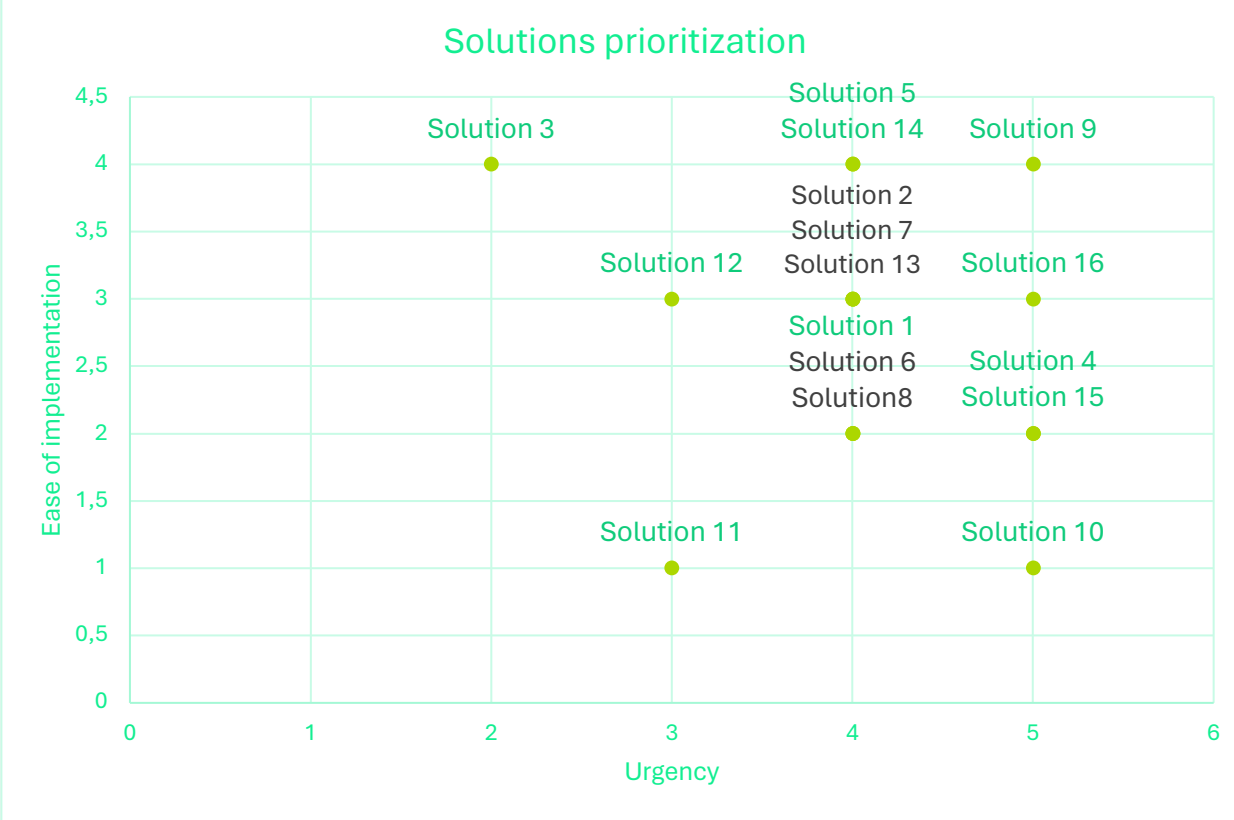

Figure 18. Solutions prioritization (Athens)

Table 5. Solutions prioritization (Athens)	
Solution 1	Hadrian Aqueduct
Solution 2	“Climate Schools 2024-2030" strategy
Solution 3	Vertical garden at Serafeio
Solution 4	Strategy for Participatory and Inclusive Processes in Decision Making
Solution 5	Institutional Strategy for Informing and Activating Youth
Solution 6	Implementation of Political Planning & Cross-Sectoral Integration
Solution 7	Monitoring, Evaluation and Learning System
Solution 8	Specialization, Maturation (Scaling) & Technical Studies
Solution 9	Renewal of Cooling Specifications in Programs/Regulations
Solution 10	Upgrading Procurement Operations and Regulations
Solution 11	Legal Separation of Jurisdictions/Authorities at Regional Level
Solution 12	Bottom-Up Knowledge Hub
Solution 13	Crisis Management Plans & Training
Solution 14	Specifications Guide for Management & Support of Existing Greenery
Solution 15	Sustainable Water Resources Management

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Solution 16	Strengthening & Mapping of Social Infrastructure

3.4.6 Target groups engagement assessment

Overall, participants were highly engaged throughout the LL, with most staying for the entire duration and actively contributing to discussions. However, the tightly packed agenda limited opportunities for introductions and deeper exchanges, underscoring the importance of allocating more time for relationship-building in future workshops.

Participants demonstrated strong engagement with the activities, initiating discussions on various topics. Nearly all participants attended for the entire day, except one who joined mid-day for certain activities and another who left earlier. The introductions during the ice-breaking session took longer than anticipated, but they were highly relevant and provided valuable space for participants to connect. This aspect should be incorporated into the planning of future workshop agendas, ensuring participants have adequate time to familiarize themselves with each other's work before engaging in the day's activities.

The methodological requirements of the LL led to a very full agenda, leaving little flexibility to address local needs. For instance, providing more time for participants to exchange perspectives and build connections would have enhanced the experience, particularly as they had committed a full workday to this collaborative effort.

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3.5 Barcelona (ES)

3.5.1 Target groups engaged

3.5.1.1 Living Lab participants

Living Lab Challenge: Wildfires

The workshop successfully engaged a wide range of stakeholders, with 19 participants invited via email and only 3 last-minute dropouts. This resulted in a strong representation of most sectors, contributing to the diversity and richness of the discussions.

Participants included stakeholders from target groups identified in D1.7, and represented a broad spectrum of expertise and interests, spanning academia, public management, civil protection, local governance, conservation, and the private sector. This diversity ensured a comprehensive dialogue encompassing both scientific and practical perspectives on wildfire management, conservation, and environmental planning (Figure 19):

Regions (TG1)

Representatives included individuals from the following institutions:

- Barcelona Metropolitan Area
- Catalan Wildfire Prevention Service
- Catalan Forestry Service
- Catalan Civil Protection
- Sant Climent de Llobregat local council - small local councils
- Collserola Natural Park

Communities (TG2)

Representatives included individuals from the following institutions:

- Garraf Forest Owners Association: Represents private forest owners, providing a local perspective.

Industry (TG3)

Representatives included individuals from the following institutions:

- Ametller Origen
- Conservation
- Collserola Natural Park

Research and Academia (TG4)

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Representatives included individuals from the following institutions:

- Barcelona Supercomputing Center
- Ecological Research Center and Forestry Applications
- Pompeu Fabra University

Policymakers (TG5)

- No representatives from TG5.

The workshop was deemed highly successful, with participants showing attentiveness and active engagement throughout the event. The interactive discussions generated numerous ideas and highlighted the need for additional time in future sessions to accommodate the high level of participation.

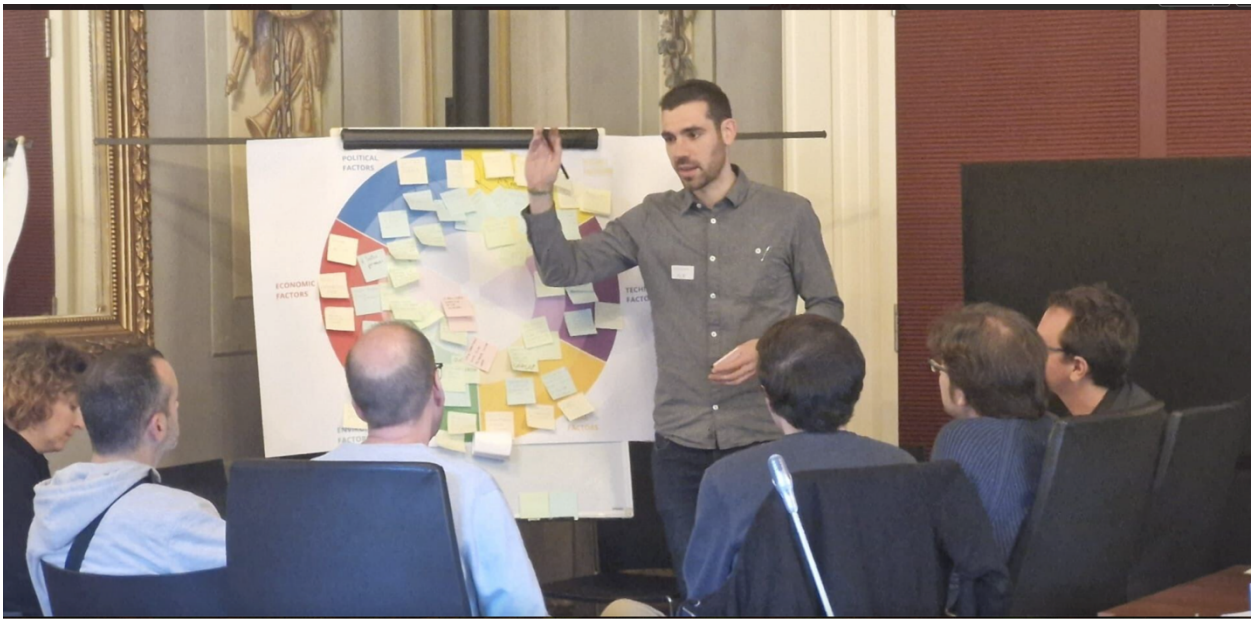

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Figure 19. Living Lab in Barcelona

3.5.1.2 Missing participants and notes

The stakeholder outreach efforts aimed to engage a diverse range of organizations and sectors relevant to the CARMINE project. However, several challenges were encountered, including last-minute cancellations, lack of availability, and limited interest from some groups. Below is an organized summary of the roles, organizations, and outcomes of the engagement:

- Barcelona Fire Service: They were unable to attend due to last-minute emergencies.

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- Catalan Fire Service: Declined to participate, citing burnout from previous projects and frustration over perceived repetitive engagement with no tangible results.
- Catalan Meteorological Service: Unable to participate due to prior commitments but expressed willingness to engage in January or February.
- Catalan Office of Climate Change: Unable to participate due to lack of availability.
- Local Councils: No responses were received from local council representatives.
- Catalan Federation of Municipalities: No responses were received.
- Association of Homeowners of Collserola (WUI): Indicated no interest in the project.
- Boscat: No responses were received
- Arran de Terra: Last-minute cancellation.
- Technical University of Catalonia: Unable to attend due to scheduling conflicts.
- Bioenergy Cluster: No responses were received.

The stakeholder engagement process faced several challenges, including last-minute cancellations from organizations such as the Barcelona Fire Service and Arran de Terra, which were unable to participate due to emergencies or unforeseen conflicts. Burnout and disinterest were evident from the Catalan Fire Service, which expressed frustration with repeated involvement in similar initiatives that failed to deliver meaningful results. Additionally, limited availability was a recurring issue among key organizations in research, climate, and meteorology, which cited scheduling conflicts or prior commitments, necessitating follow-up efforts. Furthermore, non-responsiveness from several sectors, particularly local governance, energy, and private property, pointing to the need for stronger outreach strategies. To address these challenges, WP1 leaders will offer their support the CSA to identify effective strategies in engaging the missing participants.

3.5.1.3 Engagement of vulnerable communities

Although vulnerable communities had been identified prior to the workshop [see D1.7] and representatives invited, no inputs from vulnerable communities were received during this workshop, as they did not respond to the initial invitation. Moving forward, the plan is to reach out to them again before the next workshop and arrange an informal meeting—either online, via phone call, or in person—exclusively with representatives from vulnerable communities to ensure their perspectives are included.

3.5.2 Target groups perceptions on climate change risks,

The LL in Barcelona identified 30 risks connected to climate change, emphasizing the multi-dimensional impact of these challenges. The risks involved are fairly well agreed upon by the stakeholders at the table (Figure 20).
Some ideas that came out of the debate:

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- The loss of biodiversity can be temporary and recovered in the long-term.
- Participants highlight that the main challenge is the large wildfires', not simply 'wildfires'. Wildfires are frequent in the area and in general don't pose any major problem. Only the large should be considered as a challenge.
- About "reactive legislation": Many of the regulations are based on what happened in the past to manage the danger resulting from a particular fire, however, not all the fires are equal and this kind of "reactive regulation" based on the experience of only one fire can work against the correct management of other fires .

Figure 20. PESTLE Wheel for Barcelona

Political risks:

1. Determining responsibilities - accountability for political responsibilities
2. Impact on political stability (uncertainty)
3. Unplanned reactive response
4. Inefficient emergency management
5. Losing confidence in public institutions

***R4: Inefficient emergency management. Participants identified R4 as a risk although the CSA think it could be (maybe better) though as a driver. Thus, they leave R4 as a risk to follow the participants' opinion.**

Economic risks:

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6. Significant economic losses: housing, equipment, roads, supply networks (electricity)
7. Losses for the primary sector (loss of crops, livestock…)
8. Impact on service sector (loss of tourists and visitors)
9. High fire suppression costs * compared with other proactive strategies such as forest management

Social risks:

10. Emotional harm for citizens
11. Respiratory diseases/Human health
12. If these episodes are recurrent, they result in loss of trust on political and technical management.
13. Impact on houses and communities
14. Loss of lives
15. Inequality recovery: People with more economic capacity can recover sooner.
16. Loss of cultural landscapes
17. Abandonment of rural areas and activities

Technological Risks:

18. Damage to infrastructure, property, personal services
19. Impact on infrastructure (power plants, electrical collapse and communications)

Legal risks:

20. Lack of maintenance of risky facilities, for example, power lines that cause ignitions.
21. Lack of policy coherence. Multiple institutions with diffuse competences, and sectoral legislation with contradictions among them.
22. Reactive legislation: Many of the regulations are based on what happened in the past to manage the danger resulting from a particular fire.

Environmental risks:

23. Loss of biodiversity
24. Soil erosion
25. Loss of natural heritage
26. Loss of habitats
27. Cascading effects on other risks*
28. Greenhouse gases emissions
29. Smoke pollution/air quality
30. Importance of disturbances*

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Concerning the *vulnerable communities*, there is no input from vulnerable communities in this workshop. The CSA did not receive a response from them to their invitation. They are planning to contact them again to have an informal meeting (online, by phone call or in person) with only vulnerable communities.

3.5.3 Climate Change Risks and Associated Drivers

After identifying the risks, the LL in Barcelona identified 15 key drivers contributing to the region's climate risks. These drivers reflect systemic issues across political, economic, social, technological, legal, and environmental dimensions. **Political drivers and their associated risks:**

D1. Lack of political consensus on territorial management and educational models. Lack of coordination among institutions

Associated risks:

- Determining responsibilities - accountability for political responsibilities
- Impact on political stability (uncertainty)
- Unplanned reactive response
- Inefficient emergency management
- Losses for the primary sector (loss of crops, livestock…)
- High fire suppression costs compared with other proactive strategies such as forest management
- Respiratory diseases/Human health
- Lack of maintenance of risky facilities, for example, power lines that cause ignitions.

D2. Rural abandonment

Associated risks:

- Unplanned reactive response
- Inefficient emergency management
- Losing confidence in public institutions
- High fire suppression costs compared with other proactive strategies such as forest management.
- Respiratory diseases/Human health
- Impact on houses and communities

D3. Policies are emergency targeted, but should focus on other risk phases (prevention and preparedness)

Associated risks:

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- Significant economic losses: housing, equipment, roads, supply networks (electricity)
- Losses for the primary sector (loss of crops, livestock…)
- High fire suppression costs compared with other proactive strategies such as forest management.
- Emotional harm for citizens
- Respiratory diseases/Human health
- Loss of lives
- Inequality recovery. People with more economic capacity can recover sooner
- Loss of cultural landscapes
- Abandonment of rural areas and activities
- Damage to infrastructure, property, personal services
- Impact on infrastructure (power plants, electrical collapse and communications)
- Loss of biodiversity
- Loss of natural heritage
- Smoke pollution/air quality

D4. Lack of clarity when distributing roles and competences

Associated risks:

- Determining responsibilities - accountability for political responsibilities
- Inefficient emergency management
- Losing confidence in public institutions.
- If these episodes are recurrent: loss of trust in political and technical management

D5. Lack of continued investment (both in grants and direct investments)

Associated risks:

- Inefficient emergency management.
- Emotional harm for citizens.
- Respiratory diseases/Human health.
- If these episodes are recurrent: loss of trust in political and technical management.
- Impact on houses and communities
- Loss of lives
- Inequality recovery. People with more economic capacity can recover sooner.
- Loss of cultural landscapes
- Abandonment of rural areas and activities
- Damage to infrastructure, property, personal services
- Impact on infrastructure (power plants, electrical collapse and communications)
- Lack of maintenance of risky facilities. Example: power lines that cause ignitions
- Loss of biodiversity
- Soil erosion

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- Loss of natural heritage
- Loss of habitats
- Cascading effects on other risks
- Greenhouse gases emissions
- Smoke pollution/air quality

D6. Lack of surveillance of forest areas

Associated risks:

- Significant economic losses: housing, equipment, roads, supply networks (electricity)
- Losses for the primary sector (loss of crops, livestock…)
- Loss of Lives
- Loss of cultural landscapes
- Damage to infrastructure, property, personal services
- Impact on infrastructure (power plants, electrical collapse and communications)
- Loss of biodiversity
- Soil erosion
- Loss of natural heritage
- Loss of habitats
- Cascading effects on other risks
- Greenhouse gases emissions
- Smoke pollution/air quality

❖ **Economic drivers and their associated risks:**

D7. Economic activity that can cause ignitions: electricity lines and agriculture activity

Associated risks:

- Inefficient emergency management
- Losing confidence in public institutions
- Significant economic losses: housing, equipment, roads, supply networks (electricity)
- Losses for the primary sector (loss of crops, livestock…)
- High fire suppression costs compared with other proactive strategies such as forest management
- Emotional harm for citizens
- Respiratory diseases/Human health
- If these episodes are recurrent: loss of trust in political and technical management.
- Impact on houses and communities
- Loss of Lives
- Loss of cultural landscapes

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- Damage to infrastructure, property, personal services
- Impact on infrastructure (power plants, electrical collapse and communications)
- Loss of biodiversity
- Soil erosion
- Loss of natural heritage
- Loss of habitats
- Cascading effects on other risks
- Greenhouse gases emissions
- Smoke pollution/air quality

D8. Legacy of housing development in prone-wildfire areas / Lack of self-protection measures in homes and infrastructure

Associated risks:

- Determining responsibilities - accountability for political responsibilities
- Unplanned reactive response
- Significant economic losses: housing, equipment, roads, supply networks (electricity)
- Losses for the primary sector (loss of crops, livestock…)
- High fire suppression costs compared with other proactive strategies such as forest management
- Emotional harm for citizens

D9. Lack of productivity in the primary sector

Associated risks:

- Losses for the primary sector (loss of crops, livestock…)
- High fire suppression costs compared with other proactive strategies such as forest management
- Respiratory diseases/Human health
- If these episodes are recurrent: loss of trust in political and technical management
- Impact on houses and communities

D10. Loss of primary sector activity

Associated risks:

- Losses for the primary sector (loss of crops, livestock…)
- Loss of cultural landscapes
- Loss of habitats

D11. Lack of profitability in forest management

Associated risks:

- Losses for the primary sector (loss of crops, livestock…)

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- Loss of cultural landscapes
- Loss of habitats

D12. Land use changes. Cities growing next to forests

Associated risks:

- Damage to infrastructure, property, personal services

❖ **Social drivers and their associated risks:**

D13. Social use of the environment. Disconnection between the rural and urban worlds (lack of knowledge of the urban population).

Associated risks:

- Losing confidence in public institutions
- Significant economic losses: housing, equipment, roads, supply networks (electricity)

D14. Lack of wildfire education and risk culture. Lack of wildfire experts too

Associated risks:

- Unplanned reactive response
- Inefficient emergency management
- Significant economic losses: housing, equipment, roads, supply networks (electricity)

D15. Non implementation of self-protection plans

Associated risks:

- Loss of lives
- Loss of cultural landscapes
- Damage to infrastructure, property, personal services

D16. Fake news on climate change impacts

Associated risks:

- Losing confidence in public institutions
- Lack of policy coherence. Multiple institutions with diffuse competences, and sectoral legislation with contradictions among them

D17. Poverty

Associated risks:

- Loss of lives
- Damage to infrastructure, property, personal services

D18. Lack of policy adaptation addressed to vulnerable groups

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Associated risks:

- Inequality recovery: People with more economic capacity can recover sooner.

D19. Fragmentation of forest ownership

Associated risks:

- Abandonment of rural areas and activities

D20. Little generational change in the primary sector of the rural world

Associated risks:

- Abandonment of rural areas and activities

D21. Concentration of the population in risk areas

Associated risks:

- Respiratory diseases/Human health
- Loss of lives

❖ **Technological drivers and their associated risks:**

D22. Lack of knowledge of what we have and of analysis technology

Associated risks:

- Unplanned reactive response
- High fire suppression costs compared with other proactive strategies such as forest management.

D23. Lack of self-protection plans for industry and critical facilities

Associated risks:

- Impact on infrastructure (power plants, electrical collapse and communications)
- Lack of maintenance of risky facilities. Example: power lines that cause ignitions.

D24. Lack of coordination between private companies and public agencies and local stakeholders

Associated risks:

- All Risks

❖ **Legal drivers and their associated risks:**

D25. Lack of regulations to ease land management and the education

Associated risks:

- Losing confidence in public institutions
- Impact on service sector (loss of tourists and visitors)
- Emotional harm for citizens
- Respiratory diseases/Human health

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- If these episodes are recurrent: loss of trust in political and technical management.
- Impact on houses and communities

D26. Forest property fragmentation into multiple owners

Associated risks:

- Loss of biodiversity
- Loss of habitat.

D27. Legal and administrative excess: Reactive legislation. Because of a fire, many regulations are made to manage the danger resulting from a specific fire.

Associated risks:

- Inefficient emergency management
- Losing confidence in public institutions

D28. Wildland urban interface (building is allowed within the forest)

Associated risks:

- Impact on houses and communities
- Loss of lives
- Loss of biodiversity

D29. Administration is too soft on prevention

Associated risks:

- Significant economic losses: housing, equipment, roads, supply networks (electricity)
- Losses for the primary sector (loss of crops, livestock…)
- High fire suppression costs compared with other proactive strategies such as forest management.
- Emotional harm for citizens
- Respiratory diseases/Human health
- Loss of lives
- Inequality recovery. People with more economic capacity can recover sooner
- Loss of cultural landscapes
- Abandonment of rural areas and activities
- Damage to infrastructure, property, personal services
- Impact on infrastructure (power plants, electrical collapse and communications)
- Loss of biodiversity
- Loss of natural heritage
- Smoke pollution/air quality

❖ **Environmental drivers and their associated risks:**

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D30. Lack of environmental management

Associated risks:

- Unplanned reactive response
- Inefficient emergency management
- Losing confidence in public institutions
- Impact on service sector (loss of tourists and visitors)
- High fire suppression costs compared with other proactive strategies such as forest management.
- Respiratory diseases/Human health
- If these episodes are recurrent: loss of trust in political and technical management.
- Impact on houses and communities

D31. Lack of forest management

Associated risks:

- Loss of cultural landscapes
- Loss of biodiversity
- Soil erosion
- Loss of natural heritage
- Loss of habitats
- Cascading effects on other risks
- Greenhouse gases emissions
- Smoke pollution/air quality

D32. Lack of strategic wildfire risk management in key areas

Associated risks:

- Loss of cultural landscapes
- Loss of biodiversity
- Soil erosion
- Loss of natural heritage
- Loss of habitats
- Cascading effects on other risks
- Greenhouse gases emissions
- Smoke pollution/air quality

D33. Homogeneous landscape with high fuel loads. Excessive density and poor structure

Associated risks:

- Loss of lives
- Loss of cultural landscapes

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- Damage to infrastructure, property, personal services
- Loss of biodiversity
- Soil erosion
- Loss of natural heritage
- Loss of habitats
- Cascading effects on other risks
- Greenhouse gases emissions
- Smoke pollution/air quality
- Importance of disturbances

D34. Invasive species that increase the vulnerability of native species
Associated risks:

- Loss of biodiversity

D35. Climate change: More heat, less humidity and more droughts
Associated risks:

- Loss of biodiversity
- Loss of natural heritage

D36. Vegetation structure (diffuse elements)
Associated risks:

- Loss of biodiversity
- Loss of natural heritage

As reported by the CSA, participants were discussing the lack of regulations in management. They concluded that the lack of management will lead to collapse (droughts, fires) and that the development of active management would allow them to maintain a habitat adapted to current conditions.

CSA also commented that participants identified reactive legislation as a risk (R22) and also as a driver (D27) of other risks. The idea behind it was that one of the direct consequences of a wildfire is the development of legislation as a reactive response to the occurrence of the fire. This legislation is generally done with a focus on what happened during a particular fire event. However, not all fires are the same, and in many situations, the proper management of other fires has been compromised by legislation previously focused on one fire. Therefore, this "reactive legislation", which is a direct consequence of the fire event, is at the same time the driver of other risks such as inefficient emergency management (R4).

Furthermore, the CSA noted that D9 and D10 were interrelated. Low primary productivity is directly related to losses in the primary sector activity. This makes people abandon activities in

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rural areas, which translates into less cleaning and maintenance of the forest areas. This is directly related to a higher risk of developing wildfires. D11 would operate in the same way. The lack of profitability in forest management does not favour the development of a proper maintenance of the forest areas, increasing the risk of wildfires development.

3.5.4 Adaptation and Mitigation solutions identified by target groups

The LL in Barcelona identified a comprehensive set of A&M solutions designed to address the region's climate-related challenges. These solutions aim to reduce risks, address drivers, and promote resilience. The Adaptation and Mitigation (A&M) solutions identified were connected to the risks and drivers..

Political A&M solutions

1. <u>Increase in management and intervention resources:</u>

   - **Addresses risks:**
     Unplanned reactive response
     Inefficient emergency management
     Losing confidence in public institutions
     Primary sector losses, impact on service sector (reduction in the number of tourists and visitors)
     High fire suppression costs compared with other proactive strategies such as forest management
     Respiratory diseases/human health, if these episodes are recurrent: loss of trust on political and technical management
     Impacts on houses and communities
   - **Targets drivers:**
     Rural abandonment
     Legacy of housing development in prone wildfires areas
     Lack of productivity of the primary sector
     Social use of the environment
     Lack of wildfire education and risk culture
     Lack of environmental management
   - **Associated Barriers:**
     Political 1: Lack of consensus and long-term structural policies (detached from political colour)
     Political 2: Immaturity of the governance system
     Political 3: Disconnection between technicians and politicians

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Economic: Lack of specific budgets to improve predictive models, based on knowledge of the territory.

2. Improve political coordination between the agents involved

   - **Addresses risks:** All Risks
   - **Targets drivers:** All Drivers
   - **Associated Barriers:**

     Political 1: Lack of consensus and long-term structural policies (detached from political colour)

     Political 2: Immaturity of the governance system

     Political 3: Disconnection between technicians and politicians

3. Forestry Plan on planning and legislation at the Metropolitan Area level

   - **Addresses risks:**

     Inefficient emergency management

     Losing confidence in public institutions

     Significant economic losses (housing, equipment, networks...)

     Primary sector losses, impact on service sector (reduction in the number of tourists and visitors)

     High fire suppression costs compared with other proactive strategies such as forest management

     Emotional harm for citizens

     Respiratory diseases/human health, if these episodes are recurrent: loss of trust on political and technical management

     Impacts on houses and communities
   - **Targets drivers:**

     Lack of political consensus on territorial management and educational models

     Lack of coordination among institutions

     Rural abandonment

     Economic activity that can cause ignitions: electricity lines and agriculture activity

     Lack of productivity of the primary sector

     Social use of the environment

     Disconnection between the rural and urban worlds (lack of knowledge of the urban population)

     Lack of wildfire education and risk culture

     Lack of knowledge of what we have and of analysis technology

     Lack of regulations to ease land management and education

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Lack of environmental management

- **Associated Barriers:**
  Political 1: Lack of consensus and long-term structural policies (detached from political colour)
  Political 2: Immaturity of the governance system
  Political 3: Lack of general involvement by the administration
  Legal: Different regulations make management difficult
  Environmental: High cost/Lack of personnel/Low income coming from forest exploitation

4. Climate credits: to promote forest management of the private sector through a climate market (including GHG, Biodiversity and water)

   - **Addresses risks:**
     Loss of biodiversity
     Loss of habitats
     Greenhouse gases emissions
   - **Targets drivers:**
     Lack of forest management
   - **Associated Barriers:**
     Political: Limited private sector participation/Lack of regulation for valuing ecological services/Limited tools to monitor and verify results

5. Tax breaks for forestry sector activities that meet sustainability criteria

   - **Addresses risks:**
     Loss of Lives
     Damage to infrastructure
     Loss of biodiversity
     Loss of habitats
   - **Targets drivers:**
     Lack of forest management
   - **Associated Barriers:**
     Political: Investment of public money/benefits may favour larger companies rather than small ones

6. Enhanced policy coherence

   - **Addresses risks:**

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Inefficient emergency management
Losing confidence in public institutions

- **Targets drivers:**
  Lack of inconsistencies and clarity when distributing roles and competences
- **Associated Barriers:**
  Political: Costs for restructuring policies/Institutional overlaps/Political interests

7. Invest in awareness and education

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Lack of continued investment. Both in grants and direct investments
  Lack of political consensus. (Multiplicity of administrative institutions involved)
- **Associated Barriers:**
  Social 1: Climate change denialism
  Social 2: Lack of education or social awareness

Economic A&M Solutions

8. Valorization of products derived from sustainable practices
   - **Addresses risks:**
     Loss of cultural landscapes
     Biodiversity loss
     Loss of habitats
   - **Targets drivers:**
     Lack of forest management
     Loss of primary sector activity
   - **Associated Barriers:**
     Economic: High cost to develop sustainable products compared with other practices/Limited consumer awareness

9. Ecosystem services payments (grazing, forestry…)

- **Addresses risks:**
  Losses for the primary sector (in particular they meant loss of crops, livestock…)
  High fire suppression costs compared with other proactive strategies such as forest management.
- **Targets drivers:**
  Loss of primary sector activity

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- **Associated Barriers:**
  Political: Forest abandonment due to lack of subsidies
  Economic 1: Long-term funding/Lack of framework to regulate payments/Stakeholder conflicts
  Economic 2: Forest abandonment due to lack of subsidies

10. Promotion of energy production facilities (solar, wind) as contributors of a mosaic landscape. Mosaic landscape promotion can be done through the primary sector.

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Homogenous landscape with high fuel loads
- **Associated Barriers:**
  Economic: High installation and maintenance costs/Land use change (loss of crops)/Loss of cultural landscapes
  Environmental: Loss of the primary sector is difficult to reverse/Land profitability*

11. Biofuels extraction and cost-efficient raw materials treatment (i.e. to centralize pellet production…)

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Lack of profitability in forest management
- **Associated Barriers:**
  Economic: High costs/Lack of infrastructure for centralized production

12. Promote the conversion of diesel fuel to biomass

- **Addresses risks:**
  Inefficient emergency management
  Greenhouse gases emissions
- **Targets drivers:**
  Lack of forest management
- **Associated Barriers:** No associated barriers were identified.

Social A&M Solutions

13. Include topics on risks and environmental management in the school curriculum

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- **Addresses risks:**
  Unplanned reactive reaction
  Inefficient emergency management
  Significant economic losses (housing, equipment, networks)
- **Targets drivers:**
  Rural abandonment,
  Social use of the environment.
  Disconnection between the rural and urban worlds (lack of knowledge of the urban population)
  Lack of wildfire education and risk culture
  Lack of regulations to ease land management and education
  Lack of environmental management
- **Associated Barriers:**
  Political 1: Lack of consensus and long-term structural policies (detached from political colour)
  Political 2: Disconnection between technicians and politicians

14. Civil protection protocols adapted to all target groups

- **Addresses risks:**
  Impact on houses and communities
  Loss of life
  Inefficient emergency management
- **Targets drivers:**
  Non implementation of self-protection plans
  Lack of wildfire risk culture
- **Associated Barriers:**
  Social: Funding to develop inclusive protocols/Difficulty to reach vulnerable population

15. Enhanced risk communication adapted to all target groups

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Non implementation of self-protection plans
  Lack of wildfire risk culture
- **Associated Barriers:**

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Social: Funding for campaigns/Tailor messages to different groups

16. Promotion of self-protection culture for WUI communities and citizens

    - **Addresses risks:**
      No risks were addressed.
    - **Targets drivers:**
      No implementation of self-protection plans
      Lack of wildfire risk culture
    - **Associated Barriers:**
      Social: Lack of community risk awareness/Integration with broader wildfire strategies/Who pays for the implementation of the measures?

17. Improving the transformation of knowledge from science to management and ownership:

    - **Addresses risks:**
      Abandonment of rural areas
    - **Targets drivers:**
      Concentration of the population in risk areas, lack of wildfire education and risk culture
    - **Associated Barriers:**
      Social 1: Large number of owners
      Social 2: Lack of transfer of science to the world of management and the world of property

18. Awareness. Explaining the current problems of forests to citizens

    - **Addresses risks:**
      No risks were addressed.
    - **Targets drivers:**
      Habitat fragmentation
      Social use of the environment
      Disconnection between the rural and urban worlds
      Lack of knowledge of the urban population
      Lack of awareness of the risk
    - **Associated Barriers:** No associated barriers were identified.

19. Improve the generational change of management technicians.

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- **Addresses risks:**
  Abandonment of rural areas
- **Targets drivers:**
  No drivers were targeted
- **Associated Barriers:**
  Political: Better training of staff working as managers

Technological A&M Solutions

20. Enhanced management of critical facilities looking for synergies with other activities

- **Addresses risks:**
  Lack of maintenance of risky facilities such as power lines that cause ignitions
- **Targets drivers:**
  Lack of coordination between private companies and public agencies and local stakeholders
- **Associated Barriers:**
  Technological: High cost of maintenance/Promotion of coordination/Safety standards should be reviewed.

21. Improve predictions. Improve weather models. Improve surveillance.

- **Addresses risks:**
  Inefficient emergency management
  Significant economic losses: housing, equipment, roads, supply networks (electricity)
  Losses for the primary sector (loss of crops, livestock…)
  Loss of biodiversity
  Loss of natural heritage
  Loss of habitats
- **Targets drivers:**
  No drivers were targeted.
- **Associated Barriers:**
  Technological 1: Need to overcome technological barriers such as early fire detection.
  Technological 2: Problem related with the functioning of the academic system, which does not promote the development of local knowledge (local studies are less attractive to be published in high impact international journals).

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22. Understanding future water availability. (social-political-tech)

- **Addresses risks:**
  Inefficient emergency management
- **Targets drivers:**
  Lack of environmental management
  Lack of forest management
- **Associated Barriers:** No associated barriers were identified.

Legal A&M solutions

23. Incentives from insurance companies for forest and housing owners

- **Addresses risks:**
  Inefficient emergency management
  High fire suppression costs compared with other proactive strategies such as forest management
  Emotional harm for citizens
  Respiratory diseases/Human health, if these episodes are recurrent: loss of trust on political and technical management.
- **Targets drivers:**
  Rural abandonment
  Legacy of housing development in prone-wildfire areas / Lack of self-protection measures in homes and infrastructure
  Lack of productivity in the primary sector, social use of the environment. disconnection between the rural and urban worlds (lack of knowledge of the urban population)
  Lack of regulations to ease land management and education
  Lack of environmental management
- **Associated Barriers:**
  Legal: Long-term funding/Resistance from landowners/ Abandoned land is usually of complex exploitation

24. Public/Private land management contracts to promote landscape management (i.e. Land bank, custody agreements…)

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Homogenous landscape with high fuel loads

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Forest property fragmentation into multiple owners

- **Associated Barriers:** No associated barriers were identified.

25. Urban planning linked to wildfire risk

- **Addresses risks:**
  Impact on houses and communities, loss of life
- **Targets drivers:**
  No drivers were reported.
- **Associated Barriers:**
  Legal: Limited integration of wildfire risk into urban planning processes/What happens with urbanizations already built?

26. Subsidiarity of civil protection plans, empowering the administrative level with higher capacity to reach citizens

- **Addresses risks:**
  Lack of policy coherence (multiple institutions with diffuse competences, sectoral legislation with contradictions among them…)
- **Targets drivers:**
  Lack of clarity when distributing roles and competences
- **Associated Barriers:**
  Legal: Lack of resources of local administrations/Top-down and bottom-up coordination

27. Toughen legal measures (there was debate on this, because these same legal measures are, at the same time, the barriers for managing the forest)

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Wildland urban interface (building within the forest is allowed)
  Administration is too soft on prevention.
- **Associated Barriers:** No associated barriers were identified.

28. Improve the insurance system (civil liability)

- **Addresses risks:**
  No risks were addressed.

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- **Targets drivers:**
  No drivers were targeted.
- **Associated Barriers:** No associated barriers were identified.

Environmental Solutions

29. Planning and management of wildfire strategic areas

- **Addresses risks:**
  High fire suppression costs compared with other proactive strategies such as forest management.
- **Targets drivers:**
  Lack of forest management
- **Associated Barriers:** No associated barriers were identified.

30. Mosaic landscape promotion through the primary sector

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Loss of primary sector activity
  Homogeneous landscape with high fuel loads
- **Associated Barriers:** No associated barriers were identified.

31. Training and capacitation of more forest workers and under a common framework

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Lack of forest management (done by professionals)
- **Associated Barriers:**
  Economic: Lack of training of forestry personnel
  Environmental 1: Funding/Lack of interest from young generations in forestry careers
  Environmental 2: Massive import of primary resources from third countries (and local products sold at a higher price)
  Environmental 3: Lack of human resources for reforestation

32. Prescribed burning

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- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Lack of forest management
  Homogeneous landscape with high fuel loads
- **Associated Barriers:**
  Environmental 1: Few numbers of people trained to run prescribed burning/Few days with a weather window/Smoke impact/Social perception against fire
  Environmental 2: Massive import of primary resources from third countries (and local products sold at a higher price)

33. The fuel available in strategic areas

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Lack of economic profitability of forests, homogeneous landscape with high fuel loads
  Excessive density and poor structure
- **Associated Barriers:** No associated barriers were identified.

34. Silvopastoralism (proposal with horses) (NBS)

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  Homogeneous landscape with high fuel loads, excessive density and poor structure
- **Associated Barriers:** No associated barriers were identified.

35. Reforestation of burned areas

- **Addresses risks:**
  Loss of forest, loss of biodiversity
- **Targets drivers:**
  Forest fragmentation (does not allow mature forests). There is no good quality forests.
- **Associated Barriers:** No associated barriers were identified.

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Additional comments

There was a debate about whether legal measures (regulations) should be tightened or whether there are already enough regulations. There was a bit of confusion regarding this issue, and it was reported that no consensus was reached among participants.
Each one of the A&M measures proposed was related to different risks and drivers. The results presented in the present report (taken from the provided table from the CSA raw data, to be found in the supplementary material) only compile the examples that participants were discussing, but there could be more Risks and Drivers related to each A&M that were not reported by the CSA because they were not discussed due to the limited time of the WS.
A total of 35 A&M measures were identified by the participants. From all these A&M measures, the CSA selected the 20 most important and filled in the mentimeter survey for the prioritization exercise.
Some participants identified some barriers based on some problems they found in general terms and not based on the A&M solutions proposed above. Therefore, there are some barriers not associated to an A&M solution.

3.5.5 Solutions prioritisation

For the execution of the prioritisation exercise CSA Barcelona selected 20 of the 36 A&M solutions proposed, the 20 most important. These measures were introduced in the menti meter survey to prioritise proposed solutions for wildfire management and environmental sustainability. The evaluation considered the urgency of each solution and the ease with which it could be implemented. This process provided clarity on which actions should be prioritised for immediate impact, and which require strategic planning for successful execution. The measure “Involving citizens and educating them” received the highest scores across all criteria. Solutions were classified as high, medium or low priority depending on the score they received.

High-Priority Solutions

Several solutions were identified as critical and actionable, representing immediate opportunities for addressing wildfire risks and fostering environmental resilience:

Promoting societal awareness and education:

- Raising public awareness about wildfire risks and environmental challenges is essential. Educational campaigns and outreach programs can play a pivotal role in building a more informed and proactive society.
- Including Risks and Environmental Management in School Curricula

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- Integrating environmental and risk management topics into educational systems ensures that future generations are better equipped to understand and address these challenges from an early age.

Reducing fuel in strategic areas:

- Strategic measures like silvopastoralism and controlled burns are effective in minimizing wildfire risks. These methods are practical and impactful, offering a clear path to immediate action.

Improving political coordination among agents:

- Enhanced collaboration between stakeholders involved in wildfire management and environmental policies is critical. Improved coordination will ensure that resources are optimized, and efforts are aligned toward common goals.

Increasing management and intervention resources:

- Expanding resources for wildfire prevention and environmental management is a priority to enhance the capacity for effective action and rapid responses to emerging threats.

Moderate-priority solutions

Certain initiatives, while important, may require additional planning or face implementation challenges. These include:

Improving risk communication tailored to audiences:

- Tailored communication strategies are essential for effectively conveying risks to diverse groups. Efforts should focus on ensuring messages are accessible and resonate with different audiences.

Establishing self-protection strips for population centres:

- Physical measures to protect communities, such as self-protection strips, are vital for minimizing the impact of wildfires near populated areas.

Reducing taxes for forestry and primary sector management:

- Fiscal incentives can encourage sustainable practices in forest and primary sector management. These measures support long-term environmental resilience.

Developing improved models to prevent wildfires:

- Advancing predictive models for wildfire prevention is important for strategic planning and early intervention. This requires continued investment in research and technology.

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Lower-priority solutions

Some solutions, while valuable, are less urgent or have long-term horizons. These include:

Reforestation of burnt areas:

- Although reforestation contributes to environmental restoration, it is less immediate compared to measures directly addressing wildfire risks.

Banco de Tierras:

- Establishing land banks can support sustainable land use but requires further planning and coordination to be effective.

Promoting sustainable tourism:

- Encouraging sustainable tourism practices is beneficial for long-term environmental and economic goals, but it may not address immediate wildfire management principles.

Additional comments: Silos exist between science and forest practitioners. SHs proposed that perhaps climate literacy would help.
No climate dimension in forest practices*

The prioritization process used a mentimeter. Participants scored each solution on a 1-to-5 scale based on ease of implementation, urgency, and importance, resulting in visual graphs that guided discussions. Figure 21 shows in a graphical way the outputs of the prioritization solutions. The axes show the sum of scores for each solution on a 1-to-5 scale (5=most urgent/easiest implementation).

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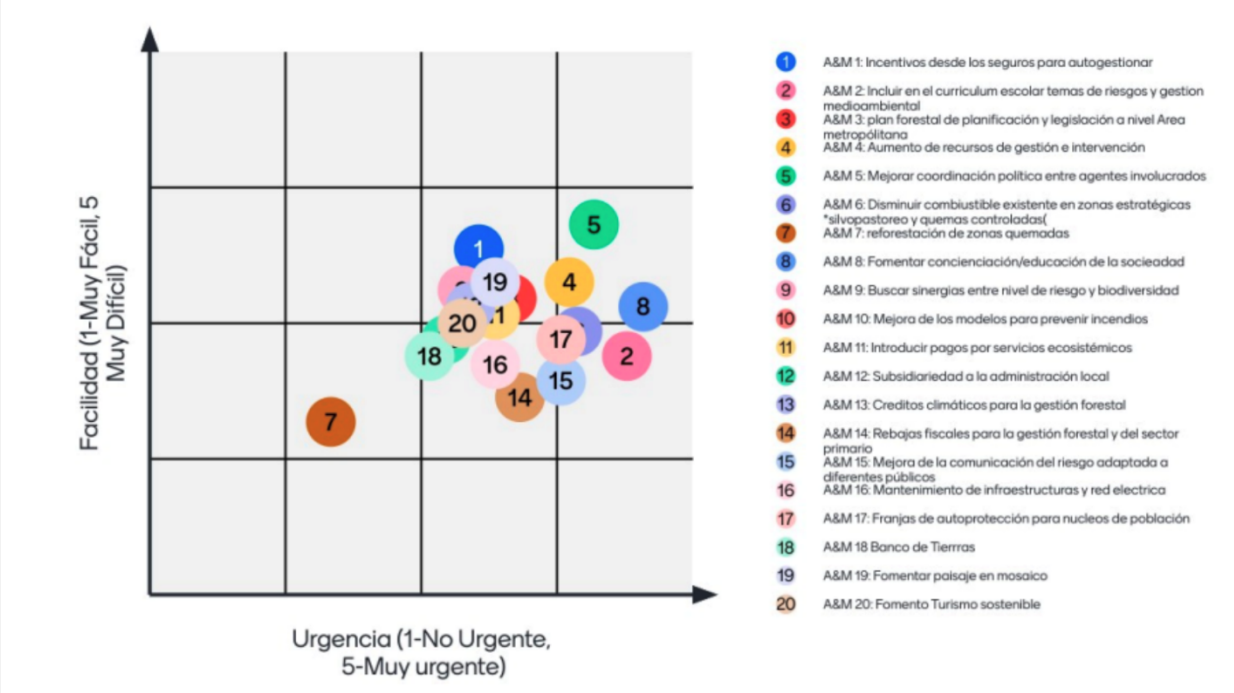

Figure 21. Results of the prioritization exercise considering the 20 A&M measures listed in Table 9.

3.5.6 Target groups engagement assessment

Participants from MeteoCat (Meteorological Service of Catalonia) were invited to this meeting but were unable to attend on the scheduled date. To ensure their input is included, plans are in place to meet with them before the next workshop and repeat the exercise with their participation. Additionally, they will be invited to attend the second LL workshop.

Vulnerable communities were also invited to this workshop, but no responses were received. To address this, the CSA will reach out again to arrange an informal online meeting or phone call to gather their input. They will also be invited to participate in the second workshop to ensure their perspectives are included.

Among the vulnerable communities, there is an activist group based in the Collserola area that was not invited to Workshop 1. Due to concerns that their potentially outspoken nature might disrupt the workshop, it was decided to engage with them separately. A meeting will be organized to establish initial contact and evaluate the best approach for their involvement. Following this interaction, the CSA will assess whether they can be included in the second workshop or if separate meetings remain the best option.

Lastly, local producers were unable to attend this workshop. Efforts will be made to connect with them through informal meetings or phone calls to gather their input and ensure their perspectives are incorporated.

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3.6 Bologna (IT)

3.6.1 Target Groups engaged

3.6.1.1 Living Lab participants

Living Lab Challenge: Heatwaves, urban pollution and vulnerable groups

The LL in Bologna actively engaged diverse stakeholders, ensuring representation across various sectors, including public administration, health services, climate organizations, academia, and NGOs. A total of 24 participants who covered all target groups identified in D1.7 contributed to the workshop, representing multiple fields and interests:

Regions (TG1)

Representatives included individuals from the following institutions:

- AIAS Fragiles-Disables
- AUSL
- COTABO
- Bologna Missione Clima
- Municipality of Bologna - Ecological transition and climate office.
- Municipality of Bologna – International relationship.
- Municipality of Bologna – City council.
- Emilia Romagna – Environment sustainability section.
- Emilia Romagna – Energy and green economy.

Communities (TG2)

Representatives included individuals from the following institutions:

- AUSER.
- Giovani nel tempo.
- Extinction rebellion.
- Legambiente
- Consumerismo.

Industry (TG3)

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Representatives included individuals from the following institutions:

- AESS Origen
- Antonio Ruberto

Research and Academia (TG4)

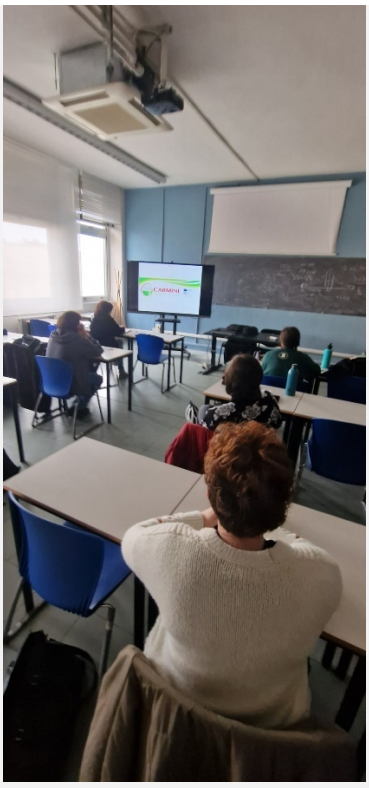
Representatives included individuals from the following institutions:

- University of Bologna - Department of energy and information
- University of Bologna - Department of quality of life.
- Acaddemia dei Georgofili.
- Cluster green tech.

Policymakers (TG5)

- ANCI (National Association of Municipalities).

Participants engaged in dynamic discussions, with facilitators managing the workshop's flow to ensure inclusivity and effective documentation of stakeholder input. Figure 22 presents the LL in Bologna.



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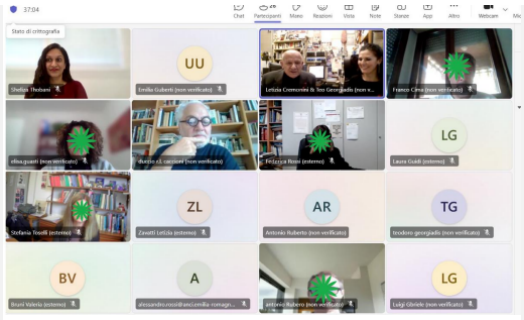

Figure 22. Living Lab in Bologna

3.6.1.2 Missing participants and notes

Despite efforts to engage a comprehensive range of stakeholders, some key organizations were unable to attend the workshop due to scheduling conflicts or prior commitments. The following notable absences were recorded:

- **Public administration:** Municipal representatives from Unione Rubicone Mare were unable to participate due to pre-existing institutional meetings.
- **NGOs and Foundations:** Organizations such as Fondazione Sempre Insieme Onlus and Fondazione Yunus could not attend but expressed interest in participating in future activities.
- **Other sectors:** Representatives involved in EU project management from FIU Rusconi Ghigi were also unavailable for the workshop.

Efforts are underway to involve these stakeholders in subsequent activities to ensure their perspectives are integrated into the project's outcomes. While some participants were missing, one to one meeting took place so as to receive additional feedback.

3.6.1.3 Engagement of vulnerable communities

Special attention was given to the inclusion of vulnerable communities such as elderly individuals, disabled people, and youth. A detailed breakdown of the vulnerable communities is presented in D1.7 and in the Table 3 of the supplementary material.

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3.6.2 Target groups perceptions on climate change risks,

The workshop facilitated comprehensive discussions to identify and address climate change risks, drivers, solutions, and barriers in Bologna. The challenge that CSA Bologna focused on was heat waves and pollution. Figure 23 presents the PESTLE wheel used in the Bologna LL Workshop.

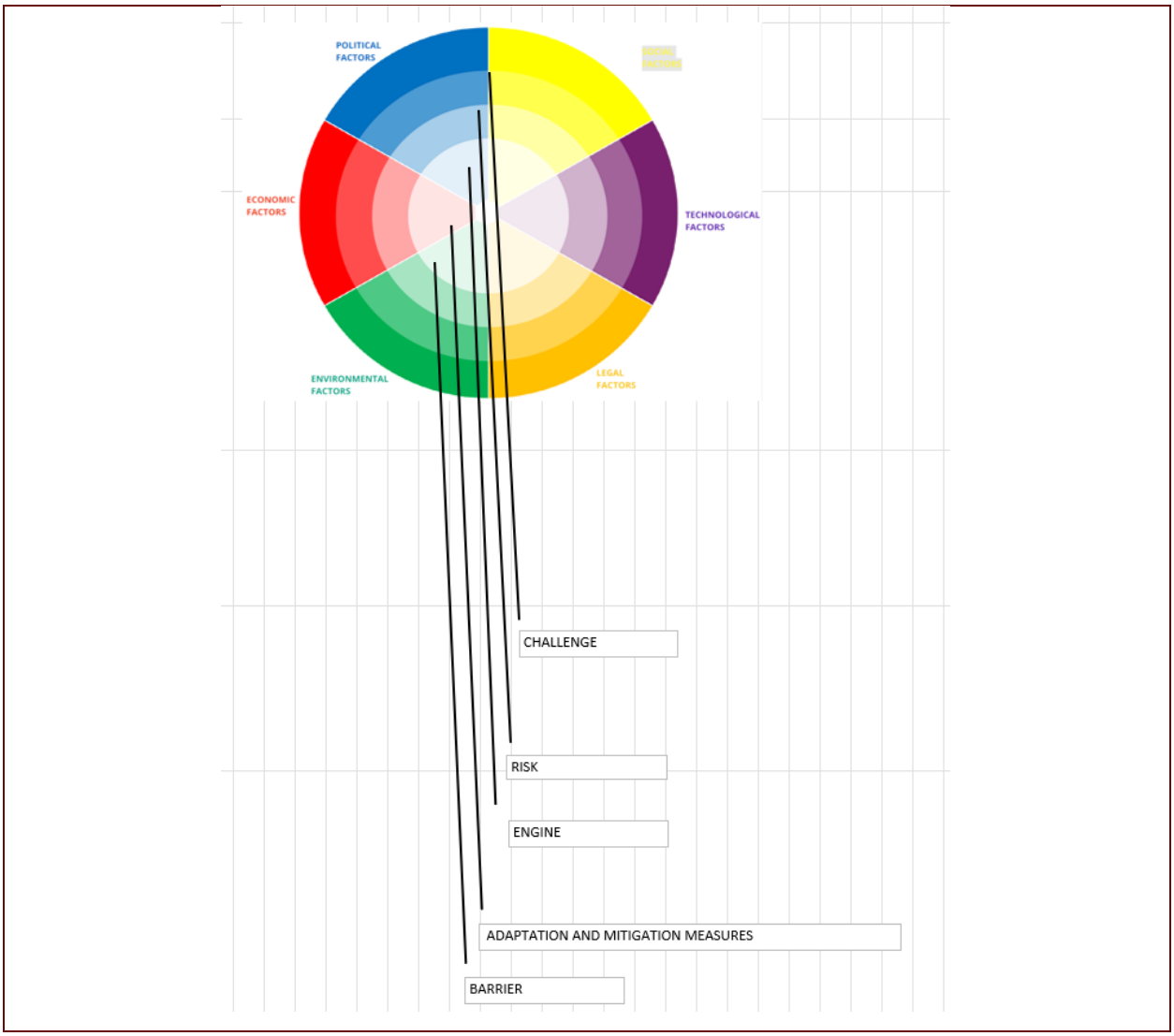

Figure 23. PESTLE Wheel for Bologna

The LL in Bologna identified 14 risks connected to climate change, emphasizing the multi-dimensional impact of these challenges..

Political risks:

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1. Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection
2. Reduction in the quality or diversification of food and their cost, which may impact health
3. The current city model is not conducive to social relations

Economic risks:

4. Current complexity in home delivery services and varying policies for delivery costs.

Social risks:

5. Wage policies, grading of delivery personnel, and their potential exposure to climate risk
6. Type of vehicles used
7. Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals
8. Insufficient daily attention to the mobility needs of frail individuals.
9. Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
10. Solitude of individuals

Technological risks:

11. Italy is losing the artisan mechanics who repair bicycles

Environmental risks:

12. Decreasing trend in demand for determined products (with increased waste and scrap) resulting in increased CO_2 due to waste disposal
13. Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
14. Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.
15. Increased urban heat island; lack of space to create green spaces

Concerning the *vulnerable communities*, one additional input was recognized: frail people tend to feel useless to society. This perception can further impair their quality of life.

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3.6.3 Climate change Risks and associated Drivers

After identifying the risks, the LL in Bologna identified 43 key drivers contributing to the region's climate risks. These drivers reflect systemic issues across political, economic, social, technological, legal, and environmental dimensions.

❖ **Political drivers and their associated risks:**

D1. Delivery policy in large retailers and neighborhood markets

Associated risks:

- Current complexity in home delivery services and different policies for delivery costs.
- Wage policies, grading of delivery personnel, and their potential exposure to climate risk.
- The type of vehicles used.
- Decreasing demand for certain products (leading to increased waste and scrap), resulting in higher CO2 emissions due to waste disposal.

D2. Incentives for conversion from thermal to electric for riders with special attention to the scooter category

Associated risks:

- Wage policies, grading of delivery personnel, and their potential exposure to climate risk.
- Decreasing demand for specific products (leading to increased waste and scrap), resulting in higher CO_2 emissions due to waste disposal.

D3. Accessibility, equity of urban structure considering the specificities of the weak/social groups involved

Associated risks:

- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.

D4. Slow mobility bicycle pedestrian

Associated risks:

- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
- Insufficient daily attention to the mobility needs of frail individuals.

D5. Public mobility

Associated risks:

- Insufficient daily attention to the mobility needs of frail individuals.

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D6. Spaces for fragile population

Associated risks:

- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.

D7. Food desert (urban food supply voids), capacity for commercial organization of neighborhood stores

Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.

D8. Prevention from a health point of view (obesity, diabetics…) through lifestyle and a city that guarantees accessibility

Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.

D9. Urban regeneration using urban planning techniques and specific policies

Associated risks:

- Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
- Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

D10. Degree of accessibility in daily practices

Associated risks:

- Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
- Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

D11. Involving the frail figures directly and their mediators

Associated risks:

- Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
- Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

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D12. Increased jobs and economies associated with the application of NBS in the urban fabric

Associated risks:

- Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
- Increased urban heat island; lack of space to create green spaces.

D13. Transfer of knowledge about green management

Associated risks:

- Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
- Increased urban heat island; lack of space to create green spaces.

D14. New housing solutions through new public-private agreements

Associated risks:

- The current city model does not foster social relationships.

D15. Role of urban agriculture for self-support and facilitation of human and social exchange

Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.
- The current city model does not foster social relationships.

D16. Shopping malls as proximity sorting in markets

Associated risks:

- Solitude of individuals.

D17. Knowledge transmission

Associated risks:

- The current city model does not foster social relationships.
- Solitude of individuals
- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.

❖ **Economic drivers and their associated risks:**

D18. Agreements with food delivery companies for free electric vehicle recharging

Associated risks:

- The type of vehicles used.

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D19. Incentive on scrapping in switching to electric vehicles
Associated risks:

- The type of vehicles used.

D20. Knowledge transfer for repairing slow mobility vehicles [also mentioned in social and technological drivers]
Associated risks:

- Insufficient daily attention to the mobility needs of frail individuals.

D21. Food desert (urban food supply voids), capacity for commercial organization of neighborhood stores
Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.

D22. Prevention from a health point of view (obesity, diabetics…) through lifestyle and a city that guarantees accessibility
Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.

D23. Involving the frail figures directly and their mediators
Associated risks:

- Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
- Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

D24. Increased jobs and economies associated with the application of NBS in the urban fabric
Associated risks:

- Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
- Increased urban heat island; lack of space to create green spaces.

D25. Transfer of knowledge about green management
Associated risks:

- Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
- Increased urban heat island; lack of space to create green spaces.

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D26. Alternative services carried out by taxis (medicine delivery)
Associated risks:

- Current complexity in home delivery services and varying policies for delivery costs.
- Wage policies, grading of delivery personnel, and their potential exposure to climate risk.

D27. Shopping malls as proximity sorting in markets
Associated risks:

- Solitude of individuals.

D28. Knowledge transmission
Associated risks:

- The current city model does not foster social relationships.
- Solitude of individuals.
- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.

❖ **Social drivers and their associated risks:**

D29. Food desert (urban food supply voids), capacity for commercial organization of neighborhood stores
Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.

D30. Prevention from a health point of view (obesity, diabetics…) through lifestyle and a city that guarantees accessibility
Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.

D31. Degree of accessibility in daily practices
Associated risks:

- Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
- Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

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D32. Involving the frail figures directly and their mediators

Associated risks:

- Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.
- Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

D33. Increased jobs and economies associated with the application of NBS in the urban fabric

Associated risks:

- Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
- Increased urban heat island; lack of space to create green spaces.

D34. Transfer of knowledge about green management

Associated risks:

- Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
- Increased urban heat island; lack of space to create green spaces.

D35. Increased quality of life and health benefits

Associated risks:

- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
- Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection.

D36. Availability of aggregation spaces

Associated risks:

- The current city model does not foster social relationships.

D37. Giving recognition to the role of the frail: what can they do for society? Enhancement of knowledge for these individuals who have much to tell and to be told. Generating opportunities for intergenerational exchange.

Associated risks:

- The current city model does not foster social relationships.
- Solitude of individuals.

D38. Role of urban agriculture for self-support and facilitation of human and social exchange.

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Associated risks:

- Reduction in the quality or diversification of food and their cost, which may impact health.
- The current city model does not foster social relationships.

D39. Role of social action groups for support of the frail population

Associated risks:

- The current city model does not foster social relationships.

D40. Shopping malls as proximity sorting in markets

Associated risks:

- Solitude of individuals

D41. Knowledge transmission

Associated risks:

- The current city model does not foster social relationships.
- Solitude of individuals.
- Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.

❖ **Technological drivers and their associated risks:**

- No drivers reported.

❖ **Legal drivers and their associated risks:**

- No drivers reported.

❖ **Environmental drivers and their associated risks:**

- No drivers reported.

3.6.4 Adaptation and mitigation solutions identified by target groups

The LL in Bologna identified a comprehensive set of 27 A&M solutions designed to address the region's climate-related challenges. These solutions aim to reduce risks, address drivers, and promote resilience. The A&M solutions identified were connected to the risks and drivers.

Political A&M solutions

1. Distribution with electric vehicles [also mentioned in economic and environmental A&M solutions]:

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- **Addresses risks:**
  Current complexity in home delivery services and varying policies for delivery costs,
  Wage policies, grading of delivery personnel, and their potential exposure to climate risk,
  The types of vehicles used,
  Decreasing trend in demand for determined products (with increased waste and scrap) resulting in increased CO2 due to waste disposal.
- **Targets drivers:**
  Delivery policy in large retailers and neighborhood markets,
  Incentives for conversion from thermal to electric for riders with special attention to the scooter category,
  Incentive to scrap in switching to electric vehicles.
- **Associated barriers:**
  Political 1: Fleet change.
  Political 2: Refueling electric vehicles.

2. Equitable and widespread food accessibility in spatial terms (distribution) economic and quality [also mentioned in economic and social A&M solutions]

   - **Addresses risks:**
     Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
   - **Targets drivers:**
     Accessibility, equity of urban structures considering the specificities of the weak/social groups involved.
   - **Associated barriers:**
     Political: Lack of coordination and specific policies for neighborhood markets and private retailers.

3. Identification of urban areas with greater commercial vocation and more attractive in terms of services (neighborhood markets, streets with greater presence of neighborhood stores, but also streets on which there are services of first necessity such as post offices, public offices, schools) on which to carry out useful interventions to improve the conditions of summer comfort and usability even in the hottest days (e.g. shading, installation of fountains, green areas, furniture) [also mentioned in social A&M solutions]:

   - **Addresses risks:**

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Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals

- **Targets drivers:**
  Accessibility, equity of urban structures considering the specificities of the weak/social groups involved
- **Associated barriers:**
  Political & economic: Lack of coordination and specific policies for neighborhood markets and private retailers.

4. Pocket parks, regeneration of interlocking urban spaces [also mentioned in economic, social and environmental A&M solutions]:

   - **Addresses risks:**
     Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
   - **Targets drivers:**
     Slow mobility bicycle – pedestrian,
     Public mobility,
     Spaces for fragile population.
   - **Associated barriers:**
     Political: Conflict parking/socialization areas.

5. Implementation of policies favouring natural commercial centers:

   - **Addresses risks:**
     Reduction in the quality or diversification of food and their cost, which may impact health,
     Insufficient daily attention to the mobility needs of frail individuals.
   - **Targets drivers:**
     Food desert (urban food supply voids),
     Capacity for commercial organization of neighborhood stores, prevention from a health point of view (obesity, diabetes…) through lifestyle and a city that guarantees accessibility.
   - **Associated barriers:**
     Political & economic: Large retailers and established relationship systems do not show sensitivity to the demands of proximity store users.
     Economic & social: Proximity stores supplied not adapted to the requirements of fragile users.

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6. Dedicating funds to project of life and pathways protected from a microclimatic point of view:

   - **Addresses risks:**
     Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks,
     Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.
   - **Targets drivers**:
     Urban regeneration using urban planning techniques and specific policies,
     Degree of accessibility in daily practices; involving the frail figures directly and their mediators
   - **Associated barriers:**
     Political & Social: Conveying financial support through the "project of life" requires not only the mindset and autonomy to pursue it but also the financial means to do so, as it represents a contract between the individual and the municipality. The health budget was established for mental disabilities and functions as a contract between the individual, their family members, and the AUSL. Two regions—Emilia-Romagna (ER) and Friuli—have implemented this approach, though the target audience could be much broader. There is a risk of creating a disparity between those who can access legal support due to their financial means and those who cannot, due to a lack of resources.
     Political: Difficulty of adjustment to existing policies regarding city mobility.
     Social 1: Failure to interpret difficulties/opportunities of the frail in daily urban living/policies not targeted on real needs.
     Social 2: Lack of knowledge of the problem by the population.
     Social 3: Dedicating funds to project of life.

7. Enforcement of reasonable accommodation regulations and Incentives for the creation of small, multipurpose commercial establishments (i.e., with the integration of proximity services in small towns and less populated hamlets, (e.g., through the provision of publicly owned spaces/buildings, tax breaks or other forms of economic incentives, promotion of public-private agreements) [also mentioned in economic and social A&M solutions]:

   - **Addresses risks:**
     Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks.,
     Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.

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- **Targets drivers**:
  Urban regeneration through the use of urban planning techniques and specific policies,
  Degree of accessibility in daily practices,
  Involving the frail figures directly and their mediators.
- **Associated barriers:**
  Political 1: Failure to interpret the difficulties/opportunities of the frail in daily urban living.
  Political 2: Policies not targeted on real needs.

8. Widespread application of NBS policies and techniques with an emphasis on green ones [also mentioned in technological and environmental A&M solutions]:

   - **Addresses risks:**
     Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty).
   - **Targets drivers:**
     Increased jobs and economies associated with the application of NBS urban fabric.
   - **Associated barriers:**
     Political, social, legal & environmental: Presence of underground utilities that reduce areas available for descaling urban soil.
     Legal: Superintendence constraints on green insertion in historic contexts.

9. Promoting through incentives and urban planning, the spread of green infrastructure and bioclimatic solutions in buildings (green walls and roofs, bioclimatic greenhouses, use of cool materials) [also mentioned in economic and technological A&M solutions]:

   - **Addresses risks:**
     Excessive building cooling costs, to the detriment of lower-income groups (fuel poverty),
     Increased urban heat island,
     Lack of space to create green spaces.
   - **Targets drivers:**
     Transfer of knowledge about green management.
   - **Associated barriers:**
     Political & economic: Historic urban fabric structure too rigid to accommodate NBS.

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10. Appropriate policies in proximity to areas experience by children and families: management of dedicated public space also in terms of services, with smart solutions to support specific needs in terms of mobility:

    - **Addresses risks:**
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
      Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection.
    - **Targets drivers:**
      Lower cost of travel,
      Increased quality of life and health benefits.
    - **Associated barriers:**
      Political: Limitation of reliable public transportation and bike lanes are not safe enough to facilitate transportation of vulnerable or frail population.
      Economic: Lower income urban zones difficult to integrate.

11. Agreements with those directly involved in distribution [also mentioned in economic A&M solutions]:

    - **Addresses risks:**
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
      Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection
    - **Targets drivers:**
      Lower cost of travel; increased quality of life and health benefits.
    - **Associated barriers:** No associated barriers identified.

12. Increasing the frequency of buses (and streetcars) on main lines and creating more bike lanes (protected from oncoming traffic and ensuring adequate separation from the road) [also mentioned in social and environmental A&M solutions]:

    - **Addresses risks:**
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
      Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection
    - **Targets drivers:**

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Lower cost of travel; increased quality of life and health benefits.

- **Associated barriers:**
  Political & social: Lower income urban zones difficult to integrate.
  Economic: High costs and limited road space due to the dominance of private cars over all other modes of transportation.
  Social: Limitation of reliable public transportation and bike lanes are not safe enough to facilitate transportation of vulnerable or frail population.

13. Interventions to moderate private traffic; infrastructural equipment useful for the safety of bicycle and pedestrian traffic (overpasses or underpasses, signage, etc.) video-monitored bicycle parking lots [also mentioned in environmental A&M solutions]:

- **Addresses risks:**
  Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
  Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection.
- **Targets drivers:**
  Lower cost of travel, increased quality of life and health benefits.
- **Associated barriers:** No associated barriers identified.

14. Build adapted housing solutions for those who are alone and that can compensate social lacks by dedicating a part of the social expenditure [also mentioned in economic and technological A&M solutions]:

- **Addresses risks:**
  The current city model is not conducive to social relations.
- **Targets drivers:**
  New housing solutions through new public-private agreements.
- **Associated barriers:**
  Political: Increased social expenditure that may meet obstacles.
  Social 1: Problems of acceptance by the elderly and disabled of the co-housing mechanism.
  Social 2: Society projected to individuality and competitivity.
  Social 3: Resistance of the elderly to get out of their routines and also out of their spaces.
  Legal: Difficulty of adjustment to existing policies regarding city mobility.

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15. Adapt proximity services based on the location of these structures [also mentioned in economic and technological A&M solutions]:

    - **Addresses risks:**
      Current complexity in home delivery services and varying policies for delivery costs,
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
      Reduction in the quality or diversification of food and their cost, which may impact health,
      The current city model is not conducive to social relations.
    - **Targets drivers:**
      Alternative services carried out by tais (medicine, delivery),
      Role of urban agriculture for self-support and facilitation of human and social exchange.
    - **Associated barriers:** No associated barriers identified.

16. Tax incentive operations dedicated to facilities that can accommodate co-housing (i.e., superbonus) [also mentioned in economic and technological A&M solutions]:

    - **Addresses risks:**
      The current city model is not conducive to social relations.
    - **Targets drivers:**
      New housing solutions through new public-private agreements.
    - **Associated barriers:** No associated barriers were identified.

17. Creation of safe routes to promote inter-vehicle exchange, and safety in existing bike lanes [also mentioned in social and environmental A&M solutions]:

    - **Addresses risks:**
      The current city model is not conducive to social relations,
      Solitude of individuals, Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks,
      Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks,
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
      Insufficient daily attention to the mobility needs of frail individuals..
    - **Targets drivers:**

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Shopping malls as proximity sorting in markets,
Accessibility, equity of urban structure considering the specificities of the fragile groups involved,
Urban regeneration through the use of urban planning techniques and specific policies.

- **Associated barriers:** No associated barriers were identified.

Economic A&M Solutions

18. Weather forecast dedicated to urban delivery operators [also mentioned in social and environmental A&M solutions]:

    - **Addresses risks:**
      Current complexity in home delivery services and varying policies for delivery costs,
      Wage policies,
      Grading of delivery personnel, and their potential exposure to climate risk, type of vehicles used,
      Decreasing trend in demand for determined products (with increased waste and scrap) resulting in increased CO2 due to waste disposal.
    - **Targets drivers:**
      Delivery policy in large retailers and neighborhood markets
    - **Associated barriers:**
      Political: Access and parking policy in urban areas.
      Economic 1: Fleet change.
      Economic 2: Refueling electric vehicles.
      Economic 3 & social: Access and parking in urban areas.

19. Organization of courses for repairing vehicles [also mentioned in technological A&M solutions]:

    - **Addresses risks:**
      Insufficient daily attention to the mobility needs of frail individuals.
    - **Targets drivers:**
      Knowledge transfer for repairing slow mobility vehicles.
    - **Associated barriers:** No associated barriers identified.

20. Ease of access promoted by optimizing the distribution of goods and services; ease of access promoted through dedicated pavements [also mentioned in social A&M solutions]:

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- **Addresses risks:**
  Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks,
  Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.
- **Targets drivers**:
  Urban regeneration through the use of urban planning techniques and specific policies;
  Degree of accessibility in daily practices,
  Involving the frail figures directly and their mediators
- **Associated barriers:**
  Social & Legal: Consider in policies dedicated to "fragile" individuals, not only the elderly, children, disabled but also parents with young children (travel with strollers, architectural barriers, sidewalk size for families etc.)

21. Gastronomic workshops to exchange traditional culinary traditions and cross-cultural gastronomic exchanges [also mentioned in social A&M solutions]:

- **Addresses risks:**
  The current city model is not conducive to social relations,
  Solitude of individuals, Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves),
  Leading to higher risks,
  Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks,
  Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
  Insufficient daily attention to the mobility needs of frail individuals..
- **Targets drivers:**
  Shopping malls as proximity sorting in markets; accessibility,
  Equity of urban structure considering the specificities of the fragile groups involved,
  Urban regeneration through the use of urban planning techniques and specific policies.
- **Associated barriers:**
  Political: Resistance of the elderly/fragile populations to get out of their routines and also out of their spaces.

Social A&M Solutions

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22. Green and blue infrastructure integrated with neighborhood markets [also mentioned in environmental A&M solutions]:

    - **Addresses risks:**
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
    - **Targets drivers:**
      Slow mobility bicycle – pedestrian, public mobility, spaces for fragile population.
    - **Associated barriers:** No associated barriers were identified.

23. Protection and shading systems where possible with pergolas:

    - **Addresses risks:**
      Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
    - **Targets drivers:**
      Slow mobility bicycle – pedestrian, public mobility, spaces for fragile population.
    - **Associated barriers:**
      Political, Economic, Social & Environmental: Conflict fast mobility/slow mobility and pedestrians.
      Economic & Social: Conflict parking/socialization areas.

24. Pathways protected from a microclimatic point of view [also mentioned in environmental A&M solutions]:

    - **Addresses risks:**
      Increased exposure to urban climate factors during daily outdoor activities (e.g., heatwaves), leading to higher risks,
      Increased exposure to urban environmental factors, such as pollution, during daily outdoor activities, leading to higher risks.
    - **Targets drivers**:
      Urban regeneration through the use of urban planning techniques and specific policies,
      Degree of accessibility in daily practices,
      Involving the frail figures directly and their mediators.
    - **Associated barriers:** No associated barriers were identified.

25. Organizing courses for green management:

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- **Addresses risks:**
  Increased urban heat island; lack of space to create green spaces,
  Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals.
- **Targets drivers:**
  Transfer of knowledge about green management.
- **Associated barriers:** No associated barriers were identified.

26. Design of waiting areas for public transportation with seating and shade structures:

- **Addresses risks:**
  Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
  Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection.
- **Targets drivers:**
  Lower cost of travel; increased quality of life and health benefits.
- **Associated barriers:** No associated barriers were identified.

Technological A&M Solutions

27. Digital platforms to increase the use of public transportation or to identify the safest bicycle routes:

- **Addresses risks:**
  Lack of recognition of the needs of vulnerable segments of the population, including the specific mobility requirements of individuals,
  Microclimate impact on social destination spaces, i.e. lack of social destination spaces with physiological protection.
- **Targets drivers:**
  Lower cost of travel; increased quality of life and health benefits.
- **Associated barriers:**
  Technological: High costs and limited road space due to the dominance of private cars over all other modes of transportation.
  Legal: Limitation of reliable public transportation and bike lanes are not safe enough to facilitate transportation of vulnerable or frail population.

Legal A&M Solutions

No legal solutions were reported.

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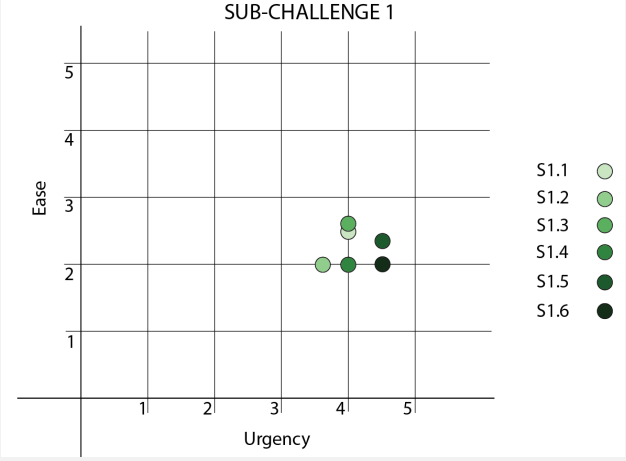
Environmental A&M solutions are included in some of the abovementioned categories. Concerning vulnerable community, the input was the possibility of starting a dedicated database; between younger and fragile older people there is difference, fragile and/or disabled older people cannot replace younger.

3.6.5 Solutions prioritisation

Table 7 presents solutions prioritisation for CSA Bologna. The axes show the sum of scores for each solution on a 1-to-5 scale (5=most urgent/easiest implementation).

Table 6. Solutions prioritisation (Bologna)



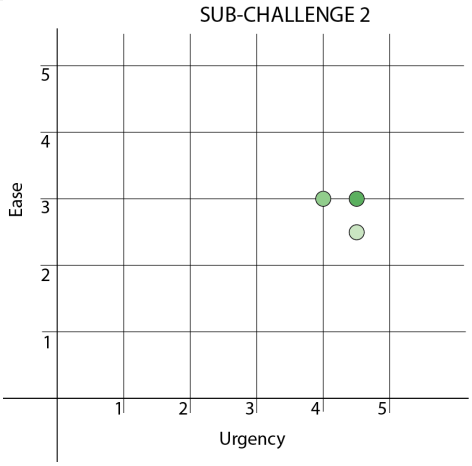
S1.1. - Distribution with electric vehicles
S1.2 - Weather forecast dedicated to urban delivery operators

S1.3. - Incentives for conversion from thermal to electric for riders with special attention to the scooter category

S1.4. - Agreements with food delivery companies for free electric vehicle recharging

S1.5. - Incentive on scrapping in switching to electric vehicles

S1.6. - Agreements with the public administration to ensure the protection of dedicated parking spaces for the disabled and temporary stops for deliveries



S1.1. - Equitable and widespread food accessibility in spatial terms (distribution) economic and quality
S1.2. - Identification of urban areas with greater commercial vocation and more attractive in terms of services (neighbourhood markets, streets with greater presence of neighbourhood stores, but also streets on which there are services of first necessity such as post offices, public offices, schools) on which to carry out useful interventions to improve the conditions of summer comfort and usability even in the hottest days (e.g.

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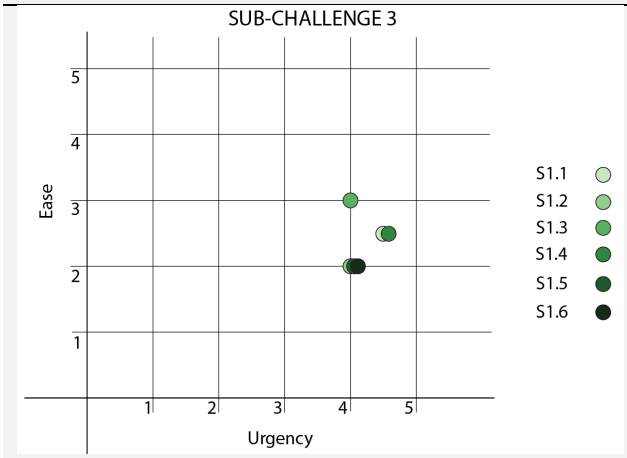
shading, installation of fountains, green areas, furniture)

S1.3. - Adjustment of the hours of commercial establishments and basic public services (e.g. changing the opening and closing times in summer)



S1.1. – Pocket parks, regeneration of interlocking urban spaces

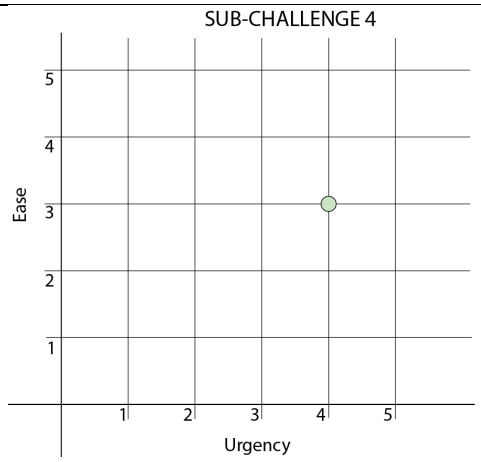
S1.2. – Organization of courses for repairing vehicles

S1.3. – Green and blue infrastructure integrated with neighbourhood markets

S1.4. – Protection and shading systems where possible with pergolas

S1.5. -_SH instance: redefine roadway space with predominance of spaces for pedestrians, bikes and local public transportation

S1.6. - Instance from Vulnerable Groups: Urban Safety: Improve the condition of the urban environment to ensure that individuals in fragile categories can carry out their daily activities with the freedom of choice. Create a detailed, comprehensive map that identifies the categories of fragile autonomy and clearly defines which categories require intervention.



S1.1. - Implementation of policies favoring natural commercial centers

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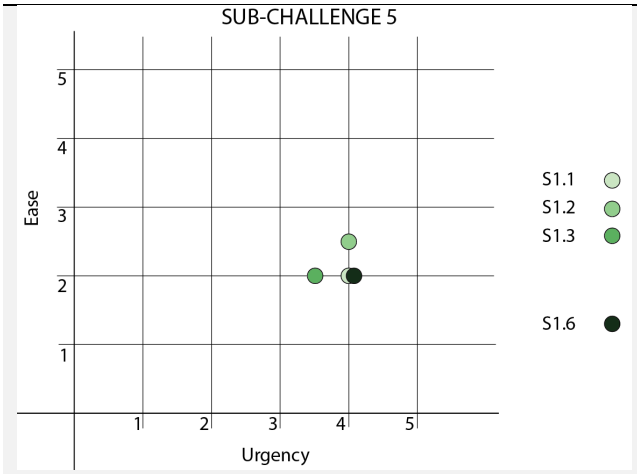
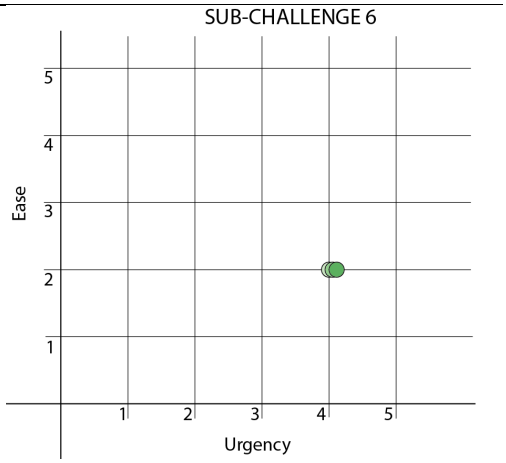


S1.1. - Pathways protected from a microclimatic point of view

S1.2. - Incentives for the creation of small, multipurpose commercial establishments, i.e., with the integration of proximity services in small towns and less populated hamlets, e.g., through the provision of publicly owned spaces/buildings, tax breaks or other forms of economic incentives, promotion of public-private agreements

S1.3. - Ease of access promoted by optimizing the distribution of goods and services ; ease of access promoted through dedicated pavements

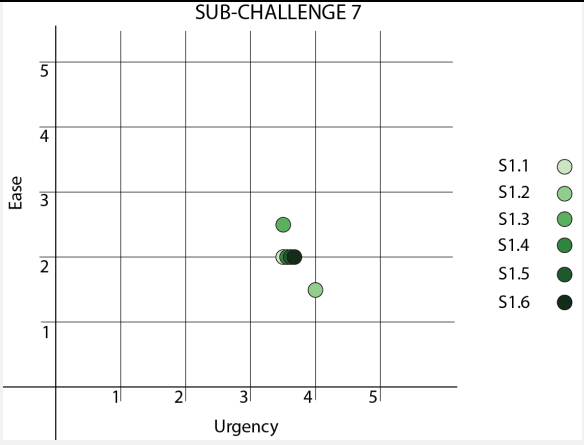
S1.6. - Knowledge transfer - Social involvement of the disabled person in activities useful to society

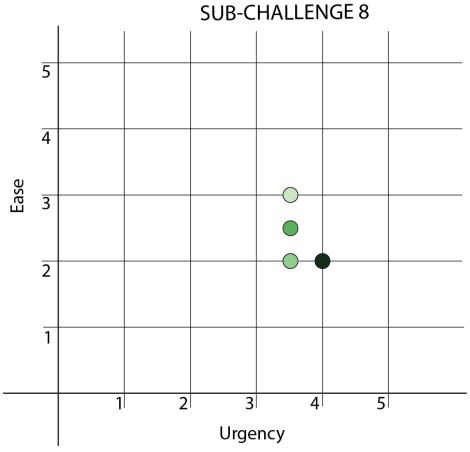


S1.1. - Widespread application of NBS policies and techniques with an emphasis on green ones

S1.2. - Promote the spread of green infrastructure and bioclimatic solutions in buildings through incentives and urban planning, including green walls and roofs, bioclimatic greenhouses, the use of cool materials, and other climate change strategies.

S1.3. - Knowledge transfer on green management and management of existing urban components (hard engineering + soft engineering)





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S1.1. - Appropriate policies in proximity to areas experienced by children and families: management of dedicated public space also in terms of services, with smart solutions to support specific needs in terms of mobility

S1.2. - Agreements with those directly involved in distribution

S1.3. - Increasing the frequency of buses (and streetcars) on main lines and creating more bike lanes (protected from oncoming traffic and ensuring adequate separation from the road)

S1.4. - Interventions to moderate private traffic; infrastructural equipment useful for the safety of bicycle and pedestrian traffic (overpasses or underpasses, signage, etc.) video-monitored bicycle parking lots

S1.5. - Design of waiting areas for public transportation with seating and shade structures

S1.6. - Digital platforms to increase the use of public transportation or to identify the safest bicycle routes

S1.1. - Build adapted housing solutions for individuals living alone, which can help address social isolation by dedicating a portion of social expenditure. These should not be residential social assistance schemes (RSAs) but single apartments with shared common areas and services.

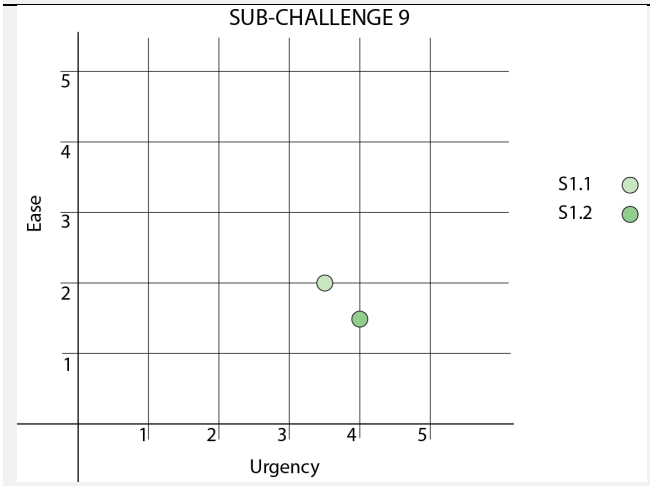
S1.2. - Adapt proximity services based on the location of these structures (see solution 1)

S1.3. - Tax incentive operations dedicated to facilities that can accommodate Co-housing (i.e superbonus)

S1.4. - Make mobility policies more sensitive to the issue of project of life + enforcement of **reasonable accommodation** regulations

S1.5. - Transfer of co-housing living experiences to elderly and disabled people, define trial periods in dedicated facilities

S1.6. - Organizing events to foster intergenerational exchange



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S1.1. - Creation of safe routes to promote inter-vehicle exchange, and safety in existing bike lanes
S1.2. - Organize gastronomic workshops to exchange traditional culinary practices and promote cross-cultural gastronomic exchanges. More broadly, host events that encourage intergenerational exchange

3.6.6 Target groups engagement assessment

The workshop demonstrated several strengths, including high participation levels, with a peak attendance of 28 participants representing various sectors such as public administration, NGOs, academia, and private organizations. The diversity of stakeholders contributed to a broad range of perspectives, ensuring comprehensive discussions. Additionally, the workshop's focus on critical challenges, including heatwaves, urban pollution, and the needs of vulnerable populations like the elderly and disabled, underscored its relevance. The preparatory matrix, developed through prior collaborations with stakeholders, was fully implemented and facilitated the workshop's objectives effectively.

However, some weaknesses were noted. Key stakeholders from public administration, NGOs, and other sectors were unable to attend due to scheduling conflicts or resource constraints. This limited the inclusion of certain perspectives, particularly from vulnerable groups and youth organizations. Feedback from the workshop highlighted the high level of awareness among participants regarding climate challenges. To address gaps in participation, follow-up one-to-one meetings were conducted with absent stakeholders, ensuring their input was still considered. The absence of some key organizations, however, pointed to the need for better scheduling and coordination in future activities to enhance stakeholder involvement.

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3.7 Brașov (RO)

3.7.1 Target Groups engaged

3.7.1.1 Living Lab participants

Living Lab Challenge: Water scarcity (special focus on drought)

The LL in Brașov, engaged a diverse range of stakeholders, ensuring representation from public administration, academia, NGOs, and private sector entities. A total of 24 participants actively participated in the workshop, representing various sectors across all target groups as described in D1.7:

Regions (TG1)

Representatives included individuals from the following institutions:

- Brașov City Hall
- Râșnov City Hall
- Ghimbav City Hall
- Romania Water Company – Brasov Branch
- Environmental Protection Agency
- National Agency for Protected Areas
- Kronstadt Forestry Company
- National Agency for Land Improvements
- Inspectorate for Emergency Situations
- Department of Social Assurance Brașov
- Water Company Brașov
- Metropolitan Agency for Sustainable Development Brașov
- County Departments of Statistics Brașov
- Agency for Sustainable Development in Brașov County (ADDJB)

Communities (TG2)

Representatives included individuals from the following institutions:

- National Council of college students – Brașov
- Agency for Energy Management and Environmental Protection
- WWF
- PROPARK

Industry (TG3)

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- No representatives from TG3.

Research and Academia (TG4)
Representatives included individuals from the following institutions:

- University Transilvania of Brașov, Faculty of Design and Environment
- University Transilvania of Brașov, Faculty of Nouriture and Tourism
- University Transilvania of Brașov, Faculty of Forestry
- National Center for Cartography
- National Institute for Research and Development in Forestry – ICAS
- National Meteorological Administration

Policymakers (TG5)

- No representatives from TG5.

Participants engaged actively in discussions, and the group division ensured a balanced perspective between sectors and genders. Facilitators and recorders ensured the smooth operation of the workshop, managing group dynamics and recording contributions effectively. Figure 24 presents the Living Lab that took place in Brasov.

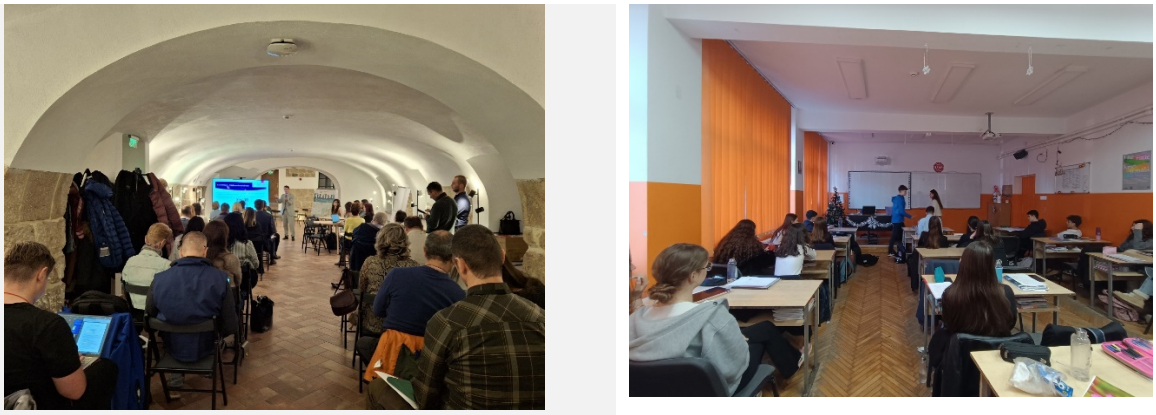

Figure 24. Living Lab in Brasov

3.7.1.2 Missing participants and notes

Despite efforts to include a wide array of stakeholders, several key organizations were absent due to resource constraints or lack of interest in the project. Notable absences included:

- **Public administration:** County Council Brașov, Săcele Hall, and other municipal bodies.

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- **Health and education sectors:** Public Health Department, Brașov Clinical Hospital for Pneumophthisiology, and the Students Association of University Transilvania Brașov.
- **NGOs:** Red Cross Brașov and Smart City Brașov.

Limited staff and scheduling conflicts were the primary reasons for non-attendance. Separate activities were planned to address the concerns of vulnerable groups and youth organizations that could not attend the workshop.

3.7.1.3 Engagement of vulnerable communities

Special attention was given to the inclusion of vulnerable communities [see D1.7] such as elderly individuals, disabled people, and youth. Although their direct participation in the workshop was limited, their needs were integrated into the discussions through proxy inputs provided by relevant representatives (e.g., Department of Social Assurance Brașov). Additional sessions with these groups were planned for December and January to collect more comprehensive insights.

3.7.2 Target groups perceptions on climate change risks,

The workshop facilitated comprehensive discussions to identify and address climate change risks, drivers, solutions, and barriers in the Brașov Metropolitan Region. Below are the detailed findings. The challenge of the LL was Water scarcity (special focus on drought). Figure 25 provides the PESTLE wheels from Brașov CSA.

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Figure 25. PESTLE Wheels for Brașov

The LL in Brașov identified 26 risks connected to climate change, emphasizing the multi-dimensional impact of these challenges.

Political risks:

1. Increasing pressure to promote policies involving more responsible water management.
2. Increasing the risk of protests.

Economic risks

3. Decrease in the profitability of agricultural activities (including costs), including the risk of bankruptcy for local farmers.
4. Decrease in attractiveness of the area for winter sports.
5. Decreasing the region's attractiveness for investments.
6. Increasing the costs of living (including food, water, energy).
7. Developing new socioeconomic activities (e.g., drilling wells)

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Social risks:

8. Impact on population health (e.g. diseases related to dehydration or poor hygiene).
9. Emergence of new pests and diseases.
10. Limiting access to drinking water (including drinking water) because of water availability, price and quality.
11. Impacting food security and increasing poverty risk.
12. Reducing well-being and quality of life.
13. Increasing the sedentariness (because of restrictions related to mobility, especially in the heat waves period)
14. Increasing the number of people vulnerable to water scarcity.

Technological risks:

15. Increasing the need to promote technologies to reduce water consumption and losses.
16. Increasing interest in improving and expanding water supply networks to reduce water losses and ensure water security.
17. Increasing interest in stocking rainwater.

Legal risks:

18. Increasing environmental crimes (e.g. use of water in different activities without legal agreement).

Environmental risks:

19. Drying up of rivers or reduction in water flow (groundwaters were also considered)
20. Increased risk of trees drying out.
21. Decrease in air quality (especially particle pollution, decreasing air humidity).
22. Impacting the quality of green areas.
23. Increasing the impact of urban heat island.
24. Degradation of wilderness (e.g. species extinction, habitat degradation, ecosystem change, new species including invasive ones and changes in phenology of plants).
25. Increasing fire risk.
26. Soil degradation.
27. Impacting water quality.
28. Impacting the quality of vegetation and wild animals (including extinction of species).
29. Increasing the interest in Genetically Modified Organism, more resilient to conditions of stress
30. Decreasing the quality of natural and agricultural resources (e.g., wood, food, water)

Concerning the *vulnerable communities*, three additional risks were identified: i) increasing the number of people vulnerable to water scarcity. ii) increasing the costs of life (including food, water,

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energy) and iii) limiting the access to drinking water (including vulnerable groups) because of water availability, price, and quality (include also the risk of water rationalization).

3.7.3 Climate change risks and associated drivers

After identifying the risks, the LL in Brașov identified 17 key drivers contributing to the region's climate risks. These drivers reflect systemic issues across political, economic, social, technological, legal, and environmental dimensions.

❖ **Political drivers and their associated risks:**

D1. Lack of coherent drought management strategies in forestry and agriculture

Associated risks:

- Increased droughts are directly affecting food security.
- The drying of trees is exacerbated by the absence of forestry-specific drought mitigation measures.
- Increased droughts increase the risk of fire.

D2. High delays in political decisions

Associated risks:

- Delays in policy implementation discourage investment in the region, impacting economic growth.
- Environmental crimes flourish in the absence of timely and decisive regulatory interventions.

❖ **Economic drivers and their associated risks:**

D3. Limited availability of funds for investments in new technology

Associated risks:

- Limited funds for new technology can reduce water access for vulnerable groups and increase the risk of rationing.
- Efforts to promote water-saving technologies are hindered by inadequate financial resources.
- Lack of investment in technology can allow illegal irrigation and other environmental crimes to deplete water resources.

D4. Increased water consumption from tourism activities

Associated risks:

- Higher seasonal demand for water by tourists exacerbates scarcity for local populations.

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- Increased water consumption from tourism drives the need to improve and expand water supply networks to prevent losses and ensure security.
- Higher water consumption from tourism strains water resources, leading to potential contamination and a decline in water quality.

D5. Development of agricultural activities

Associated risks:

- The development of agricultural activities increases pressure to implement policies that promote more responsible water management to ensure sustainability and prevent overuse.
- The expansion of agriculture increases competition for water, further impacting profitability.
- Food security is threatened by overextension of agricultural water usage.

❖ **Social drivers and their associated risks:**

D6. High number of residents using their own water supply sources

Associated risks:

- Population health is at risk due to inconsistent access to clean and reliable water sources.
- A high number of residents using their own water supply can reduce wellbeing and quality of life due to inconsistent access and potential contamination.
- When many residents rely on their own water sources, it can negatively impact water quality due to lack of proper treatment and monitoring.

D7. Low level of education and awareness of the population regarding hazards

Associated risks:

- Protests and social unrest are more likely when communities lack understanding of resource management challenges.
- Low education and awareness about environmental hazards lead to activities that degrade habitats, cause species extinction, and introduce invasive species.

D8. Increased household water consumption

Associated risks:

- Increased household water consumption reduces wellbeing and quality of life by straining resources and raising costs.
- It increases the need to promote technologies that minimize water consumption and prevent losses.

D9. Increasing number of inhabitants and households in Brașov Metropolitan Region

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Associated risks:

- The growing population in Brașov limits water access for vulnerable groups, raising prices and increasing the risk of rationing.
- More inhabitants in Brașov lead to increased environmental crimes, like illegal water use for irrigation.

❖ **Technological drivers and their associated risks:**

D10. Water losses from the network

Associated risks:

- Water losses from the network increase pressure to adopt policies for more responsible water management.
- Water losses highlight the need to promote technologies that reduce water consumption and losses.

D11. Low water storage capacity during periods of excess

Associated risks:

- Low water storage capacity during excess periods increases living costs, including food, water, and energy.
- Low water storage capacity increases the need to promote technologies that reduce water consumption and losses.
- Infrastructure deficiencies necessitate interest in expanding water storage capabilities.

D12. Existing technologies and best practices that could encourage new approaches

Associated risks:

- No risks were identified.

D13. Decreasing capacity of Lake Săcele to store water due to clogging

Associated risks:

- Clogging reduces the reservoir's capacity to mitigate river flow variability.
- Decreasing capacity of Lake Săcele to store water due to clogging impacts water quality by limiting filtration and increasing contamination risks.
- Wetlands and freshwater ecosystems suffer as key reservoirs fail to maintain hydrological balance.

❖ **Legal drivers and their associated risks:**

D14. Deficient legislative framework promoting restrictive measures for water resources management.

Associated risks:

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- A deficient legislative framework for water management increases pressure to implement policies for more responsible resource use.
- Inadequate regulations can lead to the emergence of new pests and diseases by disrupting ecosystems and water quality.

D15. Low institutional capacity to manage illegal water extraction and discharge.
Associated risks:

- Low institutional capacity to manage illegal water extraction increases the risk of protests due to public dissatisfaction.
- It limits access to drinking water for vulnerable groups, affecting availability, price, quality, and raising the risk of rationing.

D16. Urban planning deficiencies, including maintaining soil permeability.
Associated risks:

- Urban planning deficiencies, including poor soil permeability, decrease the area's attractiveness for winter sports due to altered landscapes.
- Soil degradation accelerates as impermeable surfaces dominate urban landscapes.
- Urban planning deficiencies lead to the loss of wetlands and freshwater ecosystems by disrupting natural water flow and drainage.

D17. Low level of sanctions for environmental crimes
Associated risks:

- Low sanctions for environmental crimes increase the risk of protests due to public frustration over inadequate enforcement and damage to the environment.

❖ **Environmental drivers and their associated risks:**

D18. Increasing air temperature and variability of rainfall
Associated risks:

- Increasing air temperature and rainfall variability impact population health by raising the risk of dehydration-related diseases and poor hygiene.
- Air quality declines as temperature fluctuations exacerbate particle pollution.
- Urban heat island effects intensify, compounding heat stress in urban areas.
- Rising air temperatures and reduced rainfall increase the risk of fires due to drier conditions.

3.7.4 Adaptation and Mitigation solutions identified by target groups

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The LL in Brașov identified a comprehensive set of A&M solutions designed to address the region's climate-related challenges. These solutions aim to reduce risks, address drivers, and promote resilience. The A&M solutions identified were connected to the risks and drivers.

Political A&M solutions

1. Improving the monitoring of natural water resources:

   - **Addresses risks:**
     Increasing pressure to promote policies that involve more responsible water management,
     Decrease in the profitability of agricultural activities (including costs).
   - **Targets drivers:**
     Lack of coherent drought management strategies in the forestry and agricultural sectors,
     Limited availability of funds for investments in new technology (including irrigation).
   - **Associated barriers:**
     Political: Limited collaboration between different stakeholders.
     Social: Insufficiently trained human resources.

2. Promoting a public strategy for managing water resources under severe drought:

   - **Addresses risks:**
     Decrease in attractiveness of the area for winter sports, decreasing the region's attractiveness for investments.
   - **Targets drivers:**
     Lack of coherent drought management strategies in the forestry and agricultural sectors,
     Limited availability of funds for investments in new technology (including irrigation).
   - **Associated barriers:**
     Political: Resources management not sufficiently based on scientific evidence.
     Legal: Low level of acceptance of restrictive solutions in society.
     Environmental: Informal use of water resources.

3. Fostering institutional collaboration and common policies:

   - **Addresses risks:**

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Decreasing the region's attractiveness for investments.

- **Targets drivers:**
  High delays in political decisions.
- **Associated barriers:**
  Political: Conflicting political interests.
  Economic: Low number of companies that trade new technologies.
  Environmental: Non-compliance with urban planning regulation.

4. Implementing adequate management systems (ISO 14064):

- **Addresses risks:**
  Increasing pressure to promote policies that involve more responsible water management.
- **Targets drivers:**
  Limited availability of funds for investments in innovative technology (including irrigation).
- **Associated barriers:**
  Political: Informality in the decision-making processes.

5. Implementing the CSRO directive for sustainability:

- **Addresses risks:**
  Increasing pressure to promote policies that involve more responsible water management.
- **Targets drivers:**
  Limited availability of funds for investments in innovative technology (including irrigation).
- **Associated barriers:**
  Political: Resources management not sufficiently based on scientific evidence.
  Social 1: Low level of environmental awareness related to droughts (risks, drivers, adaptation alternatives).
  Social 2: Citizen and institutions environmental responsibility.

Economic A&M solutions

6. Accessing funding for reducing exposure to climate risks:

- **Addresses risks:**

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Limiting access to drinking water (including for vulnerable groups) because of water availability, price, and quality (including also the risk of water rationalization).

- **Targets drivers:**
  Limited availability of funds for investments in innovative technology (including irrigation).
- **Associated barriers:**
  Economic 1: Competition between traditional solutions and innovative ones.
  Economic 2: Funds scarcity (covering different sectors).
  Technological: High price of new technologies.

7. Experimenting with new agricultural crops of low water consumption (including greenhouses):

- **Addresses risks:**
  Impacting food security.
- **Targets drivers:**
  Development of agricultural activities.
- **Associated barriers:**
  Social: Consumption patterns (including the existing mentalities and behaviours related to natural resources use).
  Environmental: Missing detailed information related to natural resources.

8. Eliminating the unrestricted use of groundwater and surface water by residential and agricultural activities and introducing water metering for all users.

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  No drivers were targeted.
- **Associated barriers:** No associated barriers were identified.

Social A&M solutions

9. Awareness of authorities and users about water management:

- **Addresses risks:**
  Increasing the costs of living (including food, water, energy), increasing the need to promote technologies to reduce water consumption and losses, increasing

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environmental crimes (e.g., use of water in different activities without legal agreement - irrigation).

- **Targets drivers:**
  Increased water consumption from tourism activities, Low institutional capacity to manage problems related to illegal water extraction and illegal discharge.
- **Associated barriers:**
  Political 1: Informality in the decision-making processes.
  Political 2: Limited collaboration between different stakeholders.
  Social 1: Difficulty in influencing the tourism behaviours.
  Social 2: Citizen and institutions environmental responsibility.

10. Developing sustainability-oriented training programs for public servants and staff in private companies:

- **Addresses risks:**
  Increasing the need to promote technologies to reduce water consumption and losses.
- **Targets drivers:**
  Low level of education and awareness of the population regarding hazards.
- **Associated barriers:**
  Political: Resources management not sufficiently based on scientific evidence.
  Social: Low level of environmental awareness related to droughts (risks, drivers, adaptation alternatives).
  Technological: Low capacity to use new technologies.
  Legal: Low level of acceptance of restrictive solutions in society.

11. Changes in the health system for risks related to drought:

- **Addresses risks:**
  Reducing wellbeing and quality of life, Increasing the impact of urban heat island.
- **Targets drivers:**
  Increasing air temperature and variability of rainfall.
- **Associated barriers:**
  Economic: Funds scarcity (covering different sectors).
  Social: Citizen and institutions environmental responsibility.

12. Promoting water savings:

- **Addresses risks:**

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Increasing the need to promote technologies to reduce water consumption and losses, increasing interest in stocking rainwater.

- **Targets drivers:**
  Increased water consumption from tourism activities, High number of residents using their own water supply sources, Water losses from the network.
- **Associated barriers:**
  Social 1: Consumption patterns (including the existing mentalities and behaviours related to natural resources use).
  Social 2: Difficulty in influencing the tourism behaviours.
  Environmental: Informal use of water resources.

13. Diversification of water supply resources:

- **Addresses risks:**
  Increasing interest in improving and expanding water supply networks to reduce water losses and ensure water security, increasing environmental crimes (e.g. use of water in different activities without legal agreement - irrigation).
- **Targets drivers:**
  High delays in political decisions, development of agricultural activities.
- **Associated barriers:**
  Economic: Competition between traditional solutions and innovative ones.
  Technological: Outdated technologies.

14. Developing social services for vulnerability situations:

- **Addresses risks:**
  Limiting the access to drinking water (including for vulnerable groups) because of water availability, price, and quality (include also the risk of water rationalization), reducing wellbeing and quality of life, increasing the number of people vulnerable to water scarcity.
- **Targets drivers:**
  High number of residents using their own water supply sources.
- **Associated barriers:**
  Political: Informality in the decision-making processes.

Technological A&M solutions

15. Increased access to public water system:

- **Addresses risks:**

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Increasing the costs of living (including food, water, energy), increasing interest for improving and expanding water supply networks to reduce water losses and ensure water security.

- **Targets drivers:**
  High number of residents using their own water supply sources, Increasing number of inhabitants and households in the Brașov Metropolitan Region.
- **Associated barriers:**
  Social: Consumption patterns (including the existing mentalities and behaviors related to natural resources use).

16. Developing support systems for local crises involving water and food shortages:

- **Addresses risks:**
  Increasing the risk of protests, impact on population health (e.g. diseases related to dehydration or poor hygiene), drying up of rivers or reduction in water flow.
- **Targets drivers:**
  Low level of education and awareness of the population regarding hazards, low water storage capacity during periods of excess.
- **Associated barriers:**
  Legal: Latent legislative framework.

17. Promoting NBS (e.g., artificial wetlands, green areas, trees):

- **Addresses risks:**
  Degradation of the wilderness (e.g. species extinction, habitat degradation, ecosystem change, new species, including invasive ones).
- **Targets drivers:**
  Urban planning (including maintaining areas with soil permeability).
- **Associated barriers:**
  Economic: Land ownership restrictions.

18. Promoting smart irrigation systems:

- **Addresses risks:**
  Drying up of rivers or reduction in water flow.
- **Targets drivers:**
  Water losses from the network.
- **Associated barriers:**
  Economic: Competition between traditional solutions and innovative ones.

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19. Improving wastewater treatment process:

- **Addresses risks:**
  Impact on population health (e.g. diseases related to dehydration or poor hygiene), soil degradation, impacting water quality.
- **Targets drivers:**
  Increasing number of inhabitants and households in the Brașov Metropolitan Region,
  Low institutional capacity to manage problems related to illegal water extraction and illegal discharge,
  Low level of sanctions related to environmental crimes.
- **Associated barriers:**
  Technological: Outdated technologies.
  Environmental: Informal wastewater discharges.

20. Promoting technologies with reduced resource consumption (including water recirculation):

- **Addresses risks:**
  Emergence of new pests, diseases.
- **Targets drivers:**
  Increased household water consumption.
- **Associated barriers:**
  Environmental: Informal use of water resources.

21. Diversification of energy production to reduce the dependence on hydroelectric power:

- **Addresses risks:**
  No risks were addressed.
- **Targets drivers:**
  No drivers were targeted.
- **Associated barriers:** No associated barriers were identified.

Legal A&M solutions

22. Improving urban planning:

- **Addresses risks:**
  Impacting the quality of green areas.

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- **Targets drivers:**
  High delays in political decisions, Increased household water consumption.
- **Associated barriers:**
  Social: Insufficiently trained human resources.
  Environmental: Non-compliance with urban planning regulation.

23. Promoting legislation including the risks and water access for vulnerable groups:

- **Addresses risks:**
  Decrease in air quality (especially particle pollution), Increasing the risk of fire.
- **Targets drivers:**
  Low level of education and awareness of the population regarding hazards,
  Low level of sanctions related to environmental crimes.
- **Associated barriers:**
  Legal 1: Low level of acceptance of restrictive solutions in society.
  Legal 2: Latent legislative framework.

Environmental solutions

24. Expansion of existing green areas:

- **Addresses risks:**
  Impacting the quality of green areas, Losing wetlands and freshwater ecosystems.
- **Targets drivers:**
  Urban planning (including maintaining areas with soil permeability).
- **Associated barriers:**
  Environmental: Non-compliance with urban planning regulation.

25. Reducing the crops and species with high water consumption:

- **Addresses risks:**
  Degradation of the wilderness (e.g., species extinction, habitat degradation, ecosystem change, new species, including invasive ones).
- **Targets drivers:**
  Deficient legislative framework in promoting restrictive measures related to water resources management.
- **Associated barriers:**
  Economic: Land ownership restrictions.

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26. Increasing the capacity of stocking water resources:

- **Addresses risks:**
  Increasing interest in stocking rainwater, drying up of rivers or reduction in water flow.
- **Targets drivers:**
  Low water storage capacity during periods of excess, decreasing capacity of Lake Săcele to store water due to clogging.
- **Associated barriers:**
  Political: Conflicting political interests.
  Economic: Low number of companies that trade new technologies.

27. Protecting wetlands and water bodies:

- **Addresses risks:**
  Increased risk of trees drying,
  Degradation of the wilderness (e.g. species extinction, habitat degradation, ecosystem change, new species, including invasive ones), losing wetlands and freshwater ecosystems.
- **Targets drivers:**
  Low water storage capacity during periods of excess, urban planning (including maintaining areas with soil permeability).
- **Associated barriers:**
  Environmental 1: Informal wastewater discharges.
  Environmental 2: Non-compliance with urban planning regulation.

Concerning *vulnerable communities*, three mitigation solutions were identified: developing social services for vulnerable situations, creating support systems for local crises involving water and food shortages, and promoting legislation that addresses the risks and water access for vulnerable groups.

3.7.5 Solutions prioritisation

Participants prioritised solutions based on ease of implementation, urgency, and importance. Measures like promoting water-saving practices, protecting wetlands, and improving wastewater treatment received high scores across all criteria. The prioritisation exercise underscored the need for immediate and scalable actions, such as:

- Awareness campaigns for water management.

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- Enhanced access to public water systems.
- Legislative reforms to secure water access for vulnerable communities.

The prioritization process used Google Forms and paper questionnaires. Participants scored each solution on a 1-to-5 scale based on ease of implementation, urgency, and importance, resulting in visual graphs that guided discussions. Figures 26-30 show in a graphical way the outputs of the prioritization solutions.

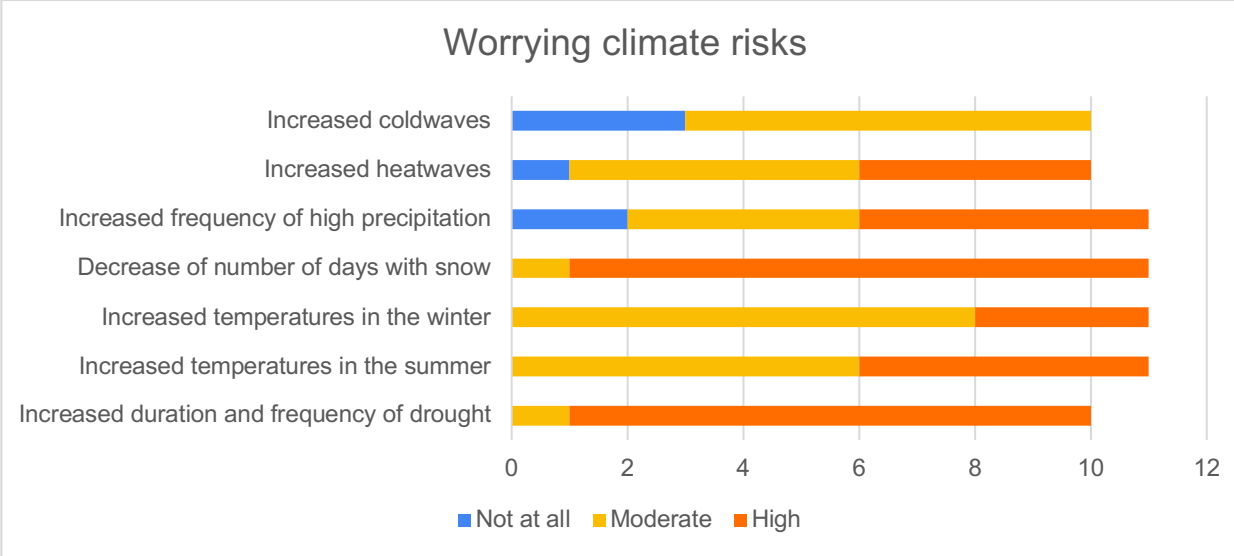

Figure 26. Worrying climate risks (Brasov)

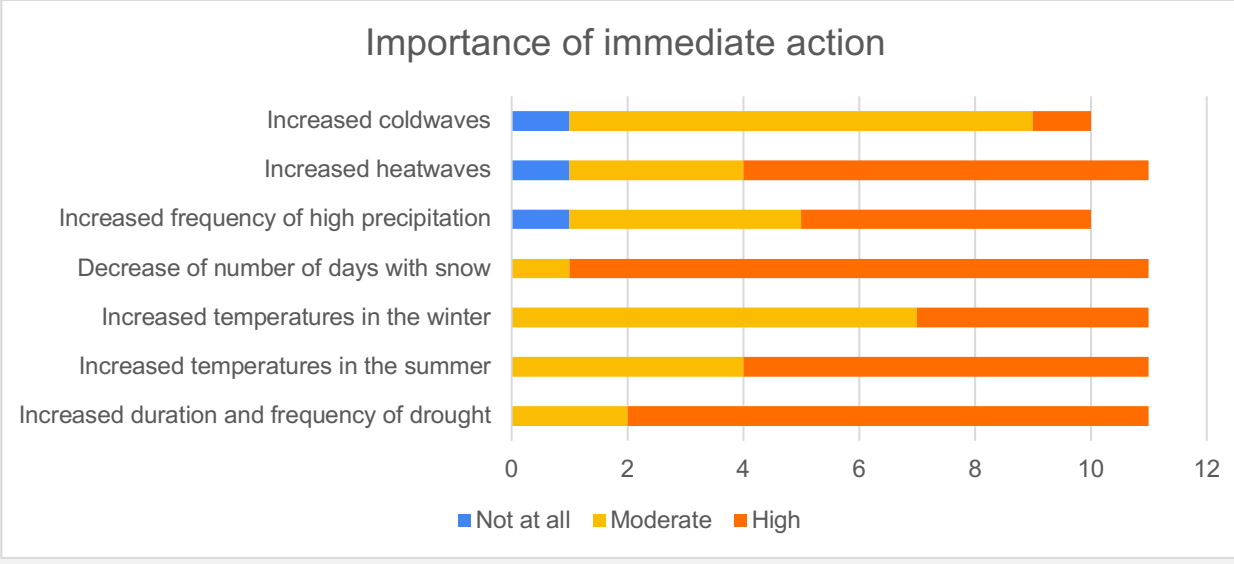

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Figure 27. Importance of immediate action (Brasov)

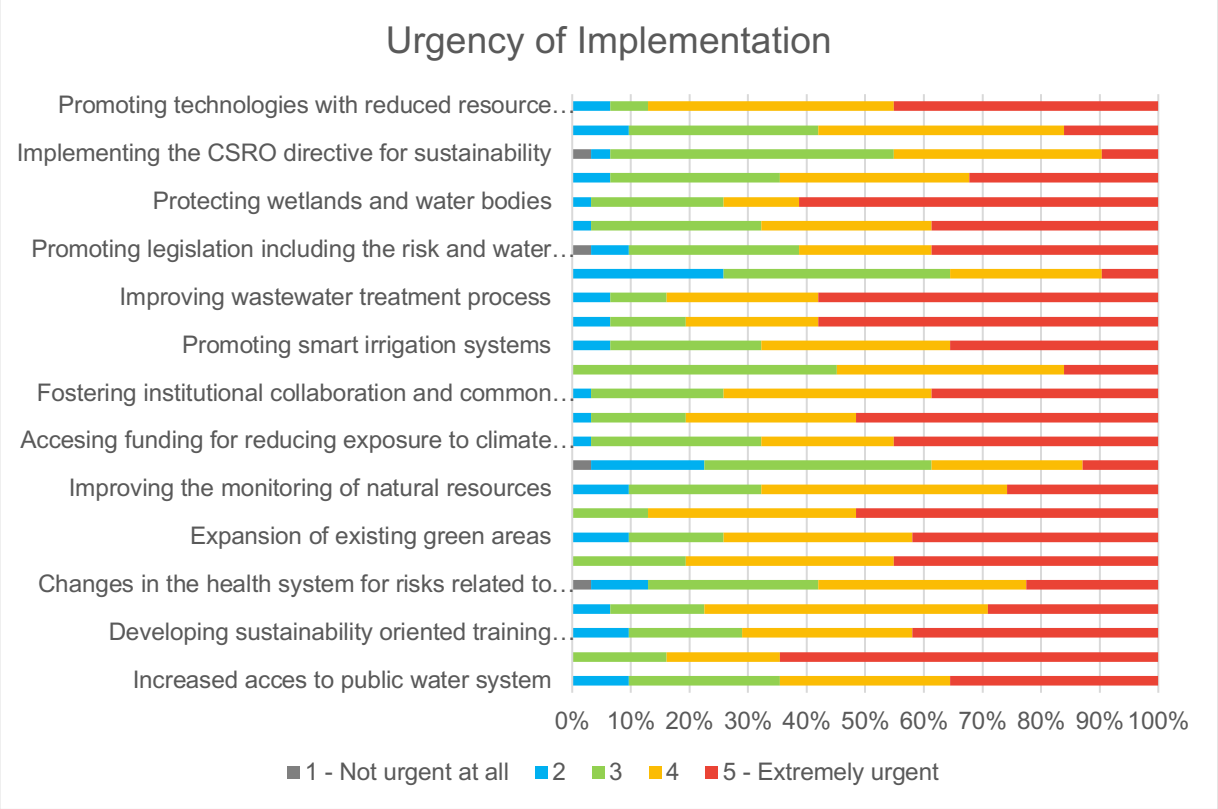

Figure 28. Urgency of implementation (Brasov)

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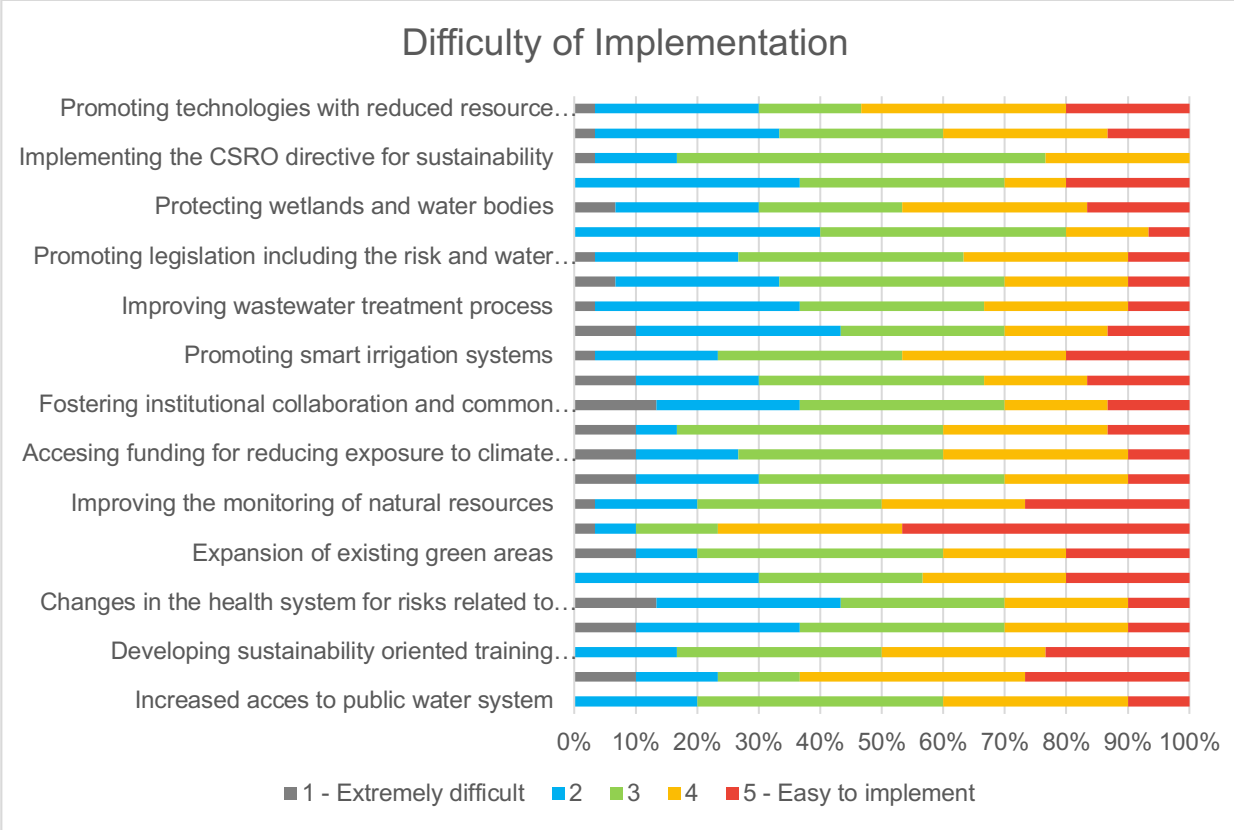

Figure 29. Difficulty of implementation (Brasov)

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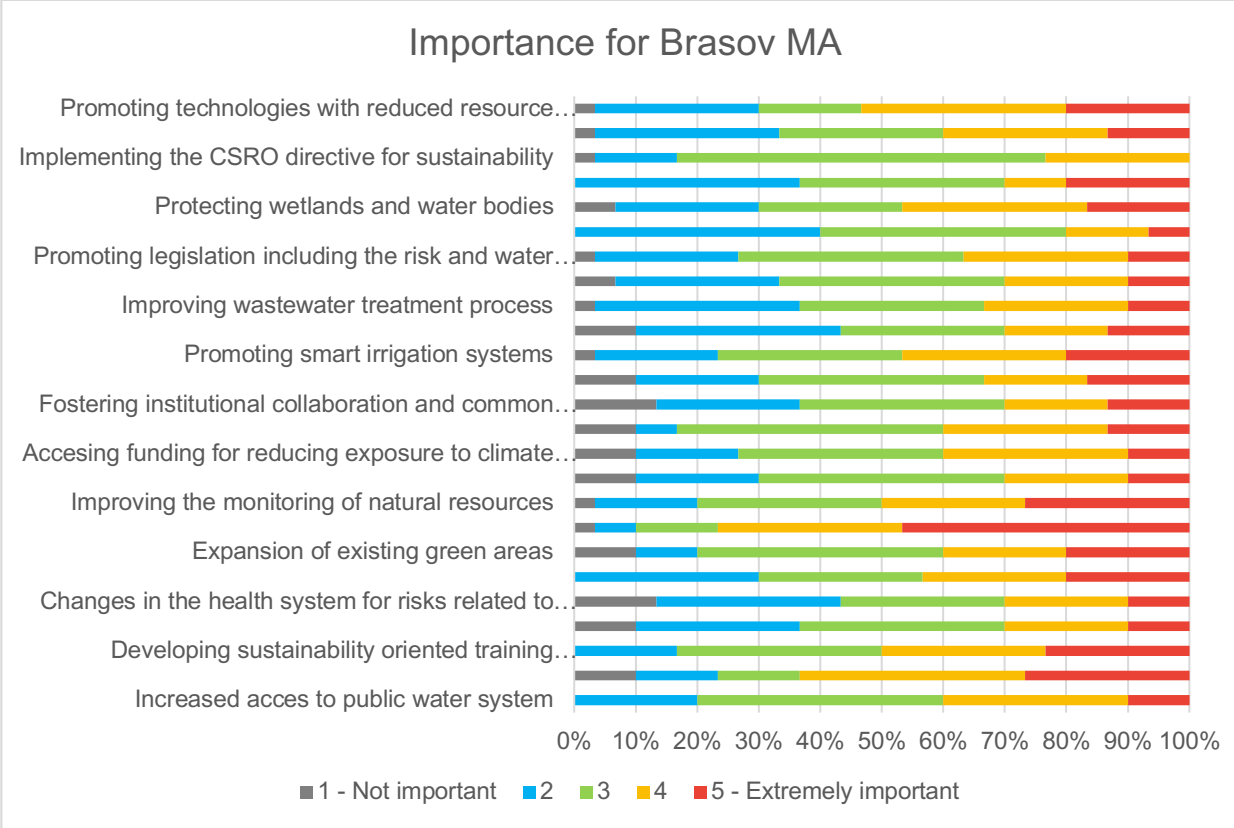

Figure 30. Importance for Brasov MA (Brasov)

3.7.5.1 Additional outputs (if any)

On 28 January 2025, a meeting was held at the Center for Older People Brașov (Căminul pentru Persoane Vârstnice Brașov – Strada Gladiolei 4) to discuss climate change and its impact on vulnerable groups. The meeting was attended by 32 participants, aged between 66 and 84 years, along with three administrative staff members. Two-thirds of the participants were women, and 12 individuals actively contributed to the discussion. The session lasted 50 minutes and followed a structured format, involving specific questions and responses. The discussions were highly constructive, highlighting past climatic events, confirming the presence of climate change in the Brașov metropolitan region, and reviewing historical risks and adaptive approaches. Participants emphasized the degradation of natural resources, its impact on human health and well-being, and identified key climate variables that have undergone significant changes. The meeting provided valuable insights and potential solutions to address these challenges.

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On 29 January 2025, a meeting was held at High College Meșotă to discuss climate risks and adaptation measures with youth. The event was attended by 101 students (aged 16-17) and seven teachers, consisting of four activities coordinated by two facilitators. A young person with autism actively contributed to the discussion, particularly regarding A&M solutions. Each activity lasted 50 minutes and followed a structured format, using a PowerPoint presentation to highlight key questions and encourage responses. The discussions were highly engaging, with detailed insights into drought risks and mitigation measures, as well as challenges in distinguishing risks from their underlying drivers. Participants focused on social, economic, and technological solutions, with the content of each discussion shaped by the specific academic profiles of the groups (socio-economy, mathematics, humanities, and health sciences). The meeting was productive, reflecting the students' deep engagement and diverse perspectives on climate challenges.

On January 29, 2025, an online meeting was held with one farmer representing the region, one planner, and three representatives from Brașov City Hall. The 90-minute discussion focused on the connection between drought and agriculture, providing valuable insights into the challenges farmers face. The farmer highlighted that the past four years have been particularly difficult due to water scarcity, leading to increased crop management costs. A key issue raised was the limited government support, which is typically provided at the end of the year, making financial planning difficult and favoring large-scale farmers. Droughts also significantly impact animal husbandry, doubling the cost of animal feed in winter and reducing milk production by 30% for sheep and 15% for cows. Additionally, water scarcity near grazing areas reduces profitability, necessitating costly transportation or pumping solutions. To mitigate these issues, the farmer proposed reducing pasture rent during drought years, shifting subsidy payments to the beginning of the year, and investing in water accessibility technologies. In the Brașov metropolitan area, changing crop patterns—such as replacing sugar beet and potatoes with corn—have attracted wild animals like wild boars, bears, and beavers, leading to increased agricultural damage. Another concern is the shift in land use in periurban areas, where traditional gardens are being replaced with water-intensive lawns, further straining groundwater resources. The farmers suggested implementing household water metering to regulate consumption. Poor local infrastructure management exacerbates water issues, as the Land Improvement Agency has not invested in maintaining or improving agricultural land, resulting in clogged drainage channels, non-functional irrigation systems, and a lack of rainwater storage strategies. The meeting was highly constructive, providing crucial recommendations to enhance water resource management and support farmers in adapting to drought conditions.

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3.7.6 Target groups engagement assessment

The engagement of target groups in Brașov was assessed as generally positive, with a few areas for improvement:

- Strengths: The diversity of participants enriched discussions and facilitated a comprehensive understanding of climate challenges. The structured approach, including group activities and digital tools, ensured balanced participation and robust outputs.
- Weaknesses: Some groups, particularly youth and women, reported feeling overshadowed during discussions, highlighting the need for more inclusive facilitation techniques. Additionally, the absence of key stakeholders in health, education, and governance sectors created gaps in the overall engagement process.

Overall, the LL workshop successfully fostered a collaborative environment and produced actionable recommendations, setting a strong foundation for future activities in the Brașov Metropolitan Region.

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3.8 Birmingham (UK)

3.8.1 Target groups engaged

3.8.1.1 Living Lab participants

Living Lab Challenge: *Surface water flooding and extreme heat*

The LL in Birmingham, engaged a diverse range of stakeholders, ensuring representation from public administration, academia, NGOs, and private sector entities. A total of 26 participants actively participated in the workshop, representing various sectors across all target groups identified in D1.7:

Regions (TG1)
Representatives included individuals from the following institutions:

- Birmingham City Council – Transport
- West Midlands Combined Authority
- Local Resilience Forum
- Birmingham City Council – Public Health

Communities (TG2)
Representatives included individuals from the following institutions:

- Civic Square
- ClimateEd – youth education charity
- Birmingham TreePeople
- Birmingham Voluntary Services Council
- Birmingham and Black Country Wildlife Trust
- City of Nature

Industry (TG3)
Representatives included individuals from the following institutions:

- Severn Trent Water

Research and Academia (TG4)
Representatives included individuals from the following institutions:

- University of Birmingham - Birmingham Institute of Forest Research (BIFoR)
- Met Office

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- University of Birmingham
- University of Birmingham - Resilient Systems and Climate Action Research Group (RSCA) x2
- Centre of Urban Wellbeing
- Birmingham City University
- University of Birmingham – West Midlands Net Zero
- Birmingham Institute Sustainability and Climate Action (BISCA)

Policymakers (TG5)

- Urban Forest and Woodland Advisory Group
- Natural England

Youth representatives participated and showed to be interested to continue engagement, appreciative of the invitation to join. The youth showed active participation in small group activity, quieter in group discussion.

3.8.1.2 Missing participants and notes

Despite efforts to include a wide array of stakeholders, several key organizations were absent due to resource constraints or lack of interest in the project. Notable absences included:

- **Public administration:** West Midlands Combined Authority Transport for West Midlands,
- **Private companies:** University of Birmingham – Business Engagement, Sustainability West Midlands and Kier Group.
- **NGOs:** Birmingham Open Spaces Forum
- **Policy:** Environment Agency
- Last minute change of plans was the primary reason for non-attendance.

3.8.1.3 Engagement of vulnerable communities

Vulnerable communities [see D1.7] were represented by two representatives of Civic Square, ClimateEd, Birmingham TreePeople, and the Birmingham Voluntary Services Council. Of the stakeholders who did not attend, the Birmingham Open Spaces Forum was the only organization explicitly identified as representing vulnerable communities. However, they did not participate in the LL.

3.8.2 Target groups perceptions on climate change risks,

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The LL in Birmingham focused on two challenges: Surface Water Flooding and Extreme Heat. Introductory talks delivered by representatives of the Birmingham City Council and the West Midlands Combined Authority described what is happening already regionally and locally in terms of adaptation. There was consensus in the group that the two climate hazards facing the city of Birmingham are surface water flooding and extreme heat. Throughout the workshop the fact that climate change impacts will be felt more severely in communities with the highest levels of deprivation was at the forefront of discussion. Figure 31 presents Birmingham's PESTLE wheel.

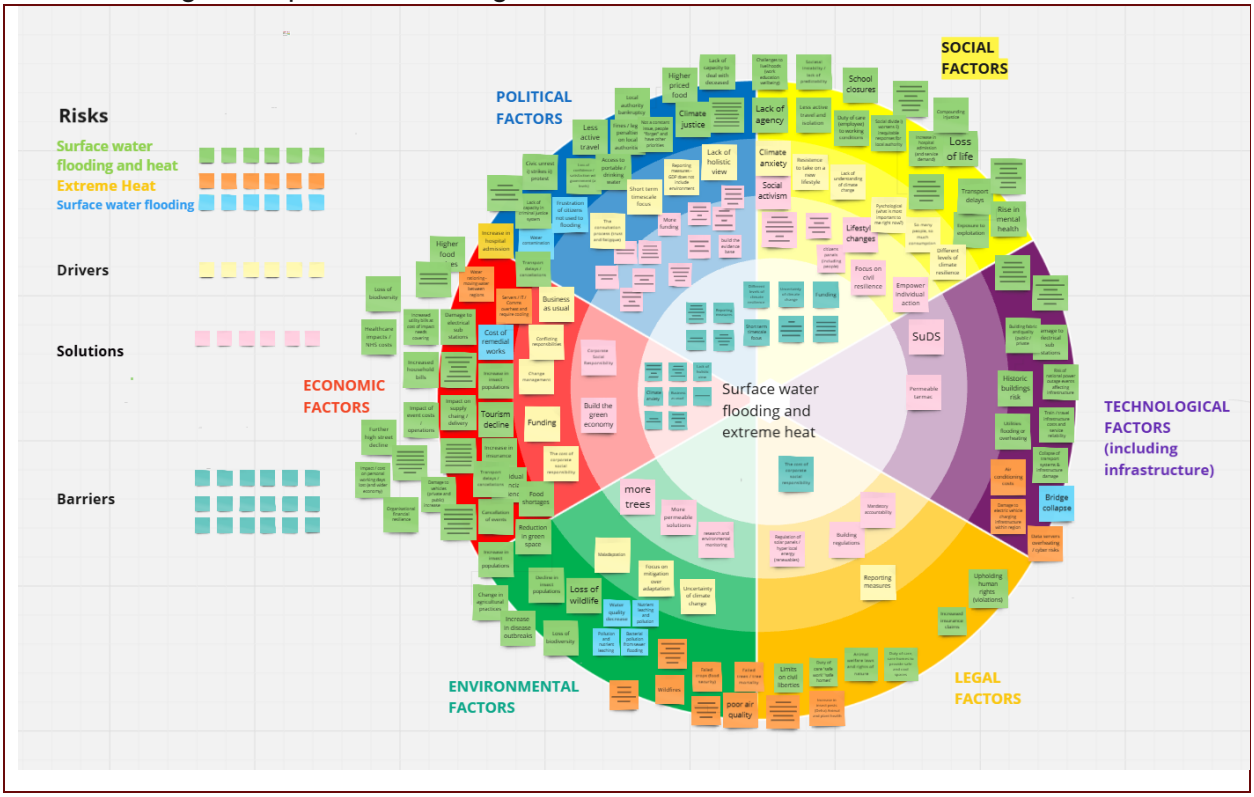

Figure 31. PESTLE Wheel for Birmingham

In total 97 risks were written on post-it notes, 15 related specifically to just extreme heat [EH] and 8 to surface water flooding [SWF]. The remaining post-it notes contained risks identified as related to both extreme heat and surface water flooding. Some of these 97 post-it notes contain duplicate risks, as the risks relate to more than one section of the PESTLE wheel, for example, damage to electrical substations was recorded as both a 'Technological and Infrastructure Risk' and an 'Economic Risk.'

Political risks:

1. Less active travel [SWF and EH]
2. Local authority bankruptcy [SWF and EH]

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3. Higher priced food [SWF and EH]
4. Lack of capacity to deal with the deceased [SWF and EH]
5. Frustration of citizens not used to flooding [SWF]
6. Civic unrest (strikes/protests) [SWF and EH]
7. Fines/legal penalties on local authorities [SWF and EH]
8. Access to resources and authoritative levers to create the SuDS / solutions to protect people's homes / infrastructure. Land being private / public [SWF and EH]
9. Lack of capacity in the criminal justice system [SWF and EH]
10. Loss of confidence/satisfaction with government (all levels) [SWF and EH]
11. Increase in hospital admissions [EH]
12. Access to portable/drinking water [SWF and EH]
13. Water contamination [SWF]
14. Not a constant issue, people "forget" and have other priorities [SWF and EH]
15. Climate justice [SWF and EH]
16. Transport delays/cancellations [SWF and EH]
17. Access to education i) school, ii) college, iii) higher education [SWF and EH]

Economic risks:

18. Increased household bills [SWF and EH]
19. Firefighting - too much focus / spend on emergency response than strategic planning [SWF and EH]
20. Damage to electrical substations [SWF and EH]
21. Loss of biodiversity [SWF and EH]
22. Further high street decline [SWF and EH]
23. Tourism decline [SWF and EH]
24. Extrematisation of gender / ecological climatic conditions outside of economy is economic risk ultimately [SWF and EH]
25. Disproportionate impact on those in poverty [SWF and EH]
26. Impact on supply chain / delivery [SWF and EH]
27. Increase in insect populations [SWF and EH]
28. Transport delays/cancellations [SWF and EH]
29. Cost of remedial works [SWF]
30. Healthcare impacts/ National Health Service (NHS) costs [SWF and EH]
31. Increased utility bills at cost of impact needs covering [SWF and EH]
32. Impact / cost on personal working days lost (and wider economy) [SWF and EH]
33. Increased design costs / adaptation including nature-based solutions e.g. project costs [SWF and EH]
34. Servers / IT / comms overheat and require cooling [EH]
35. Water rationing - moving water between regions [EH]
36. Impact of event costs / operations [SWF and EH]

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37. Increase in insurance costs [SWF and EH]
38. Individual financial resilience [SWF and EH]
39. Organizational financial resilience [SWF and EH]
40. Damage to vehicles (private and public) increases costs [SWF and EH]
41. Lack of long-term funding constraints (encourages short term decision making / business case analyses) [SWF and EH]
42. Cancellation of events [SWF and EH]
43. Food shortages [SWF and EH]
44. Higher food prices [SWF and EH]

Social risks:

45. Loss of life [SWF and EH]
46. Societal instability/lack of predictability [SWF and EH]
47. Disproportionate impact for vulnerable people (health, disabled, economic) [SWF and EH]
48. Duty of care (employee) to working conditions [SWF and EH]
49. Increase in hospital admissions (and service demand) [SWF and EH]
50. Challenges to livelihoods (work, education, wellbeing) [SWF and EH]
51. Less active travel and isolation [SWF and EH]
52. Rise mental health [SWF and EH]
53. Transport delays [SWF and EH]
54. Social divide i) worsens ii) inequitable responses for local authority [SWF and EH]
55. School closures [SWF and EH]
56. Lack of agency [SWF and EH]
57. Exposure to exploitation [SWF and EH]
58. Compounding injustice [SWF and EH]
59. Damage to transport (public and private) increases social isolation [SWF and EH]
60. Higher priced food - global food baskets challenges and local wages stagnation [SWF and EH]

Technological risks:

61. Collapse of transport systems and infrastructure damage [SWF and EH]
62. Train/Travel infrastructure costs and service reliability [SWF and EH]
63. Damage to electric vehicle charging infrastructure within region [EH]
64. Damage to electrical substations [SWF and EH]
65. Social and community centre closures impacting the people that they support [SWF and EH]
66. Air conditioning costs [EH]
67. Data servers overheating/cyber risks [EH]
68. Risk of national power outage events affecting infrastructure [SWF and EH]

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69. Bridge collapses [SWF and EH]
70. Building fabric and quality (public / private) [SWF and EH]
71. Healthcare infrastructure barriers and challenges (what does this mean?) [SWF and EH]
72. Historic buildings risk [SWF and EH]
73. Utilities flooding or overheating [SWF and EH]

Legal risks:

74. Increased insurance claims [SWF and EH]
75. Increased pressure on court service, police etc. (heat creates unrest, violence) [EH]
76. Increase in insect pests (Defra) Animal and plant health [EH]
77. Upholding human rights (violations) [SWF and EH]
78. Limits on civil liberties [SWF and EH]
79. Animal welfare laws and rights of nature [SWF and EH]
80. Duty of care 'safe work' 'safe homes' [SWF and EH]

Environmental risks:

81. Reduction in green space [SWF and EH]
82. Greater water uses with drought (water resource impact) [EH]
83. Failed crops (food security) [EH]
84. Failed trees / tree mortality [EH]
85. Water quality decreases [SWF]
86. Change in agricultural practices [SWF and EH]
87. Loss of wildlife [SWF and EH]
88. Nutrient leaching and pollution [SWF]
89. Pollution and nutrient leaching [SWF]
90. Bacterial pollution from sewer flooding [SWF]
91. Increase in insect populations [SWF and EH]
92. Wildfires [EH]
93. Survival of invasive non-native species (INNS) [EH]
94. Increase in disease outbreaks [SWF and EH]
95. Decline in insect populations [SWF and EH]
96. Poor air quality [EH]
97. Drought impacting people, wildlife, and fish [EH]
98. Loss of biodiversity [SWF and EH]

Vulnerable communities face significant challenges during climate hazards, as highlighted in the discussions. Upholding civil rights is critical, as these groups often experience a worsening social divide and are disproportionately impacted by school closures, which can result in lost income and difficulties with homeschooling due to technological poverty. Close-knit communities may

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intuitively support elderly and disabled members during such events, offering lessons that others could learn from. However, reliance on public transport makes these communities more susceptible to isolation when transport is disrupted or community centers close. Many people work in service-based roles requiring in-person presence, limiting their ability to adapt to disruptions compared to those in white-collar jobs. The cost-of-living crisis already strains these families, making it harder to access essentials like bottled water during water contamination events. Additionally, finding safe spaces becomes a challenge if their homes are damaged, especially for larger families facing disease outbreaks. Poor air quality further exacerbates their vulnerabilities, highlighting the need for tailored interventions to support these groups during climate crises. Figure 32 presents risks for surface water flooding and extreme heat for Birmingham.

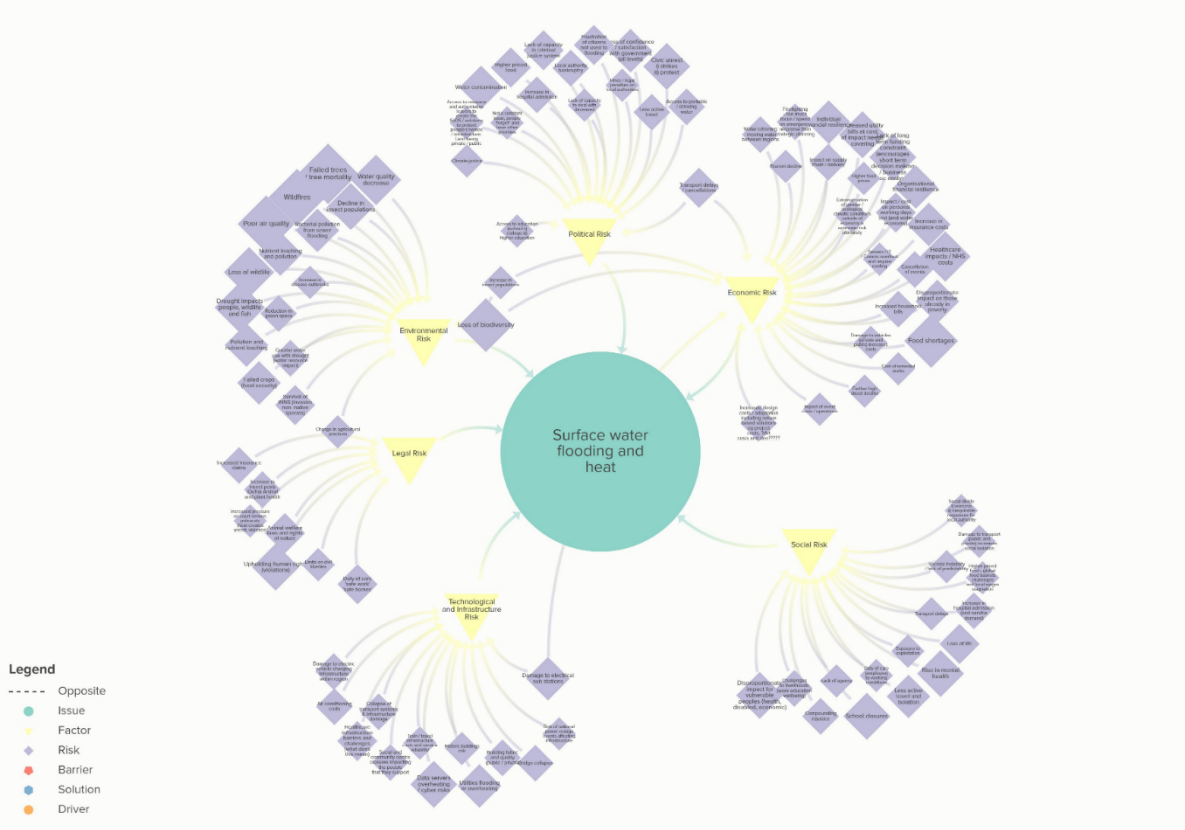

Figure 32. Kumu board for risks in Birmingham

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3.8.3 Climate change Risks and associated Drivers

After identifying the risks, the LL in Birmingham identified 25 key drivers contributing to the region's climate risks. These drivers reflect systemic issues across political, economic, social, technological, legal, and environmental dimensions.

❖ **Political drivers and their associated risks:**

D1. Politicians wishing to stay in power.

Associated risks:

- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)
- Climate justice

❖ **Economic drivers and their associated risks:**

D2. Cost of public services and Voluntary Commuity Faith and Social Enterprise (VCFSC) austerity NHS costs

Associated risks:

- Increased pressure on court service, police etc. (heat creates unrest, violence)
- Social and community centre closures impacting the people that they support.
- Healthcare infrastructure barriers and challenges (what does this mean)
- Historic buildings risk.
- Loss of life
- Societal Instability / lack of predictability
- Disproportionate impact for vulnerable people (health, disabled, economic)
- Duty of care (employee) to working conditions
- Increase in hospital admission (and service demand)
- Challenges to livelihoods (work education wellbeing)
- Less active travel and isolation
- Rise in mental health
- Transport delays
- Social divide i) worsens ii) inequitable responses for local authority.
- School closures
- Lack of agency
- Exposure to exploitation
- Compounding injustice
- Damage to transport (public and private) increases social isolation.
- Higher priced food - global food baskets challenges and local wages stagnation
- Local authority bankruptcy
- Lack of capacity to deal with the deceased
- Frustration of citizens not used to flooding.

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- Civic unrest i) strikes ii) protest.
- Fines / legal penalties on local authorities
- Lack of capacity in criminal justice system
- Loss of confidence / satisfaction with government (all levels)
- Increase in hospital admission.
- Access to education i) school, ii) college, iii) higher education
- Firefighting - too much focus / spend on emergency response than strategic planning.
- Further high street decline
- Tourism decline
- Disproportionate impact on those already in poverty
- Healthcare impacts / NHS costs
- Impact / cost on personal working days lost (and wider economy)
- Individual financial resilience
- Organisational financial resilience
- Lack of long-term funding constraint (encourages short term decision making / business case analyses)
- Cancellation of events

D3. Expectation of business as usual - imperative of work

Associated risks:

- All risks

D4. Supply chain and "just in time" delivery / expectations.

Associated risks:

- Higher priced food - global food baskets challenges and local wages stagnation
- Higher priced food
- Loss of confidence / satisfaction with government (all levels)
- Further high street decline
- Impact on supply chain / delivery
- Impact of event costs / operations
- Cancellation of events
- Food shortages
- Higher food prices
- Disproportionate impact on those already in poverty

D5. Globalisation

Associated risks:

- All risks

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❖ **Social drivers and their associated risks:**

D6. Not everyone has a voice.

Associated risks:

- Disproportionate impact for vulnerable people (health, disabled, economic)
- Challenges to livelihoods (work/ education/ wellbeing)
- Rise in mental health
- Social divide i) worsens ii) inequitable responses for local authority.
- Exposure to exploitation
- Compounding injustice

D7. Not everyone knows they need to have a voice.

Associated risks:

- Societal instability / lack of predictability
- Disproportionate impact for vulnerable people (health, disabled, economic)
- Frustration of citizens not used to flooding.
- Social divide i) worsens ii) inequitable responses for local authority.
- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)
- Not a constant issue, people "forget" and have other priorities.
- Individual financial resilience

D8. Environmental justice

Associated risks:

- Disproportionate impact for vulnerable people (health, disabled, economic)
- Rise in mental health
- Social divide i) worsens ii) inequitable responses for local authority.
- Exposure to exploitation
- Compounding injustice
- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)

D9. Misinformation and disinformation

Associated risks:

- Societal instability / lack of predictability
- Rise in mental health
- Social divide i) worsens ii) inequitable responses for local authority.
- Exposure to exploitation
- Lack of agency
- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)

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D10. Two-tiered responses

Associated risks:

- Peoples (health, disabled, economic)
- Rise in mental health
- Social divide i) worsens ii) inequitable responses for local authority.
- Exposure to exploitation
- Compounding injustice
- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)

D11. Historic inequity

Associated risks:

- Disproportionate impact for vulnerable people (health, disabled, economic)
- Rise in mental health
- Social divide i) worsens ii) inequitable responses for local authority.
- Exposure to exploitation
- Compounding injustice
- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)

❖ **Technological drivers and their associated risks:**

D12. No redundancy (infrastructure failure)

Associated risks:

- All Technological and Infrastructure Risks
- Increased insurance claims
- Increased pressure on court service, police etc. (heat creates unrest, violence)
- Upholding human rights (violations)
- Limits on civil liberties
- Duty of care, 'safe work' 'safe homes'

D13. No systems thinking.

Associated risks:

- Collapse of transport systems & infrastructure damage
- Train / travel infrastructure costs and service reliability
- Data servers overheating / cyber risks
- Transport delays
- Healthcare impacts / NHS costs
- Increased design costs / adaptation including nature-based solutions e.g., project costs,

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- Servers / IT / Comms overheat and require cooling.

D14. Technology cannot replace people.
Associated risks:
- infrastructure damage
- Train / travel infrastructure costs and service reliability
- Data servers overheating / cyber risks
- Transport delays
- Healthcare impacts / NHS costs
- Increased design costs / adaptation including nature-based solutions e.g. project costs
- Servers / IT / Comms overheat and require cooling.

D15. Lack of regulation / legislation not fit for purpose.
Associated risks:
- All risks

D16. Overreliance on technology and increased demand
Associated risks:
- Data servers overheating / cyber risks
- Risk of national power outage events affecting infrastructure
- Disproportionate impact for vulnerable peoples (health, disabled, economic)
- Servers / IT / Comms overheat and require cooling.
- Cost of remedial works
- Healthcare impacts / NHS costs

D17. Deregulation and privatisation
- All risks

❖ **Legal drivers and their associated risks:**

D18. Lack of accountability
Associated risks:
- All risks

D19. Short-termism
Associated risks:
- All risks

D20. Lack of governance of climate hazard and leadership
Associated risks:

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- All risks

❖ **Environmental drivers and their associated risks:**

D21. Material in / ventilation / insulation

Associated risks:

- Increased insurance claims
- Duty of care 'safe work'/ 'safe homes'
- Social and community centre closures impacting the people that they support.
- Air conditioning costs
- Building fabric and quality (public / private
- Historic buildings risk.
- Loss of life
- Disproportionate impact for vulnerable peoples (health, disabled, economic)
- Duty of care (employee) to working conditions
- Duty of care (employee) to working conditions
- Increase in hospital admission (and service demand)
- Challenges to livelihoods (work/education /wellbeing)
- School closures
- Loss of confidence / satisfaction with government (all levels)
- Increase in hospital admission.

D22. Continued reliance on fossil fuels.

Associated risks:

- All risks

D23. People (education and literacy)

Associated risks:

- Societal instability / lack of predictability
- Disproportionate impact for vulnerable peoples (health, disabled, economic)
- Social divide i) worsens ii) inequitable responses for local authority.
- Frustration of citizens not used to flooding.
- Civic unrest i) strikes ii) protest.
- Loss of confidence / satisfaction with government (all levels)
- Not a constant issue, people "forget" and have other priorities.
- Individual financial resilience

D24. Current and historic land management practices

Associated risks:

- Increased insurance claims
- Increase in insect pests (Defra) - animal and plant health.

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- Animal welfare laws and the rights of nature
- Higher priced food - global food baskets challenges and local wages stagnation
- Higher priced food
- Less active travel
- Frustration of citizens not used to flooding.
- Fines / legal penalties on local authorities
- Access to portable / drinking water
- Water contamination
- Loss of biodiversity
- Increase in insect populations.
- Increase in insurance costs.
- Individual financial resilience
- Organisational financial resilience
- Food shortages
- Higher food prices

D25. Emergency response resources / capability

Associated risks:

- Duty of care, 'safe work' 'safe homes'
- Increased insurance claims
- Loss of life
- Disproportionate impact for vulnerable peoples (health, disabled, economic)
- Increase in hospital admission (and service demand)
- Rise in mental health
- Increase in hospital admission.
- Frustration of citizens not used to flooding.
- Lack of capacity to deal with the deceased
- Civic unrest i) strikes ii) protest
- Loss of confidence / satisfaction with government (all levels)
- Access to portable / drinking water
- Cost of remedial works
- Healthcare impacts / NHS costs
- Increase in insurance costs.
- Disproportionate impact on those already in poverty

Discussions around *vulnerable communities* highlighted concerns about historic inequity and environmental justice, emphasizing how the costs of climate impacts are often passed onto everyone, but with disproportionate effects on those already disadvantaged. There was particular concern about the potential for a two-tiered response: one prioritizing wealthier areas with high-

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value properties, and another for less affluent communities. The conversations also underscored that not everyone has a voice or knows how to advocate for themselves, further exacerbating inequities.

3.8.4 Adaptation and Mitigation solutions identified by target groups

The LL in Birmingham identified a comprehensive set of A&M solutions designed to address the region's climate-related challenges, focusing on Surface Water Flooding and Extreme Heat. These solutions aim to reduce risks, address drivers, and promote resilience.

Political A&M solutions

1. More funding:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     All drivers
   - **Associated barriers:**
     Economic: Funding

2. Statutory responsibility for adaptation:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     Lack of accountability, short-termism,
     Lack of governance of climate hazard and leadership,
     No redundancy (infrastructure failure),
     No systems thinking, lack of regulation / legislation not fit for purpose,
     Over reliance on technology and increased demand,
     Environmental justice, expectation of business as usual - imperative of work,
     Supply chain and "just in time" delivery / expectations,
     Emergency response resources / capability
   - **Associated barriers:**

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Economic 1: Business as usual.
Economic 2: Change management.
Economic 3: Conflicting responsibilities.
Social 1: Lack of understanding of climate change.
Social 2: Different levels of climate resilience.

3. Green incentives for businesses:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     Lack of regulation / legislation not fit for purpose,
     Environmental justice,
     Historic inequity,
     Expectation of business as usual - imperative of work,
     Material in ventilation / insulation,
     Current and historic land management practices
   - **Associated barriers:**
     Economic 1: Business as usual.
     Economic 2: Conflicting responsibilities.
     Social 1: Lack of understanding of climate change.
     Social 2: Different levels of climate resilience.

4. Education skills and awareness raising:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     Lack of accountability,
     Short-termism,
     Lack of governance of climate hazard and leadership,
     No redundancy (infrastructure failure),
     No systems thinking, lack of regulation / legislation not fit for purpose,
     Not everyone has a voice,
     Not everyone knows they need to have a voice,
     Environmental justice,
     Misinformation and disinformation,
     Two-tiered responses,
     Historic inequity,

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Cost of public services and Voluntary Community Faith Social Enterprise (VCFSE) austerity NHS costs,
Expectation of business as usual - imperative of work,
Supply chain and "just in time" delivery / expectations, material in ventilation / insulation,
Continued reliance on fossil fuels, people (education and literacy),
Current and historic land management practices, emergency response resources / capability

- **Associated barriers:**
  Economic: Business as usual.
  Social 1: Resistance to take on a new lifestyle.
  Social 2: Climate anxiety.
  Social 3: Lack of understanding of climate change.
  Social 4: Different levels of climate resilience.
  Social 5: Psychological (what is most important to me right now?).
  Legal: Reporting measures.
  Environmental 1: Maladaptation.
  Environmental 2: Focus on mitigation over adaptation.

5. Accountability and skills:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Short-termism,
  Lack of governance of climate hazard and leadership,
  No redundancy (infrastructure failure),
  No systems thinking, lack of regulation / legislation not fit for purpose,
  Not everyone has a voice, not everyone knows they need to have a voice,
  Environmental justice,
  Misinformation and disinformation,
  Two-tiered responses, historic inequity,
  Cost of public services and Voluntary Community Faith Social Enterprise (VCFSE) austerity NHS costs,
  Expectation of business as usual - imperative of work,
  Supply chain and "just in time" delivery / expectations, material in ventilation / insulation, continued reliance on fossil fuels,
  People (education and literacy),
  Current and historic land management practices,

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Emergency response resources / capability,
Politicians wishing to stay in power, globalisation.

- **Associated barriers:** No associated barriers were identified.

6. Long-term pipeline not just a short-term injection:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     Short-termism,
     No systems thinking, lack of governance of climate hazard and leadership,
     Historic inequity, supply chain and "just in time" delivery / expectations,
     Continued reliance on fossil fuels,
     People (education and literacy),
     Current and historic land management practices,
     Emergency response resources / capability.
   - **Associated barriers:**
     Political 1: Reporting measures - GDP does not include environment.
     Political 2: Lack of holistic view.
     Political 3: Short term timescale focus.
     Economic: Funding.

7. Intergenerational approaches:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     Short-termism,
     No systems thinking,
     Lack of governance of climate hazard and leadership,
     Historic inequity, supply chain and "just in time" delivery / expectations,
     Continued reliance on fossil fuels,
     People (education and literacy),
     Current and historic land management practices,
     Emergency response resources / capability,
     Not everyone has a voice, not everyone knows they need to have a voice,
     Misinformation and disinformation.
   - **Associated barriers:** No associated barriers were identified.

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8. Build the evidence base:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     Lack of governance of climate hazard and leadership,
     No redundancy (infrastructure failure),
     No systems thinking, not everyone has a voice,
     Not everyone knows they need to have a voice,
     Not everyone has a voice, not everyone knows they need to have a voice,
     Historic inequity,
     Expectation of business as usual - imperative of work,
     Material in ventilation / insulation,
     Continued reliance on fossil fuels,
     People (education and literacy),
     Current and historic land management practices.
   - **Associated barriers:**
     Environmental 1: Maladaptation.
     Environmental 2: Uncertainty of climate change.

9. Co-benefits of mitigation and adaptation:

   - **Addresses risks:**
     All risks
   - **Targets drivers:**
     No systems thinking,
     Continued reliance on fossil fuels,
     Short-termism,
     Expectation of business as usual - imperative of work,
     Material in ventilation / insulation.
   - **Associated barriers:**
     Environmental: Focus on mitigation over adaptation.

10. Investment in public infrastructure:

    - **Addresses risks:**
      All risks
    - **Targets drivers:**
      Short-termism,

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Lack of governance of climate hazard and leadership,
No redundancy (infrastructure failure),
Environmental justice,
Historic inequity,
Two-tiered responses,
Cost of public services and Voluntary Community Faith Social Enterprise (VCFSE) austerity NHS costs,
Emergency response resources / capability,
People (education and literacy).

- **Associated barriers:** No associated barriers were identified.

11. Decentralisation and devolution:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability.
- **Associated barriers:** No associated barriers were identified.

12. Responsibility at all levels including citizens:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Not everyone has a voice,
  Not everyone knows they need to have a voice,
  Lack of governance of climate hazard and leadership.
- **Associated barriers:**
  Economic: Change management.
  Social: So many people, so much consumption.

Economic A&M solutions

13. Build the green economy:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Expectation of business as usual - imperative of work,

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Continued reliance on fossil fuels,
Current and historic land management practices.

- **Associated barriers:** No associated barriers were identified.

14. Corporate Social Responsibility:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Environmental justice, continued reliance on fossil fuels
- **Associated barriers:** No associated barriers were identified.

Social A&M solutions

15. Social activism:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Short-termism,
  Lack of governance of climate hazard and leadership.
- **Associated barriers:**
  Social: Psychological (what is most important to me right now?).

16. Citizens panels (including people):

- **Addresses risks:**
  Challenges to livelihoods (work education wellbeing),
  Civic unrest i) strikes ii) protest,
  Compounding injustice,
  Disproportionate impact for vulnerable peoples (health, disabled, economic),
  Exposure to exploitation,
  Frustration of citizens not used to flooding,
  Individual financial resilience,
  Loss of confidence / satisfaction with government (all levels),
  Not a constant issue,
  People "forget" and have other priorities,
  Political risk, rise in mental health,
  Social divide i) worsens ii) inequitable responses for local authority,
  Societal Instability / lack of predictability.

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- **Targets drivers:**
  Not everyone has a voice, not everyone knows they need to have a voice, people (education and literacy).
- **Associated barriers:**
  Political: The consultation process (trust and fatigue).

17. Empower individual action:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Short-termism,
  Lack of governance of climate hazard and leadership,
  Not everyone has a voice,
  Not everyone knows they need to have a voice,
  Misinformation and disinformation,
  Historic inequity,
  People (education and literacy).
- **Associated barriers:** No associated barriers were identified.

18. Individual accountability / making everyone see resilience as their responsibility:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Short-termism,
  Lack of governance of climate hazard and leadership,
  Not everyone has a voice,
  Not everyone knows they need to have a voice,
  Misinformation and disinformation,
  Historic inequity,
  People (education and literacy).
- **Associated barriers:**
  Economic: Business as usual.
  Social 1: So many people, so much consumption.
  Social 2: Lack of understanding of climate change.
  Social 3: Lack of understanding of climate change.

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Social 4: Different levels of climate resilience.

19. Lifestyle changes:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Short-termism,
  Lack of governance of climate hazard and leadership,
  Not everyone has a voice, not everyone knows they need to have a voice,
  Misinformation and disinformation,
  Historic inequity,
  People (education and literacy), continued reliance on fossil fuels.
- **Associated barriers:** No associated barriers were identified.

20. Focus on civil resilience:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Emergency response resources / capability,
  Historic inequity.
- **Associated barriers:** No associated barriers were identified.

21. Reduce per capita consumption of water:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Current and historic land management practices,
  Expectation of business as usual - imperative of work,
  Environmental justice.
- **Associated barriers:** No associated barriers were identified.

Technological A&M solutions

22. Sustainable Urban Drainage Systems (SuDS):

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- **Addresses risks:**
  Increased insurance claims,
  Increase in insect pests (Defra) Animal and plant health,
  Animal welfare laws and rights of nature,
  Higher priced food - global food baskets challenges and local wages stagnation,
  Higher priced food,
  Less active travel,
  Frustration of citizens not used to flooding,
  Fines / legal penalties on local authorities,
  Access to portable / drinking water,
  Water contamination,
  Loss of biodiversity,
  Increase in insect populations,
  Increase in insurance costs,
  Individual financial resilience,
  Organisational financial resilience,
  Food shortages,
  Higher food prices,
  Disproportionate impact for vulnerable peoples (health, disabled, economic),
  Rise in mental health,
  Social divide i) worsens ii) inequitable responses for local authority,
  Exposure to exploitation,
  Compounding injustice,
  Civic unrest i) strikes ii) protest,
  Loss of confidence / satisfaction with government (all levels).
- **Targets drivers:**
  Environmental justice,
  Historic inequity,
  Current and historic land management practices.
- **Associated barriers:** No associated barriers were identified.

23. <u>Permeable tarmac:</u>

- **Addresses risks:**
  Increased insurance claims,
  Increase in insect pests (Defra) Animal and plant health,
  Animal welfare laws and rights of nature,
  Higher priced food - global food baskets challenges and local wages stagnation,
  Higher priced food,
  Less active travel,

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Frustration of citizens not used to flooding,
Fines / legal penalties on local authorities,
Access to portable / drinking water,
Water contamination,
Loss of biodiversity,
Increase in insect populations,
Increase in insurance costs,
Individual financial resilience,
Organisational financial resilience,
Food shortages,
Higher food prices,
Disproportionate impact for vulnerable peoples (health, disabled, economic),
Rise in mental health,
Social divide i) worsens ii) inequitable responses for local authority,
Exposure to exploitation,
Compounding injustice,
Civic unrest i) strikes ii) protest,
Loss of confidence / satisfaction with government (all levels).

- **Targets drivers:**
  Environmental justice,
  Historic inequity,
  Current and historic land management practices.
- **Associated barriers:** No associated barriers were identified.

Legal A&M solutions

24. Regulation of solar panels / hyper local energy (renewables):

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Continued reliance on fossil fuels.
- **Associated barriers:** No associated barriers were identified.

25. Building regulations:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Material in / ventilation / insulation, continued reliance on fossil fuels.

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- **Associated barriers:** No associated barriers were identified.

26. Mandatory accountability:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of accountability,
  Short-termism,
  Lack of governance of climate hazard and leadership,
  No redundancy (infrastructure failure),
  No systems thinking,
  Lack of regulation / legislation not fit for purpose,
  Over reliance on technology and increased demand,
  Environmental justice,
  Expectation of business as usual - imperative of work,
  Supply chain and "just in time" delivery / expectations,
  Emergency response resources / capability.
- **Associated barriers:**
  Political: Reporting measures - GDP does not include environment.
  Economic 1: Change management.
  Economic 2: The cost of corporate social responsibility.
  Social: Psychological (what is most important to me right now?).
  Legal: Reporting measures.

Environmental solutions

27. More trees:

- **Addresses risks:**
  Increased insurance claims,
  Increase in insect pests (Defra) Animal and plant health,
  Animal welfare laws and rights of nature,
  Higher priced food - global food baskets challenges and local wages stagnation,
  Higher priced food,
  Less active travel,
  Frustration of citizens not used to flooding,
  Fines / legal penalties on local authorities, access to portable / drinking water,
  Water contamination,
  Loss of biodiversity,

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Increase in insect populations,
Increase in insurance costs,
Individual financial resilience,
Organisational financial resilience,
Food shortages,
Higher food prices,
Disproportionate impact for vulnerable peoples (health, disabled, economic),
Rise in mental health,
Social divide i) worsens ii) inequitable responses for local authority,
Exposure to exploitation,
Compounding injustice,
Civic unrest i) strikes ii) protest, loss of confidence / satisfaction with government (all levels).

- **Targets drivers:**
  Environmental justice,
  Historic inequity,
  Current and historic land management practices.
- **Associated barriers:** No associated barriers were identified.

28. Research and environmental monitoring:

- **Addresses risks:**
  All risks
- **Targets drivers:**
  Lack of governance of climate hazard and leadership,
  No redundancy (infrastructure failure),
  No systems thinking,
  Not everyone has a voice,
  Not everyone knows they need to have a voice,
  Not everyone has a voice,
  Not everyone knows they need to have a voice,
  Historic inequity,
  Expectation of business as usual - imperative of work,
  Material in ventilation / insulation,
  Continued reliance on fossil fuels,
  People (education and literacy), current and historic land management practices.
- **Associated barriers:**
  Political: Short term timescale focus.
  Environmental: Uncertainty of climate change.

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29. More permeable solutions:

- **Addresses risks:**
  Increased insurance claims,
  Increase in insect pests (Defra) Animal and plant health,
  Animal welfare laws and rights of nature,
  Higher priced food - global food baskets challenges and local wages stagnation,
  Higher priced food,
  Less active travel,
  Frustration of citizens not used to flooding,
  Fines / legal penalties on local authorities,
  Access to portable / drinking water,
  Water contamination, loss of biodiversity,
  Increase in insect populations,
  Increase in insurance costs,
  Individual financial resilience,
  Organisational financial resilience,
  Food shortages,
  Higher food prices,
  Disproportionate impact for vulnerable peoples (health, disabled, economic),
  Rise in mental health,
  Social divide i) worsens ii) inequitable responses for local authority,
  Exposure to exploitation,
  Compounding injustice,
  Civic unrest i) strikes ii) protest,
  Loss of confidence / satisfaction with government (all levels).
- **Targets drivers:**
  Environmental justice,
  Historic inequity,
  Current and historic land management practices.
- **Associated barriers:** No associated barriers were identified.

Discussions emphasized that *vulnerable communities* could benefit from the support of NGOs to empower individual action. However, as daily priorities often outweigh social activism, strategies to encourage activism must be carefully considered. Lifestyle changes, such as adopting "less is more" consumption habits to mitigate climate change, were proposed, but the messaging needs to be considerate of families that have worked hard to overcome poverty. An intergenerational approach to communication was also suggested, recognizing that a single method will not suit all audiences. he session, which concluded promptly before lunch, could have benefited from a more

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localized focus on Birmingham, nature-based solutions, and innovative adaptation engineering to better support the post-lunch activity.

Concerning vulnerable communities, it should **not** be presumed that vulnerable communities lack knowledge about climate change. However, not all individuals are willing to engage with the issue, as daily life pressures often take precedence, and additional eco-anxiety can deter further interest. Misinformation and inconsistent reporting measures also pose challenges to delivering clear and effective communication.

3.8.5 Solutions prioritisation

Participants prioritised solutions based on ease of implementation, urgency, and importance. Figure 33 and Table 8 present the solutions prioritisation of Birmingham. The axes show the sum of scores for each solution on a 1-to-5 scale (5=most urgent/easiest implementation).

Figure 33. Solutions prioritization (Birmingham)

Table 7. Solutions prioritization (Birmingham)

Prioritization of Solutions	Ease of implementation Total Number	Urgency Total number

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	[cumulative vote of all participants]	*[cumulative vote of all participants]*
Solution 1: Increase the evidence base	Ease: 1 Very easy / 2 / 3 / 4 / 5 Very difficult No of votes: 3 / 12 / 2 / 3 / 0	Urgency: 1 Not / 2 / 3 / 4 / 5 Very No of votes: 0 / 2 / 9 / 4 / 4
Solution 2: Education and awareness raising	Ease: 1 Very easy / 2 / 3 / 4 / 5 Very difficult No of votes: 3 / 4 / 7 / 6 / 1	Urgency: 1 Not / 2 / 3 / 4 / 5 Very No of votes: 0 / 0 / 1 / 4 / 15
Solution 3: Citizens panels / affording opportunities to give people a voice	Ease: 1 Very easy / 2 / 3 / 4 / 5 Very difficult No of votes: 2 / 3 / 9 / 2 / 4	Urgency: 1 Not / 2 / 3 / 4 / 5 Very No of votes: 0 / 4 / 7 / 6 / 4
Solution 4: Green incentives	Ease: 1 Very easy / 2 / 3 / 4 / 5 Very difficult No of votes: 2 / 6 / 3 / 7 / 1	Urgency: 1 Not / 2 / 3 / 4 / 5 Very No of votes: 0 / 0 / 1 / 5 / 13
Solution 5: Investment in public infrastructure	Ease: 1 Very easy / 2 / 3 / 4 / 5 Very difficult No of votes: 1 / 0 / 7 / 10 / 3	Urgency: 1 Not / 2 / 3 / 4 / 5 Very No of votes: 1 / 0 / 3 / 2 / 12
Vulnerable community inputs	In terms of education and ease, NGOs would find it easy to reach more people including vulnerable communities if they had more human resource so it is only easy if there is financial resource to support it – it is about scale. Education resources need to consider accessibility issues and language. Education could be achieved through employers in areas of high risk for flooding / heat to get employees ready for coping with disasters as part of a training program with packs to send home – 'thinking wider' how can we apply what is learnt at work to our home.	

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	While Citizen Panels have many positive features, they can't fully represent communities as only 20-30 people attend at one time, and it was questioned as to whether the panel members can be fully representative. However, to consult with the 1.1m population of Birmingham on "everything" is not plausible. The idea of Citizen Assemblies was then mentioned. The group struggled with the idea of 'Citizen Panels' as a solution as it is not explicit enough. The importance of choice of words and language in communication should not be underestimated.
Additional comments	Many delegates remarked that this task was difficult to undertake without further context about each of the solutions. We tried to pick out solutions from each of the PESTLE areas, however, in hindsight, to give this task more meaningful engagement it could have been better to identify some of the other solutions e.g. more trees, more SuDS.

3.8.6 Target groups engagement assessment

The workshop was overall a success. Despite some anticipated attrition ('no shows') for a free event, there was an adequate turnout and a good representation from the different CARMINE target groups. Delegates appreciated seeing 'new faces,' as they noted that at networking events, they often end up speaking with the same individuals.

Introductory presentations were delivered by Birmingham City Council and the West Midlands Combined Authority, outlining current regional and local adaptation efforts. These presentations were well-received but prompted audience questions, causing a delay in the first activity. Nevertheless, it was deemed important to allocate time for these questions and answers. There was general agreement among participants that surface water flooding and extreme heat are Birmingham's most pressing climate change hazards. Youth representatives expressed their enjoyment of the workshop. Although they participated actively in the small group activity and networking lunch, their contributions during the group discussions were more limited. A Mentimeter board was provided to allow written input during the discussions, but it was not used. In the future, team members could populate the board with initial contributions to encourage quieter participants to engage. NGO representatives were effective in voicing the concerns of vulnerable communities.

There was strong enthusiasm among participants to remain involved in the CARMINE project, including future workshops and the LL. There was also interest in the LL's international stakeholder hub, particularly in opportunities to connect with counterparts in other countries. The group discussions in the sessions on drivers, solutions, and barriers were fast-paced, making it challenging to capture all ideas. Having two facilitators take turns writing ideas on post-it notes worked relatively well. Conversations during the networking lunch were not formally recorded, as expected. Delegates expressed a desire to exchange contact information. A follow-up email will

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be sent to request permission to share email addresses. In conclusion, while some logistical challenges arose, the workshop was productive and well-received, with active participation and a shared commitment to the goals of the CARMINE project.

3.8.6.1 Additional outputs (if any)

General feedback on the Workshop

Overall, the workshop went well. Despite some attrition ('no shows') which had been anticipated for a free event, an adequate number of delegates and a good spread of representatives from the different CARMINE target groups attended. The delegates welcomed seeing 'new faces' as they explained that quite often at events that they talk to the same people.

Introductory talks delivered by Birmingham City Council and the West Midlands Combined Authority to describe what is happening already regionally and locally in terms of adaptation worked well. However, the presentations naturally led to questions from the audience and so there was a delay starting the first activity – however, the team felt it important to have time for the questions and answers. There were no objections to the view that the most challenging climate change hazards in Birmingham are surface water flooding and extreme heat.

The delegates invited to represent the 'youth voice' reported that they enjoyed the workshop very much, but despite active participation in the small group activity and networking lunch, their contributions were more limited during the group discussion. The facilitators offered a Mentimeter board for posting contributions to the discussion in writing, but no one took this up - perhaps next time some team members could start to populate the blank Mentimeter board with contributions to encourage quieter delegates to follow suit. The representatives of NGO's that were invited strongly represented the voice of vulnerable communities.

Overall, there was enthusiasm to stay engaged with the CARMINE project through the next few workshops and to be part of the LL. There was interest in the LL international stakeholder hub – particularly if there are potential opportunities to connect to people doing a similar job to themselves in another country.

The group discussion for the three sessions (drivers, solutions and barriers) was very fast paced. It was difficult to keep up with ideas but having two people to write down the ideas onto post it notes worked relatively well – the facilitators would take turns in capturing ideas. There were several conversations over the networking lunch which (rightly) were not captured. There was consensus that it would be good to share the email addresses of delegates so delegates can keep in touch - in a follow up email the delegates will be asked for permission to share their email address.

Even though the PESTLE wheel was printed as A0 there was little space for all the post it notes. The PESTLE wheel was placed on a movable screen and positioned as close to the audience as

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possible. However, despite using thick marker pens and standard sized post it notes it was still difficult for everyone to see the PESTLE wheel contents. It was not possible to draw the connections between the drivers and the risks due to space on the PESTLE wheel (see photos), and due to time and the fast-paced contributions. An audio recording of the workshop was made except for the first 30 minutes due to technical issues. Post workshop, the three main facilitators (Ferranti, Greenham and Brettle) listened back to the recording to capture the connections between risks and drivers and applied their own knowledge of the CSA. Due to pre-existing work commitments this post-workshop activity took place in January 2025.

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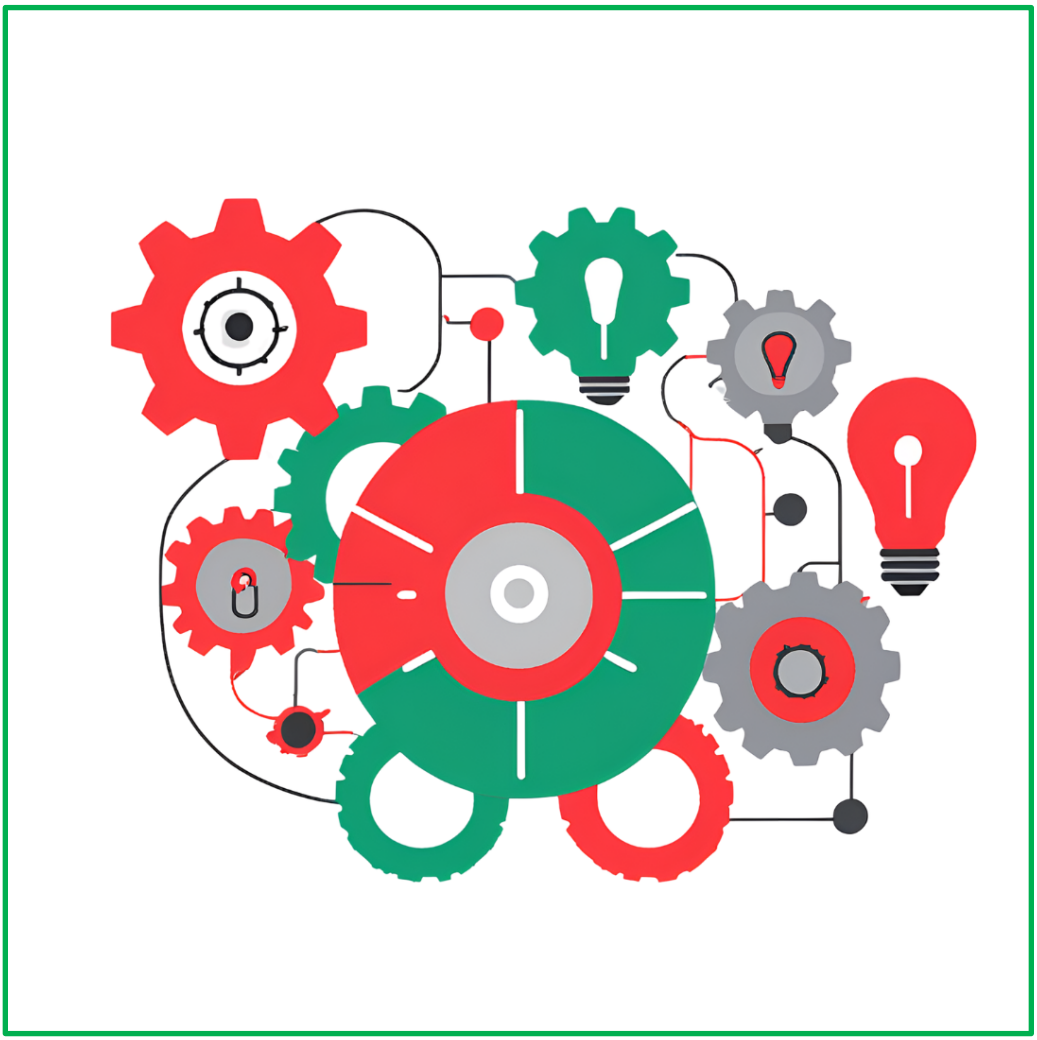
4. Reflection on the engagement of TGs in LL WS1



Stakeholder engagement in the first CARMINE LL WS1 was generally deemed as successful by all CSAs. Although each CSA tailored its workshop to address the specific challenge(s), common patterns emerged regarding levels of participant engagement, the involvement of all target groups (TGs), the vulnerable communities' inclusion, the obstacles encountered in achieving full representation as well as the strategies to overcome them. While gaps in the representation of vulnerable communities, youth, and sectoral groups in some CSA remain, the workshops demonstrated flexibility and capacity to harness the necessary local knowledge to better address

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climate change challenges in urban context. Moreover, stakeholders shown enthusiasm in being involve in highly participatory activities.

Engagement of target groups in the CSAs during WS1

Table 8: Number of organisations involved per TG per CSA

CSA	TG1/TG5	TG2	TG3	TG4	Total
Prague	5	1	1	6	**13**
Leipzig	6	1	2	6	**15**
Athens	5	5	0	3	**13**
Barcelona	7	1	1	3	**12**
Bologna	**12**	6	2	4	**24**
Brasov	**14**	4	0	6	**24**
Birmingham	4	**10**	1	**10**	**25**
Total	**53**	**28**	**7**	**38**	

Representation of target groups (TGs) across CSAs varied, though some common patterns emerged (table 9). Most CSAs had a strong representation of TG1/TG5 (policy makers1), successfully engaging municipalities and policymakers, particularly in Bologna and Brașov. However, Birmingham had the lowest representation in this category, citing resource constraints or a lack of interest in the project. Public administration representatives were present in most workshops but not always fully engaged, for example in Prague, some important public institutions like the Ministry of Regional development sent a representative who left early though due to limited interest. Similarly, in the Athens workshop, despite the CSA efforts to ensure broad participation, several targeted stakeholders from public administration and policy were notably absent

The second most represented target group was TG4 (Research and Academia), as expected, since CSAs, being from the research and academia themselves, have easier access to this stakeholder group.

The engagement of communities varies from one LL to another, with Prague, Leipzig and Barcelona having only one representative organization while Birmingham had ten. · Climate be attributed to the CSAs' specific context (e.g. limited number of existing community representative organizations), but more importantly, to the existing relationships between the research team and the local community representatives, making the engagement process more or less successful. Indeed, the pre-existence of a relationship played a crucial role in the initial invitation process.

[1] To simplify the reporting analysis, TG1 and 5 have been merged as policy makers from local to national level

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CSAs with broader representation across TGs were those with extensive networks spanning multiple sectors.

TG3 (Industry) has by far the lowest representativeness in all CSAs' LL. Some CSAs were hesitant to engage with the private sector, having had no prior collaboration with them. In other cases, the private stakeholders contacted didn't really show interest in getting involved in the CARMINE LLs. Therefore, additional efforts need to take place to ensure a better representation of the private sector. The benefits this specific group could receive from being engaged in CARMINE LLs should be further emphasized in the upcoming CARMINE engagement activities.

As a general observation regarding outreach, invitation acceptance, and actual participation in WS1, CSAs predominantly engaged SHs with whom they had prior professional relationships, either through work cooperation or previous involvement in other living labs. They tended to avoid reaching out to unfamiliar individuals. When they did, they often used distant communication methods, such as emails, rather than personal calls. In post-workshop discussions, CSAs acknowledged this tendency and reported feeling more comfortable reaching out to new stakeholders after having conducted WS1.

Vulnerable communities

As anticipated, most CSAs faced challenges in actively engaging representatives from vulnerable communities in LL participatory workshops. While invitations were extended, alternative methods such as questionnaires, interviews, and dedicated group meetings were also employed to ensure that their perspectives on climate change risks and solutions were captured.

Despite being invited, **many representatives of vulnerable communities did not attend** due to logistical barriers such as time constraints or resource limitations. Others who attended showed limited engagement in discussions, for example, women and youth sometimes felt overshadowed during group activities. The online format may have further hindered participation for vulnerable groups requiring additional support or more targeted engagement (e.g., in Leipzig). Similarly, in Bologna, although the workshop facilitated balanced discussions, some groups—notably youth—were underrepresented.

Youth representation varied across CSAs. In general, youth representatives were more engaged in small group activities but contributed less to larger discussions. In online LLs such as those in Bologna and Leipzig, youth engagement was **generally lower** compared to other participants.

To address the underrepresentation of certain groups, particularly vulnerable communities, all CSAs committed to gathering their input through follow-up engagement activities, including online meetings and direct communication methods such as phone calls. Brașov has already organized three additional meetings with representatives of the elderly, youth, and farmers (identified as a vulnerable group). These focused sessions proved to be an effective approach, as participants

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were more actively engaged compared to multi-stakeholder workshops. This validates the use of focus groups as a more effective strategy for engaging vulnerable communities rather than integrating them into broad, multi-sector discussions.

Reflection on the WS1 methodology and tools

Participant engagement was generally successful across CSAs, with stakeholders actively contributing to discussions on risks, drivers, adaptation and mitigation (A&M) solutions, and barriers. The workshops facilitated dynamic exchanges among diverse stakeholders from all five TGs. The format and tools encouraged active discussions and reflections on the implications of climate change in metropolitan regions.

The PESTLE wheel was particularly effective in identifying a broad range of risks, drivers, solutions, and barriers, going beyond the most obvious factors. Participants demonstrated high motivation, particularly in discussions on climate adaptation strategies. Representatives from vulnerable groups provided valuable insights into the risks faced by children and the elderly, underscoring the need for inclusive approaches to climate adaptation.

As with many participatory workshops, timing proved to be a challenge. Some CSAs struggled to allocate enough time for all discussion sections, while others, having scheduled full-day workshops, saw participants leave before the end.

In conclusion, despite challenges, the LL in all CSA achieved significant successes in engaging a diverse range of stakeholders in the LL WS1, fostering collaboration and laying a strong foundation for the CARMINE project. Facilitators across CSAs adapted well to cultural and logistical contexts, creating inclusive spaces for knowledge-sharing, fruitful discussions and co-design of A& M solutions. Diverse participation from all TGs was aimed but not achieved by all CSAs due to scheduling conflicts, some weakness in outreach efforts or lack of familiarity with these groups. Representation of vulnerable communities and youth was uneven across CSAs, but was anticipated and will be the focus of the upcoming efforts in engaging TGs in the CSAs. Follow-up sessions are already planned to directly involve these underrepresented groups and ensure their perspectives are fully integrated into the project's outcomes.

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5. Conclusions and Next Steps

This deliverable provides a thorough examination of the outcomes from the first phase of the CARMINE project, emphasizing the engagement of five distinct target groups (TGs) across eight diverse CSAs, namely Prague, Leipzig, Funen-Odense, Athens, Barcelona, Bologna, Brașov, and Birmingham. Through structured methodologies such as LLs and participatory workshops, stakeholders collaboratively explored climate challenges, mapped associated risks and drivers, and proposed tailored A&M solutions, which were then prioritized. The use of tools like the System Innovation Approach (SIA) and PESTLE analysis not only fostered a comprehensive understanding of the challenges but also facilitated the co-creation of innovative, context-specific solutions.

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One of the critical successes of the report lies in the diversity of perspectives captured, reflecting the unique socio-political, economic, and environmental contexts of each CSA. The inclusion of regional authorities, community representatives, industry stakeholders, researchers, and policymakers enriched the discussions, ensuring that proposed solutions are grounded in both practical realities and strategic foresight. The emphasis on participatory methods strengthened stakeholder ownership, laying a strong foundation for implementing effective climate resilience strategies.

Despite these successes, the report highlights areas for improvement, particularly in engaging vulnerable communities. While efforts were made to include marginalized groups such as the elderly, children, and economically disadvantaged populations, their participation was inconsistent across CSAs. This underscores the importance of refining outreach strategies, such as leveraging local networks, simplifying communication, and providing flexible participation options. By addressing these gaps, future workshops can achieve a more inclusive representation of voices critical to shaping equitable climate solutions.

The prioritization of solutions showcased a balanced approach, integrating considerations of urgency, feasibility, and long-term impact. Nature-Based Solutions (NBS) emerged as a key focus area, valued for their ability to address multiple risks while delivering co-benefits such as biodiversity enhancement and improved urban livability. However, barriers such as limited funding, political polarization, fragmented governance, and restrictive regulatory frameworks were consistently identified. These challenges highlight the need for stronger political commitment, cross-sectoral coordination, and capacity-building initiatives to enable the successful implementation of proposed measures.

This report also underscores the broader implications of climate resilience planning, emphasizing the need for harmonized action at local, regional, and national levels. The integration of localized knowledge into broader governance frameworks is critical for aligning community-driven insights with scalable policy recommendations. Moreover, the collaboration fostered between stakeholders during this phase has not only built trust but also established a platform for sustained dialogue and action.

Looking ahead, the insights gained from this report will inform the next stages of the CARMINE project, including subsequent workshops and LLs. By building on this strong foundation, the project is well-positioned to co-create impactful, sustainable pathways for climate-resilient development across Europe. Continued emphasis on inclusivity, innovation, and evidence-based decision-making will be essential in addressing the complex challenges of climate change and ensuring long-term resilience for communities, ecosystems, and economies alike.

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6. Appendices

6.1 CARMINE Workshop 1 – Report Template

CARMINE Workshop 1 - Report

Pre-Workshop activities

Table 1: To be completed by CS teams who carry out a separate event before Workshop 1

PRE-WORKSHOP EVENT **If applicable*

1. Case Study	*[Athens]*
2. Format	*[Type of event. E.g. coffee morning, focus group, working lunch etc.]*
3. Date and Time	*[dd/mm/yyyy, HH:MM – HH:MM]*
4. Location	*[Venue, City]*
5. Objectives	
Main outputs	

Workshop 1 activities

Table 2: List of Attendees

ATTENDEES				
Role	**Organization**	**Sector /Field**	**Vulnerable Group**	**Notes**
1.				*[Interested in taking part in other CARMINE activities,*

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				resistant to the process, motivated, neutral, quiet etc.]
2.				
3.				

Table 3: List of Missing Participants

Missing participants			
Role	**Organization**	**Sector/Field**	**Notes**
1.			*[Reason for absence, interested in taking part in other CARMINE activities]*
2.			
3.			
Vulnerable communities			*[Reason for absence, interested in taking part in other CARMINE activities]*

Table 4: Background Information

Background information	
Case Study Area	*[Athens]*
Date and Time	*[dd/mm/yyyy, duration*
Location	*[Venue, City]*
Facilitator(s)	*[List names and roles]*
Living Lab Challenge	*[What is the central challenge of the LL?]*
Living Lab additional Objectives	*[Besides the WP1 LL WS1 objectives mentioned in the guideline]*

WORKSHOP NOTES: To be used as a guide for the note taker during the workshop

Table 5: Risks (*insert as many as needed)

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Risks	Pre-identified	Final list
Political		
Economic		
Social		
Technological		
Legal		
Environmental		
Vulnerable community inputs	*[Report on the specific risks the vulnerable groups have identified]*	
Additional comments	*[General feedback on the session / any challenges faced while conducting this activity]*	

Table 6: Drivers (*insert as many as needed)

Drivers	Pre-identified	Related Risks
Political	Driver 1	Risk 1/risk 2/risk 3
	Driver 2	
	Driver 3	
Economic	Driver 1	
	Driver 2	
	Driver 3	
Social	Driver 1	
	Driver 2	
	Driver 3	
Technological	Driver 1	
	Driver 2	
	Driver 3	
Legal	Driver 1	
	Driver 2	
	Driver 3	
Environmental	Driver 1	
	Driver 2	
	Driver 3	

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Vulnerable community inputs	*[Report on the specific drivers the vulnerable groups have identified]*
Additional comments	*[General feedback on the session / any challenges faced while conducting this activity]*

Table 7: A&M Solutions (*insert as many as needed)

A & M Solutions (specify if it is Adaptation (A) or Mitigation (M) solution)	**Pre-identified**	**Final list**	**Risk** *[Report on the risk they need to address]*	**Drivers** *[Report on the drivers they need to address]*
Political				
Economic				
Social				
Technological				
Legal				
Environmental				

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Vulnerable community inputs	*[Report on the specific A&M solutions the vulnerable groups have identified]*
Additional comments	*[General feedback on the session / any challenges faced while conducting this activity]*

Table 8: Barriers (*insert as many as needed)

Barriers	Pre-identified	Final list	Related solutions
Political			
Economic			
Social			
Technological			
Legal			
Environmental			
Vulnerable community inputs	*[Report on the specific barriers the vulnerable groups have identified]*		
Additional comments	*[General feedback on the session / any challenges faced while conducting this activity]*		

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Table 9: Prioritization of Solutions *[Menti meter/provide graph as well]*

Prioritization of Solutions	**Ease of implementation Total Number** [*cumulative vote of all participants]*	**Urgency Total number** *[cumulative vote of all participants]*
Solution 1		
Solution 2		
Solution 3		
Vulnerable community inputs	*[Report on the prioritization of solutions the vulnerable groups have identified]*	
Additional comments	*[General feedback on the session / any challenges faced while conducting this activity]*	

Post Workshop Notes

To be completed by the CSA facilitators **after** the workshop

Table 10. Stakeholder Gaps

Stakeholder Gaps	*[additional LL participants to be invited to Workshop 2 based on the discussion and outputs of WS1]*

Additional Documentation [*Materials to prepare/include]*	1. Agenda 2. Pictures of the Mapping process (PESTLE wheels) 3. Interactive pool tools (e.g., mentimeter) 4. Picture of the room during the activities
Additional Activities	*[Report on the implementation of any additional activities you carried out during the workshop*]

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